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THE UNITED STATES DRILLING SCOW, EAST RIVER.

It is now just ten years since the United States Government made its first grant of money for the improvement of Hell Gate and the reduction of the reefs obstructing the East River portion of New York Harbor.

During these years the appropriations have been irregular and sadly inadequate, in view of the magnitude of the work to be done and the commercial interests involved; nevertheless the prosecution of the task has exhibited some of the most noteworthy and successful feats of submarine mining ever accomplished. In no other part of the world has there been so many or such extensive removals of rock masses by blasting under water; and in no place has the work of harbor improvement been carried on under conditions so difficult, complicated, and exacting.

Our readers are already familiar with that phase of this great work which was so splendidly illustrated in the dry mining operations at Hallett's Point. There the work was done by headings run from a shaft sunk at the base of a rocky point near the shore line. At Flood Rock substantially the same method is being employed, except that in the latter case the shallower parts of the reef, which cover several acres, have been converted into an island for the accommodation and protection of the engine house, hoisting apparatus, and other necessities for dry mining.

For the removal of the more or less deeply submerged rocks and reefs, lying in the channel at Hell Gate and in that part of the harbor between New York and Brooklyn, an entirely different method had to be adopted; and though popular interest has centered almost entirely upon the more accessible parts of the work, as at Hallett's Point, the strictly submarine part has been vastly the more difficult, and has called for a far greater degree of boldness and originality in the invention of novel means and processes.

The conditions, as already noted, were peculiar and uncommonly severe. The rock masses to be removed were large; they were washed by tides of unusual force and swiftness; the channel was thronged with shipping, and, at first, the pilots were decidedly unfriendly.

The experience of the earlier contractors had demonstrated that the intentional or accidental destruction of their drilling apparatus, by collisions with passing vessels, was by no means the least of the difficulties to be obviated or overcome. The experiment of surface blasting had proved a failure, save for the removal of projecting points. To break up the broad rock masses nothing short of deep drilling and the use of high explosives would answer. This also had been attempted, but the fixed platforms supporting the drilling engines had been knocked into deep water by colliding vessels, and the devices adopted for protecting the divers

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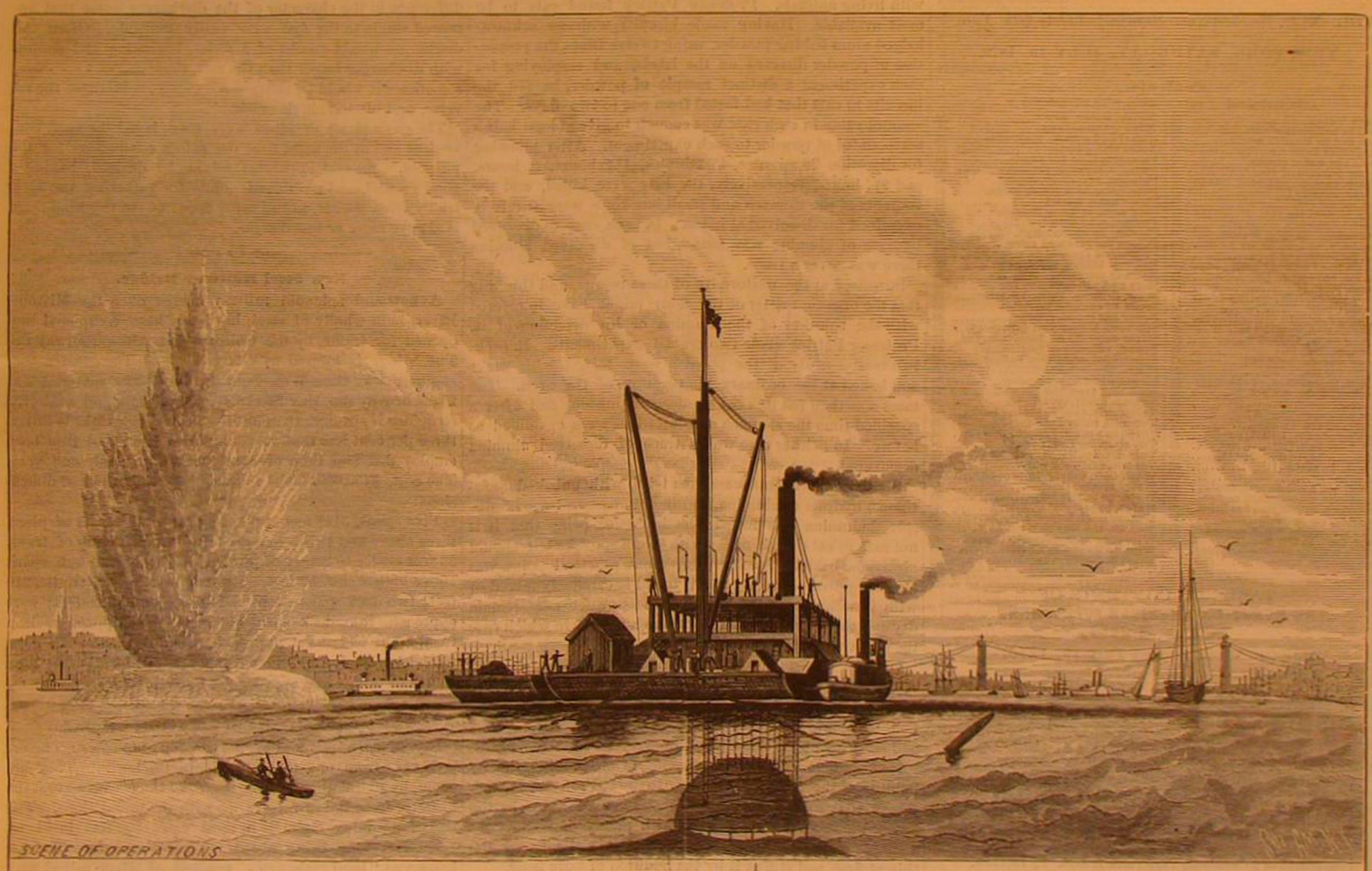
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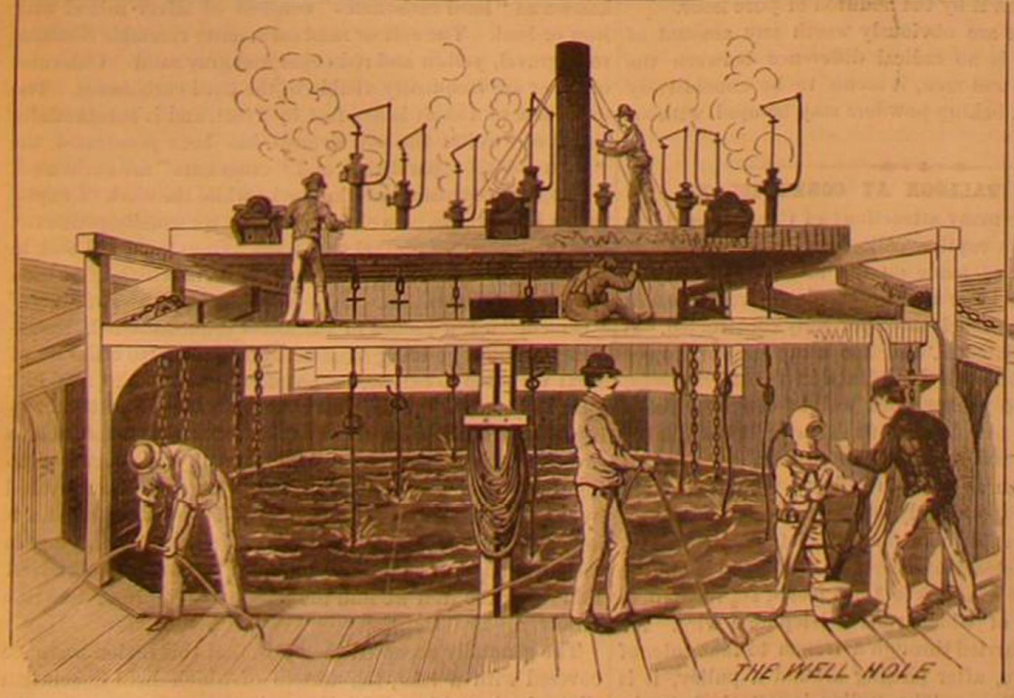
THE WELL HOLE


THE DIVER'S PREPARATIONS

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 185,
For the Week ending July 19, 1879.

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ALUM IN BAKING POWDERS.

In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found a communication from G. E. Patrick, Professor of Chemistry in the University of Kansas, giving details of a series of practical tests to determine whether the hydrate of alumina is dissolved by the gastric juice. The question has a vital bearing on the discussion as to the safety of using alum in baking powders. Professor Patrick attacks it without prejudice, by strictly scientific methods, and arrives at results which are certainly gratifying in view of the wide use of alum powders in our kitchens.

Professor Patrick takes his text from the published opinion of a prominent physician, who says, after stating the difficulties attending a thorough mixture of the ingredients of alum baking powders:

"But even if the exact proportions were maintained, the salts formed would retain their injurious properties, as they would dissolve in the gastric juice. The gastric juice contains not only lactic acid, but a large amount of hydrochloric acid, and both the sulphate and hydrate of alumina would be dissolved."

After testing by reference to authorities the statement that the gastric juice contains a large amount of hydrochloric acid, and finding the weight of evidence to be that the quantity is in reality extremely minute, and that little not free, Professor Patrick proceeds to describe his examination of the practical question whether the hydrate of alumina as it exists in bread after baking, when made with alum powders, will be dissolved in the fluids of the alimentary canal.

This question could be determined only by careful tests with living animals. Professor Patrick found cats to be most available. Having made biscuits with an acknowledged alum baking powder, using twelve times the proportion of powder directed on the labels, and employing for each experiment a distinct sample of powder, he fed the biscuits to cats that had fasted from one to two days. The amount eaten in each case was enough to give at least half a teaspoonful of powder to each experiment. After allowing for digestion 20 minutes, 45 minutes, 1½ hours, 2 hours, and 2½ hours, respectively, the cats were killed, and the contents of the stomach and small intestines were carefully examined for dissolved alumina. In each case undissolved hydrate of alumina was found, but of dissolved alumina there was never a trace.

Surprised at the uniformity of these results, and thinking that the organic matter of the flour might have interfered with the solution of the alumina or his detection of it, Professor Patrick made two crucial experiments. In each, two teaspoonfuls of the powder were mixed with water and baked at the ordinary temperature of the oven. The mass was then fed to a cat (under compulsion) and after a specified time the stomach and intestines were examined as before. In neither case was a trace of dissolved alumina discovered.

Similar experiments were then tried with unbaked (gelatinous) hydrate of alumina, and in both cases a trace of dissolved alumina was found; the inference being that it is not safe to eat dough made with alum powder—it should always be baked. Another important practical point was also suggested—namely, that if bread is carelessly mixed or with insufficient water, some of the powder may remain dry and the alum not changed to the hydrate; in which case the effect would probably be injurious.

In order to test this question, and also to furnish a check on the other experiments with biscuits, Professor Patrick had a batch made in which the mixing was less thorough than usual and with less water. These were fed to cats, and subsequent tests developed in every case a trace of dissolved alumina. These experiments, while proving the reliability of those first described, go to show, Professor Patrick thinks, that to insure the entire absence of alum in the bread, the mixing must be done with plenty of water. As a simple precaution it might be well to mix the batter too thin at first, and stiffen it by the addition of pure flour.

Tests of this nature are obviously worth any amount of theory; and if there is no radical difference between the gastric juices of cats and men, it seems to be conclusively established that alum baking powders may be used without injury to health.

THE CAPTIVE BALLOON AT CONEY ISLAND.

Not the least of the many attractions of Coney Island this summer is Mr. King's captive balloon, "Pioneer," the first ascension of which was made on the afternoon of July 1. This balloon is not as large as the Giffard captive balloon at Paris, but is said to be much more perfectly constructed. It is sixty-five feet in diameter, and has a capacity of 150,000 cubic feet. The material is Irish linen in two thicknesses. The basket or car of wicker work weighs 476 lb. Above the balloon is white, to reflect the sun's rays; below it is ornamented with dark red and green, to make it a conspicuous object against the sky. It is inflated with hydrogen, and in calm air shows on the dynamometer a lifting strain of 1,400 lb. The gas is made on the spot by Mr. A. O. Granger, by passing steam over hot iron. Wound about the drum of a very large windlass is 1,215 feet of 1½ inch rope, through the center of which runs a telephone wire. An end of this rope is carried through a trench to the center of the inclosure, where, after passing around a pulley, it is fastened to the balloon. The pulley is attached to the foundation by a universal joint of iron, so that, in whatever direction the balloon may pull, there will be no side strain on the pulley. A good hold on the sand is secured by the use of four sticks of yellow pine, each 12 feet long and 12 inches square. These are planted horizontally nine feet below the surface, and above them is a well, made of concrete. Across the top of the well lie two other similar timbers, which are strongly fastened to their fellows below by long and thick iron bolts. Mr. King says this foundation will resist a strain of 100,000 lb., while the utmost strain that wind and gas united can exert on the connecting rope of the balloon will not exceed 22,000 lb.

On its trial trip the balloon ascended three or four hundred feet, and shortly afterwards a second trip of seven hundred feet was made. At this height the view was pronounced magnificent by the small party making the first venture. All the ocean approaches of New York harbor were at their feet for a radius of thirty miles; and inland they could see the numerous towns and cities about the bay of New York. Along the Sound to Flushing, up the Hudson River as far as Tarrytown, and the Orange Valley, and other parts of New Jersey as far as Paterson, Perth Amboy, and Long Branch.

THE TELEPHONE AS A LIGHTNING INDICATOR.

Mr. George M. Hopkins, of Brooklyn, N. Y., during a recent thunder storm connected the gas and water pipes of his dwelling with an ordinary Bell telephone, and discovered that the electrical discharges were plainly indicated, either by a sharp crack or by a succession of taps. This occurred when the discharge was so distant that the thunder was inaudible. The sound also seemed to be perceived by the ear before the lightning could be seen. There was a marked difference in the character of the discharges, some that appeared single to the eye were really multiple. Often the discharges would consist of a series, beginning and ending with discharges larger than the rest, thus: —- - - - - -—, sometimes it would be thus: —- - - - -, sometimes the reverse, and often a single crack.

The gas and water pipes were used, being the most convenient and at the same time the safest conductors for the purpose. Special apparatus might be devised, having a good ground, and a series of points for gathering the electricity from the air, but in using apparatus of this kind there is always more or less danger.

New Steel Railway Bridge.

A new and splendid railway bridge over the Missouri River, built wholly of steel, has lately been completed and opened for traffic by the Chicago and Alton Railway Co. The bridge is located at Glasgow, Mo. The constructing engineer was Gen. Wm. Sooy Smith. The material was furnished by the Hay Steel Co., of Chicago, and while the structure is stronger than an iron bridge its weight is thirty-three per cent less than it would have been had iron been employed. The time of construction was only one year. The cost, $450,000. The following are the principal dimensions:

Five spans, 314⅔ feet each, from center to center of piers, three above and two below grade; all steel; depth of truss, 36 feet center to center of pins. Height of through spans above high water, 50 feet. East approach, iron trestle, 210 feet; two deck spans of iron, 140 feet each, 280 feet; west approach, iron deck span, 140 feet; west approach, iron trestle, 510 feet; west approach, wooden trestle, 864 feet total length of the bridge proper (steel) 1,573⅓ feet; total length of bridge and approaches, 3,577⅓ feet.

The Silver Deposits of Leadville, Colorado.

Says a correspondent of the Boston *Advertiser:* The ore beds vary from one to forty feet in thickness. They are generally undulating like the waves of the ocean, so that the distance from the surface varies with the undulations. The size of a mining claim is in most cases 300 feet inside by 1,500 feet long, being about ten acres in area. The ore known as "hard carbonates" consists of silver mixed with iron or lead. The soft or sand carbonates resemble common road gravel, yellow and red ocher and gray sand. Chlorides of silver are frequently visible in the hard carbonates. The usual size of a shaft is 3½ feet by 7 feet, and is substantially timbered. After the ore deposit has been penetrated, the "main entry," "parallels," and "cross cuts" are excavated, leaving the remaining ore in blocks while the work of exploration is going on. In sinking a shaft we usually penetrate, first, a deposit of gravel or "wash" from 20 to 100 feet in thickness, frequently containing bowlders which have been subjected to abrasion. Not unfrequently a stratum of "cement" a few inches in thickness is encountered, resembling Roxbury pudding stone or an old cemented cellar floor. Next we come to calcite, or porphyry—sometimes soft like "fire clay," either pure white, gray, or red—the latter showing an iron stain. The soft porphyry runs from one inch to several feet in thickness. The hard porphyry is often "picking ground" (*i. e.*, porphyry rock, which can be excavated by means of a pick), but frequently it is blasting or "shooting rock." Following the porphyry is iron ore, varying in thickness and sometimes containing a few ounces of silver. Following the iron we find the "pay ore," more or less rich in silver.

The generally accepted theory is, that this region was once covered with a lake, the waters of which held in solution silver, lead, and iron, which were in time precipitated on the bottom of the lake. The porphyry, gravel, etc., were subsequently deposited. After the precipitation came the age

of disturbance, when by volcanic action or the shrinkage of the earth's crust the deposits became contorted, sometimes tilted or broken like a "chop sea," or gently undulating like the "ground swell" of the ocean.

Farming Implements in Morocco.

An undeveloped yet promising market for farming implements is reported in Morocco by U. S. Vice-Consul John Cobb at Casablanca. In a recent communication that officer, who takes a lively interest in the promotion of American trade, writes that farming implements are much needed in that country, no improvements having been made there in that line since the days of Mohammed the Great, nearly 1,300 years ago. Mr. Cobb believes that our manufacturers will find a large field for operations there, as many of the Moors have money and are particularly fond of useful inventions. They are very conservative, however, and must see an article in use or under conditions in which it can undergo a thorough investigation before they can be made to believe in it. American goods are favorably received by them, and can be made to take the lead. Possibly our manufacturers interested in the export trade may find it worth while to correspond with Mr. Cobb.

PECULIAR STEAM WHISTLING.

Some of our river pilots have become so proficient in the use of the steam whistles of the boats under their charge as to be able to make sounds that are almost articulate in their signification of the wishes or the feelings of the pilots.

Recently a large steamboat, well laden with passengers, was unable to reach its dock on account of a row-boatman who, while leisurely rowing about, had been surprised by the sudden appearance of the steamboat, and in his efforts to get out of its way became confused, and by rowing first one way and then another, annoyed the steamer's pilot; and he, apparently becoming impatient at the delay, expressed his feelings by causing the steamer's whistle to emit a series of short peculiar whistle sounds, which expressed something to the effect of, "Come! come! take one way or another, and get out of my road some time to-day," so plainly that some of the passengers of a neighboring boat noticed it, and one, laughingly referring to the whistling, said: "That is almost equivalent to swearing by steam." The row-boatman seemed to understand it, for he immediately took one way and got out of the steamer's course.

And again the other day we heard the steam siren whistle of one boat caused to salute another, in a most laughably sarcastic manner, as if to say: "Why! how do you do?" The pilot of the other boat endeavored to respond in the same tone, but probably because his boat's whistle was of a different style, he was only able to make it sound something like the first crowing efforts of a chicken.

We have some of the best pilots in the world to manage our river steamboats; and perhaps very few persons think of the great responsibility resting on these men. At times a moment's delay, resulting, perhaps, from sudden sickness or slight mistake of the pilot or engineer, would end in a fearful loss of life and property, and yet accidents rarely occur. We hope, however, that the steam whistling proficiency above mentioned will not lead to any mistakes in regard to the correct interpretation of the established code of whistle signals.

L. L. D.

MOLECULAR CHEMISTRY.—No. 4.

H. Schroeder began the study of molecular volumes of solid bodies in 1840, and he has continued it up to the present time. His views, which have been repeatedly modified by his researches extending over so long a period, may be stated as follows in their matured form.

In any mechanical fraction of a uniform mixture, or of a compound, the constituents are contained in exactly the same proportions by weight as they are in the whole mass. The same must hold true for the proportions by volume, provided the given substance is homogeneous. Thus, in detonating gas, made by mixing two volumes of hydrogen with 1 volume of oxygen, we may say that H has the volume 2 and O the volume 1, although in reality both are diffused throughout the space represented by their combined volumes, 3. When the mixture is exploded we get only 2 volumes of H_2O instead of 3. The condensation so produced may be viewed in two ways. We may suppose that the compound is condensed as such, or else that its constituents suffer a change of volume before entering into combination, and that the volume of the compound is the sum of the volumes of its condensed constituents. The law of multiple proportions by weight may thus be made applicable to volumes. Experience has shown that every element varies so much in volume throughout the series of combinations into which it enters, that the volume of its molecule may be 2, 3, 4, 5, 6, etc., times as great in one compound as in another.

Among these numbers the factor 2 predominates just as it does in gases, where, for example, H_2 is first condensed to 1 volume and then combines with O to form 2 volumes instead of 3. In the case of solids these condensations of volume seem to depend on the forces that cause bodies to crystallize, since an element belonging to two bodies that have the same crystalline form (isomorphous bodies) is usually condensed equally in both. In other words, the volumes of elements common to a number of isomorphous bodies are generally the same. The volume of potassium (K) found, as has been explained, by dividing its molecular weight by its density, is 45·3; that of sodium (Na) is 23·9; difference, K – Na = 21·4. The difference in the volumes of their chlorides, KCl = 37·4 and NaCl = 27·1, is 10·3, or practically one half the difference of the metallic volumes of K and Na. The same result is obtained from the bromides: KBr = 44·3, NaBr = 33·4; difference, 10·9. And from the iodides: KI = 54, NaI = 43·5; difference, 10·5. Now considering the Cl volume the same in both chlorides, the Br volume the same in both bromides, and the I volume the same in both iodides, it is evident that the metals in these compounds have been condensed to one half their original volumes.

When other metals are compared in this manner with their isomorphous compounds it was found that in pairs containing strontium and lead, sodium and silver, magnesium and nickel, aluminum and iron, the heavy metals often entered into combination with their volume unchanged, while the light metals were condensed one half. Schroeder believes that this occurs too frequently to be accidental. In the rhombic sulphates and carbonates of strontium and of lead, in their oxides, in the bromides, chlorides, and iodides of sodium, and of silver, etc., the differences of volume are equal to the unchanged volume of the heavy metal minus one half the volume of the light one.

While comparing the volumes of numerous compounds in this manner Schroeder was struck by the fact that the oxygen in quartz would have exactly the same volume as the silicon associated with it, on the supposition that the silicon retains the volume that belongs to it in the free state. Finding similar relations in other compounds, he conceived the idea that the molecular volumes of the constituents might have a common measure of which they are all multiples. To this common measure he gives the name of stere. A few examples will illustrate his meaning:

Volume KI = 54·0	KCl = 37·8
NaI = 43·2	NaCl = 27·0
K – Na = 10·8	K – Na = 10·8 = 2 × 5·4
Volume NaI = 43·2	NaCl = 27·0
LiI = 37·8	LiCl = 21·6
Na – Li = 5·4	Na – Li = 5·4 = 1 × 5·4
Volume RbI = 70·2	RbCl = 54·0
KI = 54·0	KCl = 37·8
Rb – K = 16·2	Rb – K = 16·2 = 3 × 5·4.

Again, twice the volume of LiCl (2 × 21·6) is equal to the volume of NaI (43·2); twice NaCl (2 × 27·0) = KI (54·0), etc. Hence 1 volume I = 2 volumes Cl, 1 volume Na = 2 volumes Li, and 1 volume K = 2 volumes Na. We have found, then, that these substances, as well as their differences, have a common measure; and this is what Schroeder means by the expression that they have the stere 5·4.

But this is not all. Comparing still further, we get the following differences of volume:

RbI = 70·2	KI = 54·0	NaI = 43·2	LiI = 37·8
RbCl = 54·0	KCl = 37·8	NaCl = 27·0	LiCl = 21·6
I – Cl = 16·2	I – Cl = 16·2	I – Cl = 16·2	I – Cl = 16·2 = 3 × 5·4

In other words, iodine and chlorine have the same stere as the metals with which they are in each case associated. From these and many analogous examples Schroeder has quite recently generalized the proposition: "In every compound a definite volumic measure or stere predominates and causes all the components to subordinate themselves to it."

As many isomorphous bodies, such as KCl and NaCl, magnesite and calcite, potassium sulphate, selenate and chromate, have the same stere, it was natural to connect the latter with the crystalline form. Further extensive research has shown, however, that the stere does not depend directly upon the form; that there are isomorphous bodies with unlike, and heteromorphous bodies with like steres. It was found that the stere of a compound is determined entirely by that of one of its elements, which impresses its own stere on all the rest. The fact that isomorphous bodies so often have equal steres is explained by the reason that their controlling elements are also isosteric. Thus the rhombohedric carbonates of magnesia, manganese, and lime, are isosteric because Mg, Mn, and Ca have the same stere. From these observations Schroeder deduces the following law, which he calls the steric law: "In every compound the stere of one of the components predominates, in consequence of the forces active during crystallization, and impresses itself upon all the others." For example, the stere of silver (Ag) is 5·14, one half the volume 10·28, calculated from its density and equivalent. AgCl has a volume of 25·70 or 5 × 5·14; AgI = 41·1, or 8 × 5·14; AgBr = 30·84, or 6 × 5·14; Ag_2O = 30·8, or 6 × 5·14; $C_2H_3O_2Ag$ = 51·4, or 10 × 5·14. All these volumes are exact multiples of the silver stere, and consequently the other elements associated with silver must also have assumed volumes divisible by 5·14, as the law requires.

