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ROCHESTER WATER WORKS.

Probably no city in the world is better supplied with water for domestic, manufacturing, and fire purposes than the beautiful city of Rochester, N. Y. It is provided with two entirely separate and distinct plants, one supplying water from the Genesee River under the Holly system for fire purposes and fountains, for manufacturing, and for the distribution of power, the other taking pure sweet water from Hemlock Lake about thirty miles south of Rochester. This lake is situated in a mountainous region, and is supplied by a small clear stream and by springs within its borders. The water is remarkably pure and cool, and the supply is ample from this lake alone; but the city has the right to use the waters of Canadice Lake, which is near, and can be made to discharge into Hemlock Lake at a slight expense. The level of Hemlock Lake is 388 feet above the canal aqueduct in the city. The water is conveyed from the lake to a storage reservoir at Rush, about ten miles south of Rochester, in wrought iron and cast iron pipes. A large proportion—nearly ten miles—of wrought pipes is thirty-six inches in diameter. It is made in eighty foot lengths, joined at the ends by deep cast iron hubs and lead joints.

The storage reservoir is 117 feet above the Mount Hope distributing reservoir, shown in the engraving, and the two reservoirs are connected with a conduit of 24 inch cast iron pipe, following the undulations of the ground along its line. The length of this conduit is 46,064 feet, or about $8\frac{3}{4}$ miles. There are three strainers between the water of the lake and the distributing pipes; one at the lake, one at the storage reservoir, and one at the distributing reservoir. These strainers are made of galvanized iron wire netting, quarter inch mesh, and are arranged so that they may be readily replaced.

For the purpose of thoroughly aerating the water before being delivered to the citizens during the warm weather, there is a fountain in the middle of the distributing reservoir, with twenty-one openings, through which the whole of the city's water supply issues in jets, thereby exposing almost every drop to the action of the atmosphere, while during the winter the water is allowed to enter the reservoir from a submerged well situated at a point near the opposite bank, from where it enters into the city mains, in order to maintain a gentle flow or current throughout the entire length of the basin; stagnation of the water is thus rendered impossible at any time of the year.

To accomplish this conveniently, the conduit is divided in the gate house by means of a Y casting into two lines, each 24 inches diameter, one of these leading to the fountain and the other to the submerged well, both lines of pipe being laid under the banks and the clay bottom of the reservoir. A third 24 inch cast iron pipe conveys the water from the reservoir into the two 20 inch distributing mains, these pipes being likewise connected with a Y casting. The two distributing mains and the conduit are also connected in the gate house by means of valves and castings, so that the distributing reservoir may be cut out in case of fire or accident, and water supplied directly from the storage reservoir.

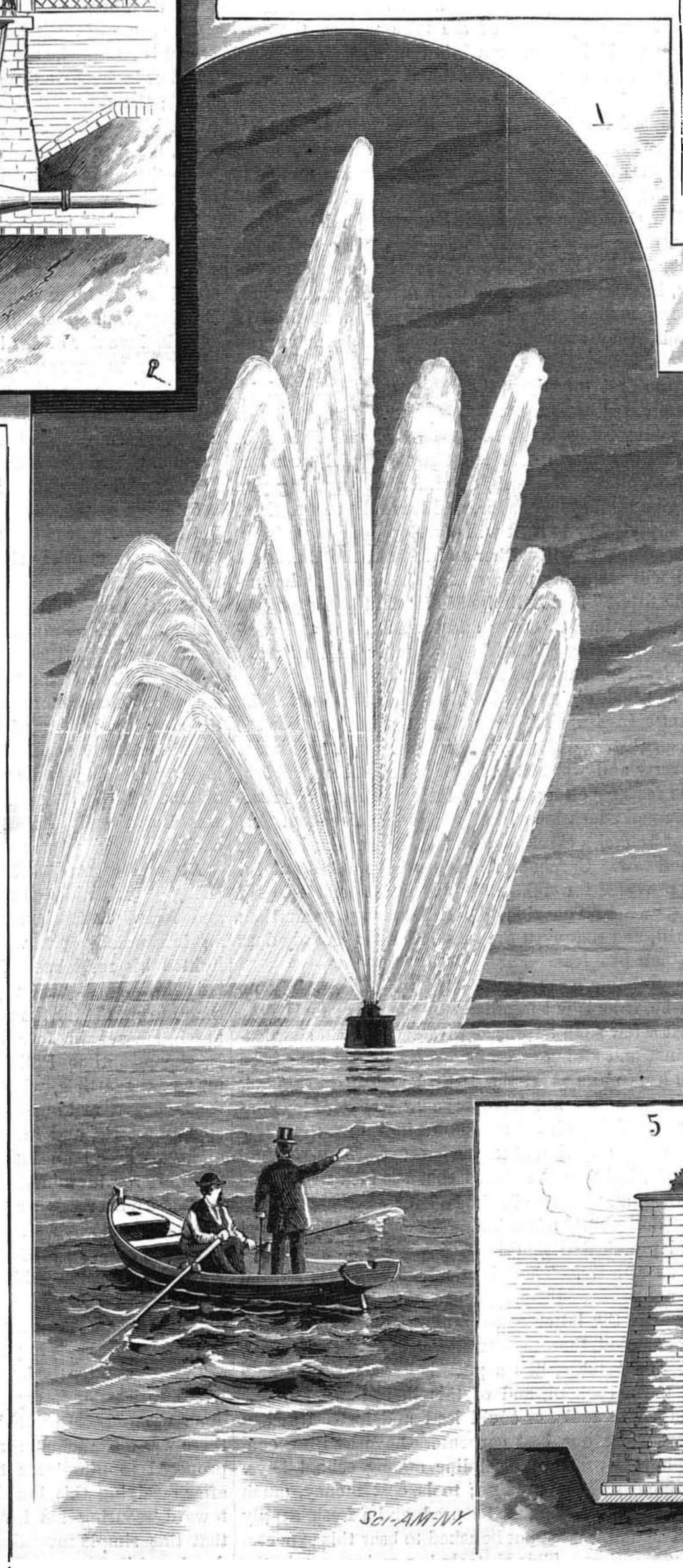
The fountain itself is plainly visible in clear weather for a distance of many miles. In its construction the 24-inch pipe was turned vertically upward by means of a curved casting and surrounded with substantial masonry. Near the top this pipe is enlarged to a diameter of three feet, and closed by means of a dome-shaped head provided with 21 orifices. The central and largest orifice is $6\frac{1}{8}$ inches in diameter, and arranged concentrically around this are the remaining 20 orifices, alternating from 2 inches to $1\frac{1}{4}$ inches in diameter. These openings can all be reduced by means of suitable caps, or any of them can be closed entirely so that the form of the fountain may be changed or varied at will.

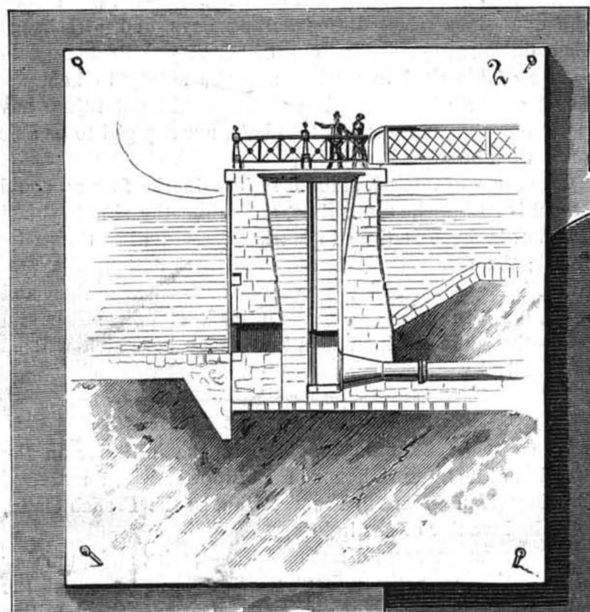
Observations as to the height of the jets have been made, and it is found that when the smaller orifices are closed and the central jet reduced to a diameter of 3 inches the water jet rises to a height of 110 feet above the surface of water in the reservoir, or to within 7·44 feet of the elevation of its source in Rush Reservoir, $8\frac{3}{4}$ miles distant; but when the central opening is increased to $6\frac{1}{8}$ inches, the jet descends to a height of about 70 feet.

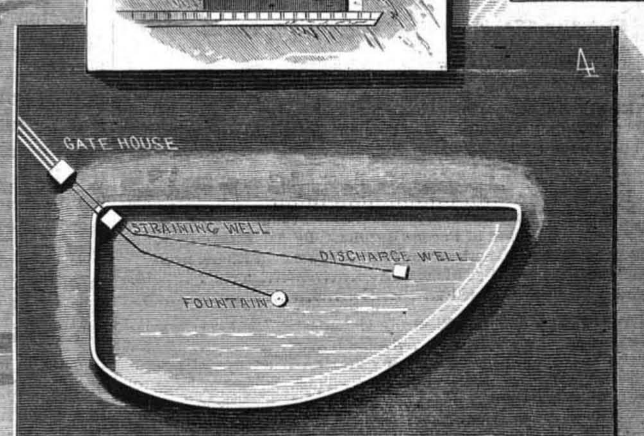
The jets as arranged during the month of May of the present year were as follows: one of 3 inches diameter; four of $1\frac{1}{4}$ inches diameter; four of $\frac{3}{4}$ inch diameter; twelve of $\frac{1}{2}$ inch diameter.

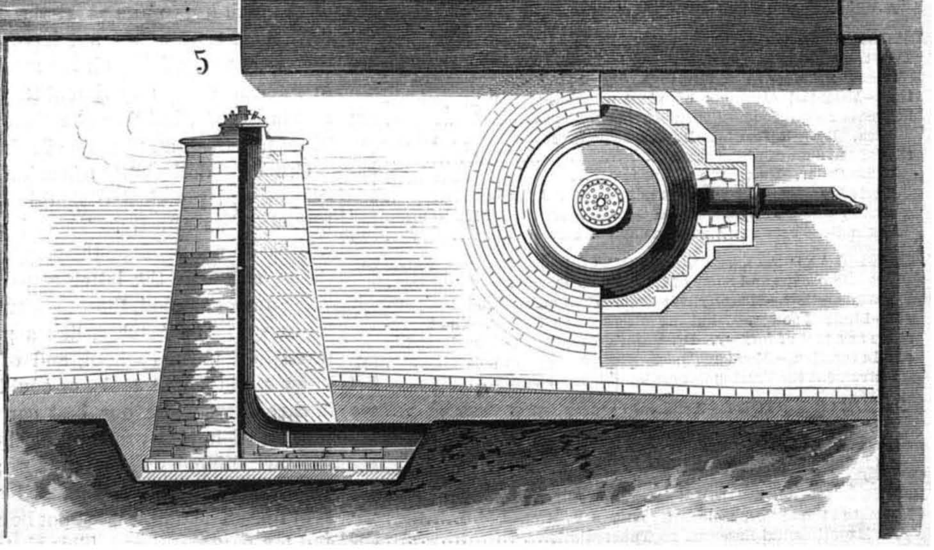
Rochester, until the completion of these water works in 1876, was supplied almost altogether from individual wells, the water of which was in most instances, as analysis has shown, fearfully polluted. In a sanitary point of view the supply of an abundance of pure water in place of the well water formerly used is of great importance.

The Holly direct-pressure system has about eight miles of distribution pipe in the business and manufacturing part *Continued on p.* 100.









1. Fountain in Distributing Reservoir.—2. Straining Well.—3 Gate House.—4 Plan of Distributing Reservoir.—5. Vertical Section and Plan of Fountain Pipe.

ROCHESTER WATER WORKS.—THE FOUNTAIN IN MOUNT HOPE RESERVOIR.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 345,

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MANUAL DEXTERITY.

From Boston on the east to St. Louis on the west, the changes are being rung on the necessity of teaching the fingers as well as the minds of school children. No well conducted teachers' institute fails to take a vote on it, and no educational magazine neglects to publish a paper on "Manual Education in the Public Schools." The great public sentiment seems to have, at last, come to the conclusion that not every free born American citizen can live by his wits, and a few must be content to turn their attention to manual labor, at least the more delicate kinds, and not, of course, such as shall raise big blisters on the finger and coarse calluses on the hands. The jack knife with which the typical school boy has been wont to carve rude characters on his desk and bench, is to be exchanged for a kit of tools, and the native instinct of "cutting" cultivated, instead of being repressed as it long has been—with what success a visit to any district schoolhouse will show. Those fingers which schoolmasters have been wont to look upon as of no other use but be cracked with an oaken ruler are to be dignified and exalted to a first place in our educational system; they are to be trained and taught to follow deftly the dictates of the brain, obedient to its every wish.

What better example of a perfect machine have we than the human hand! Remove the skin and the few little lumps of adipose tissue, and examine its intricate mechanism; its system of levers and pulleys, the economy of space achieved by one muscle passing through another, and the union of cords and tendons whereby one finger is given the power to move totally independently of the rest, and then attempt to calculate the number of movements imparted to the fingers by these few muscles. Watch the movements executed by the fingers of a musician, whether he plays the bass viol, the zither, or the piano; follow the hand of the compositor as he sets these very lines, of the type writer, the telegrapher, the rapid knitter, or a blind man reading raised characters, and tell us whether the hand is capable of being trained, or the fingers of being educated.

How many of the graduates who have this summer left their alma maters feeling that their education was completed, knew all the uses of their fingers, we are unable to say; but it is safe to assume that not one in ten had acquired more digital skill than was needed to write a letter, tie a necktie, button a lady's glove, and conceal "a crib" in his coat sleeve. It is a notorious fact that in every chemical laboratory, in every dissecting room, and every other place where young men of liberal education are compelled to handle tools, they soon find that their "fingers are all thumbs."

One of the first questions that is always discussed by every school board or institute before whom the question of manual teaching comes up is, Shall we teach only the use of tools, or shall we attempt to teach a trade and turn out finished mechanics? Do both, do either, do anything you like, only give the boys a chance, and leave the rest to time. If it has any vitality in it, it will develop into something. The useless members will wither and fall off, those most fit to survive will assuredly prosper, for the law of "the survival of the fittest" is not limited in its field to the growth of plants and animals. Cities and towns, trade and commerce, manufacturing industries, churches and schools, have their development conditioned thereby.

Boston, as usual, claims to lead in this movement. The Massachusetts Institute of Technology has been, under the late Professor Rogers, a remarkable success. Fighting its way against poverty and want, it has conquered all opposition, and Boston feels encouraged to try the experiment of incorporating manual education on her public school system. At the Dwight School a classroom has been sacrificed to the hammer and saw. Carpenters' benches have been put in, and tools provided for eighteen boys. It is needless to say that the boys need no coaxing, that it is more popular than military drill, and that even the time taken from study does not retard their progress.

There is probably no reader of this paper, certainly no inventor, who, if he is not familiar with the use of tools, does not feel that a few such lessons as that class get in sharpening, handling, and taking care of tools would not have been of as much use to him as all the Latin he learned in school, or that his time would not have been as well employed at that as in memorizing all the mountains in Asia or the rivers in Africa. This experiment may not prove a *financial* success in Boston, but we are satisfied that the idea will yet be made practical, and become in time a success.

Grant the desirability of such a modification of the school system, and practical difficulties will present themselves—have done so already. There is a lack of teachers: normal schools do not produce them, nor can they be found in the shops, although the latter can do more than the former. The number of good, thorough, enthusiastic teachers is small, because a good teacher, like a poet, is born, not manufactured in a normal school, and of this little band too few know aught about tools, or could lead and instruct a class in carpentry, while our best carpenters have as little conception of how to preserve discipline among school boys. Another difficulty is the expense; tools cost money, much more than books; wood must be used, and a fresh supply kept up. The pupils must not be asked to bear this expense, and tax payers object. This obstacle is a serious one in the free schools, where it is most needed.

It was not our intention to pass by the girls, but at present they are better provided for than boys. In Boston sewing is a regular part of the school curriculum, and they not only learn to sew but do it well. This is something that can be done at slight expense, and teachers that know how to sew are not so scarce. Mr. L. H. Marvel, in his paper on "Manual Education in the Public schools," which appeared in the June number of *Education*, says that in schools where sewing is taught the sewing does not detract from the efficiency of the other work of the school. The same writer adds: "Sewing was taught in all elementary schools half a century ago, and to boys and girls alike." It is unfortunate that this has not been kept up; it is better that a school boy should sew or knit, than that his fingers should get no training beyond that of clumsily grasping a penholder, while his body is twisted into some painful position to conform to the unhygienic law of the writing master. In the kindergarten, which too few of our children enjoy the advantages of, efforts are made to train the eye, voice, ear, and hand, but the training stops when the child enters the school, and its effects are soon dissipated. One point must, of course, be guarded against, that the occupation of the fingers be not such as to *strain* the eye or produce near-sightedness.

An ingenious teacher would have no difficulty in arranging a series of exercises equal to any of the "finger gymnastics" of the music teacher, without being half so stupid, which should embrace the use of knitting, crocheting, and sewing needles, of stilettos and bodkins, of awls and gimlets, of scissors and penknife; braiding, plaiting, tatting, netting, tying knots, and splicing small ropes, are among the operations adapted to teaching boys and girls what their fingers are good for. One of our very skillful surgeons boasts of his skill in sewing, and the ability to hem the finest cambric handkerchief; and it would not injure any boy to be able to work a button hole, nor any girl to be able to tie up a bundle.

The sense of feeling, since it resides in the fingers, could be cultivated at the same time, and while the skin is young and soft is the best time to learn to distinguish things by touch; the difference between wool and cotton, silk and linen, kid and dog skin, sheep and calf, between flour and meal, between pure sugars and mixed, between silver and lead—these are distinctions a knowledge of which will be of practical value.

EARLY HISTORY OF GAS LIGHTING.

The city of Chaumont has taken the initiative in the erection of a statue in honor of Philippe Lebon, a native of Brachay (Haute-Marne), France, who, so the French claim, was the inventor of gas lighting.

Many managers and directors of gas works, and a number of scientific men throughout France, have promised the town of Chaumont their support. A provisory committee has been formed, with the mayor of Chaumont as an honorary president, and M. Foucart, president of the Technical Society of Gas Industry in France, as the active president.

In order to place before our readers the correct idea of Lebon's relations with this wonderful invention, we give the following brief sketch of the early history of gas making.

As early as 1726, Stephen Hales, in his "Vegetable Statics," states that he obtained 180 cubic inches of an inflammable gas from the distillation of 128 grains of Newcastle coal. Bishop Watson, in his "Chemical Essays," describes experiments made on coal gas, and says that it does not lose its illuminating power when passed through water. Lord Dundonald, of Scotland, took out a patent in 1787 for making coal tar, and erected ovens for this purpose. He obtained, besides the coal tar, a quantity of coal gas, which was burnt in Culcross Abbey and considered a great curiosity.

About the year 1792, William Murdoch, a Scotchman, living in Redruth, Cornwall, began making experiments, and found that when coal was heated in an iron retort an inflammable gas was given off, and with this gas he lighted his residence. Murdoch, possessing the characteristic slowness of his people, made no further use of the gas than burning it for the amusement of his friends, and it was nearly ten years before his invention was published abroad. In the meantime Philippe Lebon, mentioned at the beginning of this article, who was then engineer of bridges and roads, began making experiments by heating wood, peat, etc., in retorts, and found that these bodies, by the action of heat, yielded an inflammable gas, which could be used not only for illumination, but also for the production of heat and power. His apparatus he called a thermolamp.

According to French authors he lighted his residence in Paris in 1796. In 1798 he read a paper before the French Academy describing his thermolamp, and this paper was translated into English and German by Winsor. In 1799 he obtained a patent in France for producing gas from peat, etc., and applying it to purposes of illumination and heating.

Two years later the brother of James Watt, being in Paris, wrote to England, saying "that if anything were to be done with Mr. Murdoch's gas, it must be done at once, as there was a Frenchman in Paris who had similar ideas, and proposed to illuminate that city by these means." Even after receiving this broad hint, Mr. Murdoch took no steps toward securing his invention by a patent, little realizing that this simple invention, in less than a century, would be developed into one of the greatest industries in the world.

Lebon had received a theoretical education, and although his theories were good, there were practical difficulties in the way which he was unable to overcome, while, on the other hand, Murdoch was more of a practical man, and, therefore, was not hindered so much with practical difficulties, and for this reason he is considered the inventor of *practical* gas lighting, for, previous to his experiments, illuminating gas was only a curiosity, and by rendering its manufacturing practical he made it an everyday necessity.

In 1792 Murdoch lighted his workshop in Redruth with gas. The first more extensive gas work was established by him in 1802, at the Soho Foundry, near Birmingham, and in 1804 a spinning mill in Manchester was lighted with gas.