The steres of all the elements hitherto determined lie between the narrow limits of 5·0 and 6·1. Thus carbon has a stere of 5·11, which it impresses on a series of organic bodies; phosphorus and arsenic cause most of their compounds to assume the stere 5·3, etc.

In Liebig's *Annalen* for 1874, and more recently in the report of the session of the Munich Academy of Sciences, December 1, 1877, Schroeder shows the applicability of his law to five important groups:

1. Silicon, quartz, sillimanite, disthene. Stere, 5·65.
2. Aluminum, corundum, chrysoberyl, diospore, andalusite. Stere, 5·14.
3. Magnesium, periclase, spinelle, olivine, diopside, humite, and garnets. Stere, 5·52.
4. Oxides and silicates of manganese. Stere, 5·52.
5. Sulphides and arsenides of iron, cobalt, nickel, copper, zinc, and lead.

Those who desire more detailed information on these points are referred to the above memoirs, and also to Liebig's *Annalen* for 1878, and to the Berlin *Chem. Gesell.* for May, 1878.

A very important corollary follows from Schroeder's law. If bodies combine only in whole volumes or steres, we can determine the molecular constitution of solids, because their molecules must contain a sufficient number of atoms to bring out the volume of each constituent as an entire multiple of the controlling stere. Thus the volume of silicon determined from its density was found to be 11·3, and its stere is consequently 5·65. To express the fact that the silicon molecule occupies two steres, Schroeder writes Si_1^2, the upper right hand exponent representing the number of steres, and the lower the number of atoms. Now the volume of quartz, to which allusion has been made before, is just double that of silicon; consequently it contains four steres, two of which belong to oxygen, and its molecular formula is written $\overline{Si_1^2}\ O_2^2$, with a line over Si to show that the compound is controlled or dominated by the silicon stere. In his calculations Schroeder marks the steres with a line drawn above, and the volumes with a line drawn below the figures; thus, $\overline{Si_1^2}\ O_2^2 = 4 \times \overline{5·65} = \underline{22·6}$. Take another example:

Corundum $\overline{Al_2^2}\ O_3^3 = 5 \times \overline{5·14} = \underline{25·7}$. This means that in corundum, as in most oxides, each oxygen atom occupies one stere; that aluminum is present with one half its metallic volume, $\frac{10·28}{2} = 5·14$; that the aluminum stere 5·14 impresses itself upon all the atoms present; and that the observed volume of corundum, 25·7, is made up of the equal volumes of five such atoms, two of aluminum and three of oxygen.

But this is not all. If the atomic weights are taken in grammes, the volumes will be expressed in cubic centimeters; thus $\overline{Ag_1^2} = 2 \times \overline{5·14} = \underline{10·28}$ means that one atom of silver or 108 grammes occupies a space of 10·28 cubic centimeters, or of two silver steres, each equal to 5·14 c.c.

A few examples will suffice to show the manner of arriving at the molecular formulas of compounds.

The observed volume of chloride of silver is 25·7, as has been stated before. This is equal to five silver steres (5 × 5·14 = 25·7). As two of these belong to the silver present, we have left three for the chlorine, and we write $\overline{Ag_2^2}\ Cl_3^3 = 5 \times \overline{5·14} = \underline{25·7}$.

The observed volume of iodide of silver is 41·12, or eight times the silver stere. Subtracting two steres for Ag, there remain six for the iodine, and we have $Ag_2^2\ I_6^6 = 8 \times \overline{5·14} = \underline{41·12}$.

The observed volume of bromide of silver is 30·84, or 6 × 5·14. Our formula is, therefore, $Ag_2^2\ Br_4^4 = 6 \times \overline{5·14} = \underline{30·84}$.

The volumic constitution of the iodides and chlorides of the alkaline metals is determined from the data already given:

$K_1^4\ I_1^4 = 10 \times \overline{5·4} = \underline{54·0}$	$K_1^4\ Cl_1^3 = 7 \times \overline{5·4} = \underline{37·8}$
$Na_1^2\ I_1^4 = 8 \times \overline{5·4} = \underline{43·2}$	$Na_1^2\ Cl_1^3 = 5 \times \overline{5·4} = \underline{27·0}$
$Li_1^1\ I_1^4 = 7 \times \overline{5·4} = \underline{37·8}$	$Li_1^1\ Cl_1^3 = 4 \times \overline{5·4} = \underline{21·6}$

Rubidium was found to contain three steres more than potassium; we have, therefore:

$Rb_1^7\ I_1^4 = 13 \times \overline{5·4} = \underline{70·2}$	$Rb_1^7\ Cl_1^3 = 10 \times \overline{5·4} = \underline{54·6}$

Again, rubidium was found to have double the volume of ammonium, and we must, therefore, write $Am_2^7\ Cl_2^6 = 13 \times \overline{5·4} = \underline{70·2}$, or twice the observed volume 35·1. The bromides have been calculated in the same way.

The difference in the densities and volumes of the two varieties of cinnabar is explained as follows: Amorphous black cinnabar is $\overline{Hg_2^2}\ S_2^2 = 11 \times \overline{5·52} = \underline{60·72}$, or twice the observed volume 30·36; while red rhombohedric cinnabar is $Hg_2^2\ S_2^2 = 11 \times \overline{5·30} = \underline{58·30}$, or twice the observed volume 29·10. In the black variety the mercury stere predominates, while the red is ruled by the sulphur stere.

Schroeder has the modesty to call his steric law simply a hypothesis, but he believes that it will force its way into general acceptance; and he concludes his memoir with the following general statements. Bodies combine only in whole volumes having whole steres, just as they have only whole atoms. Simple volumic relations are perceived in gases at equal temperatures and pressures, in liquids at temperatures producing an equal tension of their vapors, and in solids when the steres of their controlling elements are ascertained.

C. F. K.

Formation of Coal.

E. Fremy holds that there are several kinds of isomeric cellulose, constituting the skeleton of plants. Coal is not an organized substance. The vegetal impressions presented by coal are produced as in shales or other mineral matters. The chief substances contained in the cells of plants under the double influence of heat and pressure produce bodies having a great analogy to coal. The pigments, the resins, and the fats of leaves, if submitted to heat and pressure, yield compounds which approximate to bitumens. The vegetable matter which gave rise to coal has undergone, first, the peaty fermentation, the coal being then formed by a secondary transformation.

H. W. WILEY finds that one part of uranine in one million parts of water is readily detected by means of the spectroscope.

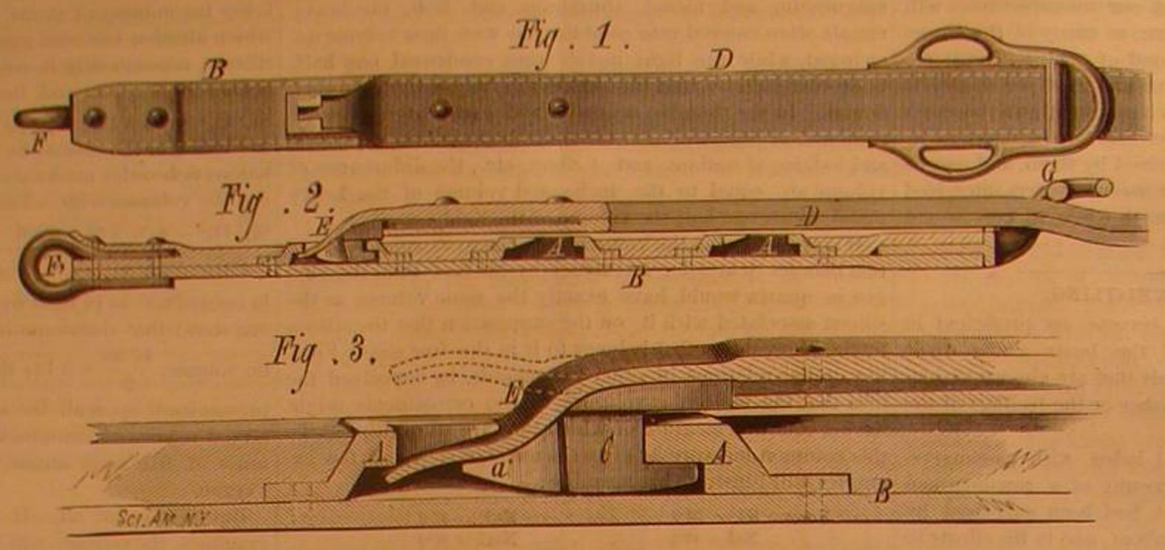
AN IMPROVED TUG COUPLING.

The annexed engraving represents an improved tug coupling recently patented by Mr. P. B. Hirsch, of 374 Blake street, Denver, Col. It is applicable to both light and heavy harness, and is easily coupled or uncoupled without twisting or turning the trace.

The metal boxes, A, are firmly embedded and riveted in the cockeye portion, B, of the coupling, and are slotted and recessed to receive the hooked metal tongue, C, secured to the trace portion, D, of the coupling. The shank of the tongue, C, is firmly riveted in the part, B, and turns downward and inward, forming a strong hook. When the tongue is inserted in one of the boxes, A, and pulled so that the hook enters the recess in the box the adjustment is complete. The flexible leather tongue, E, is then thrust into the wider part of the slot in the box, over the spur, *a'*, to prevent the accidental disengagement of the hook.

The inventor claims important advantages in regard to strength, convenience, and durability, and appearance over the ordinary forms of coupling.

Further information may be obtained by addressing the inventor as above.



HIRSCH'S TUG COUPLING.

A NEW WATER METER.

It is a well known fact that three fourths ofthe water supplied to consumers in all cities is wasted through carelessness, leaky pipes, bad plumbing, and open faucets. The unsuccessful efforts of city authorities have shown that the waste cannot be regulated and the difficulties obviated except by the use of water meters. By their use the supply would be diminished, the water taxes reduced, and each consumer would pay only for what he used—not for what his neighbor wasted. The trouble has been in the past that meters could not be made so cheap that their use could be made general. A meter must be mechanically perfect; a perfect register; certain and positive in its motion; without a dead center and a disposition to stop. A machine of such peculiar and delicate essentials is not easily obtained at a small expense.

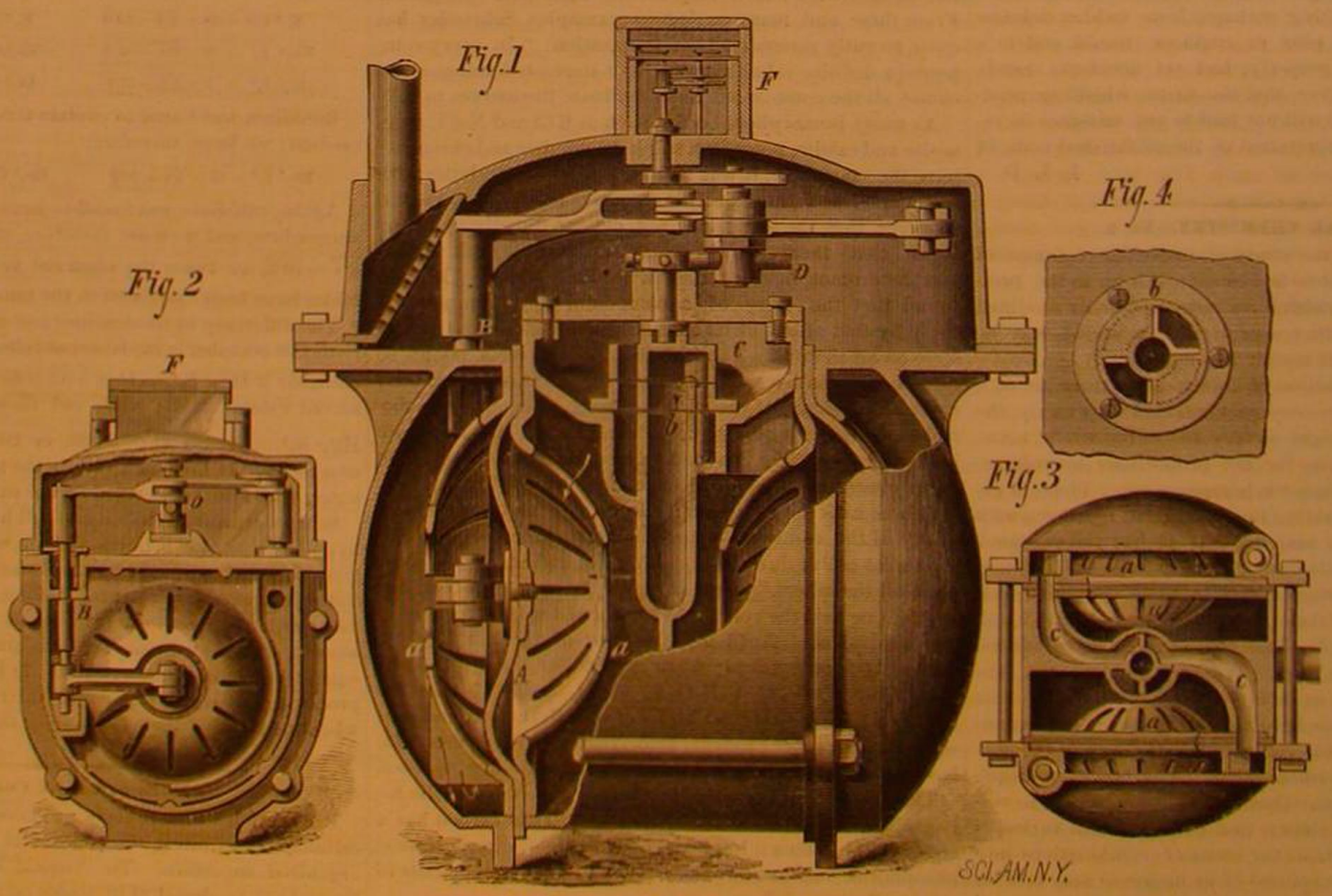
Mr. W. B. Mounteney, of the People's Gaslight and Coke Company, of Chicago, Ill., has after four years of thought and work invented a meter which he has named "The Mounteney Diaphragm Meter," and for which he claims all the excellences which such a machine should possess. It is said that the registering dial hand moved as regularly under the lightest as under the fullest pressure, and that a cubic foot of water is as accurately measured when drawn by drops as when drawn through a five eighths pipe with full pressure. The machine is noiseless and frictionless, and simple and durable in its construction, and as it is made of unfinished castings it can be made cheap.

The general form of the apparatus is shown in Fig. 1 which is a side elevation partly in section; the other figures represent details not clearly shown in Fig. 1.

The upper part of the meter chamber receives the water from the supply pipe, and contains the levers that actuate the registering mechanism and the rotary valve, C. The lower portion of the meter is divided into four compartments by a central rigid partition and the two flexible diaphragms, A. The latter are placed between concave metallic diaphragms, *a*, which are slotted to insure the easy detachment of the rubber diaphragm, and to agitate the water so as to prevent the accumulation of sediment. The rubber diaphragms are connected with the arms of the rock shafts, B, and the latter extend into the upper or receiving chamber through a simple and very effective stuffing box, and are provided with arms which are connected by links with a crank on the shaft of the valve, C. The registering mechanism at the top of the casing receives its motion from the crank on the valve shaft, and accurately records the oscillations of the diaphragms, and consequently indicates the amount of water consumed. The entrance and eduction of water to all of the compartments is controlled by the rotary valve, C, which is operated by the diaphragms through the medium of the shafts and levers already described. The water under pressure is alternately conducted to and allowed to flow from opposite sides of the pair of diaphragms, so that both diaphragms are made to traverse alternately backward and forward as the chambers are alternately filled with a measured quantity of water, which will be accurately indicated by the index and dial of the registering apparatus.

It will be noticed that this meter contains no pistons or other parts that are liable to corrode, and stick or get out of repair.

Further information may be obtained from Mr. William B. Mounteney, 39 and 41 So. Halsted street, Chicago, Ill.



MOUNTENEY'S DIAPHRAGM METER.

New French Torpedo Vessel.

The Compagnie des Forges at Chantiers de la Méditerranée have just supplied to the arsenal at Toulon a torpedo boat, whose length is 110 feet and width only 10 feet, the draught of water not exceeding 38 inches. The speed attained by this vessel at the official trials is stated to have averaged 19 knots per hour. In the front of the vessel is a chamber furnished with a tube to receive a Whitehead torpedo of the largest dimensions. When it is desired to launch the projectile the front of the vessel is opened by special mechanism, and the torpedo is projected into the water, either by means of a jet of steam or compressed air. As soon as the Whitehead torpedo has left the projecting tube it is propelled automatically by means of the motor contained within it, and pursues its course toward the object of attack at a speed exceeding 20 knots an hour.

Threatened Failure of the European Silk Crop.

The London *Saturday Review* reports that serious fears are entertained of a failure in the European silk crop. The countries which grow silk are Italy, France, and Spain, in Europe; and in Asia, China, Japan, India, Asia Minor, and Syria; to which has lately been added America. The American production, however, is so small that it may be left out of account. Asia Minor and Syria were once producers on a very large scale, but have long ceased to be so, and the Spanish crop has also become insignificant. Even France is rapidly falling off in her cultivation of the silkworm. Practically, therefore, manufacturers now depend for their supply on Italy and the far East. In Europe, we may say roughly, the Italian crop exceeds the French, upon an average, nearly four times, while the French exceeds the Spanish in a still greater proportion. We may further illustrate the important position occupied by Italy in this industry by saying that, while a good Italian crop is expected to yield about 80,000 bales, the average import from China to Europe falls short of that amount by about 15,000 bales. A failure of the Italian crop means, therefore, in effect, a failure of the European supply. Now, it is said that not only in Italy, but in France and Spain also, the intense frosts of the spring have fatally injured the cocoon. The badness of the weather, moreover, has so checked vegetation that there are not sufficient leaves for the worms, among which there is, in consequence, very great mortality. And, in addition to all this, it is feared that if heat now sets in the damage will become irremediable, as the leaves of the mulberry will be dried up altogether.

To a large extent the excitement that prevails is founded upon mere apprehension, and it is possible that matters may not turn out nearly as badly as is feared. Much may happen before harvest. But it is not to be forgotten that the injury done by the severe frost on the night of April 14, 1876, was never repaired. During the two months which followed that disaster reports were in circulation similar to those now current, but they were set down to the designs of speculators. At the end of June, however, they were found to be correct, and a sudden and extraordinary rise of price was the result. Persons interested in the trade remember all this, and are resolved not to be caught a second time. There has, therefore, been a great deal of speculative buying, and in consequence a sharp upward movement of the market during the past fortnight. Yet it does not necessarily follow that the experience of three years ago is about to be repeated.

In the trade itself the accepted estimate is that one third of the Italian crop is irreparably damaged.

From Lyons the reports are equally unfavorable. If this estimate proves correct, the European supply will fall short by, at the least, 30,000 bales. In other words, the average annual import from China would need to be increased fifty per cent to make up for the loss in Europe.

Of course we say this merely by way of illustration. The silks of India and Japan are more like those of Europe than the Chinese, and they would naturally be drawn upon more largely by European manufacturers. All these countries would therefore contribute their quotas; yet, even so, it is not to be expected that they would be able to furnish anything like the full amount. The harvest in the far East is already completed, and is said to be abundant in quantity and excellent in quality. But the cultivation was adjusted to meet an average demand. The European failure was not, and could

not have been foreseen, and consequently means do not exist of supplying this year in full measure the European deficiency, supposing it to occur. Assuming, therefore, that there is not an extraordinary falling off in the consumption, there must be a very great rise in the price of raw material.

In New York the prices of silk goods have lately been advanced.

Coal on the Pacific Coast.

The San Francisco *Journal of Commerce* reports a prospect of an abundant supply of high grade bituminous coal from Washington Territory. Among the latest beds discovered are the Carbon Mines, on Carbon River, Pierce County, 1½ to 3 miles southwest of the Northern Pacific Railroad at Wilkinson Station. They consist of five claims of 160 acres each, on which twelve coal veins have been opened. All of these can be worked by a cross cut of less than 600 feet. The coal beds, as far as they have been exposed, extend 2½ miles in length and have a thickness of 115⅝ feet.

The quantity of coal that can be moved without pumping is estimated at 26,000,000 tons. At the present rate of consumption in California this would last over forty-seven years. The coal is of all grades, from the semi-anthracite to the richest bituminous, and will supply qualities for steam, grate, domestic, forge, gas, and smelting purposes. These coals are all free from sulphur, and make from 64 to 75 per cent of splendid coke for smelting purposes. The cost of mining and delivering in San Francisco will be $4.50 to $5 per ton, so that selling at $6 per ton a very handsome profit will be made. An assay made by Henry G. Hanks, gives the following as the composition of this coal:

	Per cent.
Fixed carbon	57·9
Volatile combustible matter	35·0
Ash	5·8
Water	1·3
Total	100·0

"This shows," the *Journal of Commerce* remarks, "that they are equal in quality to any coals ever sold in San Francisco, and they may by and by be expected to lead the market. The thickness of the veins now open to view is 115⅝ feet, as against 85 feet for that of all the other veins yet opened on the Pacific Coast.

The Way to Wealth.

The Rev. Dr. R. D. Hitchcock, who is not only a prominent theologian, but a profound thinker, says: "Suppose no muscle is put into the land; no sweat moistens it; it goes back into its original wildness, and that which formerly supported one hundred civilized men, affords support for one savage. The value which land possesses has developed by labor. Have you considered how short-lived labor is? Crops last no more than a year. Railways, so long as you stop work upon them, go to pieces rapidly and cease to be valuable. Houses have to be made over constantly. St. Peter's Church, at Rome, one of the most solid of structures, is repaired annually at a cost of $30,000. [The Reverend Doctor might have added, mechanics actually live in houses erected on the top of St. Peter's, that they may watch for any defect and attend to any leak in the roof.—EDS.] A great part of the wealth of the world is only 12 months old; when men stop working it passes away. Suppose you earn $1.25 a day and spend the same, at the end of the year you are no better off than at the beginning. You have only lived. Suppose you spend $1, or, better still, 85 cents; then you have become a capitalist. Capital is wages saved, and every man can become a capitalist. I began to preach at $550 a year; I've been there, and know what it is. My rule was then, and has been ever since, to live within my income. So it would have been, no matter what my business. Spend less than you earn; then you will acquire capital, and your capital will be as good as that of any other man."

Seeds of Camellia Japonica.

The seeds, after being freed from their oil by pressure, are exhausted with alcohol, the alcoholic solution precipitated by lead acetate, and the yellow precipitate thus produced decomposed by sulphureted hydrogen; on evaporation, a bluish-white powder of bitter taste is obtained, which the author calls "camellin." This substance is almost insoluble in water, and, when boiled with sulphuric acid, reduces alkaline copper solutions; it appears by other reactions to resemble digitalin, and has the molecular formula $C_{32}H_{44}O_{12}$. Boiled with dilute sulphuric acid it yields only a small amount of sugar, showing that it is decomposed only with great difficulty or else that other substances are produced. The alcoholic filtrate, after separation of the precipitate produced by lead acetate, leaves, when evaporated, a residue of a yellow color and bitter taste, which contains sugar and tannin, and perhaps another glucoside. The Japanese consider the seeds to be a poison, and the oil was formerly used to oil the swords of Japanese warriors.

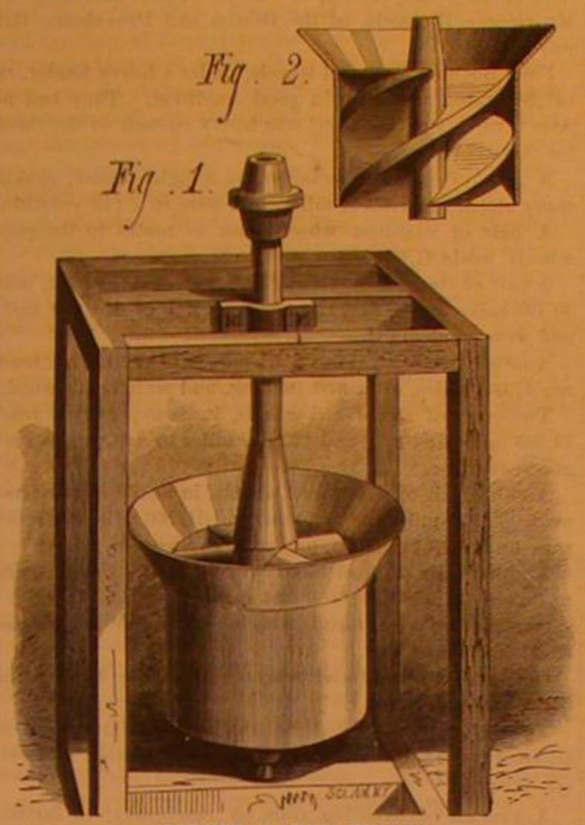
Fluorescence.

J. L. Soret has already pointed out the beautiful violet fluorescence of solutions of cerium sulphate and chloride elicited only by the extreme ultra violet rays of the induction spark, the solar rays not being sufficiently refrangible for its production. He has since found that the solutions of many salts of the earthy metals possess analogous properties. He enumerates lanthanum chloride, didymium chloride and sulphate; terbium, yttrium, erbium, ytterbium chlorides; philippium chloride; thorium sulphate; zirconium sulphate and chloride; aluminum and glucinium chlorides.

IMPROVED WATER WHEEL.

The engraving given herewith represents an improved water wheel recently patented by Mr. Albert B. Couch, of Newnan, Ga. It is designed to run perpendicularly or horizontally, or at any desired angle, and it has the advantage of being very simple and inexpensive.

The wheel consists of a spiral or screw of any desired pitch, mounted upon the shaft, and inclosed by a casing which revolves with it. The upper portion of the casing is flared, forming a funnel for receiving the water, which is delivered to the wheel in quantities just sufficient to fill the funnel without overflowing it. Figure 2 shows the internal construction.

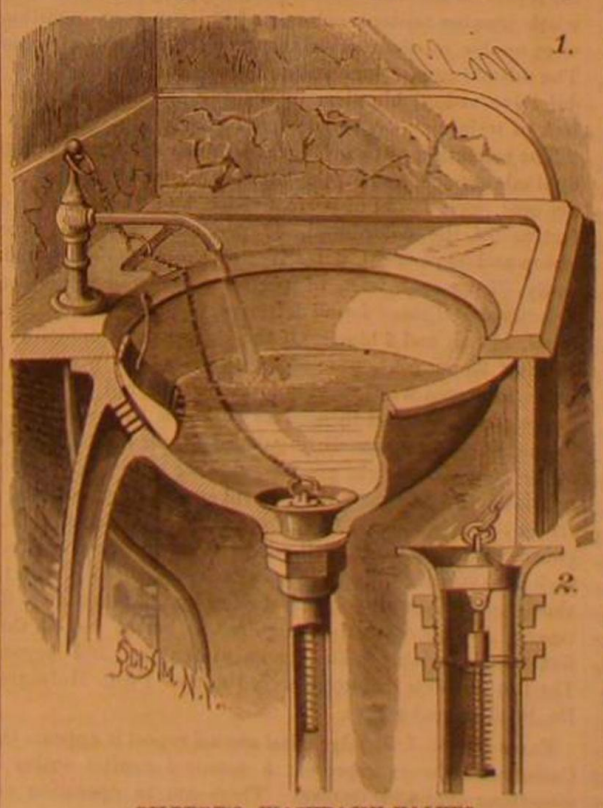


COUCH'S WATER WHEEL.

Motion is taken from the wheel by a belt which runs on the outside of the casing, or by attaching a cog wheel. The inventor claims that he realizes a percentage of power which will compare well with the best wheels in market.

IMPROVED WASHBASIN VALVES.

The plumbing of a house consists, practically, of two pipes—one connected with the water supply and the other with the sewer. Great care is taken to have the water pipes tight, so that there shall be no leakage, while comparatively little attention is paid to the drain pipes, which, in many cases, are pouring into the dwelling a flood of sewer gas.



GILBERT'S WASHBASIN VALVES.

The common water trap, when full of water, is the only device that will close a sewer pipe perfectly airtight; but the water trap is liable to be siphoned out by the rush of water through other waste pipes, permitting the entrance of gas, and when it remains full it becomes saturated with sewer gas, and is almost as pernicious as the sewer itself. In other contrivances an obstruction of the thickness of a piece of paper will allow the gas to enter. The principal thing to be accomplished is to prevent siphoning, and thus to admit of the use of the best form of trap. This is accomplished by the devices shown in the accompanying engraving, in which Fig. 1 represents a washbasin having a side broken to show the improvements in place. Fig. 2 is a vertical section of the escape valve, which is provided with a jointed stem, and a spring for holding it to its seat. The valve is opened by means of the chain, and as soon as the chain is released it closes automatically. When it is desired to hold it open for any purpose the extra ring in the chain is slipped over the top of the faucet. The joint in the valve stem permits of tipping the valve so that any obstruction in the pipe may be readily removed. The float valve, which covers the overflow, rises when the water in the basin exceeds a certain limit and allows it to escape, but when the water is below the overflow the valve closes the overflow openings, so that no air can enter the waste pipe. This being the case there can be no siphoning, and the water required to seal the S traps will remain and prevent the gas from passing, and the basin valves will prevent any emanations from the water in the trap from entering the room.

We are informed that these valves can be applied to basins already in use, and that basins are made having the valves attached.

Further information may be obtained from Mr. James McQuiston, 102 West 14th street, New York city.

RECENT AMERICAN PATENTS.

An improved life preserver and swimming plate or paddle, consisting of a disk or plate made of cork, having a mitten attached to it, and provided with a strap and buckle for securing it to the wrist, has been patented by Mr. Charles Primbs, of United States Army.

Mr. Joseph Truax, of Mount Gilead, O., has patented an improved bee-hive, having honey-boxes with loose comb guides that insure the formation of a straight comb, which may be easily removed without cutting or breaking the box.

An improved device for holding up the thills of wagons, sleighs, and other vehicles, to keep them out of the way and prevent them from being broken, has been patented by Messrs. George H. Pitcher and Leonard Young, of Lewiston, Me. It consists of a forked arm rising from and extending over the yoke, having its branches curved and made elastic for the reception of the thills.

Mr. Michael P. Low, of New York, N. Y., has patented a cheap and effective mode of fastening mica to the doors of stoves, ranges, and furnaces. The invention consists in casting on the inner side of the door, above and below the openings, lugs of peculiar form for holding the mica.

An improved ballast-log for vessels has been patented by Mr. Cesare Leparelli, of New York, N. Y. It is formed of a heavy and lighter upper part, and is designed to furnish an improved means of ballasting vessels when in port and empty.

A wardrobe hook, having at the upper part a tenon and a lip or flange for receiving a shelf, has been patented by Mr. Lewis F. Ward, of Marathon, N. Y., the object being to adapt the ordinary wardrobe-hooks for use as brackets or supports for shelves.

An improved machine for shaving the sides and edges of hoops has been patented by Messrs. A. J. Philpott & G. W. Horton, of Owensborough, Ky. The invention consists in two pairs of upright knives and a pair of horizontal knives, between which the hoop is drawn by a wheel and sweep.

An improved lamp attachment for preventing combustible dust from entering the flame, has been patented by Mr. Louis W. Peck, of Minneapolis, Minn. The device consists of a tube or box having a diaphragm or partition that causes the deposit of the dust before it reaches the flame.

An improved knocking-over bit for knitting machines, which consists in a slitted and mortised frame for holding the bits, which are of novel form, and are provided with a yielding support, has been patented by Mr. W. D. Ormsby, of Waltham, Mass.

Small Vessels for War.

A letter of Hobart Pasha to Mr. Brassey, M.P., is published in the London *Times*, reiterating his opinion that small vessels are best for fighting purposes. He says: "What we want are small, heavily-armed, fast vessels, that can, as it were, 'hop round their enemy like a cooper round a cask,' hitting him on every vulnerable point, shelling his decks at long range, and worrying him to death. Of course, the small vessels would be liable to a hard knock now and then; but you cannot go to war in kid gloves. As to bombarding forts, rely on it, in these days of 35 tons in masked batteries, or batteries cased with 30 inches of iron, the idea is obsolete—no sane man would think of such a thing. Fleets' guns can only be used against land defenses in making a diversion while landing troops. Remember, also, the immense cost of losing by torpedoes or otherwise, one of the new monsters such as Italy has built."

Palmetto Fiber for Paper.

The Fernandina (Fla.) *Mirror* reports that the machinery, lately brought to that place by Professor Loomis, for the preparation of palmetto fiber is working satisfactorily, and that the experiment is an assured success. The stalks of the scrub palmetto are used. It is said that the fiber is likely to prove useful for cordage, paper, tubs, pails, flour barrels, boats, powder kegs, and no end of other articles of general use. A portion of the fiber shipped to paper mills is intended for the manufacture of a high grade paper to be used by the Canadian Government in the printing of bank notes. Ultimately, it is said, the various grades of paper fiber will be made into pulp in Florida.

RECENT MECHANICAL INVENTIONS.

Mr. Ludwig Marx, of West Chester, Pa., has patented an improvement in barber's chairs. The back is slotted and pivoted in the frame and hinged to the bottom, the latter being arranged to slide upon rollers. A screw is provided for moving the seat back and forth.

An improved paper pulp screen, patented by Mr. John S. Warren, of Gardiner, Me., consists of a hollow screen box arranged to revolve in a tank, and containing a hollow shaft, upon which there are conical sleeves which agitate the pulp and keep the screen free.

Mr. George Hoag, of New York city, has invented an improved combined scale and coin tester. It may be used for weighing letters and other mail matter, and for testing the weight, size, and thickness of gold and silver coins. The scale pan is slotted to accommodate coins of different sizes, and two extra beams are provided, one for gold and the other for silver coin.

A bit for boring out rifles, to render them smooth and of a uniform caliber, has been patented by Mr. J. O. Martin, of Oak Level, Va. The invention consists in a bit of cylindrical shape formed at the end of the bit rod. The cutters are made by grooving the bit rod at an angle of forty-five degrees to the length of the rod. The cutters thus formed are intersected by grooves cut parallel with the axis of the rod.

An improved momentum brake for spinning mules has been patented by Mr. Jeremiah D. Stanwood, of East Killingly, Conn. It consists in a novel combination of mechanism applied to the Mason mule, which prevents the yarn from drawing out of the rolls by the standing twist, and makes it equal to that spun upon spinning frames by dispensing with twist motion and regulators.

Mr. William M. Dunn, of Graysville, Ga., has devised an improved lumber gauge for saw mills. It consists of a guide in which is placed a bar with an arm projecting from it, and carrying a roller which touches the log, and a pointer extending over a scale on the guide.

An improvement in lithographic printing machines has been patented by Mr. Joseph Krayer, of Johannisberg-on-the-Rhine, Wiesbaden, Germany. It consists in a novel combination of mechanism which cannot be described without illustrations.

An improvement in lock works for clock movements has been patented by Mr. George B. Owen, of Winsted, Conn. It consists in providing the striking cam with a clutch adjustment, so that when the minute hand is turned forward, a pin on the shaft clutches the cam and turns it against the wire lever that actuates the pawl controlling the striking wheel; but when the hand is turned back any distance less than an hour the shaft is disengaged from the cam.

Mr. John Heald, of Chorley, England, has patented an improved machine for grinding and doughing India rubber. It consists of an agitator and rollers having adjustable bearings, and a hollow roller adapted to receive either steam or water, this roller being provided with a clearing knife.

An improved stamp canceler, patented by Mr. Ernest W. Brenner, of Fort Totten, Dakota Territory, has a rotary cutter for defacing the stamp as the marking or printing device is brought into operation. The cutter is mounted upon a spirally grooved rod, which is turned by the descent of the printing stamp. The printing stamp has a novel automatic inker.

Mr. Charles Seymour, of Defiance, Ohio, has patented an improved device for balancing cylinders and cutter heads. The invention consists mainly in a frame provided with centers for holding the cylinder or cutter head. This frame is supported in gimbals or upon a universal joint, so that when the cylinder is rotated the throw due to inequalities of weight or form is made manifest, and furnishes sufficient data for the correction of the difficulty.

RAILWAY NOTES.

IN his report on the railway exhibits at the Paris Exhibition, Assistant Commissioner Anderson says, that as there is no part of the world where railroads have been such an important agency in material development as has been the case in the United States, so it is gratifying to observe that nowhere else has there been greater progress in the art of railway construction, or in the business of railway administration and management. Of the 185,000 miles of completed railways in the world in 1878, nearly one-half were in the United States. Having reference to territorial areas, this preponderance is very great, but as compared with populations, it is enormous. In 1878 there were 15,000 miles of completed railway in France. The gross receipts were $162,847,105. The average receipts per mile were $13,132. They employ 183,000 persons, or an average of 12 6-10ths per mile. The mean velocity of passenger trains an hour is 32 miles. In Great Britain there were 17,000 miles of road open in 1877, at an average cost complete of $174,000 per mile. The net earnings for 18 years have exceeded 4 26-100 per centum per annum upon the whole amount of capital invested. The rate of speed on English railways is greater than on any other railroads in the world, averaging for passenger trains 40 miles an hour, with a maximum of 70 an hour on best trains. The gauge of the trunk lines of Europe is 4 feet 8½ inches between the rails. The narrow gauge, as generally adopted in Europe, is 39 371-1000 inches. The cost of these roads is $29,000 a mile. In England narrow gauge roads have been reduced to 2 feet 11½ inches.

THE preparations for changing the gauge of the St. Louis, Iron Mountain and Southern Railway, which had been in progress for the past two months, culminated Friday night, June 27. At daybreak Saturday over 3,000 men began the work of shifting the rails, and long before night the entire line, extending from St. Louis to Texarkana—nearly 700 miles—had been changed from five feet to the standard gauge of four feet eight and one-half inches. The locomotives and cars had also been altered to correspond, and traffic under the new order of things will proceed without break or hindrance.

THE committee on the best form and material for locomotive wheels and axles, in their report to the American Rail Master Mechanics' Association, at their recent annual convention in Cincinnati, submitted the following mileages of steel-faced and steel-tired wheels. Their authority was Mr. George Richards, of the Boston and Providence Railway:

Four Bochum cast-steel wheels, under a heavy tender, ran 142,260 miles, and were in good condition. They had not been turned, and the wheel was heavy enough on the thread for three turnings.

A pair of paper wheels, under a light tender, making many stops, ran 125,941 miles, and were in a fair condition.

A pair of cast-iron wheels, run as mates to the paper wheels, made 91,062 miles, and were worn out.

A pair of steel-faced wheels, in heavy engine truck, made 50,123 miles on the first run, and a total of 121,929 miles, and were condemned.

Another pair of steel-faced wheels, in heavy engine truck, ran 47,034 miles, after first turning, and were condemned.

Two pairs of steel-faced wheels, in heavy engine truck, 79,905 miles first run, and 129,587 miles to date, and were in good condition.

Another pair of steel-faced wheels, in heavy engine truck, made 71,852 miles the first run, and 41,266 miles the second run; total, 113,118 miles, and were condemned.

Another pair of steel-faced wheels, under heavy tender, made only 31,372 miles the first run.

One pair of steel-faced wheels, in engine truck, made 38,932 miles first run.

One pair of steel-faced wheels, in engine truck, made 64,750 miles first run.

The association adopted the standard car-axle which was adopted by the Master Car-Builders' Association at Boston six years ago.

A SYSTEM of handling rails by machinery, to facilitate track-laying, has been used successfully on the Central Pacific and other railroads. A train of flat cars is provided with a system of adjustable ways, by means of which rails and ties are brought forward in a continuous stream and delivered to the trackmen on the part of the road bed where they are to be laid. It is claimed that this method greatly expedites the laying of track, besides saving the cost of teaming and the injury to the road bed by hauling heavy wagons over it, all teams being dispensed with, and more than half the men usually employed.

Dr. P. D. KEYSER, of the Will's Eye Hospital, Philadelphia, has examined for color-blindness the employes of several railways centering at Philadelphia. According to his report to the State Medical Society, 3½ per cent. of the whole number mistook colors, and 8½ per cent. additional were unable to distinguish accurately the shades of colors. The mistaking of colors was doubtless due in large part to defective vision; blunders in shading are probably due to lack of training.

The refraction of the eyes was carefully examined with the ophthalmoscope, and of the number under examination 79 per cent. were found of perfect vision and 21 per cent. defective; of the color-blind, 47 per cent. were of perfect vision and 53 per cent. defective; of those who only shaded badly, 77 per cent. were of perfect vision and 23 per cent. defective. Of those found defective, 50 per cent. were green blind, 44 red, and 6 blue. Of the 8½ per cent. defective in shading, 95 per cent. were so in greens and 5 per cent. in red. Two men who could not distinguish red from green on test, had educated themselves to know that red was an intense color, and thus distinguished bright red signals, but at the same time bright greens and other bright colors were red to them. For these they would stop their trains, and so err on the safe side. On the other hand, dark reds, dark greens, and browns were all one to them, thus making them useless as signals. Another peculiarity in one case was the ability to distinguish bright red close by, but not at a distance. A color correctly recognized as bright red at three feet was invariably called green at ten feet and beyond. The test methods employed were those of Prof. Holmgren, Dr. Stilling, and others.

FROM Mr. C. J. Brydge's last annual report it appears that Canadian railways represent a nominal capital outlay of something over $360,000,000. There are in operation and under construction 7,905 miles of road. The total train mileage is given at 19,669,447 miles. The number of passengers carried was 6,443,924. The tonnage of freight handled during the year was 7,883,472. The operating expenses for the year amounted to $16,100,102, against $16,290,091 in the preceding year; while the receipts increased from $18,742,053 to $20,520,078. There were 97 persons killed last year, against 111 the year previous; and 361 injured, against 317.

THERE are now considerably more than 300 miles of railway in operation in South Australia; during the present year a large addition to this mileage is anticipated, and many new lines are projected, such as the Port Augusta and Government Gums, and the Mount Gambia and Rivoli Vale Railways, while an important project for carrying a trunk line right across the Australian continent has been favorably received. To build such a line would take some twelve or fourteen years, but when once constructed it would have an extraordinary influence in developing the internal resources of South Australia, and Australia generally.

THE Illinois Railroad Commissioners have obtained returns from twenty-six railway companies, which show that the "life" of a locomotive engine varied on these railways from eight years to twenty-four, and that the general average duration was fifteen and a quarter years. Passenger cars endure from eight to twenty years—the average being fifteen and three quarter years; the average life of stock cars being ten years, and that of freight cars eleven and a half years; and railway bridges, of wood, endure from five to twenty years. As to the life of rails, the statistics seem to indicate that those of iron last from three to twelve years—the mean being seven; while steel rails are credited with from nine to twenty years' service—an average of fourteen years is obtained from the returns.

THE excursion car City of Worcester, devised by Mr. Jerome Marble, of Worcester, Mass., has proved to be a profitable as well as novel experiment. The car is divided into three parts, the ends for about ten feet being devoted to kitchen and pantry at one end, and to closets for clothing, lavatories, etc., at the other. The central portion has 12 double berths built after the Pullman pattern, and is fitted with tables, easy chairs, etc. The party carries a small library, an upright piano, and many of the usual accompaniments of a fine drawing room; while suspended from the bottom of the car are bunkers for provisions, fuel, hunting and fishing appliances, etc. The charge of railway companies for hauling this car is simply the regular first class fare for twelve persons. The inventor says that the cost of a trip of over 4,000 miles travel and seven weeks' duration, for a party of a dozen or more, was but a little over $200 each, this sum including all expenses. Deducting the charges of the railway companies, the expenses of the party living in the car were 57 cents a day each. In this way the disagreeables of ordinary traveling were avoided and the cost was materially reduced.

Preservative Wrapping and Packing Paper.

Mr. John F. Rodgers, of Philadelphia, claims to have discovered a preservative wrapping and packing paper for protecting cloths, furs, etc., from mildew and the ravages of moths and other insects. The patent bears date January 9, 1878. The paper used is made from woolen and cotton rags and manila rope or manila paper. This paper is saturated with a mixture of seventy parts, by measure, of the oil remaining from the distillation of coal tar naphtha by live steam with five parts crude carbolic acid, containing at least fifty per cent of phenols, twenty parts of thin coal tar heated to about 160° Fah., and five parts of refined petroleum.

After saturating the paper it is passed through squeezers and over hot rollers for the purpose of drying. When cool it is cut into sheets as desired, and the drying completed in the atmosphere. The paper thus treated is used for packing woolen clothing, cloth, furs, carpets, and all material likely to be injured by moths, mice, or virmin, and will also to a great extent, he states, prevent cotton material from mildew.

Free Labor in the South.

In an official report on Southern labor it is asserted that the number of acres of cotton cultivated had increased between 1871 and 1878 from about 7,500,000 acres to more than 12,000,000 acres. Between 1869 and 1878 there was an increase of more than 3,000,000 in the number of cattle and swine. It is estimated by Representative Whitthorne that more than $200,000,000 worth of Southern labor products enter into the purchase of merchandise and manufactured goods of New England, New York, New Jersey, and Pennsylvania. The gross earnings of the railroads of Southern States are placed at $42,927,594 per annum, and it is held that all the principal cities and towns of the South have increased decidedly in population, and that there is a constant and general growth of manufacturing establishments.

Malleable Nickel and Cobalt.

Th. Fleitmann has succeeded in obtaining the metals nickel and cobalt in malleable condition by fusing them with a very small quantity of metallic magnesium. He suspected that the absorption of carbon monoxide by the metals might be the cause of their want of malleability, and introduced the magnesium for the purpose of destroying the gas, as this metal is known to decompose the oxides of carbon. The success was very surprising. An addition of ⅛ per cent. of metallic magnesium changes the structure of the metals entirely. They can now be easily welded when hot. Nickel is malleable even when cold, while cobalt becomes extremely hard when cold, so that it will probably be applicable for cutting instruments.

At the same time the cast metals are very compact, and are almost as solid and tough as cast steel, so that the metallic parts of harness and similar objects may be made from them.

Both metals take a very high polish, and resist the action of the atmosphere very well. The author has also succeeded in welding malleable nickel and cobalt together with steel and iron, so that the pieces of iron and steel that are coated on one or both sides with nickel or cobalt may be beaten out to the thinnest plates without any separation of the metals.

THE GEYSERS OF THE AZORES.

We crossed a stretch of the plateau, and suddenly looked down on the other side of it into an immense, deep, nearly circular crater, beautifully green.

Its undulating bottom was dotted over with white houses among gardens and corn fields, and in the distance was seen a small column of steam hovering over the hot springs. We drove down a steep incline for at least a couple of miles, and at last reached the village of Furnas. The road hence to the hot springs led across a small stream fed by them, deeply stained red, and smelling strongly of sulphureted hydrogen. Thence the path went up a little valley, cut out in the low ridge of very fine light whitish ashes which separates the main Furnas valley from that part of it in which the Furnas lake is situated. It is a beautiful tiny glen, with dark evergreen foliage on its steep banks, and on the swamp borders of its narrow bed were masses of the brilliant green leaves of the eatable arum (*Caladium esculentum*), one of the staple foods of the Polynesians, their "taro." The "taro" is cultivated all over the islands, but thrives here, especially in the warm mineral water.

The Furnas lake is about three miles in circumference. There are two groups of boiling springs, the one at the margin of the lake, the other close to the town of Furnas. The boiling springs near the lake are scattered over an area of about 40 yards square, covered with a grayish clayey deposit; a geyser or hot spring formation being composed of matter deposited by the hot water. No doubt the present hot springs are the dwindled remains of former fully developed geysers.

The principal spring consists of a basin about 12 feet in diameter, full, up to within 2 feet of the brim, of a bluish water, which, in the center, is in constant and most violent ebullition, the water being thrown up a foot in height as it boils forth. A constant column of steam rises from the basin.

Near by is a sort of fissure, from which issue, at short irregular intervals, jets or splashes of boiling water mingled with steam and sulphureted hydrogen in abundance.

This spring makes a gurgling, churning sort of noise; the large basin, a sort of roar. In the sides of the fissure grow, in the area splashed by the hot water, some green lowly organized algæ (*Batryococcus*) which form a thick crust upon the rock surface. Similar growths of lowly organized plants in the water of hot springs have been observed in various parts of the world. At a couple of feet distant from this hot spring rushes up a perfectly cold iron spring with a considerable stream of water.

All around are small openings, from which sulphureted hydrogen and other gases issue with a fizzing noise, and coat the openings with bright yellow crystals of sulphur. The ground around is hot, too hot in many places for the hand to rest upon, and it is somewhat dangerous to approach the pools of hot water at all closely, since the hard crust on the surface may give way, and one may be let fall into the boiling mud.

Just above these hot springs is a beautiful mountain stream, which forms little cascades as it tumbles down to the lake valley from the fern-clad moor above.

At the town of Furnas is an inn kept for families who come in the season to drink the waters and bathe. There is a free bath house, built by the government, with marble baths and hot and cold mineral water laid on to each.

The whereabouts of the springs near the town are marked by clouds of steam. The spirngs are scattered over a larger area than at the lake springs, and the gray geyser formation is piled into irregular hillocks around them, instead of presenting a nearly flat surface, as at the other springs.