It was first introduced in this country in Baltimore in 1821, in Boston in 1822, and New York in 1827.

The reason why wood gas made by Lebon was inferior to coal gas, was afterward explained by Dumas, who proved that under the conditions of the distillation of wood employed by Lebon, the gas consisted largely of marsh gas and carbonic oxide.

Dr. Pettenkofer found that where the vapors of tar and empyreumatic oils, given off by the carbonization of wood at a comparatively low temperature, are further heated by passing through a red hot retort, a very large quantity of heavy hydrocarbon gas remains among the products, thereby greatly increasing its illuminating power.

One of the large gas companies in this city, the Mutual Gas Light Company, is at present engaged in the manufacture of gas from wood. All the other gas companies in the city, except two, are manufacturing gas from coal very similar to the manner pursued by Murdoch. The principal improvements which have been made have been in respect to its purification.

Lightning Rods.

During a recent thunder storm at Carrollton, Ill., the lightning struck the house of Mr. D. H. Gillespie, a resident of that city. The course of the electricity was as follows: Striking the lightning rod, on the top of the main part of the house, this conductor was followed until a point was reached about the middle of the peak; here, it is stated, was a bad connection which opposed the further passage of the electricity. It, therefore, here branched off down a tin gutter until arriving at the edge of the roof all conducting material ceased. The electricity then made its way across the wall, tearing off the weather boards *en route*, until another conductor was reached, this time a good one—a telephone wire connected with good earth; after reaching this wire the current passed harmlessly away into the earth.

We may here note that the house referred to was protected first, by a lightning-rod, and second, by a telephone line. It appears also that the lightning-rod, as usual, was not a well constructed one; while the telephone line (we are afraid *not* as usual), was well constructed, and, wonderful to relate, had a good and serviceable ground termination.

So long as irresponsible parties are suffered to carry on the lightning-rod business, so long must trouble and disaster be expected to ensue.

In the present case, the damage is ascribed to the defective connection at the middle of the roof. Partly, no doubt, such was the case; other elements, we think, had their share in the matter.

In the absence of a detailed description, we may assume that the lightning conductor had an imperfect ground connection, was fastened to the house with insulators, and probably did not extend to a sufficient height above the roof to be an efficient protection.

Also from the fact that the electricity left the conductor at a point on the ridge, it would appear that the said conductor extended for some distance horizontally; a position which for lightning rods is to be deprecated.

A lightning conductor fulfills two functions it facilitates the discharge of the electricity to the earth, so as to carry it off harmlessly; and it tends to prevent disruptive discharge by silently neutralizing the conditions which determine such discharge in the neighborhood of the conductor.

To effect these objects, the rod should extend to a sufficient height, to be the most salient feature of the building, no matter from which direction the storm may come. The size of the rod, if copper, should not be less than three-eighths of an inch, or of iron, not less on any consideration than nine-tenths of an inch. (We are aware that such a size will be considered preposterous by lightning-rod manufacturers, but such a size is the minimum of absolute safety.) The connection with the earth should be electrically perfect, should be branched in all possible directions, and if possible should be both soldered to gas or water mains, and to a plate sunk in moist earth. All joints should be soldered; and in no case should any portion of the rod run horizontally for more than four feet, unless ground connections are provided; where corners are to be turned they ought always to be turned with a gentle curve, and finally, lightning-rods should never be insulated from the building. Is it conceivable that a stream of electricity can jump from a cloud to earth, and can then be kept on an iron rod by half an inch of glass? We may rest satisfied that if a rod is otherwise properly constructed, atmospheric electricity will never leave a good metallic conductor for a poor wooden one.

Having noted these points, telephone men can appropriate to themselves a few lessons from them: First, that it is not safe to rely upon a lightning conductor for a ground. Second, always to be particular in constructing such a good ground wire, that a telephone ground wire shall be a synonym for a good one, as a lightning-rod ground is a bad one. Third, to have our ground wire large enough for the escape of heavy currents; this refers especially to the lightning arrester ground. Fourth, to run our ground wire to as many different points of communication with the earth as possible. Fifth, let your lightning arresters always be in good order, and your ground wires attached thereto, as straight as convenient. Finally, let us be particular in soldering joints, but if we never solder any other, let us never fail to solder the earth connection.

A telephone line is always a protection, but much more so, when properly installed, than when carelessly constructed.—*Review of Teleg. and Teleph.*

Impurities in Glycerine.

Under the title of "Adulteration of Glycerine," F. Jean contributes an article to the *Journal de Pharmacie d'Alsace-Lorraine*, in which he considers not merely adulterations intentionally added, but impurities due to carelessness in its manufacture or purification. Among them are oxide of lead, lime, and butyric acid. French perfumers and manufacturers of cosmetics test their glycerine with nitrate of silver. If no turbidity or change of color takes place in 24 hours, it is considered good.

The chloroform test for glycerine consists in mixing equal volumes of chloroform and glycerine, shaking thoroughly and then letting them stand. The upper strata is pure glycerine, while the lower one is chloroform containing all the impurities. If there were no impurities in the glycerine the chloroform remains unchanged, otherwise there will be a turbid layer just beneath the glycerine.

On adding a few drops of dilute sulphuric acid to a mixture of equal parts of glycerine and distilled water, and then a little alcohol, the presence of lime or lead will be shown by a white precipitate. The latter is reorganized by sulphydric acid, which turns the precipitate black.

Butyric acid is detected by mixing the glycerine with absolute alcohol and sulphuric acid of 66° B. On gently heating the mixture, the butyric ether is easily recognized by its agreeable odor.

Formic and oxalic acids are also found in glycerine, impurities which are of special importance to pharmacists.

They are detected as follows: Equal volumes of glycerine and sulphuric acid, specific gravity 1·83, are mixed together. Pure glycerine does not give off any carbonic oxide gas, but if either of the acids mentioned is present, an evolution of that gas will be observed. To decide whether both acids are present, and if not which one, some alcohol of 40° B. and one drop of sulphuric acid are added, and then gently heated. Formic ether (used in making essence of peaches) will be recognized at once by its characteristic odor, and proves the presence of formic acid. To another sample of the glycerine add a little solution of chloride of calcium (free from carbonate), when it will give a precipitate of oxalate of lime, if oxalic acid is present.

Sugar, glucose, dextrine, and gum are often used as intentional adulterations of glycerine, and are tested for as follows: The glycerine is mixed with 150 or 200 drops of distilled water, and 3 or 4 centigrammes of molybdate of ammonia is added, and one drop of pure nitric acid. It is boiled about 30 seconds. If sugar or dextrine is present, the mixture will be blue.

Glycerine adulterated with cane sugar or sirup acquires a brownish-black color when boiled with sulphuric acid. Glucose is detected by boiling it with caustic soda, which turns it brown.

If detected qualitatively, the quantity may be estimated by the following method: 5 grammes of glycerine are weighed out and mixed with 5 c. c. of distilled water. It is boiled in a little flask, with Barreswil's alkaline solution of tartrate of copper. The suboxide of copper is precipitated, and the precipitate dissolved again in hydrochloric acid. An excess of ammonia is added, and it is poured into a vessel containing an excess of nitrate of silver. A precipitate of metallic silver is formed and filtered out. It is washed with warm water and ammonia, calcined at a red heat, and weighed; 109·6 parts of metallic silver represent 100 of glucose.

If cane sugar or dextrine are found, it is boiled for half an hour with acidified water to convert these substances into glucose.

If none of these impurities are present, the amount of water is found by Vogel's well known method.

Elementary Composition of Starch.

The exact chemical formula for the molecule of starch is still a matter of doubt, all that is known with certainty being its percentage composition. In a communication to the *Journal fuer praktische Chemie*, F. Salomon gives some experiments of his that go to prove that pure potato starch has the empyrical formula $C_6H_{10}O_5$, or some multiple of it, $x(C_6H_{10}O_5)$, and that Naegeli's formula of $C_{36}H_{62}O_{31}$ must be rejected. Of the two formulas given by Tollens and Pfeiffer, only those which correspond to the composition $C_{24}H_{40}O_{20}$ have any claim to probability.

Salomon arrives at a very positive confirmation of the formula $C_6H_{10}O_5$, which was first given by Mulder, and based on different elementary analyses, by inverting the starch. Its accuracy was controlled by three different methods of determining the grape sugar. Salomon starts with the elementary composition of starch and the formation of dextrose—starch-sugar, grape-sugar, amylose—according to the equation $C_6H_{10}O_5+H_2O=C_6H_{12}O_6$, namely, that 100 parts of anhydrous starch yields 111·11 parts of anhydrous dextrose, while according to the equation $C_{36}H_{62}O_{31}+5H_2O=6C_6H_{12}O_6$, based on Naegeli's formula, we should expect 109·09 parts of anhydrous dextrose. The figures 111·11 and 109·09 lie so close together that it was necessary to determine the sugar formed by the copper solution, by specific gravity, and by polarization. The starch used was very carefully dried at 120° C., and its composition was, pure starch, 76·50; residue, insoluble in dilute acid, 0·247; ash, 0·273; water, 22·98.

Conversion into Sugar.—The most complete and reliable method of converting starch into sugar is that of Sachse, in which 3 grammes of air-dried starch is rinsed into a flask and mixed with 200 c. c. of water and 20 c. c. of hydrochloric acid, sp. gr. 1·125, and heated for three hours in boiling water. The solution was then neutralized with enough caustic potash to leave it just slightly acid, and diluted to a definite volume. The sugar was estimated—(1.) By Allihn's method with alkaline copper solution, the suboxide of copper filtered out on asbestos, etc. (*Jour. pr. Ch.*, xxii., p. 56). Three experiments give respectively 110·98, 111·31, 111·10 per cent dextrose, and three determinations made by Allihn, and calculated to the same quantity, gave 111·5, 110·95, and 111·2 per cent of starch-sugar. The average of these six analyses was 111·16, which is very close to that required by the formula $C_6H_{10}O_5+H_2O=C_6H_{12}O_6$.

(2.) The estimation of sugar by specific gravity was made with 130·72 grammes of air dried, corresponding to 100 grammes of pure starch, mixed with dilute sulphuric acid in such a way that 100 c. c. of liquid contained 10 grammes of pure starch. It was heated on a boiling salt water bath, and the flask had a return condenser so as to avoid loss by evaporation. The boiling was continued until there was no increase in its rotating power. To determine its specific gravity and circular polarization, a 10 per cent. solution of dextrose was previously found by numerous experiments to have a density of 1·0420. In the present experiments a gravity of 1·0424 was found, and this also corresponds to 111·11 grammes from 100 of starch. (3.) The optical experiments gave 11·12, 11·06, and 11·12 grammes, corresponding to 111·2, 110·6, and 111·2 grammes for 100 of starch, confirming the formula $C_6H_{10}O_5$.

A Curious Torpedo.

This latest offspring of Australian destructive ingenuity promises to be a distinct success. Its motive power is not compressed air, neither is it contained in the body of the torpedo. To propel the weapon through the water at a speed of from 15 knots to 20 knots an hour for 1,000 yards, a separate engine, or at least a special connection with an existing one, is necessary. This engine drives two drums, about 3 feet in diameter, with a velocity at their peripheries of 100 feet per second. Their duty is to wind in two fine steel wires, No. 18 gauge, of the same sort as that used in the deep sea sounding apparatus of Sir William Thomson. The rapid uncoiling of these wires from two small corresponding reels in the belly of the fish imparts to them, as may readily be conceived, an extremely high velocity. The reels are connected with the shafts of the two propellers which drive the torpedo through the water. The propellers work, as has long been known to be necessary to insure straight running, in opposite directions and both in one line, the shaft of one being hollow and containing the shaft of the other. Now, at first sight it would seem as if hauling a torpedo backward by two wires was a sufficiently curious way of speeding it "full speed a-head," but it is found in practice that the amount of "drag" is so small, as compared with the power utilized in spinning the reels that give motion to the propellers, that it may be left out of calculation altogether. Of course it is at once seen that this method of propulsion does away with the necessity for air-compressing engines and reservoirs pressed to 1,500 lb. on the square inch, which, however carefully constructed, must always involve a certain element of danger, however small. Neither are any delicate little engines, controlled and stopped by complicated, though exquisite mechanism, required. But these advantages, great as they may be, are as naught compared with the power possessed by the user of the Brennan torpedo to guide and govern its course and movements.

Many experiments have been recently made at Woolwich, and more especially at Chatham, and there seems little doubt, as far as can be seen at present, that the new torpedo will prove most valuable for the defense of harbors.—*Standard.*

Binoxide of Hydrogen as a Toilet Article.

When diluted with an equal volume of water, the binoxide of hydrogen can be used as a cosmetic on tender skin and for a mouth wash. For cleansing the teeth, take some prepared chalk and put it on the tooth brush, then pour the peroxide over it. The result is excellent, and it is only necessary to use the peroxide once or twice a week to keep the teeth white and free from injurious deposits.

For a wash, a little aqua ammonia is added to the diluted binoxide of hydrogen shortly before it is used; one or two drops to the tablespoonful, not more! Wherever it comes into contact with the skin, little bubbles of oxygen will be seen to be given off, while at the same time the dead and rough surface of the skin will be changed into a white soapy mass. As the binoxide only discovers the dead portion, it exposes the fresh and smooth surface, which, not being at all injured, soon gets strong and able to resist external influences. When used on hair, the hair must first be washed with soap, and then with strong alcohol to remove all the grease, then moistened with the peroxide and allowed to dry slowly.

Photography of the Billows.

When crossing the Atlantic I was desirous of obtaining some instantaneous photographs which should convey a true idea of the billows. When studying the contour of the waves with the intention of drawing the trigger upon a group of them suitable for my purpose, I was compelled to give up in despair all hope of securing anything which would at all convey a faithful idea of the scene. The strict scientific reality could easily be secured, for the photographing of waves is a very easy matter if one has rapid plates and a quick shutter, but I felt that realism in such a case would not be truth.

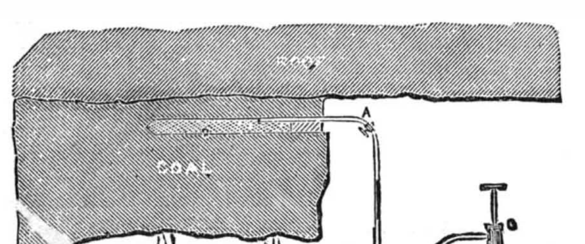
Mentioning this difficulty to Mr. Moran, the artist, with whom I conversed on that apparently paradoxical topic—the untruthfulness of real truth—he observed that artists fully realized this difficulty, and that with reference to the present case he could by a few strokes of the brush on the canvas convey a far more accurate idea of the Atlantic billows than could be obtained by any series of the most perfect realistic views that could be taken by the camera. I thought at the time what a wonderfully effective picture could be obtained if a series of instantaneous photographs of Atlantic waves, consisting of about thirty, and taken at intervals of a quarter of a second, were printed in such order as to be capable of being viewed by one of that now numerous class of thaumatropic instruments known by every kind of name from the "phenakistoscope" down to the "wheel of life," or "praxiscope." Think of such a picture being projected on the screen of the lantern and showing an Atlantic wave in actual motion!—*J. T. Taylor, in Photo Times.*

BLASTING WITH LIME.

At a recent meeting of the Iron and Steel Institute a paper by Mr. Moseley on a new system of bringing down coal was read. This was a short and useful paper, describing a system of getting coal by the aid of quicklime and water, of which something has recently been heard. The accompanying diagram shows the method in question, which is used with great success in Messrs. Smith & Moore's Shipley Collieries, Derbyshire.

The mode of operating is to employ lime in a specially caustic state made from mountain limestone. This is ground to a fine powder, and consolidated by a pressure of about forty tons into the form of cartridges, two and a half inches in diameter, having a groove along the side. These are then packed into airtight boxes to protect them from damp, and are ready to be conveyed to the mine for use. The shot holes are first drilled by means of a light boring machine, and an iron tube, about one half inch in diameter, having a small external channel or groove on the upper side, and provided also with perforations, is then inserted along the whole length of the bore hole. This tube is inclosed in a bag of calico, covering the perforations and one end, and has a tap, A, fitted on to the other end. The cartridges, B, are then inserted and lightly rammed, so as to insure their filling the bore hole.

After the cartridges have been inclosed by tamping, in the same way as with gunpowder, a small force pump, C, is connected with the tap at the end of the tube by means of a short flexible pipe, D, and a quantity of water, equal in bulk to the quantity of lime used, is forced in. The water, being



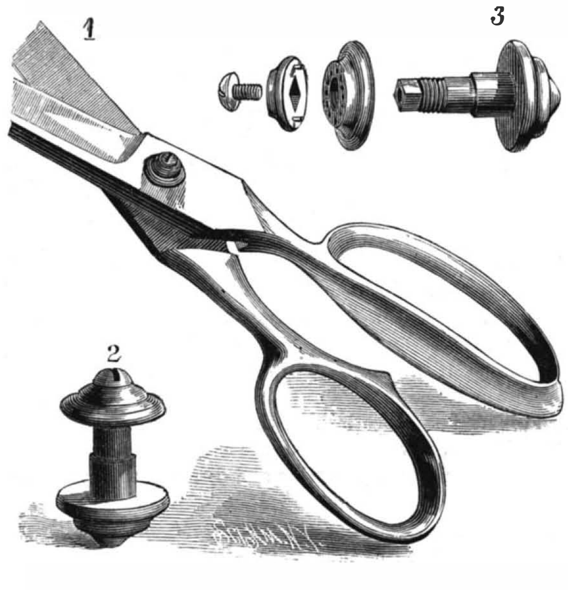
BLASTING WI[illegible] [illegible]IME.

driven to the far end of the shot hole through the tube, escapes along the groove and through the perforations and the calico, flowing toward the tamping into the lime, saturating the whole of the charge, and driving out the air before it. The tap is then closed, so as to prevent the escape of the steam generated by the action of the water on the lime, and the flexible pipe attached to the pump is disconnected. The action of the steam first takes place, cracking the coal away from the roof, and this is followed by the expansive force of the lime. The sprags are left in under the coal so as to allow the force to exert itself as far back as possible, and in many instances the coal is forced off and falls for a distance of several inches behind the end of the drilled holes. In ten to fifteen minutes, on the removal of the sprags, the coal falls clean from the roof, in large masses ready for loading, practically making no small. This system, says the *Engineer*, has the great advantage of doing away with all danger of igniting gas and causing an explosion.

NEW NUT LOCK.

The engraving shows a novel and very effective nut lock for the screw pivots of shears, scissors, and many other purposes. By this device the loosening of the retaining nut is prevented, and it does not materially differ in appearance from the common screw nut of the pivots of shears, scissors, and similar articles, while it can be applied in all cases in which absolute security against the loosening of a screw is desirable, thus making it a perfect nut lock or safety screw.

The screw pivot has a fixed head and a nut screwed on the threaded shank of the pivot, the nut having a number of



KEMMLER'S NUT LOCK FOR SCREWS.

socket holes arranged in a circle, into which the projecting pins of a cap plate enter. The cap plate has a square center opening, which fits on the square end of the screw pivot. A screw entering the end of the screw pivot holds the cap plate in place.

Fig. 1 shows the pivot screw with the improved nut lock applied to a pair of shears; Fig. 2 shows the pivot screw separated from the shears; and Fig. 3 shows the several parts separately in the order in which they go together.

Further information in regard to this useful invention may be obtained by addressing Mr. W. C. Kemmler, Columbus, Ohio.

The Poisonous Constituents of Tobacco-smoke.

A series of experiments has been recently conducted by Herr Kissling, of Bremen, with the view of ascertaining the proportions of nicotine and other poisonous substances in the smoke of cigars. His paper, in *Dingler's Polytechnisches Journal*, gives a useful *résumé* of the work of previous observers. He specifies, as strongly poisonous constituents, carbonic oxide, sulphureted hydrogen, prussic acid, picoline-bases, and nicotine. The first three occur, however, in such small proportion, and their volatility is so great, that their share in the action of tobacco-smoke on the system may be neglected. The picoline-bases, too, are present in comparatively small quantity; so that the poisonous character of the smoke may be almost exclusively attributed to the large proportion of nicotine present. Only a small part of the nicotine in a cigar is destroyed by the process of smoking, and a relatively large portion passes off with the smoke. The proportion of nicotine in the smoke depends, of course, essentially on the kind of tobacco; but the relative amount of nicotine which passes from a cigar into smoke depends chiefly on how far the cigar has been smoked, as the nicotine content of the unsmoked part of a cigar is in inverse ratio to the size of this part —*i. e.*, more nicotine the shorter the part. Evidently, in a burning cigar, the slowly-advancing zone of glow drives before it the distillable matters, so that in the yet unburnt portion a constant accumulation of these takes place. It would appear that in the case of cigars that are poor in nicotine, more of this substance relatively passes into smoke than in the case of cigars with much nicotine; also that nicotine, notwithstanding its high boiling point, has remarkable volatility.