Here the principal spring is like that at the lake, but the amount of hot steam rushing up is much greater, and the noise is almost deafening. The water is thrown up about two or three feet in a constant hot fountain. Close by are sulphur springs with hot water issuing in violent intermittent splashes; and there is also one deep chasm, from the depths of which boiling hot blue mud is jerked out in similar splashes. The mud hardens on the sides of the cavity into a crust made up of successive laminæ. The natives use the natural hot water to heat sticks or planks, in order to bend them. They also sometimes dig holes in the mud and set their kettles in them to boil. As at the other springs, there are cold springs issuing from the ground close to the boiling ones. One spring has its water charged with carbonic acid and effervescing.

All the springs empty into one small stream, which then runs down to the sea, with a complex mixture of mineral flavors in its water, and retains its heat for several miles.

In the shores of the lake there are large extents of geyser deposit, forming strata 40 to 50 feet in thickness, and evidently resulting from hot springs, now worked out, but with a few small discharge pipes of heated gas remaining active here and there.

Near the seaward end of the lake is a hole, where, as in the Grotto del Cave, an animal, when put into it, becomes stupefied by inhaling the carbonic acid gas discharged.

I made an excursion from Ponta Delgada to the Caldeira des Sette Cidades, or Caldron of the Seven Cities. It is a marvelous hollow of enormous size, with two lakes at its bottom and a number of villages in it. One slowly climbs the mountains from the sea and suddenly looks down from the crater edge upon lakes 1,500 feet below. On the flat bottom of the crater, which is covered with verdure and cultivated fields, are several small secondary craters, the whole reminding one of a crater in the moon. One of these small tracers has been so cut up by deep water courses that between them only a series of sharp radiating ridges is left standing, and the crater has thus a very fantastic appearance.—*H. N. Moseley, Notes by a Naturalist.*

The Quality of American Cotton Goods.

An assertion made in a Rhode Island newspaper, to the effect that the best cotton goods sold in that State were of English and French manufacture, naturally stirred up considerable feeling in certain quarters.

The true state of affairs seems to have been correctly described by a representative of one of our largest manufacturers of cotton goods, who frankly admitted to a *Tribune* reporter that the French manufacture a finer quality of cotton goods than we do, but these are principally lawns and light gauzy fabrics, for which a few people pay high prices. Only a small quantity of them comes here, he said, and it is not unfair to say that nine tenths of all the lawns sold in this country are of American manufacture. "Our mills are greatly improved, and the quality of fabrics turned out is far superior to that of last year. We are now making superior lawns, percales and gauze goods nearly equal to the French in fineness and far more serviceable. The very best cotton goods sold in Rhode Island may possibly be French and English, but this is not true of other States. The manufactories of New York, Massachusetts, and Connecticut make splendid cotton fabrics. The same quality of goods as that manufactured in France could be made here, but it would not pay, as these goods are purchased by only a few persons who are willing to pay 35 cents a yard for fabrics which are really not worth over 15 cents. England is not making any finer goods than America, and as a rule English goods are not so fine as American. The body of English goods is made equal to ours in weight frequently by the use of clay instead of cotton. England is even imitating our trade marks for cotton fabrics to be sent to China, and one American house has been compelled to copyright its labels in England to prevent this. A greater quantity of very fine goods for home trade is being manufactured now than ever before, and several large factories are working from 5 A.M. to 10 P.M., on fine lawns to take the place of foreign goods. There have been recently more orders to American manufactories for British trade than ever before."

Another prominent New York firm, admitting the superior fineness of certain foreign goods, said: "American cotton dress goods have greatly improved in quality, and they are taking the place of foreign cotton and worsted goods. This is especially true of the manufactures of Pennsylvania, Rhode Island, Massachusetts, and Connecticut. Within three years over 10,000 looms have been altered, greatly improving piques and light goods for spring and summer wear. There are over thirty different kinds of fine cotton goods now in market which were not manufactured in this country four years ago."

Of like effect was the testimony of a Rhode Island manufacturer, who said, relative to the fineness of American products: "There is a steady improvement going on in American cotton goods. One mill in Rhode Island is now making Victoria and bishop lawns and jaconets that are equal to anything made abroad, and British manufacturers have frankly admitted that they will destroy their American trade. Certain mills in New England are turning out percales equal to the finest foreign fabrics that formerly sold largely in our market, and at a much lower price."

The New Ocean Pier at Long Branch.

The great iron tubular pier at Long Branch is rapidly approaching completion. At the end of the pier, as far as completed, 660 feet, to which some 200 feet are to be added, there is a depth of fifteen feet at dead low water, and when the two hundred additional feet are added the depth will be twenty-two feet at dead low water. The iron spiles supporting the pier are tubular, they being, for the first 150 feet, six inches in diameter, and the remainder are eight and ten inches until nearly the end is reached, when they are twelve inches in diameter They are driven into the sand to the depth of from 14 to 17 feet. Every 20 feet from the commencement of the pier are lamp posts, each with two lamps, and at the top of each post will be a small streamer. Ash wood is exclusively used in the wood work of the structure. The pier is 25 feet in width in some places and 50 feet wide in others. The approach, not included in the total given length of 660 feet, is 94 feet long. On either side of the approach to the pier, running 250 feet each way, is a handsome pavilion, 25 feet wide, of a very pretty design. This pavilion will be fitted up with promenades, restaurants, balconies, etc. Below this are being constructed 600 bathing rooms, all supplied with gas and running water. The bathing grounds are on either side of the pier and are shaded by it. When the season is over it is proposed, says the Philadelphia *Ledger*, to remove the flooring of the pier, so that the waves can break over the iron work without doing any damage.

Coney Island Pier.

A new and splendid iron pier has lately been constructed at Coney Island, the celebrated sea shore resort, near New York City. Although the pier stands directly out in the ocean, the largest passenger boats have no difficulty in landing. On the 27th of June the first landing was made, by the steamer Grand Republic, from Bridgeport, Conn., with 4,000 passengers. At about 500 feet from the pier she slowed up, and was made fast in two minutes from the time of touching. There was a considerable swell at the time, but owing to the fender piles surrounding the pier head, there was no concussion. The band on board played, flags were waved, and the cheers from the throng on the pier were answered by cheers from the boat. The Grand Republic was received by Capt. Griffin, the pier superintendent, and his officers, and Messrs. Maclay & Davies, the constructing engineers of the work. The pier is of iron, and its construction has been remarkably rapid. The first pile was driven on April 22, and although a few finishing touches, that will require an additional two weeks, are yet to be applied, the work is practically finished for landing purposes.

There are two decks, or stories, and landings are made on the lower one, which is lined on each side with bathing houses, from which steps project into the water. On ascending by stairs to the upper deck it is found to be roofed, and bordered with restaurants, pavilions, and offices yet uncompleted. The pier is 1,000 feet long and 50 wide, with enlargements at the approach, center, and head of 120, 83, and 100 feet respectively. The upper story is 24 feet above high water, and the lower 12 feet. The pier at Scarborough, England, is of the same length, but less than half the width. The Douglas pier at the Isle of Man is also as long, but only 17 feet wide, and the celebrated Westward Ho pier is only half the length and width of the Coney Island pier. The pier stands on 260 piles, all sunk to a depth of 15 to 20 feet into the sand, and well braced. The deck floors are of Georgia pine, and the structures on the top have towers, gables, etc., giving them a picturesque appearance. The structure will be illuminated with both gas and electric lights. The depth of water at the outer end is 20 feet at high tide and 15 at low tide. The cost of the work has been over $200,000.

The Exportation of Machine Made Joinery.

The Baltimore *Sun* describes a new American enterprise in the exportation of machine made doors, window sashes, window blinds, and similar articles of joinery. The first shipment to England of this sort of goods took place in 1877, and although it was confined to doors for the cheaper class of houses, it at once met with a demand that justified the expectations of the shippers. A few window sashes and blinds were also sent; but they were chiefly intended for the British provinces, as Venetian blinds are not used in England. This new trade is, however, only in its infancy. For the first time, in 1877, some 19,000 doors and 6,284 pairs of sashes and blinds were shipped from New York to England, the greater part of which went thence to Australia and New Zealand. Since then California has supplied machine made joinery to Australia, sending there 27,000 doors last month as against some 5,000 sent direct from New York. But the transfer of the Australian demand for machine made doors to California, and its consequent loss to the Eastern States, has been compensated for by an increase in the British demand for local use. The shipments of doors to England and Scotland in 1878 were about 45,000, as against 2,800 in 1877. Up to June of the present year these shipments show a slight increase. It is a trade that is evidently capable of great extension, for all the pine lumber used in England is brought from Norway and the United States. It is a trade, too, that affects the English workman in two ways. For many years past there has been a large annual demand upon England from Australia and other British dependencies where wood of the proper kind is scarce for the doors of warehouses and private dwellings, and to economize the cost of the doors so exported they were made up into packing boxes, four doors placed longitudinally forming each box, the two ends being doors for small closets. As all the doors were hand made, the trade of making them gave employment to quite a large number of English workmen, and the diversion of this trade to California, coupled with the demand that has sprung up in England itself for the machine doors of the Eastern States, must cause a good deal of anxiety among English joiners and carpenters, in the present depressed condition of the labor market there.

A Successful Inventor and Manufacturer.

Sir Henry Bessemer has had an experience that few inventors are allowed to have, in living to see the world-wide results of his invention, and to realize the economy in resources which has been made possible by its use. The sewing machine and electric telegraph have been labor saving in their effect to an enormous extent, but with these it would have been difficult for their originators when alive to estimate the monetary value to mankind of the discoveries. With the making of steel the case, however, is different, for the saving can be figured down to a nicety on every ton made, and the annual product of the various civilized countries is pretty accurately known. From data thus collected it is estimated that in labor and material the world is a gainer to the amount of $100,000,000 a year by using the Bessemer process in converting ore into steel. Or considered in another way, the advantage of a low-priced enduring material, such as Bessemer steel, when compared with iron, has been made a matter of calculation, as far as railroad tracks are concerned, with the following astonishing results: Mr. Price Williams, who is an expert in matters of this kind, has stated that by substituting steel for iron a saving in expenditure will be made during the life of one set of steel rails on all the existing lines in Great Britain of not less than $850,000,000. In view of these facts, says the New York *Sun*, if Sir Henry has obtained in royalties the sum of $5,250,000, most persons will concede he has got no more than he deserves.

NEW PROPELLING APPARATUS.

The two views given in the engraving represent an ingenious and convenient arrangement of machinery for driving a boat by foot power. The hull of the boat is of the usual construction, having a long and tapering propeller screw, whose shaft extends forward and receives its motion from a transverse shaft placed amidships and having foot cranks arranged diametrically opposite. In front of the shaft there is a frame which supports both the steering apparatus and the seat of the operator.

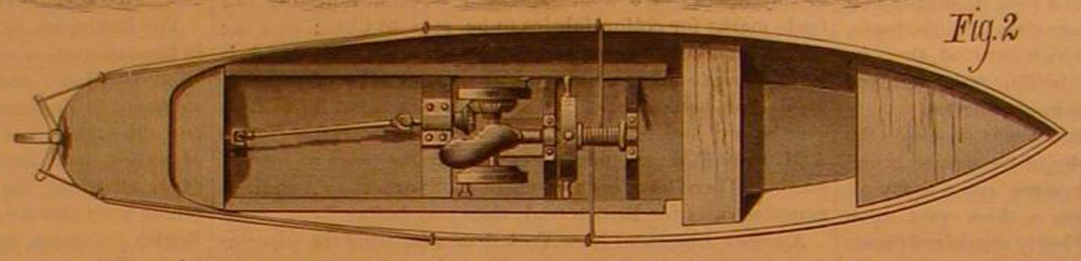
The propeller shaft is made in sections so that it may be lengthened or shortened; and the propelling and steering machinery is fixed to a single frame that may be moved backward or forward, as the loading of the boat may require.

The tiller ropes extend along the gunwale through suitable guides and are attached to the tiller. The rudder is partly supported by the screw shaft.

This invention was recently patented by Mr. A. E. Tangen, of Bismarck, Dakota Ter.

Fig. 1.

Fig. 2



TANGEN'S PROPELLING APPARATUS.

Alum not Allowed in English Bread.

George Allen, baker, of Walsall, was summoned at the instance of Mr. C. W. Stephens, sanitary inspector, for selling an article of food not compounded of the ingredients demanded, and also for selling bread containing alum, so as to be injurious to health. The inspector stated that he purchased a two-lb. loaf at the shop of defendant, and forwarded it to Mr. E. W. T. Jones, the borough analyst, whose certificate of analysis he produced. The certificate showed that the loaf was adulterated with alum in the proportion of 36 grains to the four-lb. loaf, and that such adulteration would tend to render the bread indigestible. Dr. J. Maclachlar, medical officer of health, gave it as his opinion that the quantity of alum stated would be likely to make bread injurious to health. Addressing the bench for the defense, Mr. Nanson said he did not dispute that there was alum in the loaf, but he urged that none was put in by the defendant or at his establishment, and that the flour was used just as it came from the miller. The bench, after hearing the defendant, considered the case proved, and imposed a fine of £5 and costs on the first summons, the other being withdrawn. The fine and costs amounted to £7 14s.

NEW MILLING ATTACHMENT FOR LATHES.

The invention illustrated herewith is intended to supply the wants of machinists who are unable or unwilling to purchase a milling machine and yet appreciate the great saving of labor, files, etc., effected even by the occasional use of such a machine.

This device can be easily applied to any lathe, can be removed or put in position in a fraction of a minute, and will, it is claimed, work with the smoothness and solidity of the best milling machine. It consists, essentially, of a rectangular frame swinging between the lathe centers and carrying a cutter arbor. The position of this cutter frame is adjusted and its stability secured by means of the U shaped clamping plate, which carries a tangent screw, and is itself clamped to the lathe bed in front of the head stock.

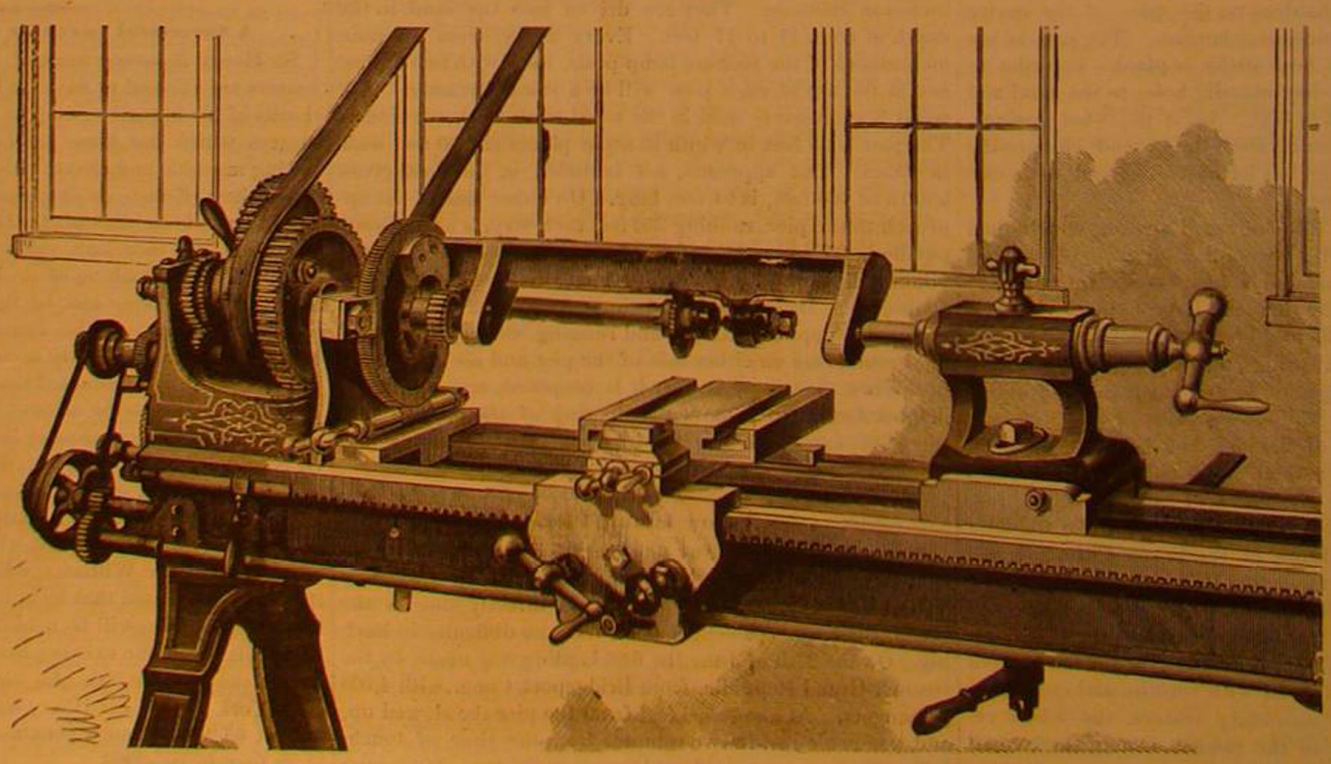
The cutter arbor runs between steel center points, the right hand point being adjustable and secured by a jam nut. It is driven by a gear which is secured to a small face plate screwed upon the lathe mandrel. The front side of this gear carries the running center of the lathe, which bears against the projection of the cutter frame. The position of the cutter frame, and consequently the height of the cutter, is adjusted by the tangent screw engaging the edge of the annular worm wheel plate which forms a part of the cutter frame. This plate, and with it the cutter frame, may be held in any position by the clamping nut which appears in front, and also by a similar nut on the opposite side, which does not show in the engraving. The cutter frame is therefore rigidly secured to the lathe bed at three points in a horizontal plane, and as the running center of the lathe occupies a central position there is no leverage or undue strain upon it.

The friction being upon hardened steel centers the machine runs easily at high speeds, and the solidity of the frame allows the taking of a heavy and smooth cut.

By relaxing a nut beneath the lathe bed and sliding back the tail stock, both clamp plate and cutter frame are released and may be lifted off together.

The bedplate runs on the cross slide of the lathe carriage, and is linked to the tool head so as to traverse with it by means of the cross feed screw. Its longitudinal motion is of course that of the lathe carriage. This bedplate is made in sizes to suit different carriages, and is fitted with centers for fluting taps, facing nuts, etc., and is provided with a vise; it will carry any planer or milling machine vise or chuck of suitable size. It need not be removed when the lathe is performing its ordinary work as it is not in the way, serves to protect the slide from dirt and chips, and is often of use in boring cylinders and similar work. An ordinary parallel vise, mounted on a bar or shank fitting in the tool post, may be used to hold work, thus dispensing with the bedplate altogether. This arrangement, though less desirable, will do good service, and may in some cases be preferred.

Further information may be obtained from Mr. William Main, Piermont, Rockland county, N. Y.



MAIN'S MILLING ATTACHMENT FOR LATHES.

Dr. Reimann advises those engaged in cotton dyeing to discontinue the use of tartar emetic. It does not fix the aniline colors themselves, but merely fastens the tannin, and as antimony can be dispensed with there is no reason why health should be endangered.

Antiquities from Chiriqui.

At a meeting of the New York Academy of Sciences, June 2, representative specimens were exhibited of a large collection of flint implements, golden frogs, potteries, and the like, obtained by Mr. McNeill, from ancient graves in Central America. These objects are for the most part now in the possession of Mr. J. S. Lamson, of this city, who described, from Mr. McNeill's notes, the manner of their occurrence in the graves about the slopes of Chiriqui mountain.

The graves cover many acres (even many square miles) at the base of Chiriqui, near the coast, lying for the most part beneath many feet of alluvial deposit. No external sign marks the place of one of these tombs, but the natives find them readily by sounding the soft earth with long iron rods, which vibrate when they come in contact with flat stones with which they are covered. Some of them are oblong in shape, like modern graves, but by far the greater part are nearly circular. The walls are all of sea-worn stones, of a kind not at present existing in the neighborhood, and the flat slabs that cover them have been brought obviously from a great distance, as no such material exists in the vicinity. It has not been discovered that these tombs are arranged with any regard to special order, but there is some sort of evidence that the larger ones have been reopened for the reception of bodies from time to time, down to a date of comparative recency.

The implements exhumed consist, in the first instance, of knives and rude weapons of stone, together with polishing stones, obviously used to smooth the surface of the pottery. The latter shows a great many interesting forms, most common of which is the jar, very pointed at the bottom, with an extremely narrow neck, and not very inclining lips. They vary in proportions from jars having a capacity of less than a pint to those capable of holding two quarts. The ruder specimens rest upon tripods, while the more highly ornamented have no legs and must have been somewhat inconvenient vessels to handle. The coarser pottery is not decorated in colors. The top is bordered with an ornamented design cut in or incised so as to resemble the modern stamp, and there are some attempts at figure work, the principal animals being the frog, the owl's face, according to some, cougar's according to other critics, and the monkey; although Prof. Putnam, of the Peabody Museum, thinks that these so-called monkeys are rude representations of the human form.

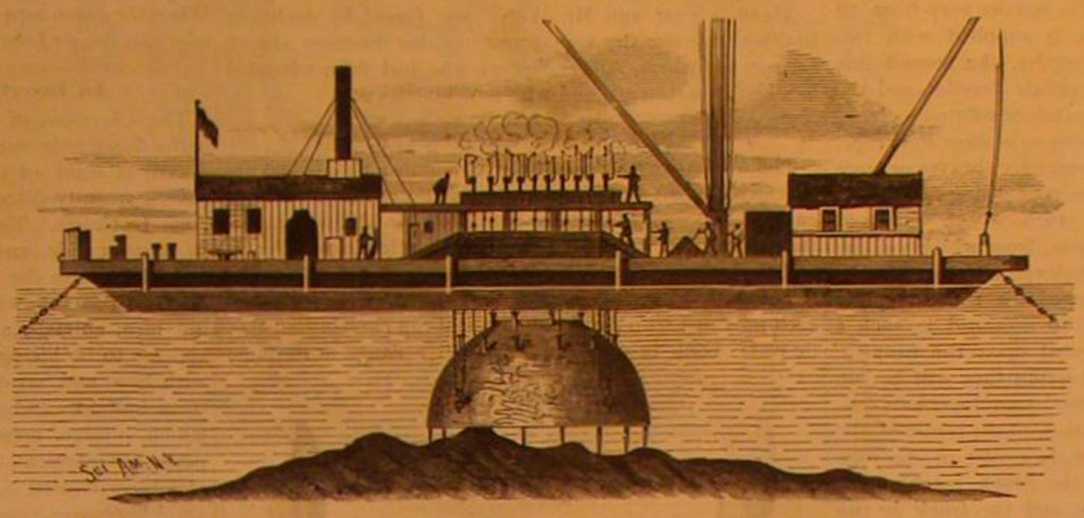
The collection has also some very curious representations of birds, which are ornamented with red stripes upon a black ground. The latter are hollow within and perforated at the tail, at the bill, and beneath the wings, so as to be used as whistles to imitate the notes of birds, and to produce different musical notes by closing one or another of the apertures with the fingers. Their use, unless to attract birds by imitating their notes, is doubtful. The legs of the tripods are heavy, pod-shaped, and hollow, containing within several balls of pottery and furnished with a slit like old-fashioned sleigh bells. Their sound when shaken is similar to that of a rattle-box; but it is scarcely credible that they were used for that purpose, although there are several pottery rattle-boxes in the collection. Professor Putnam, who had given the collection a careful examination, entered upon a very elaborate comparison of these remains with the Mexican, Peruvian, and those of the mound-builders, who, it appears, had a similar trick of hollowing out the legs of their tripods and furnishing them with movable balls. According to Professor Putnam, these remains are found as far south as Bogota, and while they have some affinity for the Mexican and Peruvian potteries, they are both less graceful in design and

less elaborate in decoration. He finds the frog a form common to them all, and so the cougar's or tiger's face. But the Mexicans usually sculptured a face or figure, head downward, upon the external aspect of each leg of the tripod, a feature seldom or never seen in this ruder work. They also ornamented their jars with hieroglyphic inscriptions (which have never been deciphered, by the way), and the latter have no place in the collection of Mr. Lamson, with a single doubtful exception. Professor Putnam did not attempt to assign any special age to these remains.

THE UNITED STATES DRILLING SCOW, EAST RIVER.

[*Continued from first page.*]

and steadying the drills while at work had proved inadequate. At this stage of the undertaking the management of the East River Improvement was intrusted to Major-General John Newton, U. S. Engineer, whose first work was to devise means for meeting the difficulties which had defeated his predecessors. The result was the drilling scow, the construction and working of which is illustrated by the accompanying engravings.

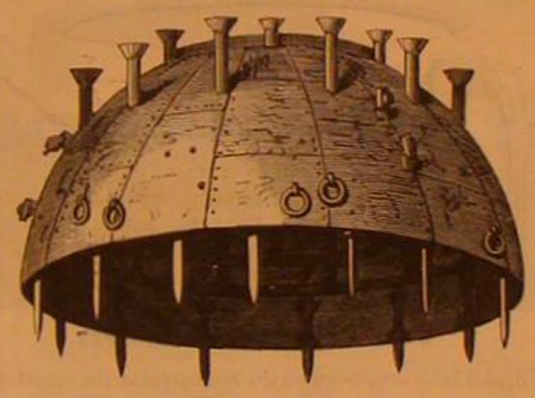


SCOW AND DOME IN POSITION.

The scow is at once a boat, a machine shop, and a fortification. Its great size, massive structure, and overhanging guard, faced with iron, were necessary for the protection of its works against collision. At first such nominal accidents were of frequent occurrence. In a little while it was demonstrated that the colliding vessels were sure to get the worst of the encounter, and since then the pilots have given the scow as wide a berth as possible. Still strictly unavoidable collisions are of almost daily occurrence, owing to the necessary position of the scow while at work, the narrowness of the channel, and the severity of the tides.

In the center of the scow is a well hole 32 feet in diameter, in which is hung a hemispherical dome of boiler plate on an iron frame. This dome, or caisson, is 30 feet in diameter, open at top and bottom, and carries a number of strong iron tubes for the protection of the drill bars. It is also furnished with a dozen stout legs, so arranged that they can be let go all at once, when one edge of the dome touches the reef to be operated on. The legs are held by self-acting cams, so that, when extended to fit the uneven surface of the reef the dome is to stand on, they are securely locked, and thus support the dome in an upright position. The hemispherical shape was chosen for the dome on account of its superior stability under the action of the fierce currents. By converting the transverse pressure of the moving masses of water into a radial pressure downward, the dome is sure to stand firm.

The dome, as shown in the cross section, is attached to the scow by chains connecting with the hoisting engines, by which it is raised and lowered. The drill engines are carried by the stout framework inclosing the well, and are so mounted that they can be placed directly over such drill tubes as may offer the best positions for drilling. Within the dome is another ingenious device, by which a drill tube can be brought directly over any point on the bottom within the 15 foot circle of the upper opening of the dome. It is rarely possible and never necessary to drill as many holes as there are drill tubes provided; the larger number—20 are in the outer circle of the dome, and an unlimited number possible in the inner circle—being furnished to make it easy to locate the drill holes to the best advantage. The drills and drill rods are together about 10 feet long, and weigh between six and seven hundred pounds each. The cutting edges of the drills are in the form of a cross, and are 5½ inches in length. Originally the drill holes were 3½ inches in diameter, but the speed of cutting was found to increase with the enlargement of the bits, and now the larger size is used exclusively. The cutting is done by the impact of the falling drill bar, which drops from two to three feet. The drill rods are connected with the piston rods of the drilling engines by ropes, a flexible coupling being necessary on account of the liability of the scow to slight movements caused by shifting currents and frequent collisions, while the dome is fixed. The length of the rope is regulated by a feed gear, to suit the changing level of the scow due to the rise and fall of the tides. The operations of the scow are grandly simple. With the dome swung by the chains the scow is anchored over the rock to be operated on, head to the tide, by stout chains fore and aft, and side anchors to insure steadiness. The anchor chains are strong enough to withstand not only the stress of the tides, but also the shock of colliding vessels. The site of the blast has already been fixed by the divers, and the scow, when in place, lies so that the dome is directly over the spot selected. Then the dome is lowered, and as soon as it touches bottom the legs are let go and the dome is unhooked from the scow. The diver next selects the most suitable points for drilling, and the drill tubes are brought into position, if within the upper circle of the dome; if not, the nearest available tubes are selected. The drilling engines are then placed, the drill rods are inserted, and the work is set going. The average penetration of the drills during a shift of 8 hours is from 7 to 10 feet, according to the nature of the rock. The average penetration for each hole ranges from 8 to 12 feet. One sharpening of the drill bit usually suffices for a hole.



THE DOME.

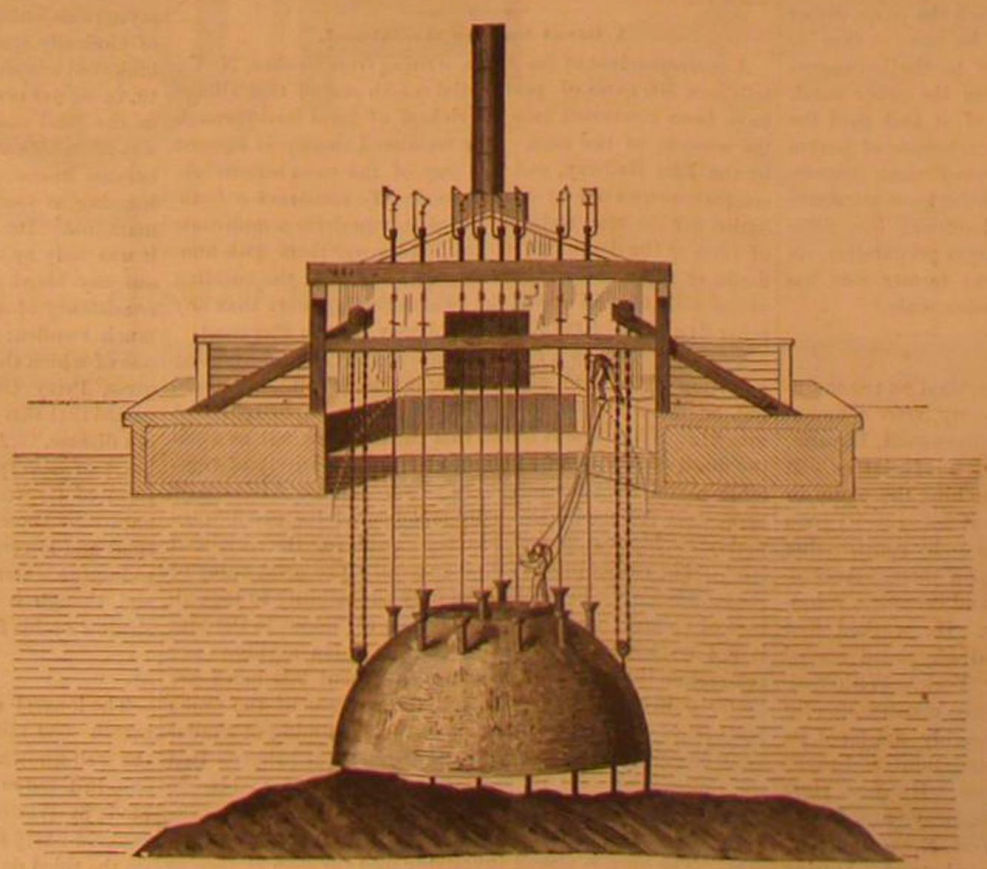
The drilling completed, the diver descends and stops the holes with wooden plugs to keep them from filling with sand and mud, connects the plugs by cords, and the last one by a line to the surface. Then the chains are hooked to the dome, the dome is raised clear of the bottom, and the scow is swung out of position or taken to some other reef.

The charges, inclosed in tin cases about 10 feet long and 5 inches, tapering to 4 inches, in diameter, are conveyed to the site of the blast on a small scow. Guided by the main line of the stoppers the diver, at slack water, descends to the first hole; the charge is passed down to him and inserted; then he proceeds to the next in order, and so on until all the drill holes are charged. In each cartridge is an exploding fuse, from which a fine wire leads to the exploding battery on the scow. When all the charges are down the diver returns to the scow, which is withdrawn to the proper distance and the blast is fired. The visible effect of the blast is the elevation of the water over the reef like a huge dome, which instantly bursts, sending up a huge tower of foam, water, and rock fragments from 50 to 200 feet in height. The appearance varies, of course, with the depth of water, the number of charges, and the amount of explosive used. The prevailing type under favorable conditions is that figured by our artist.

As many as twenty-one holes have been simultaneously fired on Diamond Reef, with a total charge of eleven hundred and forty pounds of nitro-glycerine. During recent operations the location of the dome has been determined by sextant observations, and its separate position and the position of each drill hole have been carefully laid out on a special plan of the reef. At first, the object being to remove with the greatest dispatch the more prominent points of the reef, no attempt was made to secure a uniform removal of the rock. Latterly the work has been conducted by face blasting, with a view to the most complete and economical breaking up of the reef and to facilitate the removal of the rock, which is raised by grappling.

The scow has been used for the removal of the rocks and reefs known as Diamond Reef at the mouth of East River, between Governor's Island and the Battery; Coenties Reef, six hundred yards northeastward, in East River; Pot Rock and the Frying Pan, in Hell Gate; Way's Reef, Shell Drake, and a rock opposite 125th street, Harlem River.

During the past three years, though idle much of the time for lack of appropriations, a considerable portion of Diamond Reef has been reduced to the twenty-six foot level at low water; Way's Reef has been reduced from seventeen to twenty-six feet; Coenties Reef from fifteen to twenty-five feet; and the Harlem River Rock from nine to fourteen feet. Considerable work has also been done on Pot Rock and the Frying Pan.



CROSS SECTION OF SCOW, SHOWING THE WELL HOLE.

MISCELLANEOUS INVENTIONS.

An improved window shade hanging, patented by Mr. Joseph Hemkeler, of Lowell, Mo., consists in combining with the curtain roller a second roll hung in loops of flat belts that are attached at one end to the window frame and connect the flanged spools on the ends of the rolls.

An insulator for telegraph wires, formed of a piece of glass perforated longitudinally, and a screw adapted to the perforation and having a round head provided with a square mortise for securing a key or screwdriver for driving the screw home, and having at each end a rubber ring, has been patented by Mr. J. H. Bloomfield, of Concordia, Entre Rios, Argentine Republic.

Mr. John Sherreff, of Dedham, Mass., has patented an improved mail box, provided with rawhide bunters or protectors. Its body is composed of stout paper board or vulcanized paper or fiber.

An improved article of hard rubber manufacture, formed of strips or sheets of metal foil and caoutchouc, has been patented by Messrs. Daniel F. Connell, of Brooklyn, and Edward Fagan, of New York, N. Y. The strips or shreds are distributed through the rubber to give it increased weight and density.

Mr. Prince H. Foster, of Babylon, N. Y., has patented an improved sanitary mask to be worn in sick rooms and in other places where persons may be exposed to infected or malarial air. It consists of a mask made of rubber or other suitable material, and secured air-tight to the head of the wearer by an elastic band. It is provided with valves and filters at the nose and mouth, and has transparent eye plates or windows.

Wire Rope Transportation at the Reading Iron Works.

The *Iron Age* describes a system of wire rope transportation at the Reading Iron Works, which is expected to do away with much expensive handling and carting, and will offer a good example of a system which is rapidly gaining ground in Europe, and has been repeatedly used with success both in Eastern and Western States, although not to that large extent which its advantages warrant. At the Reading Works there will be three lines of transportation, the first of which will be 1,000 feet in length. It will be used exclusively for conveying pipes manufactured in the establishment to a siding along the Reading Railroad, 90 feet in length, where the pipes will be loaded upon cars. The second line will be 800 feet in length, and will be used for the transportation of anthracite coal, while the third line will be 300 feet in length, and will carry soft coal and pea coal to the rolling mill. The trestles vary from 20 to 45 feet in height. The first line is supplied with two terminal and eight intermediate trestles, the second line with two terminal and four intermediate trestles, and the third line with two terminal and one intermediate trestle.

The main line will be equipped with an endless steel rope, 1¼ inches in diameter, which will run over sheaves or large wheels located upon the trestles, the rope fitting firmly into grooves in the circumference of each wheel. Grooved trucks will be fastened upon the chain, from which will be suspended hangers to support whatever articles may be transported. As this line will be used for carrying pipes almost exclusively, two trucks will be arranged in such a manner as to carry the pipes suspended upon the hangers. When the trucks reach the railroad siding they will be run from the endless rope upon the siding by an ingenious contrivance. From the center of the track to the center of the wheel the gauge is the same as from the center of the rope to the center of the wheel. Upon the truck reaching the siding, the rope shoots at an angle, and the truck is run upon the railroad tracks with its freight. The moment the wheel strikes the rail, the rope slips down and leaves the truck standing upon the rail. The truck is then disengaged from the rope and unloaded. While one line of loaded trucks is being conveyed from the pipe mill to the siding, a line of empty ones is being returned.

The operations of the other lines for carrying coal from the railroad sidings and dumping places to the pipe and rolling mills are of a similar character. The large sheaves, or wheels, are 8 feet in diameter, and the small sheaves are 2 and 3 feet in diameter. The coal will be carried in buckets suspended from trucks fastened to chains. The power used in operating the endless ropes will be transmitted from a stationary engine by the line of shafting in the flue-cutting department of the pipe mill.

Poison for Rats and Mice.

Carbonate of baryta has been found to be a most efficient poison for rats and similar vermin. Indeed, at a special series of trials by the Zootechnical Institute, in connection with the Royal Agricultural College, at Proskaw, this substance was found to be more efficacious than any other. It occurs as a heavy white powder, devoid of taste or smell. In the Proskaw experiments it was mixed with four times its weight of barley meal, and pellets of the paste were introduced into the holes of the rats, house mice, and field mice. A small quantity proves fatal. It appears to cause immediate and complete paralysis of the hind extremities, so that it may be assumed that mice eating of it in their holes will die within them, and so not prove destructive in their turn to domesticated animals that might otherwise devour the carcasses. It was found in practice that neither fowls nor pigeons would touch the paste, either in its soft state or when hardened by the sun; so that its employment is probably free from danger to the occupants of the poultry yards. Some rabbits, on the other hand, that got access to the paste ate heartily of it and paid the penalty with their lives. Next to the carbonate of baryta paste the ordinary phosphorus paste proved most destructive, and this, it was found by experiment, is more attractive to the mice in a soft form than when hardened into pills. But it is considerably dearer than the baryta preparation, an important factor in the calculations of the farmer who has to wage war against rodents on an extensive scale.

Albert Weber.

Albert Weber, the piano manufacturer, died on the morning of June 25th, at his residence in this city, after a lingering illness. Mr. Weber was born in Heiligenstadt, Bavaria, in 1829, and came to this country a youth of sixteen. It was his intention to make a living by teaching the piano or by obtaining a position as an organist, but his sagacity soon taught him that there was more to be made by constructing musical instruments than by playing upon them. Accordingly, he abandoned his earlier notions and became a voluntary apprentice to a piano manufacturer. He worked first with Van Winckle, of Port Chester, and afterward served an apprenticeship with Holder, of New York. With assiduity he devoted himself to the art of piano construction for about six years, in which time he thoroughly mastered its details and intricacies, and then, being ambitious and aspiring, set up in business on his own account. His first store was a little music shop on West Broadway, near White street. Later, he moved further up West Broadway, and opened a store near the corner of Lispenard street. During these years his business continued to increase, and in 1864 he moved to more extensive premises at the corner of Broome and Crosby streets. About this date he began to be known to the musicians of this city; teachers and players flocked to his store, and his pianos came rapidly into favor. In a few years he was well known in professional circles, and in 1869 his business had assumed such proportions as to render another step up town both expedient and necessary. In that year, therefore, he moved to the extensive warerooms on Fifth avenue, which have since been occupied by the firm. Here his business reached splendid proportions.

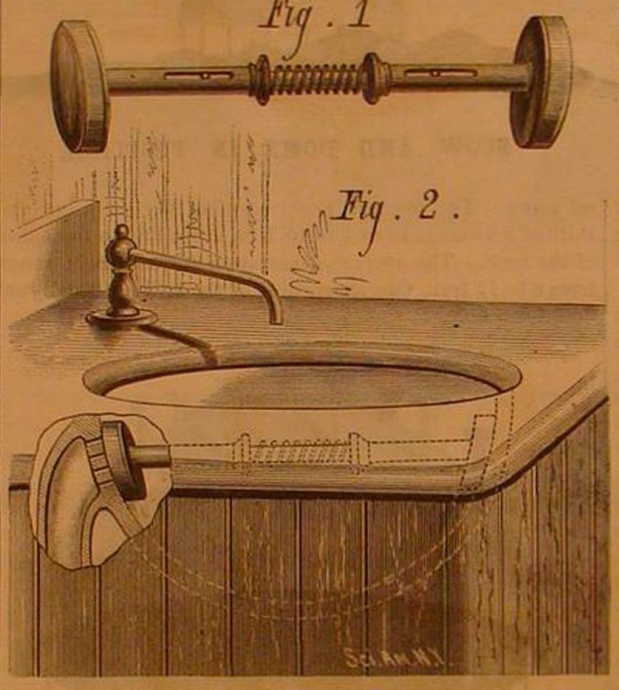
While he was in Broome street he built, in 1868, the manufactory in Seventh avenue, which, in 1876, was enlarged to a frontage of 262 feet on Seventeenth street, and of 204 feet on the avenue. About 400 men are regularly employed, and the yearly product is now between 1,800 and 2,000 instruments. Mr. Weber gave his personal supervision to the manufacture of 14,500 pianos.

About a year ago Mr. Weber was forced by declining health to transfer the management of the business almost entirely to his son, Albert Weber, who had been educated in all its departments, and who now inherits it.

NEW SEWER GAS STOPPER.

The accompanying engraving represents a simple and apparently efficient device for preventing the entrance of sewer gas into a house through the overflow pipe of a washbasin. Its construction will be understood by referring to Fig. 1, and the manner of applying it is shown in Fig. 2.

The stopper consists of two longitudinally slotted tubes, each provided with a curved elliptical cap carrying an elastic pad. Each tube is provided with a flange at its inner



WEMPLE'S SEWER GAS STOPPER.

end, and both are placed on the rod carrying the spiral spring that forces the two tubes apart. The stopper is applied to the basin by pressing the two tubes toward each other, placing one pad over the overflow holes, and then allowing the device to expand by the pressure of the spring. These stoppers are made of different lengths to suit basins of various sizes.

Further information may be obtained from the inventor, Mr. Christopher Y. Wemple, Nos. 2 to 10 Worth street, New York city.

A Great Swamp Reclaimed.

A correspondent of the *Times*, writing from Goshen, N. Y., tells how 500 acres of pestilential marsh east of that village have been converted into the richest of farm land through the wisdom of one man. The reclaimed swamp is crossed by the Erie Railway, and was one of the most serious obstacles encountered by its engineers. To construct a foundation for the road bed it was necessary to drive a multitude of piles to the depth of 100 feet, and cover them with hundreds of thousands of loads of stone and dirt; the building of one mile of road across the swamp costing more than any other five miles of the road from Jersey City to Piermont.

Twenty years ago a farmer conceived the idea of draining a portion of the tract and making it tillable soil. By ditching, he reclaimed 60 acres. The first acre he bought cost him $1. When it was found that the draining left as a soil the finest of black muck, composed almost entirely of vegetable mould, the price advanced to $17 an acre. After the 60 acres were reclaimed, the price still further increased, until to-day as high as $1,000 has been paid for the reclaimed land. The ruling price is $500 an acre. The great value of the land is owing to its extraordinary adaptability to the culture of onions. A crop of 800 bushels of onions to the acre is not uncommon, and the Greycourt onion meadows are celebrated throughout the country. About 300 acres are under cultivation this year, and the success of the onion business in the meadows has led to the reclaiming of similar lands in other parts of the country, until it is believed that the onion crop of Orange county will amount to 500,000 bushels this year. The average price received by onion raisers is $1 a bushel. The average yield is 300 bushels to the acre. The crop is almost invariably sold for cash as soon as it is ready for market, and as it matures early in the season, the farmer is allowed abundant time to keep his land in the condition necessary to its productiveness.

There are 17,000 acres of swamp land in the Wallkill Valley, which will eventually be converted into this muck soil, which is the best in the world for vegetable raising. The land, after draining, is tilled with the slightest labor. Onion seed is sown by a hand drill, and the greatest labor is in keeping down the weeds after the plant begins to grow. This work is done by boys and girls. Hundreds of these may be seen in the growing season on their hands and knees between the onion rows, pulling up the weeds that the rich soil calls rapidly into existence. The weeding requires skill and care, as the soil is so loose that there is constant danger of tearing up the young and tender plants by their roots, or removing their covering of earth. The red onion is the variety grown most successfully, as the dark muck gives the white onion a dirty hue, which injures its marketable value. When the onion tops are at the height of their growth, their odor fills the air for great distances around.

An Inscribed Cavern in Wisconsin.

The *Chronicle*, of La Crosse, Wis., of June 15, prints half a dozen rude engravings, said to be exact tracings (reduced) of some of the pictures on the walls of a small cavern recently discovered in Barre township, some miles from La Crosse. The cave is described as thirty feet long by thirteen wide, and at its largest dimensions about eight feet high above the sand, which is from three to six feet deep. Upon the walls are very rude carvings representing men, animals, arms, implements, and something that appears to be hieroglyphics. One picture represents a man with bow and arrow, shooting at an animal. There are three buffaloes and one rabbit represented; three animals which, if large, must have been hippopotami; one that appears to represent the mastodon, and one moose, quite plainly delineated. There are eight representations of what are either canoes, much carved, or, which they more resemble, hammocks. One sketch of a man is quite plain. He wears a kind of chaplet, or crown, and was probably chief of his tribe or clan. There are many fragments of pictures where the rock has decomposed. It is coarse, soft, white sandstone. On one side there is a space about two feet high and two and one half feet into the wall, that has in time decomposed and fallen out. Above are the upper fragments of pictures and below the lower, showing that they were made when the rock was entire. From the depth to which the decomposition had reached in a dry and dark cavern, they must have been quite ancient.

These carvings, as copied by the *Chronicle*, are such as are commonly made by savages the world over. The alleged mastodon looks more like a hog, while the hippopotamus might be any square muzzled animal. The *Chronicle* says: "Every one who has visited the spot so far has come away convinced that the cave far ante-dates anything short of the ancient cave dwellers, and it needs only a sight of the interior of the room to convince the most hardened skeptic that there is no possibility of humbug." Among the visitors named are Dr. H. G. Miller, who, it is said, has made careful studies of the remains of the mound builders; and Hon. Hugh Cameron, who is described as a well informed geologist. The latter pronounced the discovery as a very important one. This, we take it, will depend entirely on the correctness of the conjecture that some of the animals represented are the prehistoric creatures named.

New Diseases.

Professor Winckel, the Director of the Royal Lying-in Institution at Dresden, has reported to the Congress of Children's Doctors, lately held in Berlin, observations upon a mysterious children's disease, which he had an opportunity of clinically studying in his own institution. An epidemic broke out toward the end of March. Of 23 children attacked, 19, or 82 per cent, died, and the average duration of illness in the fatal cases was 32 hours. The illness began with a sort of sudden stupefaction of the children. The respiration became hoarse, accompanied with groaning and occasional foaming at the mouth. The change in the blood was remarkable. Dr. Winckel made incisions in some cases, but it was only by using pressure that he was able to squeeze out any blood. It was a thick, brown-black fluid, of the consistency of a sirup. The body became flaccid, the liver much swollen; presently convulsions supervened, during one of which the child expired. The President of the Congress, Privy Councilor Dr. Gerhardt, of Würzburg, suggested that this new disorder should be designated "Winckel's disease." Another disease has become apparent in the heart of a very crowded portion of London. It is a new form of Cyprus fever, and a diagnosis of a recent malignant case shows the patient to be suffering from hallucinations and lowered vitality. The faculty ascribe the disease to impure water, and have given it the name of detephobia, and, though it is seldom fatal, the sufferer remains but a shadow of his former self.

Weston's Walk.

The longest distance ever made in a six days' walking match—550 miles—was accomplished by Edward Weston, the well known pedestrian, in the contest for the championship in London, June 16–21. The best previous record was made by Weston's opponent, Brown, in April last, when he covered 542½ miles. In the last contest Brown broke down on the third day, and made, in all, only 453 miles. Weston's daily records were respectively 123, 97, 93, 77, 83, 77 miles.

PLOWING BY ELECTRICITY.

Experiments have just been made at Sermaize (Marne), France, with a new system of mechanical plowing, the invention of MM. Chrétien & Félix, two engineers of the above place, who are already favorably known to the industrial world.