Anhydro-sulphamin-benzoic Acid.

Anhydro-sulphamin-benzoic acid, the recent addition to the list of chemical products, is described as a white crystalline substance, very soluble in alcohol, but sparingly soluble in water, and characterized by a sweetness so great that the merest trace of the alcoholic solution in water gives it a distinctly sweet taste. Its discoverer, Dr. Constantine Falberg, estimates that it has from twenty to thirty times the sweetness of cane sugar. Should it prove wholesome and producible in quantity, with comparative cheapness, it may play an important part in the future social and industrial history of the world.

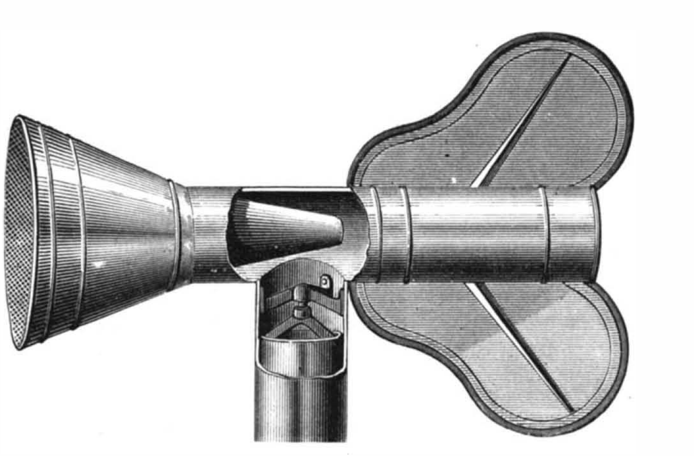
A Submarine Detecter.

The importance of being able readily to discover the locality of a submerged torpedo or a metallic obstruction in time of war, or of lost anchors, chains, or electric cables in time of peace can hardly be over-estimated, and hence the value of a submarine detecter, the working of which we have recently seen demonstrated. This instrument is the invention of Captain McEvoy, who is well known in connection with submarine engineering and torpedoes, in which he has from time to time introduced some very marked improvements. The apparatus consists of a small mahogany box, in which there is a pair of coils or bobbins, a vibrator similar to that employed in electric bells for making and breaking contact, and a telephone. To this box is attached a given length of flexible cable, with four conducting wires in it. To the other end of this cable is attached a flat wooden case, in which there are two coils. This case is weighted so that it will readily sink when placed in the water. There are also terminals on the box for attaching battery wires, and an arrangement for putting on and cutting off the current is provided. There are two complete circuits through the box, cable, and wooden case, the one primary and the other secondary. The battery, the vibrator, one coil in the box, and one coil in the wooden case are in the primary circuit, while the telephone, one coil in the box, and one coil in the wooden case are in the secondary circuit. When the battery is on, the coils in the box are adjusted so that little or no noise from the make-and-break action of the vibrator is heard in the telephone. When thus adjusted the instrument is ready for work, and if the wooden case is then brought near a metallic body a loud noise is heard in the telephone, thus indicating the proximity and locality of such a body. The principle upon which this invention is based is that of the induction balance of Professor Hughes. In Captain McEvoy's apparatus the application of the principle to the detection of the presence of metallic bodies through the sense of hearing has been worked out in a very ingenious and equally practical manner. The instrument cannot fail to prove invaluable in discovering and locating the position of the objects we have mentioned, as well as in indicating the whereabouts of sunken ships, helping to recover treasures, and in assisting generally the operations of divers.

NEW VENTILATOR.

We give herewith an engraving of a novel ventilator, patented by Mr. J. M Fennerty, and manufactured by the Fennerty Siphon Ventilator Co., of Memphis, Tenn. This ventilator, as will be seen by reference to the engraving, is made on the ejector principle, a winged horizontal tube, having on its end facing the wind a funnel projecting into it, and beyond the vertical pipe with which the horizontal pipe communicates, and over which it is pivoted. The vertical pipe is provided with a valve which prevents any possibility of a downward draught.

The wind blowing in the funnel creates a partial vacuum at the upper end of the vertical pipe, which insures a continual upward draught in the pipe. The vanes are sufficiently large to keep the funnel always facing the wind, so that the slightest breeze concentrates a stream of air at the smaller end of the funnel, and creates an upward movement of the air to the vertical pipe.



FENNERTY'S VENTILATOR.

This ventilator is well adapted for ventilating dwellings, cars, steamboats, mills, and mines. It has no parts to wear or become injured by exposure. It is inexpensive in its construction, and can be made by ordinary tools.

Examination of Glasses.

The author applies the known blowpipe reactions. Lead in glass or enamel is detected by heating for a minute or two a bead of the sample fused to the end of a small glass rod. Glass free from lead shows no change. Specimens containing much lead blacken, and the bead becomes opaque. Green cupriferous glass, if heated in the reduction flame, is colored in parts an intense purple red. The simultaneous presence of lead masks this reaction. If a fragment which is to be tested for copper or gold is heated in a glass tube, and if both are drawn out a little while soft, the color due to gold remains unchanged, while red copper-glass becomes perfectly colorless.—*Max Müller.*

FRENCH AND ENGLISH WAR SHIPS COMPARED.

At the recent English naval exhibition a number of fine models of war ships of different nations were shown, which, according to the *Engineer*, were of their kind among the most beautiful models ever produced. The armor plates in the models were all made of iron, and being left unpainted, the eye at once takes in what parts are armored, except where covered over with wood. Our contemporary gives the following descriptions:

1. The Admiral Duperré—model nearly 6 feet long, the vessel being 320 feet long, Figs 1 and 2. Her chief artillery features are the great height above water of her heavy guns, viz., 27½ feet; the fact that they fire *en barbette*, being fixed on turntables; and, lastly, her broadside armament of 5½ inch guns. This vessel has a great power of all-round fire with her four heavy 46-ton guns, which are placed two in barbette towers projecting over the ship's side on each bow, and two in towers over the keel, one in the middle of the quarter-deck and one abaft the mizzen mast. She has fourteen broadside 5½ inch guns. As to armor, she is only armored vertically along her water-line and on her barbette towers, the thickness on the belt being 21·6 inches, and on the towers 12 inches. She has a horizontal armored deck flush with the upper edges of the belt and hurricane decks, protecting the barbette guns from the fire of machine guns in tops.

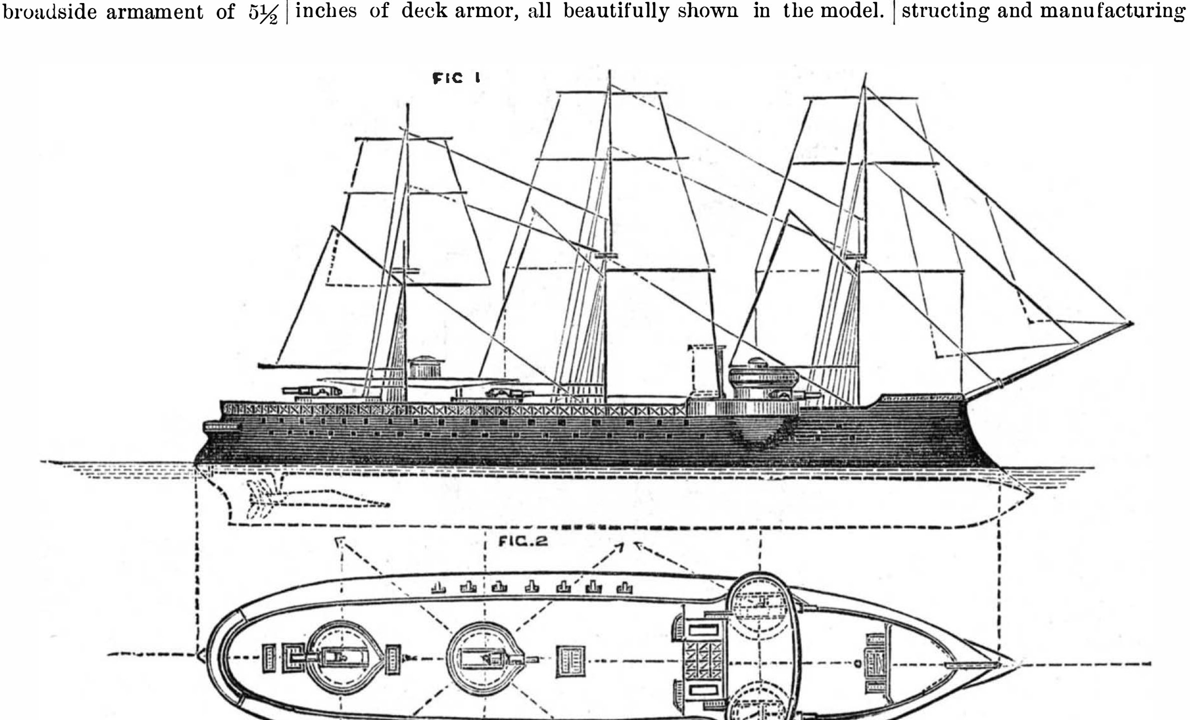
As to form, she has the two marked peculiarities of French armor-clad sea-going ships—an enormous knife-like ram and the narrowed upper deck due to the tumbling home of the sides. She is in the full sense a broadside ship, and fully masted.

2. The Redoubtable has, in a less degree, the characteristic features of great command, narrowed upper deck, and knife-like ram. She is very flat bottomed, and has three keels. She is a central battery ship, armored with 9½ inch plates on her central battery, and her water-line 14 inch plates, and having a horizontal armored deck—2⅓ inches. She has four powerful guns—12½ inches—in her central battery; three—10½ inches—in turntables on barbette towers on the upper deck; two light guns on her poop firing ahead; and six—5½ inches—broadside guns on the upper deck. The tumble home of her sides causes her citadel to project, and enables her heavy guns to have a great sweep of fire, shooting nearly fore and aft if necessary. This is again a fully masted broadside ship. The flaw in her is that she has a single screw, which puts her at a certain disadvantage in turning and ramming.

3. The Devastation. This is another central battery and broadside ship. She has 15 inches of armor on her belts, and a horizontal armored deck of 2¼ inches. The battery has 9½ inches. She carries four heavy 13⅜ inch guns—query, 46 tons—in her central battery; two heavy guns—10½ inches—on her upper deck; and six medium guns—5½ inches—of which two are on the poop and four on the broadsides. The chief features in this ship appear to be the great power of her six heavy guns and the special power of depression, coupled with the high command of her two 10½ inch guns, which are considerably exposed, but receive some protection from a steel shield which moves on the traversing platform, beautifully shown on the model. There are also the usual features in this class of French ships of the tumbling home of the sides and projection of the citadel, with consequent wide sweep of guns, knife-like ram, etc. This vessel is, in our opinion, greatly in advance of the Redoubtable, which she resembles in many respects. She has twin screws.

4. The Tempête. This is a first-class coast defender. She is protected with 11¾ inches of vertical armor, and 2 inches of deck armor, all beautifully shown in the model. She has one turret, with two 10½ inch guns. The peculiar form of turret adopted in the French navy with central conning tower is well seen in this model.

The French ships are shapely and imposing compared with ours. Their high decks and formidable armaments of guns contrast strongly with the heavy low structure seen, for example, in our Devastation, where, if the turret ports happen to be turned away, not a gun is visible. We recollect seeing some army officers arrive at Chatham, who were shown the Glatton, but who failed to see any man-of-war till it was explained to them that the structure that they mistook for a steamboat pier was the then notable ironclad. How the French and English ships would stand in war is another question. The French offer a large target to artillery, and the men are greatly exposed. Our ships are not in a position to take full advantage of this, because they have only a very few guns, which are so heavy that their powers would be wasted in firing at anything except the vital parts of their adversaries. As we have on other occasions pointed out, the great need of the English ships is a second armament of medium guns. Speaking generally, the French ships are calculated to obtain great offensive results with their large armaments of guns, but are very vulnerable.



THE FRENCH WAR SHIP ADMIRAL DUPERRE.

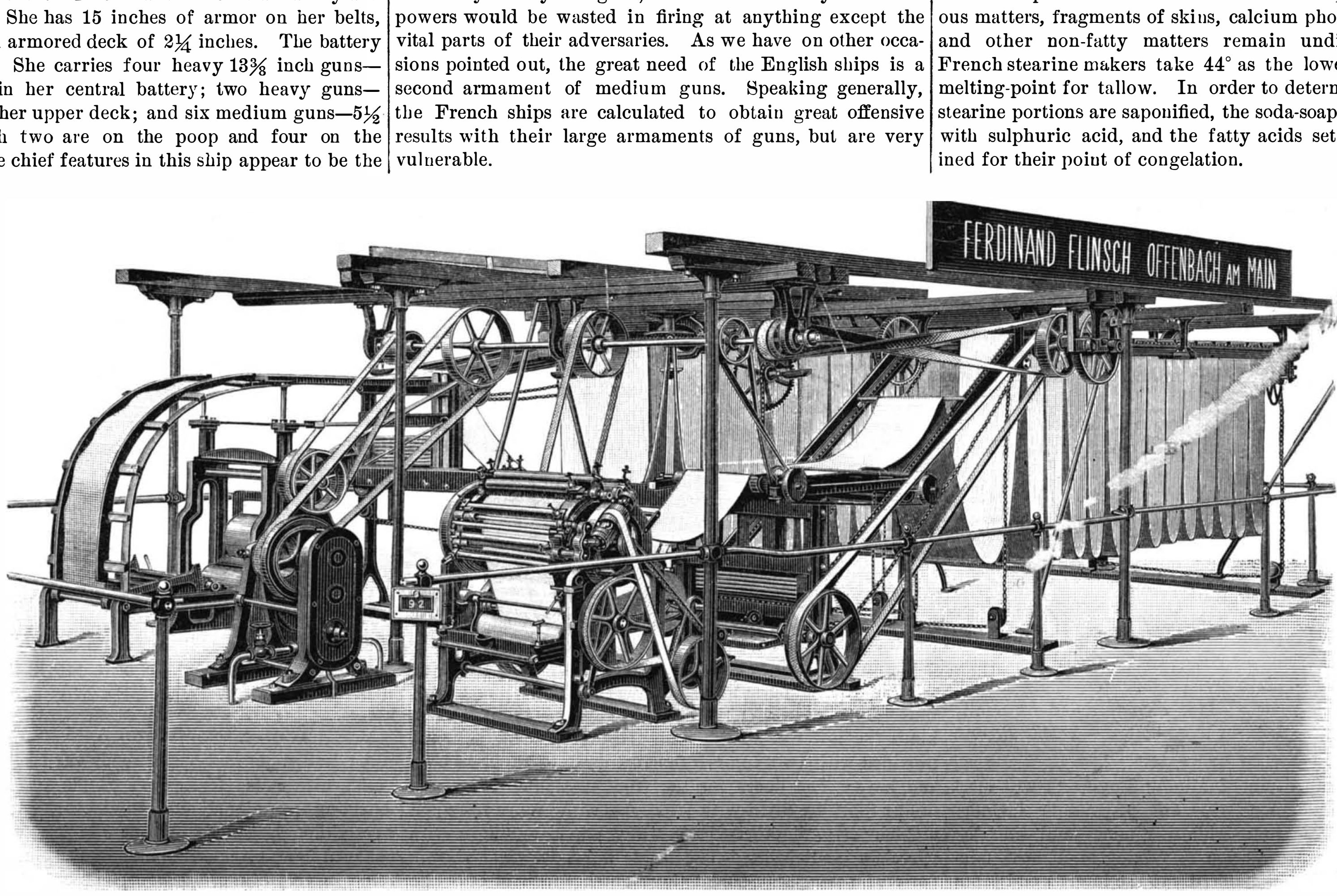
MACHINE FOR COLORING AND GROUNDING PAPER FOR PAPER HANGINGS, ETC.

In printing offices, book-binderies, paper hanging factories, etc., large quantities of colored paper are used which is generally colored on one side only. Formerly these colored papers were produced by manual labor, but of late machines have been used for applying the color, rubbing the same on the paper, drying the paper, and then smoothing the same.

Mr. Ferdinand Flinsch, of Offenbach a. M., Germany, is well known as a manufacturer of machines for coloring paper; and the machine exhibited at the patent exhibition in Frankfurt a. M. gives ample proof of his ability in constructing and manufacturing machines of this class. In the annexed engraving a perspective view of this highly interesting machine is shown. Into the machine the paper is placed in large rolls; it is then unwound by the machine, colored, dried, smoothed, pressed, and finally wound into a roll. The first machine in which the roll of white paper is placed is a coloring machine, and the same draws the paper through coloring mechanisms, and then takes it over a large cylinder, upon which the color is distributed on the paper by a series of rotating brushes. The moist paper is then conducted upon a second machine, which is used for drying it. In this second machine the moist paper is hung on a series of rods or shafts, and is moved backward and forward on the same a greater or less length of time until it is dry. This drying machine is very interesting, and is different from other similar machines inasmuch as chains are used to turn the rods, whereas heretofore belts or ropes were used, which produced irregular movement, as the ropes or belts contracted more or less, and thus some parts of the sheets were moved faster than others. These defects are avoided by the use of the chains. The paper is conducted through the space or room several times, and thus a very great length of paper can be dried within a very small space. After the paper has been dried it is passed to the winding machine, which winds it into a very solid and firm roll, the edges of which are as smooth as if they had been turned off. The fourth machine is an automatic adjuster for the rods or shafts on which the paper is hung while drying. A small steam engine of about one-half horse power is sufficient to drive all the machines.—*Der Practische Maschinen-Constructeur.*

Examination of Tallow at Paris.

The sample is first dissolved in chloroform, when gelatinous matters, fragments of skins, calcium phosphate of lime, and other non-fatty matters remain undissolved. The French stearine makers take 44° as the lowest permissible melting-point for tallow. In order to determine oleine and stearine portions are saponified, the soda-soap is decomposed with sulphuric acid, and the fatty acids set free are examined for their point of congelation.



MACHINE FOR COLORING AND GROUNDING PAPER FOR PAPER HANGINGS ETC.

ROCHESTER WATER WORKS.

(*Continued from first page.*)

of the city. These pipes were laid in the same trench and at the same time as the mains of the gravitation system from Hemlock Lake, and although the two systems are entirely independent of each other, they are connected together occasionally by means of interposed stop gates, so that in case of an emergency either water supply may be used in either system.

The building containing the direct-pressure pumping machinery is located on Brown's millrace, which takes water from the Genesee River, a short distance above the high falls. This water supplies the turbines which drive the pumps, while the water supplied to the suction pits of the pumps is received through a 24-inch wrought-iron pipe from another millrace, further up the river, where the water is not so greatly contaminated with sewage and the refuse of the many manufactories. This supply pipe and the principal distributing main of the Hemlock Lake system have been connected by pipes and valves, so that in case of necessity the lake water can be delivered into the suction wells of the engine house, and thence pumped into the mains of the direct pressure system.

The machinery of the direct pressure pumping system consists of three distinct parts: the first is a set of four combined steam piston engines, with cylinders 16 inches diameter and 27 inch stroke, arranged to exhaust into a condenser or into the open air.

To these four engines, four double acting pumps, 10 inches in diameter and 27 inch stroke, are attached, the piston rod of each steam cylinder being continued through the pump. These rods, however, are made in two pieces, so that they can be uncoupled if required. Any one of the engines may be disconnected from its crank pin, leaving the others free to work.

The second part of the machinery consists of a rotary steam engine, placed in front of the steam set, and operating two rotary pumps for throwing fire streams. The reciprocating engines may also be thrown into gear so as to operate one or both of the rotary pumps.

The third part of the works consists of eight double acting pumps, arranged in two sets, each having four cylinders, 9 inches in diameter and 24 inch stroke. Each of these sets of pumps is driven by a turbine working under a head of about 90 feet. These turbines, although only 25 inches in diameter, are rated at 250 horse power each.

The four combined steam piston engines will develop 300 horse power, and the rotary engines are equal to 150 horse power. Their pumping capacity is 3,000,000 gallons in twenty-four hours, and that of the water set is 4,000,000 gallons in twenty-four hours.

The amount of water supplied daily from Hemlock Lake is about 3,000,000 gallons. It will thus be seen that the city of Rochester is provided with two distinct and separate systems of waterworks, either of which may be furnished with water from the other supply, affording double security and insuring a continuous and plentiful supply.