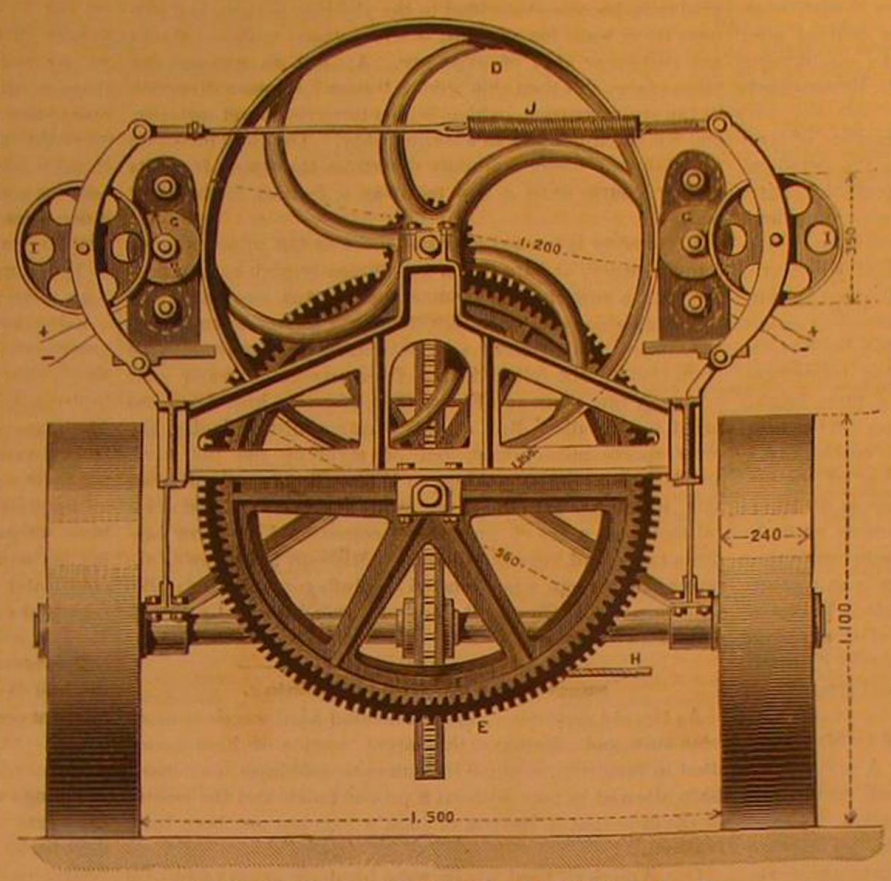
Tillage by mechanical power, as practiced at present in England, the United States, and some parts of France, is based on the use of locomotive steam engines placed on a headland and actuating drums over which passes an endless steel rope serving to carry the plow back and forth over the field. These machines are very high priced; it costs a great deal to manage them and keep them in repair. Special care has to be exercised to make them work well; they are difficult to manage in the fields, especially in rainy weather; and, finally, they require a considerable supply of water. The work, however, is better done; and the deep tillage of the soil that mechanical plowing alone can effect, multiplies the nutritive surfaces of the arable layer and gives a mean increase of 30 per cent. in crops. But in spite of all its advantages, steam plowing has made little headway in France, both on account of the parceling out of the lands among numerous proprietors, and the inconveniences that we have just enumerated.

With a view to the more general adoption of mechanical power on farms, the engineers mentioned above have devised an arrangement by which motive power in a certain fixed position may be employed to do the work of several adjacent farms through the medium of electricity as an agent of transmission. They have for this purpose adopted the Gramme dynamo-electric machine for the generation of electricity, and similar machines as the electro-dynamic agent for reconversion of the electricity, conveyed to any required distance by cables, into motive power.

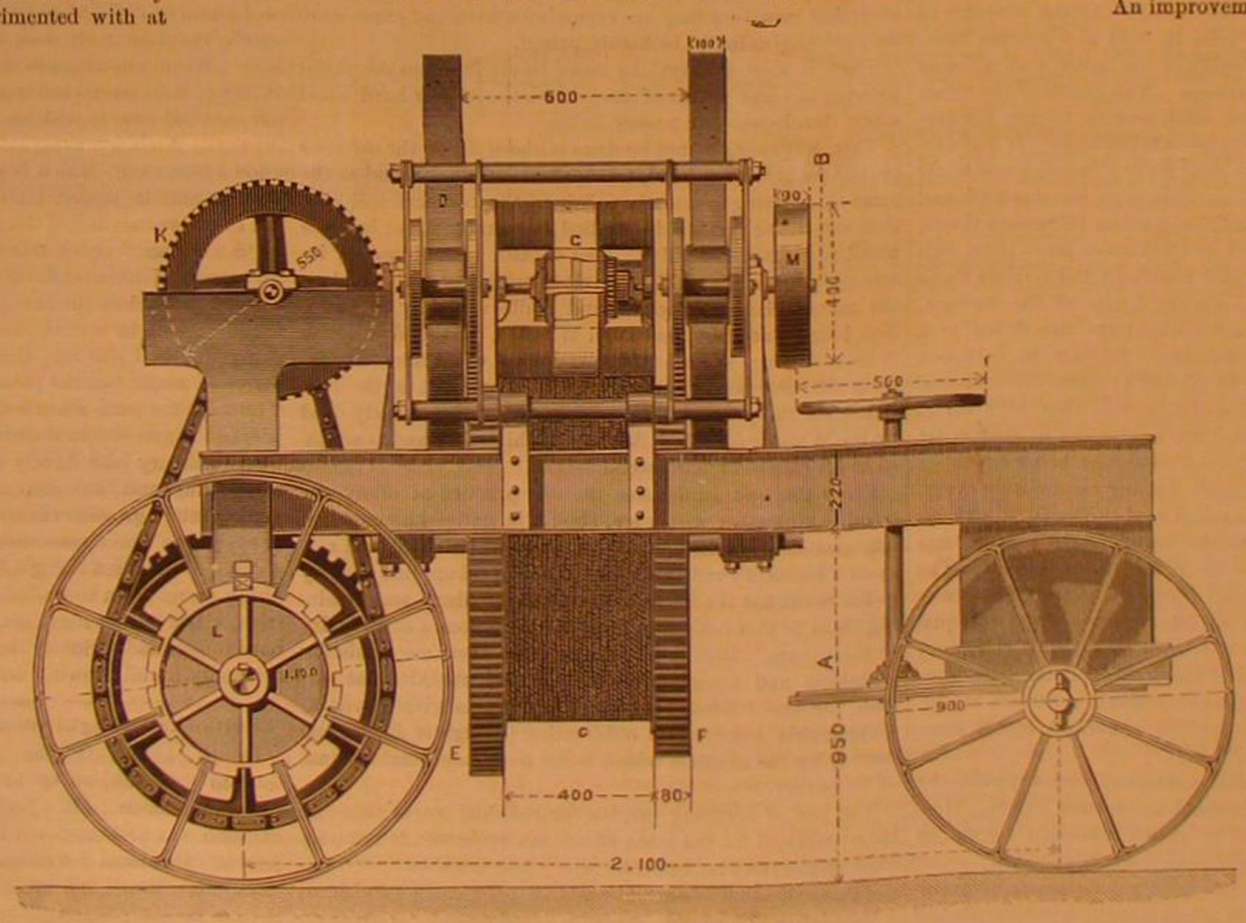
Two forms of these machines have already been established and experimented with at Sermaize—one of them designed for unloading beet boats, and the other for plowing. The former was in operation all of last winter, and its use was found to effect a saving of about 40 per cent over manual labor. Besides this, the beets were unloaded very much quicker (a matter of capital importance in the sugar-making industry) and without the aid of special workmen, who cannot always be depended upon. Within the past few weeks the power has been transmitted to some neighboring fields, which have been plowed by a balance plow and the windlasses which we illustrate herewith. Each of these consists of a carriage of wrought iron, the two side frame pieces being of I section, mounted on four iron wheels. Two Gramme electro-dynamic machines, G G, are mounted on a hinged frame attached to the side frames. These machines are connected together at their upper parts by means of a simple connecting rod and a pair of India rubber rings (the arrangement of friction wheel, I, and the spiral spring, J, was removed after trial, as not giving sufficient rigidity, though the friction was very small), which hold the pulleys on the end of the Gramme machine spindles, against the pulleys, D D. The small pulleys in the Gramme machines are covered with gutta percha. The hauling drum, C, receives the movement of the pulleys, D, by means of the pinions, E or F, which give the slow or fast speed respectively. Upon the end of the spindle carrying the pulleys, D, is fixed a bevel pinion gearing with the bevel wheel, K, upon the shaft carrying which is a pitch pinion, over which and the wheel, L, runs a pitch chain, by which the headland movement of the windlass is obtained. The steering of the windlass is effected by the hand wheel, as shown in front. For working, the hind wheels are fixed upon the axle by a set screw, which is loosened for traveling. The rope, H, is of steel, half an inch diameter and 1·3 miles in length, as used at Sermaize. The electric cables are carried on posts, as for telegraphic purposes. They consist of wires each 0·04 inch in diameter, giving a total sectional area of about 0·33 inch. In the experiments the windlasses, constituted as above, were placed at a distance of 664 feet apart, and by means of commutators the electricity was alternately passed through the one and the other pair of machines as the plow crossed and recrossed the field. An engine in the sugar factory already mentioned, and situated 1,300 feet from the field, gave motion to the dynamo-electric machines which supplied the electricity, about eight horse power being employed. When in light ground two furrows have been made, but in heavy ground only one, the power transmitted to the plow being but that of three to four horses. The designers will, however, soon have machinery ready which will enable them to use a four furrow plow.

The gramme machines at the works were driven at 1,600 revolutions per minute, while those on the windlasses made 800 per minute. The pulleys, D, made 133 revolutions per minute, and the hauling drums 14 and 27 under the slow and fast speeds respectively, the corresponding speeds of the plow being 164 and 266 feet per minute. The furrows were 10·8 inches wide and 7·87 inches deep. Making two furrows, about 24 square yards were plowed per minute. It was found that about 50 per cent of the work of the fixed engine was realized on the field, and that the efficiency of the electro-dynamic apparatus is from 30 to 60 per cent, according to the distance of transmission.

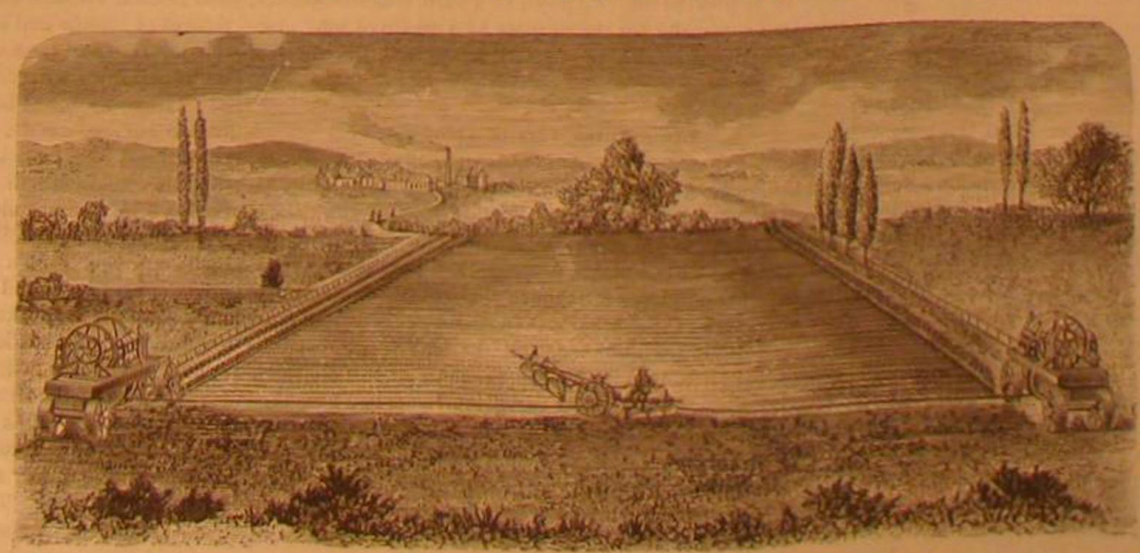
It is urged that the apparatus will provide in France the means of supplanting much hand labor, which is somewhat scarce, and that by its means many falls of water not now used may be usefully employed for generating power for transmission. Our illustrations are copied from those which have appeared in the *Revue Industrielle*.



TRANSVERSE SECTION ON LINE A B.



APPARATUS FOR PLOWING BY ELECTRICITY.



PLOWING BY ELECTRICITY AT SERMAIZE, FRANCE.

NEW AGRICULTURAL INVENTIONS.

An improvement in check row corn planters, consisting chiefly in the peculiar arrangement of devices for imparting motion from the drive shaft to the feed slides, and in a contrivance for throwing the slide-operating mechanism into and out of gear, has been patented by Mr. Charles G. Everet, of Belfontaine, O.

Mr. Aaron F. French, of Denison, Iowa, has patented an improved harrow, having its tooth bars connected by tubes threaded externally to receive the nuts by which the bars are held in place, and threaded internally to receive the hooks and eyes that connect the different sections of the harrow.

A new machine for planting corn in hills at a uniform distance apart has been patented by Mr. Theodore F. Tanner, of Jefferson City, Mo. It consists of a frame, carrying seed boxes, mounted on wheels, and provided with valves and slides that are opened at regular intervals by connections from the driving wheels of the apparatus.

An improved fertilizer distributer has been patented by Mr. William Hodges, of Okolona, Miss. The machine is provided with a hopper having hinged ends that are connected with a shaft or roller so that they may be drawn inward to aid in the discharge of the fertilizer.

Messrs. Arthur C. and Reuben W. Sriver, of New Baltimore, O., have patented an improved harvester reel and dropper, the principal features of which consist in novel means for regulating the vertical adjustment of the reel above the cutter bar, and in a device for intermittently discharging the cut grain.

Petroleum as a Steam-Maker.

To-day there are 7,000,000 barrels, of 40 gallons each, of crude petroleum above ground in the oil regions. This vast accumulation of heat and light producing material is going a begging at 64 cents per barrel. Every hour adds to this ocean of oil; in spite of the enormous consumption the stock accumulates. Every new use to which petroleum is applied possesses interest to producers, and the day that shall see crude oil take the place of coal as a steam producer will be a glad day for mankind in general and oil men in particular. That such a day is not very far distant seems evident after an inspection of the working, recently, of an oil burning device tested on a river steamer at the Monongahela wharf.

A representative of the *Telegraph*, with a number of river men and steamboat owners, was present upon the occasion, and the object of this article is to briefly set forth the claims to public attention possessed by the device under consideration. The invention is the property of the American Hydro-Carbon Gas Company—John Campbell, General Manager—and embraces simple but vital principles of construction, wherein atmospheric air and steam are combined in proper proportions with oil, and injected into the firebox beneath the boilers in the form of spray. The latter being immediately converted into inflammable gas becomes a pure, bright, powerful flame, devoid of smoke and producing intense heat.

To accomplish this result extremely simple machinery is used. A small hole is drilled into the iron front of the firebox, and into this passes a tube which branches as it leaves this point into two pipes. One of these connects with the boiler itself, and the other with the receptacle containing crude oil. At the juncture of these pipes there is an aperture for the admission of outer, or atmospheric air. Valves of peculiar construction regulate the quantity of steam or oil admitted to the furnace. This is all the machinery required, but its operation is wonderfully complete and remarkably successful.

The little steamer Billy Collins was selected by Mr. Campbell for the test and was fired up at 9 A.M. A preliminary blaze of wood under the boiler raised the small quantity of steam necessary to start the burner into operation. The oil valve was opened a trifle, the steam valve ditto. The petroleum trickled into the feed pipe, was caught up by the steam, and both plunged into the depths of the firebox, a mass of many-tongued, roaring, brilliant flame. As the pressure of steam increased, this flame grew in fury and intense heat, roaring through the entire length of the boiler with a sound like the coming of a thunderstorm. The needle of the steam gauge climbed rapidly up the dial, and in twenty minutes the safety valve blew off at 120 pounds pressure. It was a remarkable sight. Here was a boat puffing through the water with no sign of smoke from her chimneys, no speck of soot in flues or firebox, no fireman, no opening of furnace doors, no dirt, no coal going in, and no clinkers or ashes to be seen anywhere. A turn of the hand regulated the terrible flame that seemed trying to overpower the limits of the furnace, and another turn of the hand brought the fire down to a quiet little flame, a foot or two long. During the forenoon occupied by the test, about 20 gallons of crude oil were consumed, and Mr. Campbell's estimate was, that with oil at one dollar per barrel, this fuel was equivalent to coal at six cents, in heat producing value, other things being equal.

But other things are not equal, by any means, and everything is in favor of oil as against coal. The labor and expense of "firing up" is dispensed with, and the engineer can regulate the flame as he does the steam in his engines. The danger from sparks and flying cinders is entirely done away with. The space occupied by oil, as compared to an equal value of coal, is very much less, and this much is gained for cargo. Further, the wear and tear upon boilers, grate bars, etc., is infinitely less, and, it seems scarcely necessary to add, the comfort of passengers is greatly enhanced by the absolute freedom from dirt of all kinds.

To the western boatman this method of steam producing is full of interest. "Coal is coal" on western rivers. Here is a fuel that seems provided by nature especially for use on craft where every atom of carrying space is valuable.

To ocean going steamers this device must prove of extraordinary interest. A tank of oil situated at a remote end of the ship would hold fuel sufficient for a double trip, and supplant the great coal bunkers with their attendant dirt. Space prevents even a glance at the possibilities of this burner on the ocean.

To railroad men this burner is full of promise also. A locomotive boiler, with its many tubes, would be pierced in every part with this wonderful oil flame, and the benefits arising from the entire absence of sparks, cinders, and smoke are simply incalculable. In fact the "hydrocarbon" folks have got a "big thing," and upon their success in introducing their device to the public, and in overcoming popular prejudices, depends not a little the future of the oil trade.—*Pittsburg Telegraph.*

The Missouri River.

To be appreciated Missouri River must be seen and heard during the April or June rise, when its waters are red and thick with the powdered soil they have brought from the mountains and stolen from the farms in the valleys. Then it pours and swirls and eddies along with a treacherous sound between a chuckle and a half suppressed whisper, that repels while it fascinates the listener. It made millions of acres of rich black deposits, on which it still holds a mortgage, the foreclosure of which no man can foresee. Hundreds of farmers, after clearing away the heavy timber and raising fine crops year after year, on their eighty or more acres of deep, inexhaustible river bottom, have seen their entire possessions swept away in a few days by a sudden and unexpected "change of channel" during an April or June "rise." These changes of channel have different causes. Sometimes a giant cottonwood tree that has been uprooted where the river has risen upon the forest above, is borne down by the current and lodged in the mud, where it will gradually become embedded in the yielding bottom, and perhaps lie in wait for months, or even years, without giving any particular sign of existence. At last an unusual rise takes place, and then this hidden "snag" creates a diversion in the strong current, which begins to circle round the spot, and which culminates in a boiling eddy. The eddy increases in depth and force, gradually diverting the water from its former course until a new pathway is formed in the river bed.

If the eddy is located near the shore at the upper edge of a promontory, and the water is sufficiently high to overflow the flats, a new channel is sometimes carved straight across some valuable farm or timber strip, and a river town, where steamboats took freight and passengers last year, may be from two to six miles distant from navigable water next year. A few years ago Forest City, Mo., was kissed day and night by the dirty lips of this Western flirt. To-day the river sports miles away, out of sight of the old love, and is whispering soft things to White Cloud on the Kansas side, which has gained a river, while the State has lost several thousand acres of productive cotton land that now supports cattle and hogs in Missouri. Missouri River towns are never safe, except when located on bluffs, or table lands, like Omaha, White Cloud, St. Joseph, and Kansas City.—*St. Paul Pioneer Press.*

Suggestions on Wood Finishing.

As the old methods of finely finishing hard woods have all been slow and expensive, the larger portion of hard woods used in furniture, musical instruments, buildings, etc., have been allowed to pass without a proper finish, and the beauty of effect sought in the use of such woods has not been fully realized.

Our American hard woods were formerly so very plentiful and cheap that their true merits were not properly appreciated; but now that they are becoming scarce and expensive, they are beginning to be highly prized.

There is scarcely anything more beautiful than the variegated colors and grains of many varieties of our hard wood when developed by a proper finish.

This, however, cannot be done without filling the softer or porous parts with a hard, transparent substance, and at the same time giving a smooth polish to the compact solid, so that when the varnish is applied it cannot strike into the wood and change its color. The varnish should merely lie smoothly upon the surface, giving brilliancy and effect to the natural beauty of color and endless variety of grain. Not long since Mr. Nathaniel Wheeler, of the Wheeler & Wilson Sewing Machine Co., patented a wood filler, which, from the testimony of those who have used it, is the best article for the purpose yet produced. It is extensively used by the Wheeler & Wilson Sewing Machine Co., and is adapted to all classes of hard wood work.

From the best authorities the old practice of oiling the wood is altogether wrong and should be entirely abandoned. Any one at all skilled in the art of wood-finishing will see, upon a moment's reflection, that a coat of oil applied directly to the wood has the effect of swelling the fibers, and retaining them in that condition until the oil becomes entirely dry or disappears. During all this time the fibers are gradually shrinking, and consequently moving and checking the varnish. Oil also "burns" the wood, and in time gives it a dark, disagreeable color, quite obliterating the lighter shades and destroying the contrast which is the most important element of its beauty.

The use of scraping varnish for polished work, although long practiced for the want of something better, is not only slow and expensive, but otherwise objectionable.

The application of several coats of poor rosin varnish, as a foundation for durable work, is inconsistent. A little reflection should satisfy any one that such a filler cannot possibly be as good as one composed of a hard, tough substance, prepared especially for the purpose by a person of long practical experience, which thoroughly unites with the fibers of the wood.

Lime Juice versus Alcohol.

There are visible signs of no uncertain kind that alcohol, as a beverage, is not likely in the future to have quite its own way, even in the metropolis. Coffee taverns and coffee tavern companies are being established now at a rapid rate, and, as far as we can judge, have worked very successfully. But before these places were much thought of—that is, about two years ago—those who looked about them might have observed in the windows and at the bars of most public houses, eating houses, and ginshops, more or less conspicuous advertisements of several varieties of so called lime juice beverages. We have at the present moment before us examples of several of this kind, and there is no doubt that, particularly during the warmer months (though these, by the way, are now few and far between), lime juice and its components constitute among the metropolitan public an exceeding popular drink.

Most people have had, or think they have had, at one time of life, some variety of cutaneous affection, which often takes the convenient synonym of scurvy. And as the latter disease was not many years since much written and talked about in connection with the mercantile marine, and still more, two years ago, in connection with the Royal Navy, we cannot be much surprised at the success of those who endeavor, for commercial purposes, to promote the sale of such drinks. It seems, however, that they do not meet with the unqualified approval of publicans, or rather of distillers and brewers. The former are now absolutely compelled to keep them, to sell them, and to advertise them. But, if we are correctly informed, the poor man's friend, in the shape of the licensed victualer, deprecates the imbibition of lime juice in any form whatever. He sells it because the inevitable law of commerce—that is, supply and demand—compels him to do so. But he will tell the individual who asks for a glass that it promotes acidity of the stomach, that it deranges the kidneys, congests the liver, corrodes the intestinal canal, and so on, and then the customer is told that he had much better keep to the old glass of "bitters" or "gin," etc.

Being tolerably certain that the reports as to this sort of gossip are substantially correct, we counsel the public to turn a deaf ear to such elaborate and ignorant nonsense, and to drink their lime juice whenever and wherever they list. There are with this as with other liquids pure and adulterated varieties, and as to this matter they must, of course, use their own judgment. But they may be assured that, as a rule, lime juice is, particularly during the summer, a far more wholesome drink than any form of alcohol, and that, say, an ounce or two of the pure juice in a tumbler of really cold water, sweetened to taste, is about the pleasantest beverage that can be taken when the thermometer is over 65° or 70° Fah. We commend this drink to the attention of the coffee tavern companies, but recommend them to procure the best West India lime juice, as more wholesome than any mixture containing other ingredients.—*Lancet.*

The Stinging Tree.

Though the tropical scrubs of Queensland are very luxuriant and beautiful, they are not without their dangerous drawbacks, for there is one plant growing in them that is really deadly in its effects—that is to say, deadly in the same way that one would apply the term to fire; as, if a certain proportion of one's body is burnt by the stinging tree, death will be the result. It would be as safe to pass through fires as to fall into one of these trees. They are found growing from two to three inches high to ten and fifteen feet; in the old ones the stem is whitish, and red berries usually grow on the top. It emits a peculiar disagreeable smell, but it is best known by its leaf, which is nearly round, having a point on the top, and is jagged all round the edge, like the nettle. All the leaves are large—some larger than a saucer.

"Sometimes," says a traveler, "while shooting turkeys in the scrubs I have entirely forgotten the stinging tree till warned of its close proximity by its smell, and I have then found myself in a little forest of them. I was only once stung, and that was very lightly. Its effects are curious. It leaves no mark, but the pain is maddening, and for months afterward the part, when touched, is tender in rainy weather, or when it gets wet in washing, etc. I have seen a man who treats ordinary pain lightly roll on the ground in agony after being stung; and I have known a horse so completely mad after getting into a grove of the trees that he rushed open-mouthed at every one who approached him, and had to be shot in the scrub. Dogs when stung will rush about, whining piteously, biting pieces from the affected part." The small stinging trees, a few inches high, are as dangerous as any, being so hard to see, and seriously imperiling one's ankles. The scrub is usually found growing among palm trees.

Caution to Draughtsmen.—Arsenic in Water Colors.

Dr. H. Fleck, in the *Chemiker Zeitung*, calls attention to this subject by the sudden death of a mechanical draughtsman. On a *post mortem* examination the cause of death was first supposed to be oxalate, and then a narcotic poison. Chemical investigation showed that the liver, kidneys, lungs, heart, and brain were impregnated with arsenic, though the œsophagus contained not a trace, and the stomach with its contents gave a barely perceptible arsenical mirror. The general circumstances of the case excluding the suspicions of suicide and malicious poisoning, it was found that the deceased had been in the habit when drawing of placing the pencil filled with color between his lips in order to point it. The water colors he had used were analyzed, and while Indian ink, gamboge, carmine, blue, red eosin ink, and neutral tint were found perfectly free from arsenic, a sample of sepia contained 3·08 per cent of arsenious acid, terra di Sienna 3·14, and a reddish brown color, the name of which was indistinct, 3·15. Burnt Sienna, Vandyck brown, bister, bladder green, brown ocher, Indian red, umber, raw and burnt, were also found arseniferous. Most of these colors are essentially iron lakes. Hence it appears that the mere presence of ferric oxide, except in a hydrated state and accompanied by free magnesia in quantity sufficient to neutralize the acids of the stomach, does not act as an antidote to arsenious acid. This case seems likewise to prove that arsenic taken in minute doses can accumulate in the system until it can be readily recognized in all organs, and can exert a dangerous action. This result seems to prove that the impunity with which the peasants of Styria consume small doses of arsenic must depend upon circumstances not yet fully understood.

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.

LEFFEL'S WATERWHEEL BOOK. Springfield, Ohio: James Leffel & Co. 1879–1880.

The James Leffel turbine water wheel may fairly be accounted one of the great prime movers of American mechanical industry, there being over 8,000 of them in successful use, giving nearly 500,000 horse power. One recently built for a mining company runs under a head of 300 feet, the highest head thus far utilized in this country. The descriptive book in hand is a new and improved edition, handsomely printed and full of information of use to owners of water powers of every description.

ILLUSTRATED MANUAL OF THE BOOKWALTER ENGINE. Springfield: James Leffel & Co.

The manual of the Bookwalter Engine is more pronouncedly a descriptive price list. It is [worth consulting by any one contemplating the purchase of a small portable engine and boiler.

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.

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.

(1) S. T. C. asks (1) for directions for making a good ice box. A. Make the box and cover with hollow walls, which may be simply filled with air. The cover should fit well, and the box should be lined throughout with zinc. 2. Which makes the best of the following: Three thicknesses of good board or two thicknesses of board filled in with charcoal? A. The latter.

(2) L. & H. asks: Is it possible to well metallize by galvanoplasty, a large piece of clay or terra cotta work, such as a bust, natural size, or a group or statuette, and if so please let us know if there is a more efficient way to prepare it than the use of plumbago? A. It is difficult to impart a uniformly adherent coating of metal on such ware. A good method is to coat the ware with a varnish composed of shellac 6 parts, borax 1 part, boiling water q. s. to form a thick sirup. When this is nearly dry it is thickly and uniformly coated with a metallic bronze powder and thoroughly dried to about 110° Fah., before suspending in the "striking" bath. It is essential that the first film be thrown on expeditiously. After plating the articles may be placed for a short time in water heated to about 200° Fah.

(3) G. A. H. asks: 1. Will the gravity battery keep best on an open or on a closed circuit? A. The closed circuit is best. 2. Will tin on one side of the copper spirals make any difference? A. There should be no tin on the copper. You may remove the tin by heating the copper red hot and plunging it into water.

(4) H. H. C. asks: 1. Can two or more of the electric machines described in No. 161, SCIENTIFIC AMERICAN SUPPLEMENT, be worked together to advantage by foot power? A. No, it is not an easy matter to drive a single one. 2. Should the wires of the first connect with the magnet of the second? A. The wires might be connected in this way, but it would be better to make a single machine of double the size.

(5) C. B. B. asks: 1. How can I polish fancy woods? A. Take rather thick alcoholic shellac varnish 2 parts, boiled linseed oil 1 part, shake well together before using. Apply with a rubber and rub briskly until the varnish is hard and *bright*. 2. Could not a boat only large enough to carry one person be run by clockwork, and if not, why? A. Yes, but it would economize power by applying it directly to the propelling mechanism. 3. I intend making a barometer; how can I make the scale and have it correct? A. The barometer scale is simply a scale of inches, divided into tenths.

(6) H. R. M. asks the process by which the gloss is produced upon photographs, and whether the same process can be employed with what is termed heliotypes or artotypes, as published in some of the illustrated papers of New York, and if not, explain the means employed; also please state the ifference betweeu the two latter named terms. How can arto or heliotypes be mounted on cardboard suitable for albums? A. For albumen prints the warmed burnishing press used by photographers is all that is required, we believe. A rather weak solution of white wax in absolute alcohol is sometimes used as well for artotype or heliotype as for ordinary solar prints. It is simply sponged over the mounted print, which is then passed through the warm burnishing press, by which the fine gloss is imparted. Solution of bleached shellac in alcohol (1 to 10) is also occasionally used. Good starch paste is very generally used for mounting. For a description of heliotype processes consult Vogel's "Chemistry of Light and Photography." The artotype process so-called was patented by Johann B. Obernette, of Munich, in 1878 (208'14). It consists in forming first on a transparent or non-transparent plate a coating or film of albumen and soluble glass, and adding to this the sensitive film. The first coating is composed of: albumen 7 parts, soluble glass 3, water 8. The second or sensitizing bath is composed of: gelatine 50 grammes, fish glue (isinglass) 50, ammonium bichromate 15, water 1 liter. Filter for use.

(7) O. E. P. writes: In your issue of June 21, "Notes and Queries," (30), D. J. W. asks for a receipt for blue writing ink. I make it by dissolving the common preparation sold in every grocery, known as "Sawyer's washing blue," in clear water. It dissolves instantly, does not give much trouble by thickening, and never fades. Any desired shade may be had by varying the quantity of water. I have used it for measure lines on mechanical drawings made 10 years ago, and it is as bright now as when put on.

(8) O. A. R. asks: 1. Has there ever been an invention made to work two telegraph instruments at once on the same line? A. Yes, and it is common to transmit four messages simultaneously over a single wire. 2. How can I take the rust off the brass of an instrument? A. You should remove it with fine emery paper or crocus cloth or paper. 3. How many jars will it take to run telegraph line with a loop of 1,800 feet wire—900 each way, size of wire No. 18, soft iron? A. It depends altogether on the resistance of your instruments. No. 18 wire is too small; use No. 10.

(9) C. A. V. asks if gutta percha and India rubber can be dissolved and mixed by boiling together in any liquid. A. Caoutchouc and gutta percha are both quite soluble in naphtha, benzole, and carbon disulphide. The latter, when mixed with about six per cent of absolute alcohol, is one of the best solvents. The solution is performed in the cold (best in the open air), as it would not be safe or economical to heat these volatile and inflammable liquids. Exposed to the air the solutions soon evaporate, leaving the gums in their original condition.

(10) B. M. asks how many Tom Thumb batteries, made in the manner described on page 101 of the SCIENTIFIC AMERICAN Reference Book, would it take to raise ½ inch of No. 40 platinum wire to a red heat. A. About forty.

(11) W. W. B. asks: What can I use to remove rust from small watch pinions that will not cause the pinion to rust after applying? A. Soften with oil and apply a little emery flour.

(12) S. T. asks (1) if water becomes purified by freezing. A. Water is purified from most contaminating substances by crystallizing (freezing). 2. Will it purify itself by running a few miles? A. It depends very much upon the nature of the soil or bed; over a gravelly bed, usually yes.

(13) W. J. R. writes: In your answer to query No. 36, to "Student," page 380, current volume, June 14, you say his engine 8x12 in. is "badly proportioned" to produce the power estimated by him, namely "100 lb. pressure, 100 revolutions—24·5 horse power." Will you please state why? A. Because of the loss at every stroke by the clearance and waste spaces.

(14) B. P. C. writes: I am running an engine of about 6 horse power, 8 inches stroke, driving wheel 30 inches, makes 200 revolutions per minute, belted to a 48 inch wheel on shaft which makes 130 revolutions per minute. Am about to change to an engine of 12 horse power, 12 inches stroke, with driving wheel of 48 inches. What size wheel do I want on shaft, and what number of revolutions of engine, to produce the same result, namely, 130 revolutions of shaft? A. If you run your new engine 130 revolutions per minute you need not change your wheel; as you have equal diameter on both shafts, the driven shaft will run same speed as the engine.

(15) "Medicus" asks: When water and other bodies are freezing, heat is given out, and when water or the same bodies are thawing, cold is given out. Some of our elementary text books upon natural philosophy teach this. Is it true, and what is the *modus operandi*? A. Condensation is accompanied by an elimination of heat; liquefaction by an absorption of heat (from surrounding bodies). Consult Professor Tyndall's "Heat as a Mode of Motion."

(16) W. M. writes: In nearly all works referring to the computation of indicated horse power of steam engines from indicator cards of the same, the rule for finding the mean effective pressure during any stroke of piston assumes that the back pressure during that stroke is shown on the same card as shows the initial pressure. Should not the pressure on the opposite side of piston be obtained for the opposite card, and the mean effective pressure computed therefrom? A. Yes.

(17) W. H. M. asks: 1. Is it necessary to level an engine (portable) both ways, across and parallel with the valve seat? A. No, the necessity for leveling is that the heating surfaces of the boiler may be properly covered. 2. In lining up a cylinder of a portable engine, where the slides are attached to the front cylinder head, how would you line it up—line the slides or the other parts first? A. Line everything by the center line of the cylinder in one direction, and by center of shaft in the other. 3. Would it be necessary to have front cover upon the cylinder and then stretch line? A. No.

(18) J. G. writes: F proposes to put a windmill wheel on an ordinary hand car and gear it from said wheel, and contends it will propel the car against the wind, size of wheel optional. Opposition say no. Please decide. A. F is right, if he uses properly proportioned gearing, but the speed will be low.

(19) G. A. D. asks for the process of making lime water. A. Agitate an ounce of pure caustic lime in a pint bottle nearly filled with water, and after the lime has subsided decant the clear supernatant liquid. It must be kept in well stoppered bottles.

(20) J. R. L. asks: What is the best way to get water up a hill 28 feet rise and 60 feet distant? If suction pump, what size? We want water to supply steam engine on top of hill. A. You can use a pump driven by your steam engine, or if you have a sufficient reservoir on top of the hill, a pump driven by a windmill. Size of pump depends upon the quantity of water you wish to raise.

(21) J. D. M. asks how to test water to ascertain if there is lead in it. A. Evaporate a sample of the water nearly to dryness, and mix the remainder with a small quantity of sulphureted hydrogen water (hydrosulphuric acid). The formation of a precipitate or of a dark precipitate or cloud indicates lead. 2. To find out whether there is any decaying substance in my well? A. Treat one sample of the water with a cold saturated solution of tannic acid, another with enough dilute solution of potassium permanganate to produce a faint color; if a slight gelatinous precipitate forms in the first, even after 24 hours' standing, or if the latter quickly loses the color imparted by the permanganate, the water should not be used.

(22) A. M. writes: It is stated that in a boiler (with all the flues and crown sheet covered with water) where the fire is direct and intense the water assumes a spheroidal form and is not in contact with the plates at all. It is said that the master mechanic of some Eastern railroad had proved it by inserting a small pipe in the smoke arch end of a locomotive until it reached the flue sheet of the fire box, and nothing issued but blue steam, and he got no water until he drew it away from the flue sheet for half an inch, and in another case a pipe was introduced through the top of return flue boiler until within three eighths of an inch of the bottom sheet, and upon opening the cock a small quantity of water (that had stood in the pipe) came forth and then nothing but steam, nor did he get any more water until he removed the lower end of the pipe three quarters of an inch from the bottom of the boiler. It does not look likely. What is your opinion on the matter? A. This is a point that must be determined by the temperature of the fire and the conducting power of the metal. That the water can be driven from the metal surface has been frequently shown, but it does not occur under the ordinary conditions of a steam boiler, except when so badly designed that there is no proper circulation. In a locomotive boiler too small for its work and forced by a sharp jet the repulsion may occur.

(23) F. W. B. asks: 1. Would an engine 3x1½ (three by one and a half) inches be large enough to run a boat fifteen feet long by thirty inches in width? How large a boiler would it require? A. Yes, at a moderate speed. 2. Would a boiler made of No. 17 copper, with 4 2-inch flues, made on the vertical plan, furnish sufficient steam? A. No. 3. Which is preferable for running on creeks and other shallow places, a screw or paddle wheel? A. For so small boats a screw running partly out of water.

(24) F. T. asks: Should any kind of oil be used on belts for elevators or driving machinery: if so, what kind? A. Neat's foot oil.

(25) G. O. L. D. writes: I have some soft rubber and "gold rags," containing gold leaf. By what process can I get the gold out of the rubber and rags? A. Incinerate on a hot iron plate, mix with about 2-3 its weight of a mixture of equal parts salt and carbonate of soda, and submit to a white heat in a Hessian crucible for about twenty minutes, adding a small quantity of niter occasionally; cool in the crucible—the button will be found at the bottom.

(26) T. H. K. writes that he has discovered that smoking coffee will cure consumption. [The active alkaloid (caffeine) in coffee suffers more or less complete decomposition under the circumstances, but the products yielded have little or no therapeutic value in this connection, as far as known. Smoking coffee berries will not cure pulmonary consumption, though it would doubtless prove a comparatively harmless if not pleasant substitute for tobacco.]

(27) C. H. M. asks: Why are not electro-magnetic machines used instead of galvanic batteries for telegraphing purposes? Can they not be so used? A. They are largely used for private lines.

(28) E. K. asks how to coat whitening and give it a gold color so that it can be burnished and leave some parts matt or dead gold color? A. Coat with gold size, and when this is nearly dry, apply gold leaf or a suitable bronze powder.

(29) E. H. asks for a recipe for removing the gloss imparted to fine diagonal cloths after they are slightly worn. A. The glossiness cannot be permanently removed, since it is due to the loss of the nap. It may be temporarily remedied by the use of a little ammonia water.

(30) W. H. asks: What is the process of making solid emery wheels, and if there is more than one process, and if they are patented? A. Many of the best wheels are cemented with vulcanized rubber, borax, or zinc chloride (or oxychloride), and barium carbonate; other materials, such as feldspar and clay, alkaline silicates, litharge and japan, shellac, and other resinous and gummy matters, albumen and lime, etc.

(31) G. A. W. writes: I am working at electrosilver and gold plating, and as it has been some years since I worked at it, my memory has failed me in some things. 1. My solutions (silver) striking and plating are composed of the following: namely, striking to 1 gallon of water, ¾ ounce silver (chloride), 1 lb. cyanide potassium (fused), 4 ounces of sal soda. Plating to 1 gallon water, 1 ounce silver, ¾ lb. of cyanide potassium, 4 ounces of sal soda, and a little white caustic potash in each. Now I would like to know if these are all the necessary ingredients; if not, please enlighten me. A. Yes, the soda and potash are not essential. 2. If bisulphide carbon will make silver solution plate bright, will it answer for gold; if not, what will, and how used? How are the various colors obtained? A. No. See article on page 2540, No. 160, of SCIENTIFIC AMERICAN SUPPLEMENT. 3 What preparation is used for coating work to be sectio..a. or spot gilt, and how prepared and removed? I have been using asphaltum, but in removing it with turpentine it has a tendency to stain the work and will not work well in the solution either hot or cold. A. Asphaltum varnish or paraffine. 4. I am using Smee's batteries for plating. I see some account of carbon sheets being substituted for the platinized silver: are they immersed in the same liquid (diluted SO_4), if so are they cheaper and less trouble? A. Yes. 5. What acids, and the proportions, used to dissolve platinum, and can a sheet of silver be coated by being merely passed through the hot solution? How is the best and most permanent way of platinizing silver sheets? A. Hydrochloric acid, 3 parts; nitric acid, 1 part; heat to about 160° Fah. Attach the clean plate to the zinc pole of a weak battery and immerse in the cold solution somewhat diluted. 6. In my Bunsen batteries I use nitric acid in the porous cups with the carbons, am I right? A. Yes. Solution of potassium bichromate and moderately strong sulphuric acid solution may be advantageously substituted.

(32) H. F. G. asks: 1. What is the weight of a bushel of bituminous coal? A. 76 to 80 lb. 2. How much water will a bushel of such coal evaporate burned in an ordinary locomotive furnace? A. Ordinarily from 6 to 7½ lb. per pound of coal.

(33) E. J. O. asks: What will remove coal tar from hair cloth, such as chair bottoms, without injuring it? A. Naphtha, benzole, or carbon disulphide. Use a stiff brush if necessary.

(34) A. U. L. asks: 1. Would the rail of a railroad track make a good conductor for a telephone for reasonable distances? A. No. 2. Must the wires leading into the house be insulated? A. Yes. 3. What kind of a battery is the best, say for a distance of three or four miles, and how many cells of same? A. No battery is requisite. 4. I have recently seen such articles as glass and porcelain cemented together so as to sustain a weight of several hundred pounds, by a cement sold under the name of stratina, or London cement. Can you tell what its composition is? It seems to be very effective. A. Dissolve glue in warm strong acetic acid to form a sirupy solution.

(35) H. H. W. asks (1) if brick is ever used in covering locomotive boilers? A. No. 2. If not, please give the name of some cheap covering that would do. A. Asbestos covering; a mixture of clay and cow hair; or hair felt, or even old carpets or blankets.

(36) W. H. W. asks: Will sound travel faster in a dense than in a rare atmosphere, and why? A. The velocity of sound is not materially affected by the density of the air. Its intensity is diminished by increased atmospheric density. It has been determined that the velocity of sound decreases with the temperature about 1·1 feet for every degree.

(37) G. C. asks: 1. Please give me a rule for compounding gear for a lathe.

A. $\frac{T\,S}{t'\,t}\,I = N$; $\frac{t\,t'}{I\,T} = S$. T representing the number of teeth in traverse screw wheel; S, number in stud wheel gearing in mandrel; t, number in wheel upon mandrel, and t', number in gearing upon stud pinion, gearing in T; I, number of threads per inch upon traverse screw; N, number to be cut. 2. Please tell me how to make a cheap telephone. A. See full directions for making telephones in SUPPLEMENT, 142.

(38) J. H. W. asks: Can you inform me why a hazel switch will turn in the hands of some persons, who claim to be able to discover water or mineral by this means? A great many declare that it will not turn. I used to think so myself until I tried it last summer, and found that there were certain places in which the rod would turn in spite of me. I held it so tight that the bark peeled off. I cannot account for it myself, and have been laughed at for asserting that there is some truth in the claims of men who call themselves diviners until I am tired of it. Have never seen the matter explained. A. The rod is moved by the voluntary or involuntary muscular action of the hands of the operator, and not by any mysterious external influence, as many suppose.

(39) C. C. A. asks how to make a compound with which to insulate wire. A. Shellac varnish will do very well, providing the wire is wound before the varnish becomes thoroughly dry.

(40) J. A. W. writes: I would inquire through your paper of the M.Ds. if a connection between the aorta and pulmonary artery where they cross is common. I found in examining the heart of a calf that was sold in market for veal a phenomenon of this kind; if it occurred in one instance might it not in another, and what would be the physical results of such a case? The opening was as large as the carotid artery; no appearance of any valves, but the tissue was very thick and firm.

(41) Y. & O. ask: 1. How ought a cheap ice house to be built on top of ground? A. See SUPPLEMENTS 55, 59, and 116. 2. How can I construct a lightning rod which will answer all the purposes, and cost less than those sold by dealers? A. See p. 348, (10), current volume of the SCIENTIFIC AMERICAN.

(42) W. B. W. writes: Seeing an article in SCIENTIFIC AMERICAN by Dr. Rollin R. Grigg, of Buffalo, N. Y., I ask for information ("The Cause of Consumption"): What will heal the mucous membranes and the stopping of the waste of albumen? A. The author of the article referred to has kindly given us the following: There is no one medicine that can cure all cases of irritated and abraded mucous membranes and stop the waste of albumen. A variety of remedies is required to do this, in the different cases, and the treatment must be governed to a great extent by the peculiarities of constitution, and by the condition and the symptoms of each patient at the time the case is taken in hand. Furthermore, this is a diseased condition, where every case should be under the care of an educated, judicious physician, as much as severe cases of typhoid fever, diphtheria, or any of the other most intricate diseases. I will say, however, for the encouragement of all, on this now almost hopeless subject, that there is a series of most reliable physiological facts bearing directly upon the curability of all cases in the first stages, and which shows that of all tissues the mucous membranes are the most quickly and easily healed of any by proper treatment.

(43) E. W. C. writes: The screws in our cheese presses are 1¾ of an inch in diameter. From the center of the screw to the end of the lever it is 2 feet and 5 inches. Five turns of the screw move it 1 inch. How many pounds pressure will 150 pounds weight applied to the end of the lever produce? What is the rule for finding it? A. Theoretically, 136,800 pounds, but there should be a large deduction for friction. The weight (150 pounds) × distance moved through (76 feet = 912 inches) divided by distance through which the screw moves (1 inch) $\frac{150 \times 912}{1} = 136{,}800$ pounds.

(44) H. H. asks: 1. Would it be possible or practical to run a small light boat, say 2½ feet wide, 12 feet long, with a spring motor similar to those used for small toys? A. Yes, but the power required to wind up the springs had better be applied direct to oars. 2. Could an electric engine be used instead of the above, how would the cost compare with steam engine? A. Yes. The cost of the electric engine would be greater than that of a steam engine, and the cost of running it would be about fifty times as much.

(45) J. T. asks (1) how saw blades are tempered. A. They are usually heated in a reverberatory furnace and hardened and tempered in oil. 2. Can temper be taken out by heating a saw in the fire? A. Yes, but the saw will be ruined. 3. Where an iron mandrel runs in wooden bearings, what kind of wood is best for bearings? A. Hard birch or maple. 4. Which is best, pine or hickory? A. Hickory.

(46) O. L. P. asks: Will it require more power to work an elevator perpendicularly than it will to operate a similar one on an inclined plane at 45 degrees? If so, what is the rule to find difference of power required? A. The power will be the same, not taking friction into consideration.

(47) V. A. N. asks for the size of steam ports in a cylinder 2 by 3 inches. Is 3-16 by 1¼ inch too large? A. 3-16 by 1 inch is sufficient.

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

J. N. J.—The sample of ore is quite rich in copper (copper glance) and contains also traces of silver. A chemical analysis or assay will be necessary to ascertain the proportions of these and the value of the ore. The property is valuable.—H. J. P.—1. A serpentine rock—it contains no copper. 2. Talcose slate.—C. H. M.—It is quartzite.

COMMUNICATIONS RECEIVED.

On Boiler Explosions. By S. P.
On the Collared Peccary. By J. R. G.
On the Movement of Light in Space. By A. S.
On Theory of Creation. By W. P. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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June 10, 1879,

AND EACH BEARING THAT DATE.

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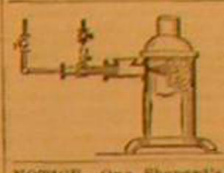

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Vol. XLI.—No. 4. [NEW SERIES.] NEW YORK, JULY 26, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

THE ELECTRIC LIGHT IN PHOTOGRAPHY.

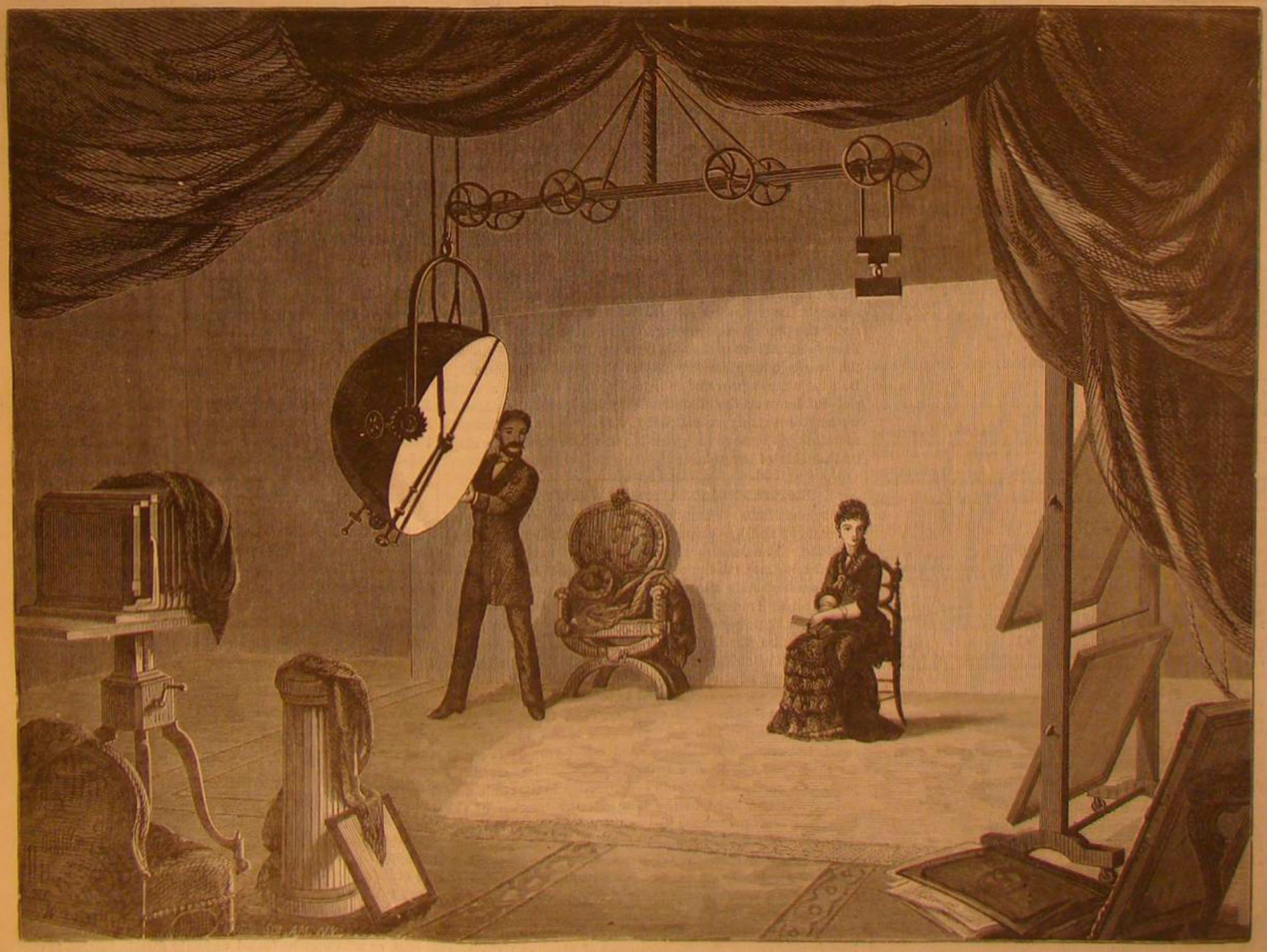
The idea of photographing by the electric light has long been entertained, but the light emanating from a single point renders the shadows too abrupt, and the contrasts too great, to admit of using it in making photographic portraits. Recently, however, the invention of our countryman, Mr. Vander Weyde, for some time in practical use in London, has been introduced in Paris by Mr. Liébert, which diffuses the light, renders it soft and mellow, and imparts to it the particular quality required in making photographic portrajts. Not long since we alluded to the fact that it had become quite the fashion in Paris, for parties of ladies and gentlemen to resort to photographic studios, after dinner or before the opera, for the purpose of sitting for photographs, and we now present an engraving of the apparatus employed.