For our information, and for the plans and elevations, we are indebted to Mr. J. Nelson Tubbs, Chief Engineer of the Rochester Waterworks Department. We are indebted to Mr. G. S. Allis, of Rochester, for the photograph from which we have taken our view of the fountain.

The Aniline Blues.

The finest aniline blues are the highest in price of all the anilines, the light methylene blue being quoted at 100 to 120 francs the kilo, or $9.00 to $10.00 per pound in Paris. They are much sought for, and the *Moniteur de la Teinture* brings an account of an analogous blue called *bleu d'æthylene*, symbol ÆB, which is reported to be made by Oehler, at Offenbach, in all the tints and shades, and with the full range of metallic basis—alumina, tin, zinc, antimony, and iron. Samples of these colors are given in the *Moniteur* as fixed upon loose cotton, cotton thread of various grades, and as printed on fine cotton cloth. They are very beautiful, and justify the claim that they perfectly penetrate the fiber of the cotton. It is claimed that these colors are equal to indigo in brilliancy and fixedness. Double combinations of insoluble metallic tannates are formed with the coloring matter, and these combinations of the astringent with a metallic salt may vary according to the shade desired. Thus we obtain:

1. A shade of pure blue with tannate of ammonia.
2. A deep blue, shading upon violet, with tannate of tin.
3. A rich pure blue with tannate of antimony.
4. A shade of pure blue tinged with red with the tannate of zinc.

The tannate of iron affords darker shades. Varying the proportions of tannate of iron with the æthylene blue, the results vary from a grayish blue to an indigo copper blue, and a full blue black.

By employing yellows and reds in the dying bath with the æthylene, ÆB, we produce a great variety of shades of green, brown, mode, etc. This æthylene blue resists light well, and also the fulling process. It is recommended especially for dyeing cotton *en flotte*, or loose cotton.—*Textile Record.*

THE American Institute of Mining Engineers will meet in Denver, Colorado, Aug. 19. The programme includes numerous excursions to neighboring mines and smelting works. The Denver exhibition of mining appliances, minerals, and so on, will add materially to the interest and profit of the meeting to the members.

A CHEAP COTTAGE.

Mr. J. F. Wellilver, Montour county, Pa., sends to the *Country Gentleman* the following design for a cheap and ornamental frame cottage, with descriptions in substance as follows: The house cost $1,000, and has on the first floor three good-sized rooms; a vestibule 5 by 6 feet, out of which a door leads to both parlor and dining room; a stairway leading to the chambers opens out of the dining room, and the stairs to the cellar are placed directly under, and open into the kitchen, which is of convenient size. Immediately back of it is placed the pantry, which is 5 by 6½ feet. A rear entry, 3½ by 5 feet, affords means of entrance to the house from the back porch. In the second story there are three good-sized bed-rooms, all nearly square, and each provided with a closet of convenient size. A center passageway, which is lighted by a low window in the rear, affords means of communication with the several rooms. Space has been fairly economized throughout in the planning of this building. A cellar 6 feet 6 inches in height is under the entire building; there is to be a cistern under the pan-

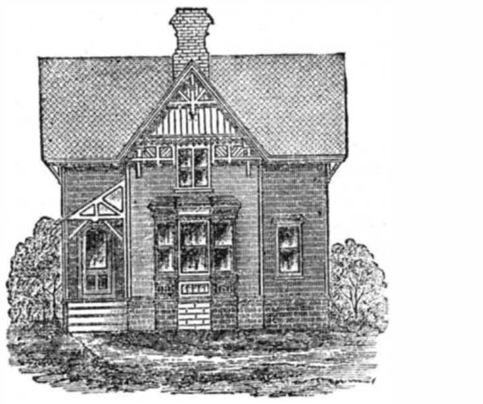


Fig. 1.—Elevation.

try, the excavation for which is to be one foot deeper than that of the cellar. A sink in the corner of the kitchen next to the pantry will have a pump connecting with the cistern.

The foundation below the ground is of field stone, while that above the ground is of quarry stone; the walls 18 inches thick. All the rooms, with the exception of the rear chamber, are accommodated by the one central chimney, which starts from the bottom of the cellar. A grate is provided for the parlor, stovepipe thimbles being inserted for the dining room, kitchen, and the two front chambers. The frame is of sound hemlock, the principal sills being 4 by 8 inches, and the cross sills 6 by 10 inches; the joists are 2 by 9 inches; 16 inches between centers, with one course of bridging through the center. The studs for corners, windows, and doors are 4 by 4 inches, all others to be 2 by 4 inches, 16 inches between centers. The rafters are 2 by 4 inches, 16 inches between centers. Valley rafters, 3 by 7 inches; cellar beams, 2 by 6 inches; all timber well nailed or spiked together.

The exterior is sheeted with sound, seasoned and planed hemlock boards, over which is a simple course of 8-pound rosin-sized building paper. Good white pine siding forms the outside finish. The roof of the bay window is covered with tin, while the main roof is of the best quality of sawed white pine shingles, 18 inches long, and laid 5½ inches to the weather. The roof, preparatory for shingling, is sheeted with hemlock boards, laid with 1½ inch open joints. The

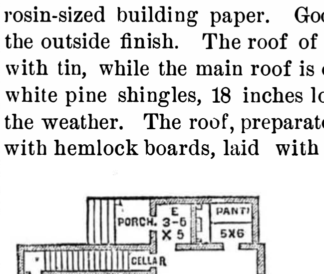


Fig. 2.—Plan of First Floor.

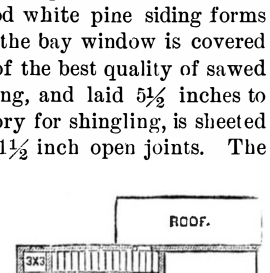


Fig. 3.—Plan of Second Floor.

cornice, window frames, corner boards, parlor bay window, and all outside casings and trimmings, are of good white pine lumber, thoroughly seasoned. The glass required is of the best quality of American, single thickness. The sashes are 1½ inches thick, fitted with pulleys and weights. The outside doors are 1¾ inches thick; the inside doors (with the exception of closets), 1½ inches thick, and the closet doors, 1¼ inches thick. All are four-paneled excepting the porch doors, which have glass above the middle rails. The hardware used about the doors is the best of its kind; the lower doors are hung with three bolts each, and provided with two tumbler mortise locks, with brass bolts and keys. The doors for the front vestibule, parlor, and dining-room are fitted with jet knobs, with bronze roses and escutcheons; all others have white porcelain knobs with porcelain escutcheons. The inside finish is white pine in parlor for all parts except the mantel, which is of white oak. The dining-room is fitted with ash wainscoting and casings, with cherry plinth, cap, and mouldings. The kitchen and other rooms are finished in white pine; the casings for the bed-rooms are 4½ inches wide. The roses are 5 inches wide. The pantry is ceiled up 2 feet 6 inches high to the counter shelf; above the counter shelf there are four shelves supported with rabbeted cleats. Cupboards are constructed under the counter shelf, having two shelves each. The closets have three shelves each. The plastering is put on in the best manner and of the best material. The exterior woodwork is painted with three coats of the best lead and oil; the color a light greenish drab with trimmings a few shades darker; the window blinds are of a color between the two.

The Magnaghi Floating Compass.

The floating compass, invented by Captain Magnaghi, is now in use on board the Duilio, and will probably be generally adopted in the Italian Navy. Its main feature, says *Engineering*, is the suspension of the needle in water, to which has been added one-tenth its volume of alcohol, contained in a vessel with a perforated bottom, which allows the liquid to rest ultimately on an elastic diaphragm. The addition of the alcohol prevents the water from freezing under low temperatures; and the elastic diaphragm allows it to expand and contract during atmospheric changes, without danger of breaking the glass which covers it, or admitting air. On this liquid the needle floats, inclosed in a hermetically-sealed ellipsoidal case, which is very delicately suspended upon a conical brass pivot. The pivot has a sapphire top and a jade point, and the friction is diminished to the utmost possible degree by the most perfect polish. The needle usually consists of six bundles, each made up of five pieces of the best ribbon steel, thoroughly tempered before being magnetized, and separately tested after. These pieces are kept apart by strips of cardboard soaked in oil, and their number can be increased if necessary. Wherever in the apparatus two metal surfaces or edges meet, friction is prevented, and closure secured, by a layer of blotting paper soaked in mineral wax. This is exclusively used for the purpose, because it is insoluble in alcohol; and even the marks and figures in the outside ring are rendered distinct by being filled in with the same substance blackened. All the interior parts of the instrument are silvered, in order to prevent oxidation and galvanic action between the various metals composing it, and to keep the fluid perfectly colorless and transparent. The compass proper (including the floating case with the needles) weighs in the air about 750 grammes; but in the liquid it exercises a pressure of only about 6 grammes on the point of support. The chief advantage claimed for this invention is that the resistance of water being great toward rapid movements and inconsiderable toward slight ones, it leaves the motions of the needle practically free, while shielding it (by its own incompressibility) from all shocks from without. The compasses of the Duilio were not in the least agitated by the discharge of the 100-ton gun, nor by the motion of the screw, although the supports on which they were placed were in such a position as to feel the vibration greatly. They were somewhat disturbed by the rolling and pitching of the vessel; and to meet this difficulty, modifications were made in the shape and arrangement of the different parts, so as to render the floating case thoroughly centrifugal, distribute great portion of the weight round the circumference, and fix the point of suspension very little above the center of gravity. The result of these arrangements is, that when the compass is tilted by the movement of the ship, the needle is so slow to change its position, that before it has again become horizontal the motion is reversed, and the inclination counteracted. The needle is also very little affected by changes in the angle at which the terrestrial magnetic current is inclined to the horizon, which varies in different localities, in consequence of the needles being so much shorter than the diameter of the compass, and being placed too low with regard to the point of suspension. This is proved by the simple test of holding a powerful magnet directly over the north point of the compass, when even this great increase to the vertical force produces only a very slight change in the inclination of the needle. The compass is fitted with a special sextant, in which various improvements have been introduced, to increase the facility and accuracy with which observations can be taken, especially in twilight and cloudy weather.

Danger of Handling Domestic Pets.

Dr. McCall Anderson, in a paper on "The Diagnosis of Diseases of the Skin," in the *Medical Times and Gazette* (p. 601), traces the development of the disease known as favus (*Porrigo favosa*) in human beings to mice suffering from the disease. Cats, which eat the mice, catch the disease, and have been known to communicate it to the children who handled them. Fowls have also been known to suffer from it. The danger of allowing children to handle domestic pets which are suffering from skin disease is probably often overlooked, and deserves to be made known more widely than it is at present.

Testing for Mineral Acid in Vinegar.

An Italian journal recommends the use of methylaniline violet, also called Hofmann's purple and Paris violet, for detecting free mineral acids in vinegar. A solution of this dye, although containing but 0·1 per cent of it, will be changed to an ultramarine blue by mineral acids, even when they are very dilute, while organic acids do not affect the color.

Honey Ants.

BY GRANT ALLEN.

The Garden of the Gods in Colorado is a bit of show-scenery of the true American type—a green amphitheater, studded with vast ledges and cliffs of red sandstone, weathered here and there into chimneys or pillars, in which a distorted fancy traces some vague resemblance to the sculptured forms of the Hellenic gods. Hither, a few years since, Dr. McCook, of Philadelphia, went on his way to New Mexico, where he wished to study the habits and manners of a famous, but little-known insect, the honey ant. To his surprise, he accidentally stumbled here upon the very creatures he had set out to find. There are two kinds of entomologists; one kind, now, let us hope, rapidly verging to extinction, sticks a pin through his specimens, mounts them in a cabinet, gives them systematic names, and then considers that he has performed the whole duty of a man and a naturalist; the other kind, now, let us hope, growing more usual every day, goes afield to watch the very life of the creatures themselves at home, and tries to learn their habits and customs in their own native haunts. Dr. McCook belongs to the second class. He forthwith pitched his tent (literally) in the Garden of the Gods, and proceeded to study the honey ants on the spot.

Like many other ants, these little honey-eaters are divided into different castes or classes; for besides the primary division into queens or fertile females, winged ants or males, and workers or neuters, the last-named class is further sub divided into three castes of majors, minors, and minims or dwarfs. But the special peculiarity which gives so much interest to this species is the fact that it possesses, apparently at least, a fourth caste, that of the honey-bearers, whose abdomen is distended till it is almost spherical by a vast quantity of nectar stored within it. Dr. McCook opened several of the nests, and found these honey-bearers suspended like flies from the ceiling, to which they clung by their legs and appendages. All over the vaulted dome of the ant-hill, these little creatures were clustered in numbers, their yellow bodies pressed tight to the roof, while their big round stomachs hung down behind from the slender waist, perfect globes of translucent tissue, showing the amber honey distinctly through the distended skin. They looked like large white currants, or sweet-water grapes; and as they were actually filled with grape-sugar, the resemblance was really quite as true inside as out.

Where did the honey come from? That was the next question. Everybody knows that ants are very fond of sugar, and they often steal the nectar in flowers which the plant has put there to entice the fertilizing bee. So much damage do they do in this way, that many plants have clothed their stalks with hairs, or sticky glands, on purpose, in order to prevent the ants from creeping up the stem and rifling the nectary. In other cases, however, plants actually lay by honey to allure the ants, when they have anything to gain from their visits, as in the case of those Central American acacias, mentioned by Mr. Belt, which have a nectar gland on the leaf-stalk to attract certain bellicose ants, which so protect them from the ravages of their leaf-cutting congeners. Of course, everybody has heard, too, how our own species sucks honeydew from the little aphides, or plant-lice, which have often been described as ant-cows. But it is not in either of these ways that the honey-ants get their sugar. Dr. McCook had a little trouble in settling this matter at first, for the honey ants are a nocturnal species, and he had to follow them through the thick scrub, lantern in hand; still, he satisfactorily settled at last that they obtain the nectar from the galls on an oak, where it must simply be exuded as an accidental product of injury. The workers take it home with them, and give it to the honey-bearers, who swallow but do not digest it. They keep it in their crops ready for use, exactly as bees keep it in cells of the honey-comb. When the workers are hungry they caress a honey-bearer with their antennæ, whereupon she presses back a little of the nectar up her throat, and the workers sip it from her mouth. The honey-bearers, in short, have been converted into living honey-jars. They are thus passively useful to the community, for in this curiously-ordered commonwealth they also serve who only stand and wait.

How could such a strange result as this have been brought about? Dr. McCook, though not himself an avowed evolutionist, has supplied us with facts which seem to suggest the proper answer to this difficult question. He has shown that the rotunds (as he calls them) are not, in all probability, a separate caste, but are merely certain specialized individuals taken at haphazard from the worker-major class. He saw himself in the nests many worker-majors, which seemed at that moment actually in course of transformation into honey-bearers. Now, it is easy enough to understand why these social insects should wish to store up food against emergencies. At all times, the queen, the young female ants, the males, and the grubs or larvæ are entirely dependent upon others for support. Hence, alike among bees and ants, stores of food are habitually laid by, sometimes in the form of honey in combs and bee-bread, as with the hive-bee; sometimes in the form of seeds and grains, as with the harvesting ants. During the winter months or the rainy season, when food fails outdoors, there must be some reservoir at home to meet the demand of the starving community. Under such circumstances, any trick of manner which tended to produce a habit of storing food would be highly useful to the nest as a whole; and, taking nests as units in the struggle for existence, which they really are, those nests which possessed any such trick would survive in seasons when others might perish. So the tendency, once set up, would grow and be strengthened from generation to generation, those ants which stored most food being most likely to tide over bad times, and to hand on their own peculiarities to the other swarms or nests which took origin from them.

A set of primitive ants, living upon the honey of the oak-galls, have no tendency to produce wax, like bees, because their habits with regard to their larvæ do not lead them to make such cells at all. The eggs and grubs simply lie about loose among the chambers of the ant-hill, instead of being confined in regular hexagonal cradles. Hence the bees' mode of honey-storing is practically impossible for them; they have not the groundwork habit from which it might be developed. But the ants have a crop, or first stomach, in which they store their undigested food, before passing it into the gizzard, exactly as in fowls. When ants come back from feeding, whether on flowers, on aphides, or on galls, their crops are very much distended; and they can bring back the food to their mouths from these distended crops, to supply the grubs and their other helpless dependents in the nest. If, therefore, some of the ants were largely to over-eat themselves, they would be able to feed an exceptionally large number of dependents.

Dr. McCook observed that some very greedy workers, returning to the nest, fastened themselves upon the roof in the same position as the honey-bearers, and in fact seemed gradually to grow into rotunds. The other ants would soon learn that such lazy, overgrown creatures were the best to go to for food; and, in time, these gorgers might easily become specialized into a honey-bearing set of insects. The workers would bring them honey, which they would store up and disgorge as needed for the benefit of the rest as a whole. If the honey passed into their gizzards and was digested, they would be a positive dead loss to the community, and so the tendency would soon be eliminated by natural selection, because the nests possessing such workers could not hold their own in bad times against neighboring communities. But as only a very small quantity is ever digested—just as much as is necessary to keep up the sedentary life of such immovable fixtures—the effect is about the same as if the honey were stored in cells of wax. The ants, in fact, utilize the only good vessel or utensil they have at their disposal, the flexible and extensible abdomen of their own comrades.

The greatest difficulty is to understand how the workers first acquired the habit of feeding these lazy members to such repletion; but as all ants "take toll" of one another, this is much less of a crux than it looks at first sight. A very greedy ant, which not only ate much itself while out foraging, but also took toll of all others in the nest, after it was too full to move about readily, would be in a fair way to become a rotund. And as it would thus be performing a useful function for the rest, at the same time that it was gratifying its own epicurean tastes, the habit would soon become fixed and specialized, till at last we should get just such a regular and settled form of honey-storing as we see in this Colorado species. Indeed, another totally distinct type of ant in Australia has arrived at exactly the same device quite separately, as so often happens in nature under similar circumstances. Whatever benefits one creature under any given conditions will also benefit others whose conditions are identical; and thus we often get adaptive resemblances between plants and animals very widely removed from one another in genealogical order.—*Knowledge.*

The Blue Process of Copying Tracings.

As we have had several inquiries recently in regard to the best method of copying tracings by what is known as the "blue printing process," we will give a brief description of the method employed by us; we do not say it is the best, but it certainly is as simple as any other, and has always given us perfect satisfaction.

The materials required are as follows:

1st. A board a little larger than the tracing to be copied. The drawing-board on which the drawing and tracing are made can always be used.

2d. Two or three thicknesses of flannel or other soft white cloth, which is to be smoothly tacked to the above board to form a good smooth surface, on which to lay the sensitized paper and tracing while printing.

3d. A plate of common double-thick window glass of good quality, slightly larger than the tracing which it is wished to copy. The function of the glass is to keep the tracing and sensitized paper closely and smoothly pressed together while printing.

4th. The chemicals for sensitizing the paper. These consist simply of equal parts, by weight, of citrate of iron and ammonia, and red prussiate of potash. These can be obtained at any drug store. The price should not be over 8 or 10 cents per ounce for each.

5th. A stone or yellow glass bottle to keep the solution of the above chemicals in. If there is but little copying to do, an ordinary glass bottle will do, and the solution made fresh whenever it is wanted for immediate use.

6th. A shallow earthen dish in which to place the solution when using it. A common dinner-plate is as good as anything for this purpose.

7th A brush, a soft paste-brush about 4 inches wide, is the best thing we know of.

8th. Plenty of cold water in which to wash the copies after they have been exposed to the sunlight. The outlet of an ordinary sink may be closed, by placing a piece of paper over it with a weight on top to keep the paper down, and the sink filled with water, if the sink is large enough to lay the copy in. If it is not, it would be better to make a water-tight box about 5 or 6 inches deep, and 6 inches wider and longer than the drawing to be copied.

9th. A good quality of white book-paper.

Dissolve the chemicals in cold water in the following proportions: 1 ounce of citrate of iron and ammonia, 1 ounce of red prussiate of potash, 8 ounces of water. They may all be put into a bottle together and shaken up. Ten minutes will suffice to dissolve them.

Lay a sheet of the paper to be sensitized on a smooth table or board; pour a little of the solution into the earthen dish or plate, and apply a good even coating of it to the paper with the brush; then tack the paper to a board by two adjacent corners, and set it in a dark place to dry; one hour is sufficient for the drying; then place its sensitized side up, on the board on which you have smoothly tacked the white flannel cloth; lay your tracing which you wish to copy on top of it; on top of all lay the glass plate, being careful that paper and tracing are both smooth and in perfect contact with each other, and lay the whole thing out in the sunlight. Between eleven and two o'clock in the summer time, on a clear day, from 6 to 10 minutes will be sufficiently long to expose it; at other seasons a longer time will be required. If your location does not admit of direct sunlight, the printing may be done in the shade, or even on a cloudy day; but from one to two hours and a half will be required for exposure. A little experience will soon enable any one to judge of the proper time for exposure on different days. After exposure, place your print in the sink or trough of water before mentioned, and wash thoroughly, letting it soak from 3 to 5 minutes. Upon immersion in the water, the drawing, hardly visible before, will appear in clear white lines on a dark blue ground. After washing, tack up against the wall, or other convenient place, by the corners to dry. This finishes the operation, which is very simple throughout.—*The Locomotive.*

Requisites for a Good Operator.

A correspondent writes that he is able to transmit forty-two words a minute, by the watch, for a considerable length of time, and to receive, without difficulty, the writing of a private line with forty offices, some of them occupied by Western Union operators, and he desires to know whether this degree of skill entitles him to be rated as a good operator. Inquiries of this kind are often received, implying that ability to transmit and receive a specified number of words per minute constitutes a standard by which a good or a "first-class" operator may be distinguished—an error very common to novices, and very mischievous. Speed, when combined with other qualifications, is certainly a very desirable accomplishment, but it is not the first requisite of telegraphic skill. Some of the men who have ranked highest in the profession have not been remarkable for speed. It is the old story of the tortoise and the hare over again; it is the steady gait and sound judgment that tell. If the correspondent can transmit forty-two words a minute in good, ringing Morse, and can transcribe from a line at the same rate, making every letter unmistakably legible (not necessarily ornate); if he can quickly adjust his instrument to every variation in the circuit, particularly in bad weather, or on a faulty line; if in sending he exercises judgment, and gauges his writing to the ability of the receiver; if he has that peculiar telegraphic sense which enables him to instantly detect an error, even in a cipher message; if he never "breaks" except when in doubt as to the correctness of a word, and then always breaks; if his habits are irreproachable; if he has the good sense never to allow his temper to be ruffled by anything that occurs on the line; if he can do and be and suffer all this for nine hours a day, without leaving his chair, then he may justly claim to be a good operator. If, in addition to these accomplishments, he can transmit forty-two words a minute with one hand, while "timing" with the other the messages he has sent, and can eat his frugal luncheon without suspending either of the other operations, he may be regarded as a first-class operator, and will probably have no difficulty in obtaining a position at from $70 to $80 per month. All that is then necessary is for him to become thoroughly conversant with the properties of electricity, and the applications thereof, and he is reasonably certain (if he lives) to reach the top of the profession, the length of time required depending to a great extent upon the maneuvers of a certain gentleman in New York, Mr. Jay Gould.—*The Operator.*

Delicate Tests for Sulphurous Acid.

L. Liebermann gives the following as the most delicate test for sulphurous acid in wine, cider, and other liquors: A portion of the wine is distilled off, about 15 or 20 c. c. (one-half ounce), and diluted with an equal volume of distilled water and a few drops of an iodic acid solution added. If sulphurous acid is present the acid acquires a yellowish-brown color; chloroform shaken with it becomes pink in color. If the liquid contains 1 part acid in 500,000 parts, 2 c. c. is sufficient to detect it. Or some of the wine is distilled, chloride of barium and hydrochloric acid added. The liquid remains clear until concentrated nitric acid is added and heated, when a white precipitate forms. It can also be converted into sulphydric acid by means of sodium amalgam and hydrochloric acid and then detected by lead paper.

CONTRACTORS' PLANT.

We give engravings of several machines for hoisting and handling heavy materials. They are especially adapted to the wants of contractors, and find extensive use in quarries in elevating materials for building, for working derricks, and for numberless purposes that need not be mentioned.

In Fig. 1 of the engravings is shown a horse power and boom hoister for working a derrick, a powerful machine, by which a horse can raise eight or ten tons, and at the same time raise the boom while the whole weight is on the derrick, or lower it if required, or one part can be worked independently of another, or the several parts of the machine can be worked together, thus enabling the builder to place a stone exactly where he may require it. The brake is so simple and powerful that little effort is required to hold a very heavy stone within an inch of where it is to be laid, and the brake on the boom drum enables the attendant to lower the boom to any desired place with the greatest speed.

With a long boom it gives great facilities in work, and the boom hoister does away with the tedious old way of raising the boom by hand. For quarrying this machine is peculiarly adapted. A stone can be placed in or out, the full sweep of the boom giving the stone cutter great advantage in his work. The machine is also very effective in loading stone on a truck or car placed anywhere within range of the boom.

Fig. 2 shows a horse power, without boom hoisting attachment, for raising or lowering stone or any heavy material. It is small, easily handled, durable, and light working. It works on cast steel shafts, and has no clutches to throw out or in gear. The gear wheels can be put out or in gear while the horse is in motion. There are flanges on pitch line of gears to prevent them from breaking. The machine has gearing attachment to take up slack rope by hand, and a powerful brake to hold the stone wherever required. The manufacturers inform us that a stone three or four tons weight can easily be handled by this machine.

Fig. 3 represents a horse-power machine for raising a bucket or weight weighing from three to five hundred pounds seventy-five feet per minute. It is designed principally for mining purposes, or raising building material in the erection of high buildings. The machine is small, light, and easily handled, but sufficiently strong to do the desired work. It can be thrown out or in gear while in motion. A powerful brake-band is applied to the drum, so that in case of an accident to the driving gear the drum still remains wholly under the control of the driver. He can hold the weight where it may be required, or lower it at any desired speed. This machine has an attachment on the drum to take up slack-rope by hand.

For further information, address the Contractors' Plant Manufacturing Co., 296 Exchange Street, Buffalo, N. Y.

Animal Charcoal Filters.

Animal charcoal has been generally regarded as one of the best materials for packing filters intended for the purification of water for drinking and culinary purposes, but Professor Frankland, in a recent letter to the London *Times*, gives the results of his investigations concerning it as follows: My first experiments on the filtration of water through animal charcoal were made on the New River Company's supply in the year 1866, and they showed that a large proportion of the organic matter was removed from the water. These experiments were afterward repeated, in 1870, with Thames water supplied in London, which contains a much larger proportion of organic matter, and in this case also the animal charcoal removed a large proportion of the impurity. In continuing the use of the filter with Thames water, however, it became evident that the polluting matter removed from the water was only stored up in the pores of the charcoal, for, after the lapse of a few months, it developed vast numbers of animalcules, which passed out of the filter with the water, rendering the latter more impure than it was before filtration. As a memoer of the Royal Commission on River Pollution and Domestic Water Supply, I reported in 1874 on these experiments as follows: "Myriads of minute worms were developed in the animal charcoal, and passed out with the water, when these filters were used for Thames water, and when the charcoal was not renewed at sufficiently short intervals. The property which animal charcoal possesses in a high degree of favoring the growth of the low forms of organic life is a serious drawback to its use as a filtering medium for potable waters." Animal charcoal can only be used with safety for waters of considerable initial purity; and even when so used, it is essential that it should be renovated at frequent intervals, not by mere washing, but by actual ignition in a close vessel.

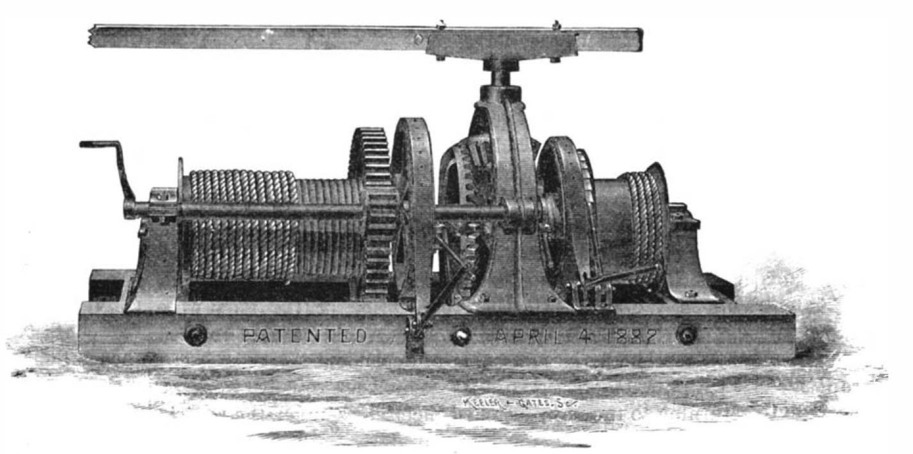


Fig. 1.—DERRICK HORSE POWER AND BOOM HOISTER.

The Food Supply of Europe.

Notwithstanding the enormous outflow of population from Europe, and the simple if not scanty diet of the poorer masses that remain, the problem of food supply is already a serious one. The increase of population is about 3,000,000 a year, while the annual food product is equal only to eleven months' consumption. The rest, aggregating nearly 800,000 tons of meat and 8,500,000 tons of grain, has to be imported.

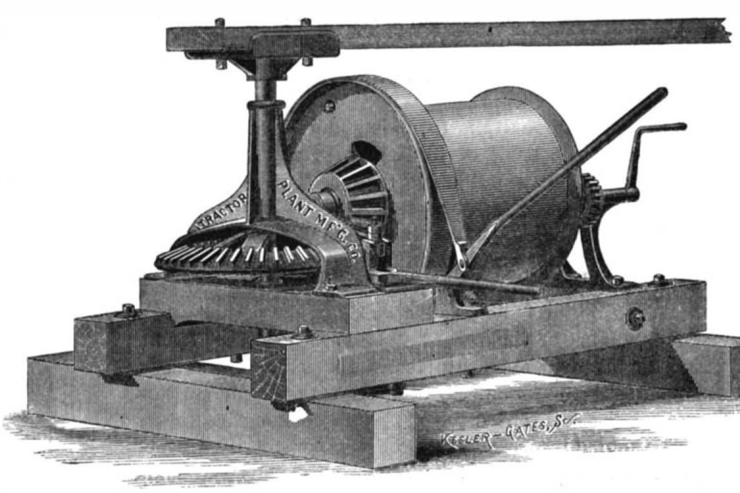


Fig. 2.—HORSE POWER FOR CONTRACTORS.

The chief deficit is in the British Islands, which have import every year nearly 300,000,000 bushels of grain and 650,000 tons of meat.

An Arizona High Bridge.

The completion of the iron bridge of the Atlantic and Pacific Railway over the cañon Diablo, in Arizona, adds another to the list of high bridges. It spans a dark gloomy gorge some 250 feet deep. The bridge is 240 feet above the water, 541 feet long, weighs 837,130 pounds, and cost $200,000.

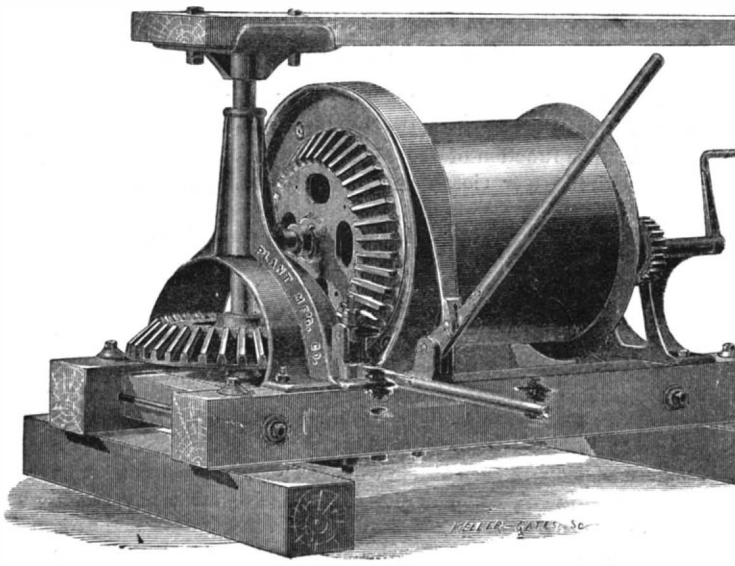


Fig. 3.—HORSE POWER FOR MINERS AND BUILDERS.

Impervious Walls.

Every builder knows the tendency there is in a warm house to draw up the damp from a saturated soil. It has, indeed, been remarked by Prof. Rolleston and others that every warm building has the effect of creating a kind of barometric pressure, by which the gases and vapory particles in the soil rise within the area covered. We have seen the application of asphalt to foundations and areas covered become a pretty general measure of precaution in preventing these effects; but it is rather remarkable to find no preventive means taken to arrest the absorption of damp into walls above the roof level, and into cellars and basements. We rarely find asphalt, or any other bituminous material, like the "hygeian rock" composition used for any but horizontal courses.

Mr. E. Christian, not long since, called attention to the use of asphalt placed vertically, and it is strange to find architects and builders going on building basements in damp soils, and taking no other precaution than using Portland cement upon puddle or clay. Very often, as in the case of houses at Oxford, Salisbury, and other marshy places, the cellars of houses are surrounded at all times by water, or rather the supersaturated soil. But builders and architects seem to think in such places that walls below the ground level may be damp without detriment, so long as they put a course in to check its course upward beyond the ground floor. The remedies are in the hands of architects. Cases, indeed, here and there of cellars being incased by asphalt may be found as early as 1857, and in one case a depth of five feet of water was kept out of a basement by the use of Claridge's asphalt. We also know of some dock stores treated with this material several feet below water, the asphalt being applied to the walls as well as the floor. In building cellar walls of houses the best plan is to connect the horizontal layer with the vertical casing of this material; the damp proof or horizontal course ought to be made to extend beyond the side of wall on the outside by forming a set-off on the footing, so that at the junction of the vertical casing with the horizontal course a good filleting of the asphalt may be made. Walls with vertical courses may also be constructed in two half-bricks, or a brick on flat and one on edge, and the cavity filled up with the new bituminous compound, the hygeian rock composition. Such a wall is stronger than a solid one of mortar, as the material binds the two thicknesses together by running into the joints partly.

We have, therefore, two excellent plans of rendering cellars impervious; but there are other positions in which the vertical lining is not used as it ought to be. We mean in parapet walls and copings and chimney-stacks. The best material for this purpose is Claridge's asphalt. Let us take a house with a coped parapet. Here the asphalt ought to be placed below the coping stones, then brought down the parapet on the inside, and finished at the flashing with a fillet. Even a skirting of the material may be adapted, and lead work and gutters saved. The work is best done by raking out a joint of mortar of the wall so as to form a key for the asphalt. Another important application of the vertical impervious lining is the protection of gable walls, which ought always to have asphalt worked under the copings and brought down below the slates, or to the level necessary to insure dryness. Chimney-stacks and all vertical brickwork above the roof let in as much wet from porous bricks as the foundations, and may be defended by courses of asphalt as a coping, and just below the roofing surface, so as to intercept absorption downward.—*Building News.*

Explosive Alloys of Zinc and Platinum.

Osmium, is the only one of the platinum metals which does not retain zinc when its alloy with a large excess of zinc is treated with an acid capable of dissolving this metal The others retain obstinately about 10 to 12 per cent, and the metals insoluble in *aqua regia* (rhodium, iridium, and ruthenium) remain in the state of peculiar products, without metallic luster, which seem to be an allotropic modification of the true alloys. It is impossible to comminute the osmides by mechanical action. A triple alloy of osmium, iridium, and zinc, if heated to about 300°, takes fire suddenly, almost with explosion, diffusing fumes of zinc and of osmic acid.—*H. Sainte-Claire Deville and H. Debray.*

A NEW SPECIES OF ZEBRA.

(*Equus Grevyi, M. Edw.*)

The progress in our geographical knowledge, the exploration of distant countries that had not before been visited by Europeans, and a profound study of certain corners of our own soil, have, in recent times, singularly increased the domain of the natural sciences. Animals of all sorts have been described, and, thanks to the zeal of traveling naturalists, and to the commercial relations established with foreign countries, a host of new species has come to enrich our museums. Yet, in such acquisitions, all branches of natural history have not been equally favored; for, as regards the number, if not the value of the specimens, entomology and malacology have received the larger part. Under such circumstances, the discovery of a mammal, especially one of large size, assumes the proportions of a true scientific event. So we have thought we should interest our readers if we gave them as faithful a representation as possible, along with a succinct description, of a zebra which will soon ornament the galleries of the Museum of Natural History at Paris.

This zebra, which was captured in that region of Eastern Africa which is called the country of the Gallas, has been for some days at the Menagerie of the Jardin des Plantes. It was offered as a present to the President of the Republic of France by His Majesty Menelek, the King of Choa, and given by the former to the Museum of Natural History. The animal, which was brought to France by Mr. Brémond, was given, during its voyage and on its arrival, all the care desirable; but, at the moment when it was hoped that some interesting observations were to be made upon it, it was suddenly taken off by a stroke of apoplexy, brought on no doubt by the fatigue attending a long trip by rail succeeding an ocean voyage that occurred at the hottest season of the year. Happily, the remains have been preserved, and, mounted with much art, they permit of appreciating, as well as if living, the distinguishing characters of this species which, up to the present time, had entirely escaped the researches of travelers. Comparisons between this zebra and other representatives of the genus *Equus* are the more easy in that the group contains, at the present day, only a very small number of species. These, moreover, are divided into two categories—on the one hand, species having a coat of uniform color, or one marked only with a dark band on the dorsal line, as the horse, ass, dzigguetai, and hemippus; and, on the other hand, such as have a coat marked transversely by more or less numerous bands, as the common zebra, the dauw, or Burchell's zebra, and the quagga. It is evidently to this latter category that belongs the animal whose portrait we now publish, the likeness being reproduced from an excellent photograph taken by Dr. Villanes. But this zebra, which Mr. Milne Edwards proposes to name Grevy's zebra (*Equus Grevyi*) cannot be confounded with any form previously known. In fact, in the quagga, which inhabits Southern Africa, and which in its proportions resembles a horse rather than an ass, the head, neck, and front of the body only exhibit stripes of a dark chestnut-brown, while the posterior portions, the legs and the tail, are grayish white. In the dauw (*Equus Burchelli*), which lives in the same country, the brown stripes are prolonged on the posterior part of the body, but the tail is hairy up to the root like that of the quagga and horse. Finally, in the ordinary zebra (*Equus zebra*), which is met with from the Cape up to the south of Abyssinia, and which, in the markings of its coat and the form of its tail, makes a nearer approach to Grevy's zebra, the transverse stripes are much less numerous, not so fine, and are less clearly defined than in the new species, and there is not along the spine a so well defined dark stripe. This latter, which is of a purplish black, starts from the beginning of the mane, on the withers, and is bordered on either side, on the rump, by a wide, white band, and is prolonged into a tapering stripe along the tail. Two-thirds of the tail is cylindrical and covered with short hairs, as in the ass and zebra, while the extremity carries a tuft of long black and white ones.

The animal that we are describing was still young, judging from its dentition, and yet its size was that of a fully adult zebra, it measuring not less than four feet in height at the withers. The markings that ornament its coat seem as if traced with the pencil, and are of a purple brown verging on black, standing out boldly on a ground which is white with just a suggestion of gray. As may be judged by the figure, a few of them bifurcate and anastomose on the shoulders and thighs, and also on the forehead; but a little lower, between the eyes, they run parallel and end before reaching the extremity of the nose (which is of a brownish color), so that the latter is marked transversely by a colorless zone. On the contrary, there is remarked upon each ear, a little under the tip, a black band, which is prolonged along the edge of the pavilion. As for the mane, that exhibits an alternation of black hairs with tufts of white.

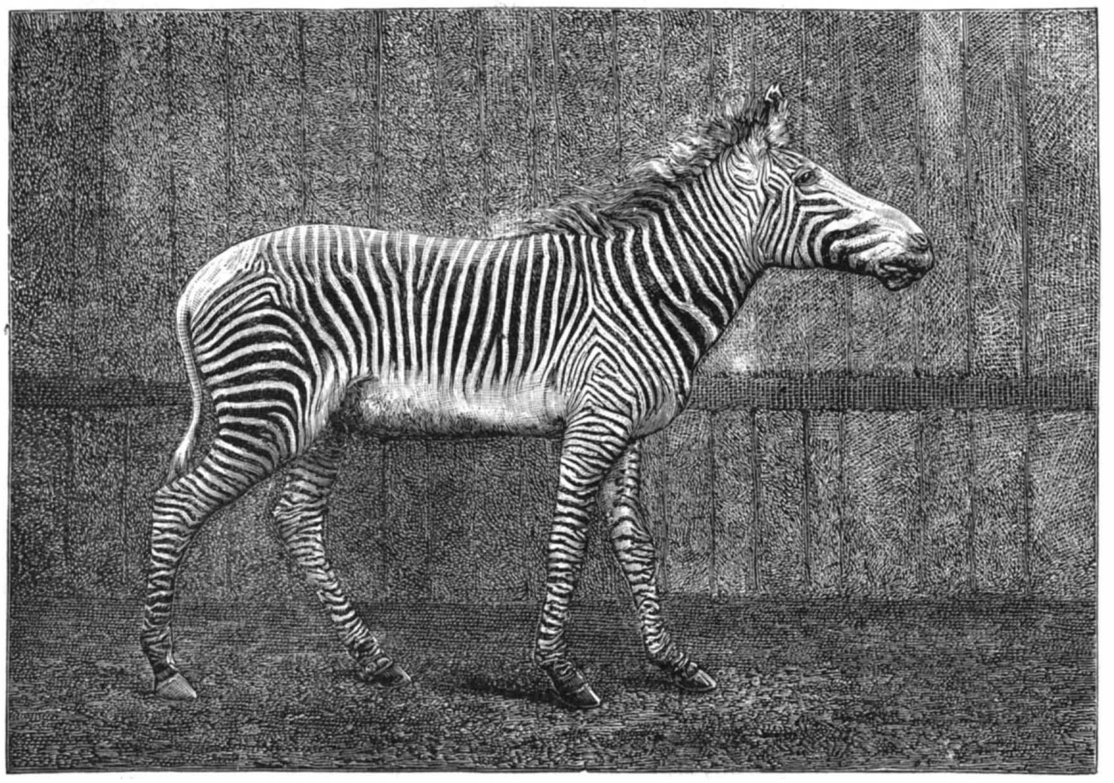


Fig. 1.—A NEW SPECIES OF ZEBRA.—FROM A PHOTOGRAPH.

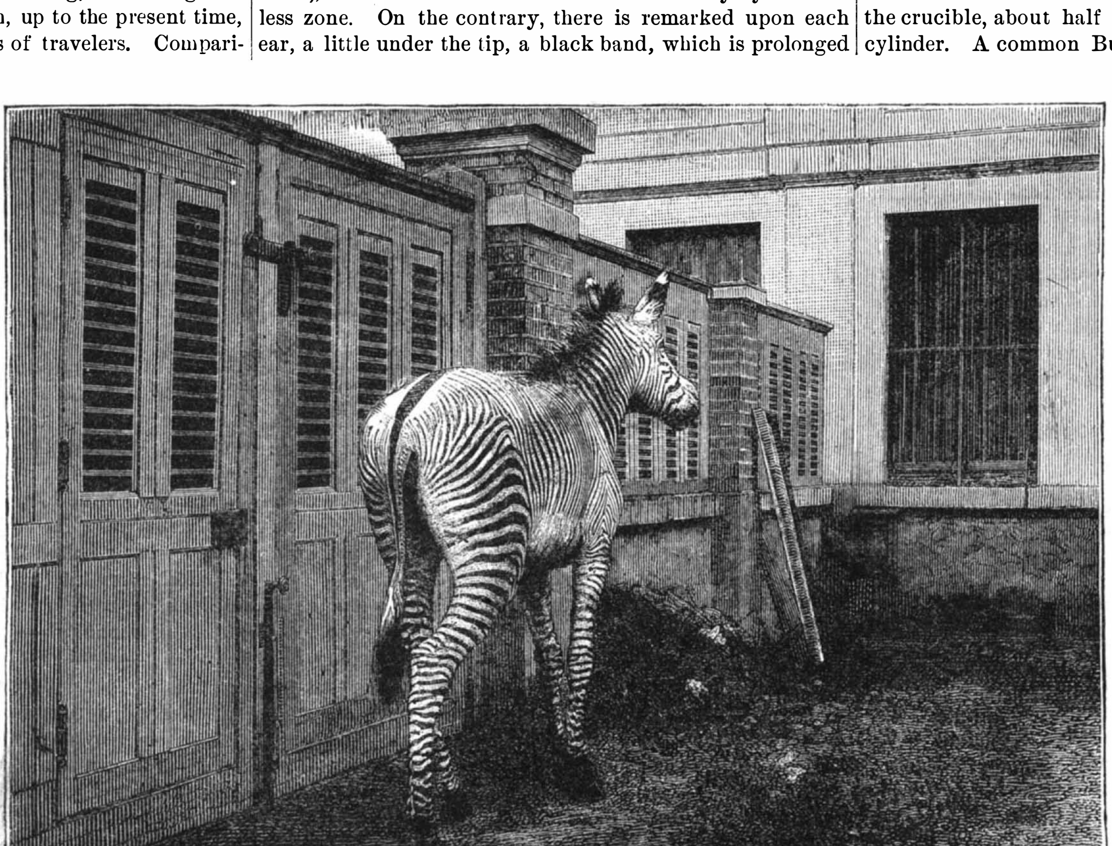


Fig. 2.—NEW SPECIES OF ZEBRA.—THREE-QUARTERS VIEW.

Unfortunately, we know nothing of the habits of this interesting species, but everything leads to the belief that they are the same as those of other horses with striped coats. All travelers are in accord in saying that the latter live either in the plains or in the broken portions of Africa, in herds of ten to thirty individuals, which are generally placed under the leadership of one or several males, and which sometimes associate with herds of antelopes, or even of ostriches. But, strange enough, in spite of their sociable instincts, it appears that zebras of one species never mingle with those of another. The voice of these animals is harsh and resounding, partaking of the braying of the ass and the neighing of the horse.

In gait they are extremely swift, and when running at full speed can hardly be ridden down by the best race horse. So it is generally through strategy that these quadrupeds are caught, and it is even alleged that when a horseman has succeeded in entering into the midst of a herd, and in separating the young from their parents, he can without difficulty make himself followed by the colts, who take the horse for their mother. The majority of the zoological gardens possess dauws, zebras, or quaggas, and at different times the directors of such establishments have endeavored to tame these animals and make them serve as saddle or wagon horses; but their efforts have rarely been crowned with success. On the contrary, the dauw, the zebra, the quagga, the ass, the dzigguetai, and the horse have been successfully crossed with each other in different ways; and it is a fact worthy of remark that hybrids have been constantly obtained which exhibit the zebra stripes on the legs, even when one of the parents had a coat of uniform color. The persistence of such a character after crossing gives proof, evidently, in favor of its antiquity, and we may, strictly speaking, in relying on this phenomenon of atavism, hold that the horses of tertiary periods had a coat striped like that of the zebras of the present epoch.—*E. Oustalet, in La Nature.*

ASH IN FLOUR.—Ten grms. of the sample are carbonized in a spacious platinum capsule, which is readily effected in less than ten minutes. The charred mass is then broken up with a platinum spatula into fragments the size of a pea, and transferred to a middle-sized platinum crucible. If any carbon adheres to the sides of the capsule it is easily incinerated, and may then be added to the bulk. Over the open crucible is turned a cylinder of mica, wide enough to leave an interval of 2 to 3 mm. between its inside and the outside of the crucible, about half the height of which is within the cylinder. A common Bunsen burner effects the complete incineration of the carbon in six to eight hours at a low red heat.—*C. Weigelt.*

Alumina in Ferric Oxide.

The solution of alumina and ferric oxide, which should not exceed 100 c. c., is mixed with ammonia until the free acid is chiefly neutralized. He then adds a concentrated solution of hyposulphite to reduce the ferric oxide to the ferrous condition. The solution thus prepared is slowly poured into a boiling ammoniacal solution of potassium cyanide, the volume of which is at least double that of the solution of alumina and iron. The clear greenish yellow liquid thus obtained, after being heated for a short time, is cooled quickly and completely by setting the beaker in cold water, and is then acidified with hydrochloric acid. The alumina is then precipitated with ammonium carbonate; the precipitate is allowed to settle, collected on a filter, and washed with boiling water. The alumina appears nearly white if the proportion of iron is relatively small, and if the separation of iron cyanides has been avoided by working expeditiously. If the precipitate has a dirty yellowish color, it is digested along with the filter in dilute hydrochloric acid (1: 4). The iron cyanides remain insoluble, while the alumina is dissolved, and is reprecipitated from the filtrate in the known manner.—*E. Donath.*

THE Albany Aniline and Chemical Works, Albany, N. Y., are adding new buildings, an average of 300 feet square, and are arranging to manufacture all the colors that can be made in Europe.

Naphthaline.

BY DR. GUSTAV SCHULTZ, INSTRUCTOR IN CHEMISTRY AT THE UNIVERSITY OF STRASSBURG.

In visiting gas works, the attentive observer will notice a white crystalline sublimate which accumulates, frequently in considerable quantities, on the walls of the gasometers. It consists of almost pure naphthaline, a hydrocarbon made up of 93·7 per cent of carbon, and 6·3 of hydrogen. When heated to 217° C. (422½° Fahr.), this substance begins to boil; but like many other substances, musk for example, it possesses the property of volatilizing to a very considerable extent at ordinary temperatures. Although the illuminating gas that is made from coal is purified over and again, both by physical and chemical means, before it is sent out into the street mains, yet the naphthaline is so volatile that some of it is always present in coal gas, and, indeed, increases its illuminating power. Frequently, when gas pipes are cleaned that are distant several miles from the works, fine plates of naphthaline are found in them. In fact, the pipes are often stopped up with this naphthaline which has been carried along and then deposited there.

HOW IT IS FORMED.

Naphthaline is formed, like many other hydrocarbons that are capable of resisting a great heat, whenever stone coal, brown coal, or wood are subjected to what is known as dry distillation, *i. e.*, strongly heated out of the air. When alcohol, vinegar, ether, and many other organic substances that contain hydrogen, are subjected to a high temperature, as, for example, passing them through iron tubes heated to redness, more or less naphtha is formed. For the same reason, this hydrocarbon last named is *always* present in coal tar, wood tar, and similar products obtained from organic bodies by the application of great heat.

ITS OCCURRENCE IN COAL TAR.

Naphthaline is present in large quantities, up to 8 per cent in coal tar, and as this has been consumed in enormous quantities for several years past in the manufacture of colors, of carbolic acid, and of benzole, the amount being estimated at about six million hundredweight, it may not be uninteresting to learn how the naphthaline thus obtained is disposed of and made useful to mankind.

THE FIRST NAPHTHALINE RED.

This hydrocarbon has been known since 1820, when it was first discovered by Garden, but its introduction into the arts only dates back about 20 years, when the distillation of coal tar in large quantities for the production of benzole, to be used in making the aniline colors, began. In order to utilize the naphthaline, which was then won as a by-product, attempts were made to make dyes in a total analogous way to what they are made from benzole, and by the same methods as those by which the aniline dyes were produced. But poor success at first rewarded their efforts. Of all the dyes made at that time, only one, the *naphthaline red*, that was discovered by Schiendl, of Vienna, and named by him Magdala red to commemorate the Abyssinian victory, attracted any considerable attention, on account of its delicate pink tint and its fluorescence. But at present even that dye is almost entirely supplanted by eosine, so that but little of it is manufactured now. For a short time a small quantity of naphthaline was used in making benzoic acid, by a process in which phthalic acid formed the intermediate stage. But all these varied uses of it do not consume an amount at all proportioned to the great quantity of it that is made, so that it became necessary, in order to get rid of it or to make any use at all of it, to burn it and convert it into fine lampblack that can be used for India ink and varnish.

In this, as in many other waste products furnished by the great industries, the progress of science points out a road that is likely to lead to a rational utilization of it. Although at present the naphthaline obtained in making gas from coal and in working up coal tar, is not all used economically, still the quantity which is either used directly or converted into valuable products is very considerable, and daily increases.

ITS PREPARATION FROM COAL TAR.

Before taking a survey of the naphthaline industry of the present, let us briefly consider the method by which the hydrocarbon is separated from the coal tar, and purified. The tar is first distilled in wrought iron boilers, which are provided with covers and pipes to carry off the vapors, which are carefully cooled and collected.

First come over low boiling oils and ammoniacal water; next follows the "light oil," called so because it floats on water; then a product which sinks in water, and hence called "heavy oil." A portion of the latter solidifies to a buttery mass of a green color. This is very valuable because it contains anthracene, the starting point in making artificial alizarine, and hence also called anthracene oil. The residue remaining in the kettle is drawn off, and when cold forms a brilliant black pitch, used under the name of artificial asphalt for street pavement, for making pipes, and numerous other purposes.

The latter portion of the light oil and the earlier portion of the heavy oil furnish the material from which naphthaline is made. When this product is cool, the naphthaline gradually separates and is freed from the oily contaminations by filtering and pressing out. Since the hydrocarbon always contains basic and acid bodies, they are to be removed by sulphuric acid and caustic soda lye. Finally, the purified substance is subjected to distillation or sublimation, when it is obtained in a pure white condition.

IN CARBURETERS.

In this condition the naphthaline is ready for use, as, for example, to increase the illuminating power of gas. For this purpose, small lamps have recently been constructed which have a small metallic capsule to hold the naphtha line. The gas that is to be carbureted is passed through the hydrocarbon, when it becomes charged with the vapors, and then passes to a burner where it is ignited. The flame heats a metallic plate which is connected with the metallic capsule above mentioned, so as to vaporize the naphthaline more rapidly, and thus increase the brightness of the gas flame.

AS AN ANTISEPTIC.

Naphthaline has recently found a new and important use in medicine. It has been found that this hydrocarbon is an excellent antiseptic, which kills fungi and bacteria in a short time. For surgical bandages and in contagious diseases, so far as experiments have been made, it has answered an excellent purpose, and seems well adapted to replace in many cases those antiseptics now so much used, namely, carbolic and salicylic acids, and iodoform. It has one great advantage over carbolic acid, being absolutely free from poison, and can therefore be used in any desired quantity without causing any disturbance. It also surpasses all other antiseptics in cheapness. As 100 kilos of pure naphthaline can be bought for 60 marks (about 7 cents per pound), there is no doubt that it will soon find general use for medical purposes.

TO DESTROY MOTHS.

The lower animals are easily driven away or killed by the vapors of naphthaline, and it has been used for a long time as protection against moths, both in museums, especially in collections of beetles, and in the household. Recently, it has been used with success in the itch, and in general it can be used for all kinds of vermin and insects, especially in summer.

NAPHTHALINE DYES.

All these uses are, however, insignificant, both in quantity and multiplicity, in comparison with its use in making dyes, for which purpose several thousand kilogrammes are used daily. The reds are the chief dyes made from naphthaline, but yellows and blues are also produced. Among the former, especially, are the numerous representatives of eosine, and the azo-dyes, which are so abundant in the trade, and by their excellence threaten to supplant cochineal, just as artificial alizarine from the anthracene of coal tar has crippled the madder industry, which a few years ago was so flourishing in southern France.

It is worthy of remark that these artificial dyes made from naphthaline were not discovered "by chance," but are the result of extensive scientific investigations. This again shows what an advantage it is to science and to industry when theory and practice go hand in hand, and mutually aid and sustain each other. While science is aided by industries that furnish her with materials to investigate, she, on the other side, points to valuable methods of utilizing discoveries, and of making use of what would otherwise be waste products. Thus she has indicated rational uses for naphthaline that had formerly been an almost useless product of the aniline color industry, which was only in the way, and a nuisance.

With the entrance of naphthaline into the circle of other coal-tar products which can be converted into magnificently colored substances, we approach the fulfillment of the hope of those enthusiasts who would celebrate, in the artificial dyestuffs from coal-tar, the resurrection of the colors of the flowers of an early vegetation now submerged and converted into coal.—*Humboldt.*

Poisonous Leaves.

Beset as children and the ignorant are by dangers which they cannot measure and can hardly be blamed for falling into, it is a wonder rather that they so seldom incur fatal consequences than that they should sometimes eat leaves of an injurious character. The only safe rule for children to observe is never to eat anything that they have not been positively assured is wholesome by their parents.

No doubt it is an excellent thing that children should be so well nourished as to remove to a large extent the temptation to eat wild leaves. Moreover, modern gardening has brought into perfection so many table vegetables that we are enabled to enlist a natural dislike to the juices of uncultivated plants on the side of caution, as compared with the pleasantness of the wholesome green meat of home. But children sometimes will stray on a ramble, and become hungry when at a distance from "shops" or home, and thus it cannot be useless to know what are the more dangerous kinds of leaves which must be avoided by all who wish to preserve their lives. The strongest barriers of prohibition we can erect should be placed to protect the young from their own heedlessness, which at times leads them to do all forbidden things and to test all maxims and commandments, disobedience to which is supposed to entail divers pains and penalties.

Some of our most admired flowers, which we should least willingly banish from cultivation, are associated with green leaves of a very poisonous character. The narrow long leaves of the daffodil act as an irritant poison; the delicate compound leaves of laburnum have a narcotic and acrid juice which causes purging, vomiting, and has not unfrequently led to death. The narrow leaves of the meadow saffron or autumn crocus give rise to the utmost irritation of the throat, thirst, dilated pupils, with vomiting and purging. The dangerous character of aconite or monkshood leaves is doubtless well known, but each generation of children requires instruction to avoid above all things these large palm-shaped leaves, dark green on the upper surface. The utmost depression, often blindness, tingling all over the body, parching and burning of the throat and stomach, are some of the horrible symptoms which are preludes to death from this most deadly of vegetable poisons. Almost equally desirable is it to avoid the large ovate leaves of the foxglove. The heart has been known to be depressed so exceedingly by the action of these leaves as to beat only seventeen times a minute, with the pupils of the eyes widely dilated. In a case of this kind it cannot be too forcibly recollected that the sufferer should be kept strictly lying down, to save the strength of the heart as much as possible. The leaves of the pasque-flower (*Anemone pulsatilla*) and of various species of ranunculus (crowfoots) are to be named as being injurious, and belonging to attractive flowers.

Leaves of coarse weeds, however, provide an abundant quota of danger, but frequently their strong scent and bitter or nauseous taste give timely warning against their being consumed. Of all our British orders of plants, perhaps the umbelliferous order contributes the rankest and most widespread elements of danger. The tall hemlock is everywhere known to be poisonous, and it is one of the most abundant occupants of the hedge. A peculiar "mousy" odor can generally be recognized on squeezing the leaves, which are deep green in color and trebly compound, the small lobes being lanceolate and deeply cut. It is said that the mousy smell can be detected in water containing not more than a fifty-thousandth part of the juice. Hemlock is both an irritant to any sore place and a general, narcotic poison, producing headache, imperfect vision, loss of power to swallow, and extreme drowsiness, with complete paralysis of voluntary muscles and muscles of respiration. The water dropwort, too, a flourishing ditch plant; the water hemlock (*Cicuta virosa*), fool's parsley (*Æthusa cynapium*), must be ranked among our most dangerous poisonous plants belonging to the umbelliferous order. The fool's parsley leaves are sometimes mistaken for genuine parsley, but their nauseous odor and darker leaves should prevent this. The nightshade order is another with dangerous and often extremely poisonous leaves. Indeed, no nightshade can be regarded as safe, while the deadly nightshade, with its oval uncut leaves, soft, smooth, and stalked, are in the highest degree to be avoided. Henbane and thorn-apple, again, with their large and much-indented leaves, are conspicuous members of the "dangerous classes." Holly leaves contain a juice which is both narcotic and acrid, causing vomiting, pain, and purging. Even elder leaves and privet leaves may produce active and injurious irritation when eaten.

The leaves of the arun or cuckoo-pint, large, arrow-shaped, and glossy, have often caused death. Two are sufficient to produce great pain, vomiting, etc. One of the very disagreeable symptoms is a great swelling-up of the tongue from the amount of irritation; children's tongues especially may become so swollen that the swallowing of remedies or of emetics is very difficult. In such a case the administration of melted fresh butter freely has proved beneficial, and after vomiting has taken place freely, strong coffee should be given. Savin and yew leaves are both most poisonous, yew being narcotic as well as acrid, although it is vulgarly supposed that the fresh leaves are not injurious—a mistake from which some have suffered. With regard to treatment in cases of poisoning by leaves, the principles are the same as we mentioned in our article of February 4 last. If no doctor is at hand, produce vomiting till all offending matter is expelled, and when considerable sleepiness or drowsiness has come on give strong tea or coffee, and again bring on vomiting; then stimulate and rouse the brain in every possible mode, as formerly recommended.

Finally, we would say do not too readily regard leaves as harmless because you may know or hear of cases in which no injury has resulted from eating them. From the eating of almost every kind of leaf we have mentioned repeated deaths have been occasioned, and none of them can be eaten with impunity.—*Land and Water.*

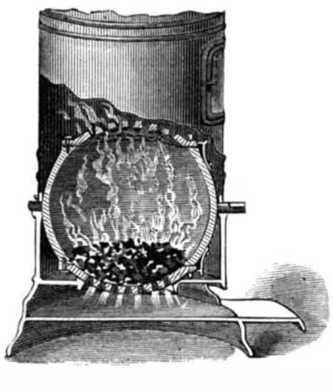
Salting out Soap.

The large quantity of salt in the under lyes from which soap has been removed by the ordinary method of salting out, has hitherto made the recovery of glycerine from it either difficult or unprofitable. This suggested the conversion of the common salt into some other soda salt that was not so difficult to remove. Still this conversion presented great difficulties. Jaffé and Darmstaedter, of Charlottenburg, therefore concluded to try salting out with other salts. [Caustic soda was used long ago for this purpose, and we believe is patented in this country.—ED.] They found that the sulphates, especially sulphate of potash, soda, or ammonia, could be used with advantage. The under lye obtained by salting out with these salts is neutralized with sulphuric acid, whereby the excess of caustic soda, necessarily employed in the saponification, is converted into a sulphate. It is then filtered and evaporated, when the sulphates crystallize out. They may be purified and used over again for the same purpose, namely, salting out a new batch of soap. The glycerine that remains after the salt has crystallized out is not so impure but that it can be easily purified in the usual manner, viz., distilled in a current of steam.

RECENT INVENTIONS.

Novel Fire Box.

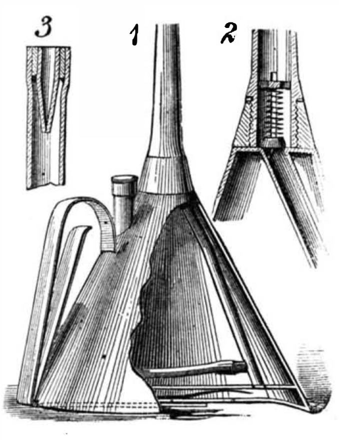
The engraving represents a reversible rotative fire box recently patented by Mr. C. K. Villas, of Alstead, N. H. This invention consists of a spherical or globe-shape chamber or box, provided with apertured or slotted covers covering opposite openings therein. The advantages claimed for it are the easy, clean, and economical method of freeing the fire box of ashes and clinkers, rocking the fire box to and fro with a crank generally being all that is required. By turning it over and over the coal will be loosened and the ashes entirely removed. The apertures may be so small that very little coal can escape with the ashes. It will be seen that by this improvement the objectionable process of dumping is entirely avoided. To remove the clinkers the fire box is filled with coal and reversed, bringing



the clinkers at the top of the box, where they may be readily got at and removed. In this fire box a fire can be built. The fire box is filled nearly full of coal, and the fire is built on top. The firebox is then reversed, bringing the fire under the coal; and in the same way when the fire goes out, with the box nearly full of coal, the fire can be built on the top and the box reversed. With this fire box a fire can not only be readily built, but by opening a check draught and whirling the fire box rapidly around the fire can be easily extinguished, leaving the coal free of ashes and ready for another fire. With this arrangement a fire need not be kept burning longer than desirable at any time, as it can be rebuilt with very little trouble.

Spring Bottom Oil Can.

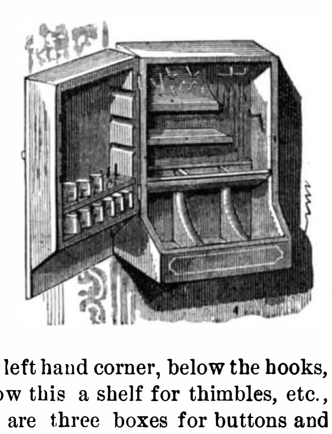
In the accompanying engraving is shown an improvement in spring bottom oil cans recently patented by Mr. Xavier St. Pierre, of Bullionville, Nev. A partition is placed a little above the bottom of a common spring bottom oil can, cutting off a space. A discharge pipe extends from the space along the interior of the can to the nozzle, into which it discharges through a small valve A flexible tube that will fall down with the oil when the can is inverted, and has a check valve at its free end, is attached to a branch of the discharge pipe near the partition. Between the partition and the bottom of the can is a spring to assist the bottom in its reaction for drawing oil from the can through the flexible tube. The cork of the filling opening has a check valve that



allows air to pass into the can. When the bottom of the can is pressed the oil between the partition and the spring bottom passes out of the discharge pipe, and when it is released the reaction of the spring and bottom draws oil from the can through the flexible tube and fills the space. This can may be used where cans of ordinary construction cannot, as in places below the floor, and is more economical, the check valve in the nozzle preventing waste.

Lady's Work Box.

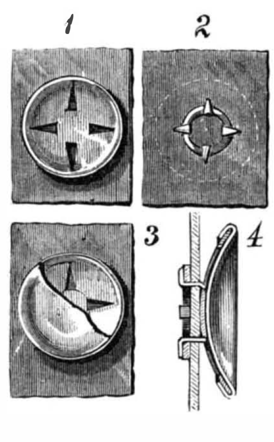
A lady's work box, in which a large number of small articles may be conveniently and handily arranged in a small space, has recently been patented by Mr. Hugh S. Dickson, of La Harpe, Ill. The main part of the box—as shown in the annexed engraving—is secured to the wall of a room, and to it is hinged a swinging cover. At its lower end the main part of the box is extended forward, and the side pieces of the cover are cut so as to close over the extension, the front board of the cover reaching to the bottom of and inclosing the extension when the box is closed. At the upper end of the box are hooks for knitting nee-



dles, scissors, etc. At the left hand corner, below the hooks, is a pincushion, and below this a shelf for thimbles, etc., and below this shelf there are three boxes for buttons and other articles, and in the lower part of the box there are three large compartments. Between the side pieces of the cover there are shelves provided with a series of pins for holding spools. The work box is very convenient, and when closed up occupies but little space, and keeps all the articles together and free from dust.

Button and Button Attachment.

Mr. John Wilde, of North Attleborough, Mass., has recently patented an improved button and means of attaching the same. The button is made of metal, and concavo-convex in form. It is stamped to form two or more radial prongs within the outer margin of its body and attached at their uncut ends to the body. These prongs constitute the fastening. To secure the button to the cloth the prongs, which taper and terminate in a point, are bent backward at right angles or thereabout to the face of the button, and projected through the cloth, after which they are turned or bent over against the inner side of the cloth, or over a ring or perforated disk, answering as a washer, around the outer edge portion of which the pointed ends of the prongs may be bent, if desired. This clinch-



es the button securely to its place. The button may be made of a separate face and back piece, secured together to form a body, and with the fastening prongs struck up out of the back piece of the body.

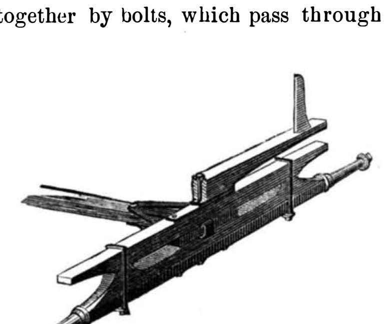
Improved Trace Carrier.

A trace carrier for harness, so constructed as to hold the side, back, and crupper straps without stitching the straps, and without the use of buckles or rivets, has recently been patented by Mr. Walter Downing, of Van Orin, Ill., and is shown in the annexed engraving. The carrier consists of an upper and a lower part, held together by a central screw, and between these parts the hip, back, and crupper straps are firmly clamped and held. The main portion of the upper part is made conical, and is cast with headed hooks for holding the cock-eyes of the traces, and also has an elevated guard to prevent the lines from catching on the hooks, and its under surface is a flat

plane, except that a square recess is formed in the center. The lower part has formed on its upper surface a square stud, which fits in the recess of the upper part, and also radial recesses, in which the hip, back, and crupper straps are placed, and with extensions formed at their outer ends with loops for holding the strap from lateral movement. This device is cheap and durable, and may be applied to fastening rosettes, uniting the parts of a five-ring halter, breast piece for riding bridle and martingale, and various other places.

Gear Coupling for Wagons.

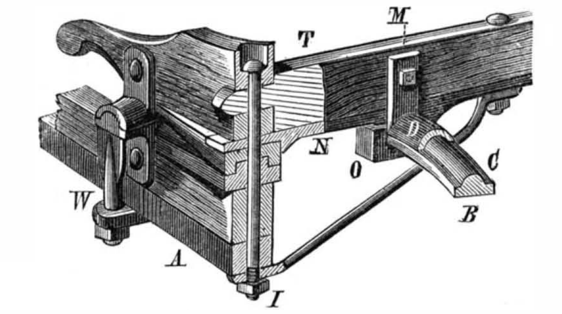
An improved device for coupling the reach to the forward axle of a wagon, recently patented by Mr. Reuben C. Lyon, of Centralia, Wis., is shown in the accompanying engraving. At the center of the forward axle, and between it and the sand-board, is placed a block, the sand-board, block, and axle being held together by bolts, which pass through them all. A U-shaped plate embraces the block, and extends to the rear, its rear end being perforated to receive a king bolt, which passes through the end of the reach, which is placed between the rear ends of the U plate. This plate is braced by rods



which hold it firm against lateral movement. The bolster is pivoted upon the sand-board by a bolt which passes through the bolster and sand-board, and screws into a nut sunk into the under side of the sand-board. By this construction the necessity for boring and weakening the forward axle for the passage of the king bolt is avoided, and the sand-board is supported in the center.

Fifth Wheel for Carriages.

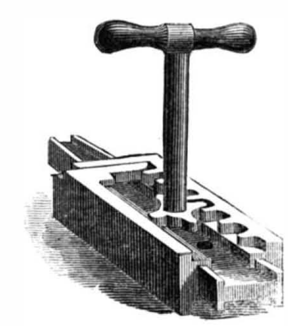
Mr. Robert Weber, of Corsicana, Tex., has recently patented improvements in the construction of the fifth wheels of carriages, by which they are made more cheaply and are more readily removed and attached. The under half of the circle of the fifth wheel has on its upper side a half-round tongue, and the upper half of the wheel has a groove of corresponding shape on its under side. The wheel has center plates that connect the sides of the circle and rest upon the bedpiece of the axle and the head block of the gearing, and it is also provided with clips to secure it to the axle bed, head block, and reach. If the axle or other parts are to be



taken off for repairs it is easily done by unscrewing the clips, and by this construction the wheel and its connecting parts are made very substantial and durable.

Printer's Quoin.

Mr. Otto C. Springer, of 588 Detroit St., Cleveland, O., has recently patented an improved printer's quoin, which is shown in the annexed engraving. The quoin consists of three wedges, one bearing on the inner side of the chase, another against the outer side of the furniture, and the third placed between the other two. The outer wedges are about the same height as an ordinary quoin. The middle wedge is opposite to, and about one-third as thick as, the outer wedges. On the inner sides of the outer wedges are grooves, and the central wedge has on it opposite sides ribs, that engage with the grooves of outer wedges. On the inner side of one of the outer wedges is a rack, and in the central wedge is a number of holes



in which to place a key, that is provided near its lower end with a pinion to engage with the rack. By turning the key in one direction the inner wedge is driven between the outer ones, forcing them laterally from each other until the quoin is tight in its place, and by turning the key in the opposite direction the quoin is released. The quoin is simple, cheap, durable, and strong, and is not liable to get out of order.

Dyeing Glove Leather.

Hitherto kid and other kinds of glove leather have been dyed by hand, the dye being put on with a brush. The process is not only slow and tedious, but has the farther disadvantage that the leather has a broad ugly looking border on the flesh side, and that in spite of special care a perfectly uniform color is not obtained. To avoid both of these, Kristen, of Brunn, makes use of centrifugal force for dyeing leather uniformly. The skin that is to be dyed is fastened to the center of a rotating horizontal disk; the dye is poured on in the middle, and by a rapid rotation of the disk evenly distributed over the surface of the skin. The disk can be rotated by hand or by machinery, and the dye pumped on the skin, or allowed to run down on it from a higher reservoir. The excess of dye thrown off the edges of the disk run down into a reservoir beneath, and can be dipped up and poured on it again until the color is deep enough.

To carry the operation into practice Kristen makes use of a machine that consists essentially of a horizontal revolving table, that carries the hide in connection with a pump to put on the dye, which is evenly distributed by centrifugal force, the excess being caught in a funnel that carries it back to the receiver. The whole operation of dyeing each skin does not take over ten or fifteen minutes. One man can watch and attend to five machines placed together on the same shaft, and in twelve hours can easily dye 150 skins, which will be perfectly uniform and free from spots.—*D. I. Z.*

Weight of a Million Dollars.

Mr. E. B. Elliott, the Government Actuary, has computed the weight of a million dollars in gold and silver coin, as follows:

The standard gold dollar of the United States contains of gold of nine-tenths fineness, 25·8 grains, and the standard silver dollar contains of silver of nine-tenths of fineness, 412·5 grains. One million standard gold dollars, consequently, weigh 25,800,000 grains, or 53,750 ounces troy, or 4,479 1-6 pounds troy, of 5,760 grains each, or 3,685.71 pounds avoirdupois of 7,000 grains each, or 1 843-1,000 "short" tons of 2,000 pounds avoirdupois each, or 1 645-1,000 "long" tons of 2,240 pounds avoirdupois each. One million standard silver dollars weigh 412,500,000 grains, or 859,375 ounces troy, or 71,614.58 pounds troy, or 58,928.57 pounds avoirdupois, or 29 464-1,000 "short" tons of 2,000 pounds avoirdupois each, or 26 307-1,000 "long" tons of 2 240 pounds avoirdupois each. In round numbers the following table represents the weight of a million dollars in the coins named:

Description of coin.	*Tons.*
Standard gold coin	1⅞
Standard silver coin	26¾
Subsidiary silver coin	25
Minor coin, five-cent nickel	100

ENGINEERING INVENTIONS.

An improved car coupling has recently been patented by Mr. George T. Arnold, of Lancaster, Ky., in which a coupling bar is used, that has a short bar pivoted in a slot in each of its ends, and so arranged that when the bar is set for coupling the short bar will project in the line of the coupling bar, for entering the link sockets of the drawheads. This socket has a pin on one of its sides and a shoulder on the other, against which, as the cars are coupled, the short piece of the coupling bar is turned into position to draw by a spring plate in the bottom of the socket. When the pin is pulled out, the short bar is turned into position to uncouple by being drawn against the shoulder only. A device for holding the pin up for self-coupling by the ordinary link is tripped by the link when it enters the socket, allowing the pin to drop.

Mr. William E. Hill, of Big Rapids, Mich., has patented a device to steady saw-mill saws, and prevent the breaking of the saw or guides by a sudden jar. The base plate of the saw-guide is bolted adjustably to the mill-frame in such a position as to receive the saw between the two jaws. To the plate are also attached two bearings, to receive the shaft of the guide jaws, and by a lever secured to the shaft, the jaws can be turned to bring them nearer or farther from the timber. One of the jaws is adjustable, so that the space between them may be adapted to the thickness of the saw. On a hand wheel shaft, placed at right angles with the guide shaft, is secured an eccentric which works between two lugs secured by jam nuts to the guide shaft. By this device the saw guide may be moved laterally in either direction. Between the jam nuts and the lugs are interposed elastic washers that prevent the saw or guide from being broken by a sudden jar.

A car coupling that is certain in its action, cheap, and durable, has been patented by Mr. William Hallett, of Truro, Nova Scotia. Back of the throat of an ordinary drawhead is a recess in which is a pawl that swings up when the coupling-link enters the recess, and drops back to a vertical position when the link has passed in. On the top of the drawhead, over the pawl, are projections which are perforated for the passage of pins. To the lower pin the pawl is pivoted, and to the upper one a tumbling weight that is connected to the pawl is pivoted by a small chain. The tumblers are of greater weight than the pawls, and when turned so that their center of gravity passes the pivot, their weight will elevate the pawls and disengage the coupling-links.

Mr. Thomas F. Witherbee, of Port Henry, N. Y., has patented a regulator for blowing engines, by which a given supply of air may be furnished to blast furnaces, regardless of the steam pressure or the resistance of the air. A piston which works in an air cylinder, connected to the blast pipe, is attached to the rod of a speed governor which controls the supply of steam to the engine. Weights placed upon the rod are so proportioned as to represent a given number of revolutions of the engine, and the size of the air cylinder is proportioned as required to vary the governor rod according to the variations in the air pressure. To the piston rod is also attached a piston which works in a steam cylinder connected by a pipe with the steam generator, the steam and air cylinders being of proper relative proportions. In operation, if the air pressure increases, the piston of the air cylinder is pressed down, causing more steam to be admitted to the engine, and if the steam pressure increases, it causes the piston in steam cylinder to move up and shut off steam to the extent required to keep down the revolutions.

A car coupling of great strength and durability has been patented by Mr. Leslie Long, of Sublette, Ill. The front end of the drawhead is of the usual construction. Two levers that extend from the front to near the back end of the drawhead are pivoted near their middle in its upper and lower sides, and to their front ends pivoted pins that work in the pin holes of the drawhead. The inner ends of the pins bend slightly backward to form hooks, and spiral springs at their outer ends keep the hooks pressed toward each other. The inner ends of the levers connect by chains to a windlass, whose shaft has bearings in the drawhead, and at its outer end has a hand wheel by which the windlass is operated. The coupling bar, which has a double hook at each end, is forced into the drawhead of the other cars between the pin hooks, which, after the barbed part of the coupling bar passes them, are immediately forced into their former places by their springs, preventing the coupling bar from being withdrawn.

Messrs. William H. Stewart and Emery J. Chapman, of Denver, Col., have patented a novel and efficient device for removing sediment from the bottom of holes being drilled in rock. A tube that is threaded, and has a series of notches at its lower end, has also at this end a series of upwardly projecting funnel shaped cups. The upper end of the tube is removably attached to an air compressor. The tube is placed in the drill hole, and when the air compressor is operated, the compressed air is forced through the lower end of the tube. The air strikes against the sediment at the bottom of the drill hole and carries it upward, when it falls back and the greater part drops in the cups. When the cups are filled the tube is drawn up and emptied. The operation is repeated until the sediment is removed.

A coupling device, especially adapted for use on freight cars, has been patented by Mr. David B. Duncan, of New Richmond, O. The drawhead has its top and front end open, and the coupling hooks, which are alike, have their front edges at such an angle as to ride over an abutment to connect in coupling. At the heel of the hook is a lateral cam that forms the abutment for the engagement of the opposite hook. The heel of the hook is pivoted to the sides of the drawhead by a bolt from which a link is also suspended. A chain secured to each hook connects it with a crank shaft journaled in bearings on the end of the car, and turned either by a lever at the side of the car, or by a wheel placed at the top of the car. When the cars are run together, the end of each hook rides over and engages with the cam on the heel of the opposite hook.

MECHANICAL INVENTIONS.

An invention by which a stay is provided for the body of a buggy, that prevents it from swaying backward or forward and at the same time allows the body to rise and fall vertically, has been patented by Edwin J. Strong, of Powhattan, Ia. A bent hanger is bolted to the bottom of the buggy body, and near its lower end is pivoted at its middle a vertical compensating lever. To the upper end of the lever a rod is hinged that is pivotally secured to a brace attached to the front end of the reach, and to its lower end is hinged a rod of the same length, the outer end of which is jointed to an arm secured to the rear axle. As the box moves up and down, the opposite ends of the lever describe opposite curves, and its pivotal point moves up and down vertically.

An improvement in the class of breech-loading firearms, in which the dropping down of the barrel is made to effect the cocking of the hammers by deflecting a cocking lever, has been patented by Messrs. John T. Rogers & John Rogers, of Birmingham, Eng. The barrels of the firearm are connected by and hinged to the body by a base pin which is of the usual construction and placed in the usual position. Intermediate pressure levers are placed between the part of the barrel beyond the base pin and the cocking devices, in such a manner that they can be worked for operating the cocking device, without striking the base pin or passing its center. When the barrels are depressed to open the breech in the act of loading, the pressure on the intermediate levers at their outer ends raises the opposite ends that are beneath the hammers, and the hammers are thus thrown back.

AGRICULTURAL INVENTIONS.

Mr. Phillip Smith, of Sidney, O., has patented an improved earth scraper, the body of which is made of a sheet of steel, struck up to form its sides, and an end plate is formed with flanges at its ends and on its bottom edge, and is secured to the sides and bottom of the body, by rivets. Runners are secured on the bottom of the scraper by means of screws, that are beveled at their ends, and are concaved on their under side, to prevent the scraper from sliding around when in use. Handles are secured to the outside of the scraper by means of staple plates, and bolts which pass from the inside of the scraper, through the handles and the staple plates, and are secured by nuts on the outside of the plates. The draw bail is attached in any suitable manner.

A convenient and cheap safety tie for cattle has been patented by Mr. Merrill J. Worth, of Wilton, N. C. A cylindrical stanchion bar, secured at top and bottom, is provided with two rings that encircle it. A metal rod of suitable size and shape has a loop at one end which incloses the upper of the rings, and the lower is formed into a hook to engage with the lower ring of the bar. The hook is provided with a spring catch. From the upper stanchion bar, a short arm depends that is provided with a pin upon which the hook of the bow is placed when the animal is let out of the stanchion. With this construction the animal tied is restrained in the least possible degree.

An invention by which ensilage in silos is protected from the effects of air has been patented by Mr. Charles H. Roberts, of Lloyd, N. Y. The door opening of the silo is provided with rabbets to receive the ends of the planks used to close it. A piece of tarred felt paper, or any fabric impervious to air and moisture, is placed against the inner sides of the planks in such a manner that the covering overlaps the ends of the planks and also laps down on the bottom of the silo. The ensilage is packed against the covering as the silo is filled, and when it is full a cover of the fabric may be spread over the top and the usual planks and weights placed above it.

A cheap and economical power for running cotton gins has been patented by Mr. William H. Davis, of Verona, Miss. An upright kingpost, journaled in a suitable frame, carries at its upper end a horizontal wheel grooved on its periphery for a rope or belt. Below this wheel the kingpost has arms to which animals are to be attached. In upright posts in front of the kingpost a horizontal shaft is journaled which has a large band pulley and a small grooved pulley. Over the small pulley the belt from the large drive wheel passes, and transmits motion to the shaft and large pulley, and from this pulley motion is transmitted to the pulley of a gin or other machine by a belt. The main belt, as it passes between its pulleys, is supported, guided, and tightened by a system of vertical and horizontal rollers attached to a guide located between the two pulleys.

A plow, in which the height and width of the plowshare can be adjusted, has been patented by Mr. Matthew M. Beard, of Holmes Co., Miss. The front shank of the plow frame has a vertical longitudinal slot near its middle, and a short distance below this is a similar slot that is notched on its edges, and the shank also has a rabbet along its outer edge. The plowshare has two apertures that correspond with the slots in the front shank, and it also has a flange on its edge. The plowshare is so placed upon the shank that its flange passes into the rabbet of the shank, and bolts passed through the slots of the shank, and the apertures of the plowshare secure them. The bolts are placed near the upper or lower ends of slots, according as the share is to be adjusted higher or lower.

A simple and effective machine for breaking the stalks of cotton plants has been patented by Mr. Neill McDuffie, of Kentyre, S. C. A roller about twelve inches in diameter, and of such a length as to reach over two rows of stalks, has near each of its ends a series of sharp radial blades, which are as long as the width of the row. This roller is hung in a frame, so as to rotate as it is drawn over the ground. Diverging arms are attached to the front side of the frame, which gather the leaning stalks, in advance of and into line with the blades of the roller, where they are held until they are caught by the blades and broken.

Mechanism for holding gates securely in place when opened has been patented by Mr. William H. Mills, of Clear Creek, Ill. The gate and posts are of the usual construction, and to one or both sides of the lower part of the forward end of the gate is hinged a pawl, in such a position that its lower end will rest upon the ground. To an eye on the upper side of the pawl is secured a rod, the other end of which is attached to the forward end of a lever that is pivoted on the top of the gate. The hinges of the pawls are so formed that the free end of the pawl, when it is raised, will come in contact with the gate before the eye to which the connecting rod is attached. A spring presses the forward end of the lever down to hold the pawls to the ground, and a loop on to the gate can be swung over its rear end to hold the parts away from the ground when opening and closing the gate.

Mr. Miles Robinson, of Wichita, Kan., has patented a combined drag and sulky plow, by which plowing and harrowing may be done at the same time. The drag is attached to the outside of an ordinary sulky plow frame, and is so constructed that it may be raised or lowered to suit the depth of furrow turned by the plow, and it may also be swung up out of contact with the ground, so as not to interfere with turning or marking out the lands. When the drag is set the proper height from the bottom of the plow, if the plow is not in the ground the drag will be suspended above it, but when the plow enters the ground the drag will rest sufficiently upon the furrows to cause them to be thoroughly harrowed.

MISCELLANEOUS INVENTIONS.

A smoke-consuming fireplace has been patented by Mr. Mathew Ingram, of Manchester, Eng. The main combustion chamber of the fireplace has the ordinary front bars, and a solid bottom. Below this chamber is an auxiliary combustion chamber, which has a door and air valve, and is divided longitudinally by a diaphragm, which extends nearly to its door. A flue leads from the main chamber to the auxiliary chamber, and from thence under the diaphragm to the main chimney flue. A damper is placed in the direct draught above the main combustion chamber, and is to be open when the fire is started, and when the chimney is sufficiently hot to create a draught this damper is closed and the flue damper opened, and the draught is taken through the auxiliary chamber. This causes the products of combustion from the main chamber to pass into the auxiliary chamber, where they are mixed with the air from the valve in the door, causing them to burst into a flame.

Mr. Carl Beseler, of New York City, has patented a device by which a strong light may be thrown into the patient's mouth during dental operations. The light chamber is a sheet metal cylinder, which has a downward extension to admit the burner, and an upward extension for the escape of the products of combustion. In one end of the cylinder is a concaved reflector, and near the other end is a convex lens which concentrates the rays of light from the burner. On the light chamber is an arm to which mirrors are attached, so that the light from the light chamber is reflected upon the work to be done, and a shade placed on the forward end of the chamber protects the eyes of the operator from the light. The head of the stand is adjustable vertically, and is provided with a circular shelf for holding the dentist's tools.

Mr. George C. Miller, of Johnstown, Pa., has patented an inkstand in which the evaporation and thickening of the ink are prevented, and dust and similar matter are kept from it. The inkstand may be of any suitable form, and is provided in its top with an aperture, which is closed by a lid pivoted to the under side of the top, and a weight attached to the lid retains it closed. An angular arm projects from the top toward the right-hand side of the inkstand, and when the pen is to be dipped into the ink the arm of the lid is pressed downward by the little finger of the hand holding the pen, carrying with it the lid, and the pen is passed into the ink, but when the hand and pen are withdrawn the weight closes the lid automatically.

Annie S. Evans, of Kingston, Can., has patented a device by means of which sick and infirm persons may be comfortably raised and supported in different postures on ordinary bedsteads. The invention consists of a divided and hinged bed bottom, to the under side of which braces are hinged, the lower ends of which are hinged upon the sideboard. The braces at the head of the couch may be made extensible, so as to raise the head of the bed bottom higher than the center, so that the bottom may be used either as a chair or reclining couch. For raising or lowering the bed a windlass is journaled on the sideboards of the bed, and receives a strap connected to the cross-bars of the hinged bed. An adjustable rest is provided for the feet.

Mr. Stephen S. Ward, of Greenfield, Mass., has recently patented improvements in the manner of attaching the handles to knives and forks, by which greater strength and durability are secured. The blade of the knife is formed with two outside tangs, having at their ends hook-shaped lugs turning inward and backward, and a middle tang that is shorter, and comes to a point at its end. The handle is grooved on its edges for receiving the outer tangs and formed with a central hole for the middle tang, and also has a cross aperture connecting the grooves for the outer tangs, in which metal is cast to bind the hooks of the tangs firmly. Bolsters and caps may be applied in the usual manner.

An improved guard for carving-forks has recently been patented by Mr. Stephen S. Ward, of Greenfield, Mass. The guard piece has its end forked to stride the neck of the fork, and at a slight distance back of the point of separation is a slot. The device which retains the guard to the fork consists of a plate spring attached at one end of the neck of the fork, and has at its outer end a lip which takes over the bar which forms the bottom of the slot in the guard, and retains the guard in its closed position. When the guard is raised for use the end of the spring enters the slot, and the lip prevents the guard from slipping forward.

An improvement in fastenings for bracelets and scarf rings has been patented by Mr. Elijah Atkins, of Birmingham, Eng. The bracelet is made in two parts, hinged together at one end. To the outer end of one of these parts are attached two stationary catches that are rounded at their ends, and have slots on their inner edges. In the outer end of the other part are catches consisting of angle plates, having short and long arms. From the edges of the short arms lugs project outward, that engage with the slots of the catches of the opposite part, and their long arms project through the sides of the bracelet. The catches are pressed apart by a spring, to engage with the catches of the other part of the bracelet when the parts are closed together.

Mr. William H. Brownell, of Brooklyn, N. Y., has patented an improvement in easels by which the surface to be painted on can be placed in the most desirable position. The support of the easel is a folding frame consisting of front standards, supporting legs, and notched holding pieces to prevent the frame from spreading. An auxiliary frame for supporting the work is hinged at its lower end to the front portion of this frame, and corresponds with it in width and length above its hinges. The inner edges of the upright parts of the auxiliary frame are grooved, and slides which hold the work move up and down in these grooves. Notched bars pivoted to this frame engage with pins on the main frame to hold it in position.

A gauge for use in boring railroad ties for the insertion of intersecting bolts, has been patented by Mr. Thomas J. Bush, of Lexington, Ky. The main frame of the gauge consists of two main base plates, upon which are upright supports and an elevated table placed on the supports. The uprights rest on each side of the rail, and have at their outer sides lugs to which are pivoted swinging jaws for clasping the tread of the rail. The base plates have holes near the bottom, through which the boring tool passes, and at the outer edges are upward extensions to which are attached plates in which the boring tool rests, and that are adjustable in all directions, to bring the tool in such position that the holes in each side of the rail will have the same inclination, and will properly intersect each other.

A feed water heater, in which the water is purified as well as heated, has been patented by Mr. Robert W. Jones, of London, O. The heater is a horizontal cylinder divided into two unequal chambers by a vertical diaphragm that is perforated near its top and bottom. In the larger chamber are pans, one above another, having perforated sides, and below the pans is a grating, all being suitably supported. The feed water enters this chamber through a pipe at its top, and the exhaust steam from the engine enters the end of the smaller chamber through a pipe in its upper part, and through the perforations in the upper part of the diaphragm passes into the larger, and heats the feed water as it falls from one pan to another, and causing it to deposit the greater portion of the lime held in solution. The water then flows through the lower part of the diaphragm to the small chamber and, becoming further heated, is taken out to the boiler.

A device by which the axles and boxes of cars are prevented from being heated has been patented by Mr. Henry Bouchard, of St. Elmo, Ala. A rotary fan secured to the lower face of one of the trucks is driven by a belt that passes over a pulley on one of the car axles. To the nozzle of the fan is secured a rubber tube that is attached at its outer end to a pipe secured to the bottom of the car. From this pipe rubber tubes lead to pipes that open into the car axle boxes. Branch pipes also lead up from the main pipe through the floor of the car. When the car is in motion the fan is rotated and air forced into the car, cooling and ventilating it, and is also forced into the axle boxes, keeping the axle cool. A small lubricating box, that has on its upper surface a semicircular bearing for the passage of the axle, has between its lower face and the bottom of the axle box springs that keep the lubricant contained in the box in contact with the car axle.

Mr. William F. Wellman, of Belfast, Me., has patented an improved table leaf supporter that locks itself automatically when raised, and can be unlocked readily in case the leaf is to be lowered. One end of a bar is pivoted to the under side of the leaf of the table, and its opposite end is pivoted to a bar twice as long as this bar, the outer end of the longer bar being pivoted to the lower edge of the rail between the table legs. A keeper rod is secured to the upper surface of the longer bar, and extends from the lower end to the middle of the bar. A spiral spring is attached at its ends to the under side of the table leaf and to the keeper, on which it moves up and down. The joint of the long and short bars will pass a trifle above a right line when the leaf is raised, and the spring holds it in this condition until it is drawn down, when it slides along the keeper until it is at the lower end, and the leaf hangs down perpendicularly.

An invention to provide a means by which doors may be readily raised or lowered on their sheaves has been patented by Mr. Isaac Somers, of Detroit, Mich. The sheave is inclosed in a casing formed of angle plates, concaved on their faces, and having flanges for screws, and it is journaled in a saddle that slides in ways on the inside of the casing. Above the ways in which the saddle moves is a projection, and between this and the upper end of the saddle a wedge is placed by which the sheave can be adjusted. The wedge is moved for adjustment by means of a thumbscrew, the inner end of which engages with the wedge. The casing is let into a recess made in the lower corner of the door, and it is only necessary to turn the thumbscrew in one direction or the other to raise or lower the door as desired.

Mr. David Grubb, of Union, Ind., has patented improvements in the class of wagon brakes in which the brake is applied by the animal's holding back upon the tongue. A plate is secured on top of the rear hounds of the wagon, which supports the brake bar and to which it is hinged. The two ends of a forked arm are secured near the ends of the brake bar, and the closed end of the fork connects with the rear end of the wagon tongue. The tongue is constructed and arranged with the front hounds, so that when the horses hold back against it the rear end presses against the front end of the forked bar and operates the brake. By a peculiar construction of the head of the wagon-hammer, when it is turned to the rear, the tongue cannot press the brake, and the wagon can be backed without applying the brake.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

HOUSE DRAINAGE AND SANITARY PLUMBING. By Wm. Paul Gerhard. Providence: E. L. Freeman, State Printer.

This report, prepared for the Rhode Island State Board of Health, presents in an eminently straightforward practical way the principles of a perfect system of house drainage as developed by the best sanitary engineering, and reviews in detail the best results of recent invention in the production of sanitary plumbing apparatus and appliances. The work is illustrated by many engravings and diagrams.

A TREATISE ON RIVERS AND CANALS, RELATING TO THE CONTROL AND IMPROVEMENT OF RIVERS, AND THE DESIGN, CONSTRUCTION, AND DEVELOPMENT OF CANALS. By L. T. Vernon-Harcourt. Oxford: The Clarendon Press.

The specially valuable feature of this treatise lies in the score of plates of part II., which carry numerous figures illustrating the plans and more important characteristics of the principal works for the improvement of European and American rivers, the principal inland and ship canals of the world, and the various engineering devices employed in this class of works. Without attempting to be exhaustive this part of the treatise embodies a vast amount of information not easily accessible elsewhere. The text is a plain matter-of-fact statement of well established principles, with concise descriptions of the more recent works of importance on rivers and canals. Though intended for the instruction of young engineers, the treatise is admirably fitted for non-professional reading and reference in connection with the great commercial movements of the day. Every man of affairs is interested in the works here described, as important factors of national development and commercial progress.

PROGRESS REPORT OF THE MISSISSIPPI RIVER COMMISSION FOR 1881, WITH MINORITY REPORT. Washington: Government Printing Office.

Contains reports of surveys and examinations of the Mississippi and its channel during the year 1881, with statement of the work of the same character laid out for the current year; works of improvement contemplated and the preparations made therefor; remarks on levees and outlets; discussions of the Red and Atchafalaya rivers, and of the flood of April and May, 1881; remarks on borings made and deductions therefrom; upon the mutual relations of river sections under varying conditions of discharge and curvature; remarks on Vicksburg Harbor and Bonnet Carré Crevasse; description of improvement works between Cairo and the mouth of the Missouri; legislation needed; communication from Jas. B. Eads relative to the effects of levees, etc.; also voluminous appendices relative to the works of improvement in progress, with many illustrative plates and diagrams. It is a pity the volume lacks an index to make the information it carries readily accessible.

THE GATES OF THE RIVERS. A Supplement to the World's Navigation.

In this privately circulated pamphlet Mr. W. T. Stackpole, of Fairbury, Ill., says a good many things that are true and a good many others that are not intelligible in the absence of the pamphlet to which this is supplementary. The drift of it all would appear to be that everything done hitherto by engineers for the improvement of river navigation is wrong, and that the right thing is to be done only with Mr. Stackpole's (undescribed) steam channel sweeper.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) J. B. E. asks: What is the best plan for renovating feathers? A. Feathers are now generally renovated by exposing them in a tight wooden or iron vessel to the action of live steam for an hour or more.

(2) G. F. P. writes: 1. How can I color white feathers black for artificial fly making; also the same red, brown, and yellow? A. For black, dissolve half an ounce logwood extract in a quart of water and boil in this for half an hour; then put into a little water with two pounds of iron sulphate. Finally rinse in running water. Repeat if necessary. For the other colors use the appropriate soluble aniline or coal tar dyes in hot water.

(3) N. K. W. asks: 1. What is the contents of the Babcock fire extinguisher, and how is it made? A. A strong aqueous solution of bicarbonate of soda, and a leaden cup full of oil of vitriol (sulphuric acid). When this cup of acid is inverted into the soda solution sulphate of soda is formed and carbonic acid (gas) is liberated in large quantities. The reaction is represented as follows: $(HNaCO_3)_2+H_2SO_4=Na_2SO_4+2H_2O+2CO_2$. When the materials are quite pure 81 ounces of the bicarbonate reacting with 48 ounces of sulphuric acid produce 44 ounces of the gas. 2. Can you tell me how I can apply electricity to cause a wheel to revolve? A. See article on dynamo machines in SUPPLEMENT, No. 161.

(4) M. A. S. asks: Will you kindly answer, in your Answers to Correspondents column, what shall I use for a cheap good hard solder for German silver; it must stand some hammering? Also, what proportion must I use for a silver solder for above? In a recent issue you had, under the head of alloys, a solder for German silver: German silver, 5 parts; tin, 4 parts. I tried it, but it is as brittle as glass, also varied the proportions with same results. A. Coin silver, 2 parts; good sheet brass, 1 part. This is equivalent to silver, 24 parts; copper, 9 parts; zinc, 3 parts. This makes a tough, malleable, and fairly white solder for German silver; but, as German silver varies much in its composition, and also its melting point, if required for an easy flowing solder, the above can be varied by adding very small portions of zinc and tin, say one-twentieth of the whole weight for each, until you get the required melting temperature. If you had used two parts zinc in place of its equivalent of tin, in your trial, you would have a better solder, but not equal to the above for malleability.

(5) L. C. asks: How many Atlantic cables are there and between what points are they laid? A. Between Heart's Content and Valentia, 3; between Torbay and Ballingskillys, 1; between Duxbury, Mass., and Brest, 1; between Cape Cod and Brest, 1; between Canso and Penzance, 2; total, 8.

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

M. M. S.—The ore is of little value in its crude state. If roasted slightly, ground, bolted, and barreled properly it might bring fifteen dollars a ton in New York. Unlabeled samples in spool cotton box are argillaceous lime carbonate selvage, with an incrustation of iron sulphide, possibly containing a little gold. An assay would be advisable.—W. M. E.—It is an impure hornblende rock, and probably contains nothing of value.—A. E. N.—Sample of "fiber" received but no letter.—H. Z.—Hematitic argillite, containing a small quantity of molybdenite.—S. F. P.—It is an antimonial silver sulphide. If the small sample in any way represents the body of ore the property will prove very valuable.—G. M. M.—The imperfect mixture is probably due to an over burden of carbon in part of the charge, a cold pot and overquick tap, otherwise the metal would be of uniform texture.—E. J. F.—Both are impure silicious earth, useful for some polishing purposes and glass and enamel making.—J. B. W.—It is galena—lead sulphide—the principal ore of lead.—C. M. C.—1. Chiefly hornblende. 3. An argillaceous rock interspersed with hornblende. 2. Chiefly hornblende.—P. P.—It is copper containing a small per cent of iron—not native. The ore from which this was produced may be found in the vicinity. As an ore of copper it is valuable.—W. M. R.—It is a partially altered iron sulphide—possibly contains traces of silver. An assay would be necessary to determine this.—R. S.—It is a kaolin containing a small per cent of calciferous matter. We would advise an analysis.

[OFFICIAL.]

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FOR WHICH

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

July 18, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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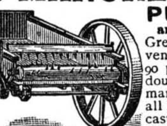

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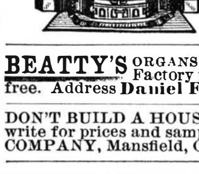

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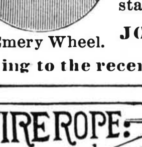

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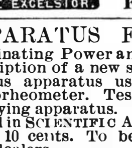

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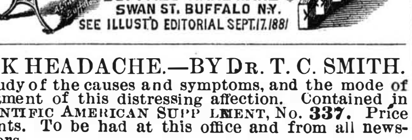

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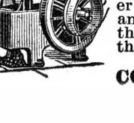

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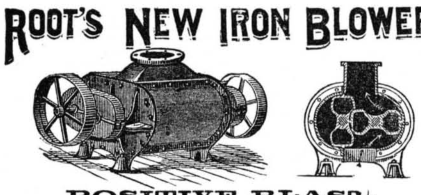

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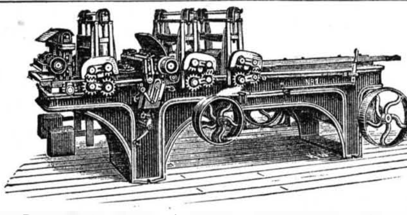

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