The light used for the purpose is that of the voltaic arc, the lamp being placed in the huge concave reflector suspended by a system of pulleys, levers, and counter-weights, so that it may be readily adjusted or moved about. The reflector is made of opaque porcelain, lined with paper stucco, which is tinted blue. The carbon pencils between which the voltaic arc is formed are placed almost at a right angle to each other. The light has normally a power equal to about 300 to 400 Carcel lamps, but it can be made more powerful by increasing the speed of the Gramme machine.

The light of the voltaic arc is twice reflected. A small reflector placed in front of the lamp throws the light upon the interior surface of the large reflector, whence it is thrown in any required direction according to the will of the operator. The carbons are adjusted by means of screws, so that the maximum effect of the current may be realized, and flickering and variations in the light avoided. The Gramme machine used in connection with this apparatus is driven by a five horse-power gas motor.

A photographer provided with this apparatus is not at the mercy of the weather, neither is he controlled by the time of day, as he has the absolute management of the light. This arrangement of the electric light might be used to advantage in illuminating public places, railway stations, theaters, etc., as the light is very powerful, and yet so diffused that it does not pain the eye.

We give in another column an interesting account of a suit brought by the patentee of this apparatus against infringers in Paris.



PHOTOGRAPHS BY ELECTRIC LIGHT.

Distinguishing Butter from Lard, Beef Fats, etc.

Mr. William Gustavus Crook, public analyst for Norwich, England, describes a method which will in a few minutes distinguish butter from the fat of beef, mutton, or pork, or mixtures of them.

The sample to be examined(if in the form of butter) must be first melted and rendered pretty free from water and salt, by filtration if necessary; ten grains are then to be put into a test tube and liquefied by placing the tube in hot water at about 150° Fah.; remove the tube when ready, and add thirty minims of carbolic acid (Calvert's No. 2 acid, in crystals, one pound; distilled water, two fluid ounces). Shake the mixture, and again place it in the water bath until it is transparent. Set the tube aside for a time. If the sample thus treated be pure butter, a perfect solution will be the result; if beef, mutton, or pork fat, the mixture will resolve itself into two solutions of different densities, with a clear line of demarkation; the denser of the two solutions, if beef fat, will occupy about 49·7; lard, 49·6; mutton, 44 per cent of the entire volume; when sufficiently cooled, more or less deposit will be observed in the uppermost solution. If olive oil be thus tested, the substratum will occupy about 50 per cent; with castor oil, there is no separation. With some solid fats (not likely to be used fraudulently) no separation whatever takes place; the addition of a minute portion of alkanet root will render the reading of the scale extremely distinct by artificial light. The author states that the above method (although not intended to surpass other processes) is capable of wide application, the saving of a large amount of time, and the reliability of its results will at once recommend it as a "first step" in butter analysis.

The Science of Life.

How few of us acquire this science until we are old enough for life to have lost half its charms! The science of life consists in knowing how to take care of your health, how to make use of people, how to make the most of yourself, and how to push your way in the world. These are the things which, the *Herald of Health* thinks, everybody ought to know and which very few people do know. How never to get sick, how to develop your health and strength to the utmost, how to make every man you meet your friend—all these and many other things are to be included in the science of living, and the pity is that we only appreciate it at its true value when the bloom of life is gone.

A BILL, reducing the rate of interest in the State of New York from seven to six per cent, passed the Legislature last winter, and has recently received the Governor's signature. The new act takes effect on the first day of January, 1880.

Scientific American.

ESTABLISHED 1845.

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VOL. XLI., No. 4. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, JULY 26, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 186,

For the Week ending July 19, 1879.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN POLAR EXPEDITION.

On the afternoon of July 8 the steamer Jeannette sailed from San Francisco for a cruise in the Arctic Sea by way of Behring's Strait.

The Jeannette is a bark rigged steamer of 420 tons register, 200 horse power, and admirably constructed for meeting the perils of Arctic navigation. She was built in 1862 by the British Government. She was then known as the Pandora, and made a voyage to the Arctic seas. Last year she was purchased by Mr. James Gordon Bennett, and by special act of Congress registered as an American vessel under her present name. Lieutenant Geo. W. De Long, U.S.N., was, with the approval of Secretary Thompson, placed in charge of her and took her out to San Francisco, where, at Mare Island, she was thoroughly overhauled and put in order for her polar voyage. Her bows were filled in with solid timber, and her hull was materially strengthened by bracing. The engine was thoroughly overhauled, two extra propellers, duplicates of all parts of the machinery likely to break, and a complete set of machinists' tools with stock being also provided.

She has a steam launch, five strong whale boats rigged with sails and boat covers, and a folding boat that can be used in the water or upon runners on the ice. The sails, including rolling topsails that can be furled from the deck, are all new and stout; the spread of canvas is 6,858 square feet.

In the outfit are included eight Arctic tents, each 6 feet by 9, a suit of spare sails, and a number of ice saws with which ice from 10 to 15 feet in thickness can be cut. A deck house roofed over and fastened together by mortises and screw bolts is provided, which can be taken down and put up at will. The cabin and forecastle are padded inside with several thicknesses of felt, and the poop deck is covered with three thicknesses of stout canvas painted over. The ship will be heated by stoves burning soft coal.

The officers of the ship and the scientific members of the expedition are eight in number: Lieutenant George W. De Long, U.S.N., Commander; Lieutenant C. W. Chipp, U.S.N., Executive Officer; Lieutenant John W. Danenhower, U.S.N., Navigating and Ordnance Officer; G. W. Melville, U.S.N., Engineer; Dr. J. M. M. Ambler, U.S.N., Surgeon; Jerome J. Collins, Meteorologist and Chief of Land Parties and Sledging Expeditions; Raymond L. Newcomb, Naturalist; Captain William Dunbar, Ice Pilot. The crew, including seamen, machinists, carpenters, firemen, and coal passers, number twenty, and there are three Chinamen to serve as cook, steward, and cabin boy. The principal officers have all seen Arctic service; and the crew have been carefully selected for their physical and mental fitness for their arduous undertaking. The choice was made from 1,300 applicants.

Special pains have been taken to secure the most perfect outfit possible in the way of clothing and provisions. The ship is provided for three years, and, with the exception of flour and its preparations, all the food stores are in the form of condensed meats, vegetables, and fruits. Ample rations of beer, tea, and coffee will be served. The whole cost of the expedition—in many respects the best equipped that ever set sail for the Arctic regions—will be defrayed by Mr. Bennett.

The grand object of the expedition is to add to our knowledge of the unexplored regions in the neighborhood of the North Pole—if possible to attain to that long sought and apparently unapproachable geographical position. The magnetic and meteorological problems to be studied and possibly solved in those parts are of high importance; and there is no telling what geographical and climatic surprises may not await the plucky voyagers, who have started on the first deliberate assault upon the pole by way of the Pacific. Should the warm current which enters the Arctic Sea through Behring's Strait prove of sufficient volume to have a material influence on the climate within the seventieth parallel, we may reasonably expect that the Jeannette will at least do something to remove the great blank which covers our maps on that side of the pole.

PROPOSED EXPLORATION OF WESTERN ASIA.

A scheme for a systematic and competent exploration of the seats of ancient empire in Western Asia is talked of in England. The success which has attended the exploration of Palestine and the limited research that has been made in other parts of Asia Minor give assurance of grand discoveries to result from such an enterprise. Speaking of the relics already possessed, throwing light on the ancient Babylonian empire, the London *Globe* remarks that they cannot but fill with astonishment any one who will take the trouble to examine them, showing, as they do, that in an age of the world which we are accustomed to regard as an age of all but universal darkness and savagery, there flourished a degree of learning and civilization which seems in many respects to have been but little behind our own. It is really startling to find a library catalogue compiled some 4,000 years ago, appended to which is a direction to the student to write down and hand to the librarian the number of the book he wishes to consult, just as he would have to do today at the British Museum or the Guildhall Library. There are now in the collection at Bloomsbury, Assyrian bas-reliefs testifying to an extinct but advanced civilization to an extent of which comparatively few persons have any idea.

Fortunately the ancient libraries of Mesopotamia were largely made up of tablets composed of clay, and the fact that many of these have survived the wreck of the empires, and the extinction of the learning and civilization to which they testify, and are now in our possession, of course affords abundant reason to believe that Western Asia still possesses hidden treasures of a similar kind, such as would certainly have the most profound interest for every department of learning. So great an addition has recently been made to our knowledge of this old world that it is a matter for wonder that men and money and state influence have not by this time been secured for the prosecution of earnest and extensive exploration.

FLINT IMPLEMENTS OF THE ABORIGINES.

On another page will be found an interesting article on flint implements and their mode of manufacture by the earlier tribes of Indians. Mr. Frank H. Cushing, the author of these researches, is a man only about twenty-three years old, and holds the office of Curator of the Ethnological Department of the Smithsonian Institution, Washington. Up to the time when Mr. Cushing undertook, by putting himself in the identical position of the Aztecs and mound builders—using nothing but sticks and various shaped stones, such as he found on the river banks, to work with—the problem of how these implements of the prehistoric races were made had puzzled the antiquarian student. Mr. Cushing has kindly furnished us the sketches from which our engravings are made, and the description is from the author's paper read before the Anthropological Society at the Smithsonian Institution at its last meeting. We are sure the result of Mr. Cushing's researches will be read with interest by scientists and antiquarians in all parts of the world.

Sir William Fothergill Cooke.

The projector and constructor of the first telegraph line in England, Sir William Fothergill Cooke, died recently. He was born at Ealing, in 1806, and after graduation at the University of Edinburgh, spent five years in the service of the East Indian Army. On his return he took up the study of anatomy and physiology first at Paris, continuing at Heidelberg. At the latter place, in 1836, his attention was directed to the subject of electricity, to which he soon devoted himself exclusively. He constructed an experimental telegraphic instrument, which he took to England and endeavored to introduce on the Liverpool and Manchester Railway. This was two years after Professor Morse had privately demonstrated the success of his invention. Associating himself with Wheatstone, Cooke perfected his invention, so far at least as to make it practicable, and in June, 1837, Cooke and Wheatstone together took out the first patent for an electric telegraph, the mechanism of which, however, was quite unlike that of the Morse instrument. The first line constructed by Wheatstone and Cooke was finished early in 1839, and several other lines had been set up in England before Morse's Washington and Baltimore line was constructed in 1844. Cooke was knighted in 1869, and pensioned in 1871.

The Great Suspension Bridge between New York and Brooklyn.

At a meeting of the Trustees of the New York and Brooklyn Bridge, July 7, the contract for supplying the steel and iron for the suspended superstructure was awarded to the Edgemoor Iron Co. The contract calls for 10,728,000 pounds of steel and 34,000 pounds of iron. The bid of the Edgemoor Iron Co. was $4\frac{35}{100}$ cents a pound, amounting to $468,147. Chief Engineer Roebling said that when the change from iron to steel was first contemplated he supposed that the difference in price would be at least $100,000, but in fact the lowest bid for steel exceeded by only $4,000 the accepted bid for iron last year. The difference between the lowest bid and the lowest bid for crucible steel was $334,000.

Both towers of the bridge have been completed, the last work on the Brooklyn tower having been finished July 5. Mr. Kingsley expressed the belief that through this contract it would be possible to complete the bridge by January 1, 1881. The financial condition of the bridge on June 30 was as follows: Total receipts, $10,623,492.94; total expenditures, $10,523,574.86; outstanding liabilities, $112,807.62.

No Favoritism—No Presents.

Mr. Franklin B. Gowen, the indefatigable President of the Philadelphia and Reading Railroad, who has put himself so emphatically on record against the tyranny of trades unionism, has recently, according to the *Railway Review*, issued an order regarding the employment of new men on his road, which we regard eminently just and proper. Premising that he has discovered that bosses and superintendents have shown great favoritism in the employment of men, setting aside prior and worthy applicants, and giving positions to those who are related to them, or belong to the same society, lodge, church, or political party as themselves, or who have contributed toward making them presents, he calls the attention of those who have charge of the employment of men to the fact that the company "knows neither politics, sect, religion, nor nationality." He says: "Every able-bodied man of good moral character, no matter what may be his politics, nationality, or religion, is entitled to employment (if there is a vacancy) in the order in which his application is made." This is the correct doctrine; and the order which follows should be among the regulations of every railway company. It is, that any superintendent or boss who, in any manner, directly or indirectly, receives any presents or other valuable consideration from his employes, or who may be found unjustly discriminating in the employment of men in favor of his relatives, or in favor of

any particular party, nationality, religion, or association, shall be summarily dismissed from the service.

It would be well if the proprietors or chief officers in some other branches of business where large numbers of men are employed, would exact similar requirements of their superintendents or under officers.

A TROPICAL FRUIT.

A writer in the *Gardener's Chronicle*, in an article on the edible fruits of the forests and gardens of the Eastern tropics, gives a long and interesting account of that singular fruit the durion. He says that the regal durion (*Durio zibethinus*), like the finest of nectarines or melting pears, must be eaten fresh and just at one particular point of ripeness, and then it is a fruit fit for a king. So highly is this vegetable custard valued that as much as a dollar each is often paid for fine specimens of the first fruits of the durion crops brought into the Eastern markets. It is a universal favorite with both Malays and Chinese, but the opinions of Europeans vary as to its merits. It is a paradox, "the best of fruits with the worst of characters," and, as the Malays say, you may enjoy the durion, but you should never speak of it outside of your own dwelling. Its odor is so potent, so vague, so insinuating, that it can scarcely be tolerated inside of the house. Indeed nature here seems to have gone a little aside to disgust us with a fruit which is, perhaps, of all others, the most fascinating to the palate when once we have "broken the ice," as represented by the foul odor at first presented to that most critical of all organs of sense, the nose. As a matter of course, it is never brought to table in the usual way, and yet the chances are that whoever is lucky enough to taste a good fruit of it to begin with, soon develops into a surreptitious durion eater. There is scarcely any limit to durion eating if you once begin it; it grows on one like the opium habit or other acquired taste; but, on the other hand, the very suggestion of eating such an "unchaste fruit," is to many as intolerable as the thoughts alone of supping off cheese and spring onions, washed down with beer, and following it by a whiff from a short "dhudeen," by way of dessert.

About the middle or end of July, durion fruits are very common in Singapore, and their spiny skins lie about the streets in all directions. As you pass along you become aware of a peculiar odor all around you—an odor like that of a putrid sewer when half suppressed by holding a perfumed handkerchief to the nose—a blending of a good deal that is nasty with a *soupçon* of something rather sweet and nice. On opening a fruit for yourself, you find that the perfume, like that of musk plant, ceases to be evident after you have once had a fair whiff at it at close quarters. The flavor of the straw-colored, custard-like pulp surrounding the large chestnut like seeds is perfectly unique; and to taste it, as Wallace tells us, is a "new sensation worth a journey to the East to experience." The pulp is sweet, rich, and satisfying, but never cloys; the richness seems counteracted by a delicate acidity, and the want of grape-like juiciness is supplied by the most creamy softness of the pulp as it melts away, ice-like, on your tongue. The durion is one of Dame Nature's "made dishes," and if it be possible for you to imagine the flavor of a combination of corn flour and rotten cheese, nectarines, crushed filberts, a dash of pineapple, a spoonful of old dry sherry, thick cream, apricot pulp, and a *soupçon* of garlic, all reduced to the consistency of a rich custard, you have a glimmering idea of the durion, but, as before pointed out, the odor is almost unmentionable—perfectly indescribable. The fruit itself is as large as a Cadiz melon, and its leathery skin is protected by sharp broad-based spines similar to those of a horse-chestnut. There are many varieties in the Bornean woods some but little larger than horse-chestnut fruits, and having only two seeds; others larger but with stiff orange-red pulp, not at all nice to eat, however hungry you may be, and even the larger kinds, with creamy pulp and many seeds, vary greatly in flavor. The trees vary from 70 to 150 feet in height, with tall, straight boles and spreading tops, and the foliage is oblong acuminate, dark green above, paler and covered with reddish hairs or scales below. The fruits of the finer varieties fall when ripe, and are often the cause of serious accidents to the natives. The clusters of large white flowers are produced about April, and form a great attraction to an enormous species of bat, a kind said to be one of the greatest pests of Eastern fruit-groves. The finest fruits are obtained from cultivated trees.

The tree does well in Sumatra, Java, Celebes, and the Spice Islands, and even as far north as Mindanao. Forests of it exist on the Malay Peninsula, and very fine fruit is brought to Singapore from Siam about July or August. It does not succeed well in India, and cannot be grown in the West Indies.

FIRE-FLIES.

The insects termed fire-flies in America, and which lend such a charm to our summer nights, are soft-winged beetles of the family *Lampyridæ*, which have the property of emitting from the abdomen flashes of soft, phosphorescent light. There are several distinct species of these so-called "fire-flies" indigenous to North America, the most common and widely distributed of which is *Photinus pyralis* (Linn.). This insect most abounds in the Southwest, where, during summer evenings its constantly recurring flashes of light beautifully illumine the air. The perfect insect is of oblong form, somewhat flattened, and varies from ¼ to ⅝ of an inch in length. The wing-covers are dull black, margined with pale yellow. The thorax is yellow, with a central black spot having on each side a patch of rose color. The under side of the abdomen is dark brown, with the exception of the two terminal segments from which the light is emitted, which are sulphur yellow. The manner in which the flashes of light are produced is not yet satisfactorily determined, but would seem to be the result of sudden, irregular inspirations of air accompanied by a peculiar voluntary action of certain abdominal muscles. The larva of this species, which may serve to illustrate the larval habits of the family, lives in the earth and subsists mainly on earth worms. It is of an elongate slender form, each joint having on top a horny brown plate, which is ornamented with a central straight line of white, inclosed between two curved lines of the same color. The sides are soft, and rose colored, with the white spiracles situated on elevated brown patches. The under surface is cream color, and each segment is marked in the center with two small brown spots. The thoracic legs are quite long, and the posterior extremity is provided with a singular fan-like proleg, which not only assists in locomotion, but serves to cleanse the head and fore part of the body from the impurities that may adhere after the larva has been feeding. The pupa is formed within an oval cavity in the earth, and is white, with a tinge of crimson along the back and sides. It remains in this state only about ten days. Both larva and pupa have the power of emitting light, though in a much less degree than the mature insect.

The "fire-fly" most common in the more Northern States is the *Photuris pennsylvanicus* (De Geer). In some species of both the genera here mentioned, the females are incapable of flight, the true wings being entirely undeveloped, and the wing-covers very short; while in the well-known glow-worm of Europe (*Lampyris noctiluca*), belonging to the same family, the female retains the larval form, and has the merest rudiments of wings.—*Prof C. V. Riley.*

Discovery of Another Mastodon.

In 1845 the largest and most perfect skeleton of a mastodon ever found was taken from a swamp in the town of New Windsor, near Newburg, N. Y. It was set up by Dr. Warren, and is now in the Boston Museum.

On July 5, the bones of another mastodon were discovered in the same neighborhood—namely, on the farm of Hugh Kelly, at Little Britain, N. Y. The skeleton appears to be nearly if not quite complete, and the separate bones are in fine condition.

The dimensions of the chief parts of the skeleton found are as follows: The skull is 45 inches long, 28 wide, 29 high, and 23¼ between the eyes. The diameter of the nostrils is 6 inches, the nostrils extending into the head 2 feet. Four teeth were found in each jaw in an excellent state of preservation. The enamel is of a bluish tint and unbroken. The four back teeth are eight-pointed, measure 7 by 3¼ inches, and stand 3 inches out of the jaw. The four front teeth are six-pointed, and measure 4¼ by 3½ inches. The depth of forehead is 18 inches; the eye-sockets are 7 inches in diameter, and the ear-sockets 18 inches in diameter. On each side and above the mouth are holes measuring 6½ inches in diameter, from which probably protruded the tusks, which have not yet been found. These openings extend into the skull a depth of two feet. There are eight fangs on each back tooth and six on each front one. The space between the rows of teeth across the jaws measures 7½ inches on the upper and 6¼ inches on the lower jaw. In the center of the forehead is a cavity measuring 11 by 4 inches. It cannot be surmised what this cavity indicates, unless it be for a trunk between the tusks corresponding to that of an elephant. The lower jaw was joined to the upper after they had been unearthed, making a perfect skull. It is estimated that the skull complete will not weigh less than 600 pounds.

The fore-leg, including the thigh bone, measures 7 feet in length, and it weighs, it is judged, 150 pounds. The first joint of the hind leg measures 2 feet 5 inches in length, and the second joint of the same leg 3 feet 4 inches. The only part of the other fore-leg yet found is the second joint, measuring 3 feet 10 inches in length. A dozen or more sections of the spine are among the bones unearthed. The largest measures 10 by 16 inches. A score or more other bones are among the lot, among them that of a toe, measuring 6½ by 4½ inches.

These measurements indicate an animal rivaling in size the one described by Dr. Warren.

Swift's Comet.

In a letter to the *Tribune*, with regard to the comet discovered by him, June 17, Mr. Swift reports, under date of July 5, that from observations made by Professor Hough, Director of the Dearborn Observatory, Chicago, on June 23, and by Professor S. C. Chandler, at Boston, on the 26-30, Professor Chandler has computed the following parabolic elements referred to the mean equinox of 1879·

Perihelion passage—May 30·2115, Washington mean time.

Longitude perihelion	11°	35′	24″
Longitude node	56°	4′	0″
Inclination	70°	38′	3″
Logarithm of perihelion distance			0·09482

Motion retrograde.

These elements resemble those of no comet which has been observed during authentic history. In fact, they differ widely from all recorded comets since 370 years B. C. down to our own time. If correctly calculated the orbit of this comet is parabolic, and the comet is visiting us for the first and last time. It is now receding from the sun rather rapidly, but is approaching the earth somewhat slowly, and will be visible for several weeks, but only through the telescope. Professor Chandler thinks it was at its maximum brilliancy on the 1st of July, when it was just visible with a 2½ inch telescope.

The reader must not lose sight of the curious fact that the comet on the 13th passes quite near the Pole Star and almost exactly over the true pole of the heavens, which accounts for the abrupt change in right ascension.

One very clear night Mr. Swift has seen a broad but very short and faint tail inclined at a considerable angle from a point opposite the sun. On another clear night he was able to see an exceedingly minute star-like nucleus which appeared to be double. Neither of the last two phenomena could be seen except by eyes long trained to viewing faint objects, and then only on nights exceptionally clear and with instruments of fine definition.

Decease of Two American Ship Builders.

With the death of John Dimon, recently, the last of the old-time ship builders of New York passed away. Mr. Dimon was born at Jamesport, L. I., in 1794. He apprenticed himself to Henry Eckford, ship builder, at an early age, and when but eighteen years old was sent by the latter to Sackett's Harbor to help in building the frigates which served in the war of 1812. Afterward, associated with Stephen Smith, Dimon became a prosperous ship builder, building many noted clipper ships, and at a later day many steamships, notably for the Pacific Mail Steamship Company. Mr. Dimon retired from business in 1854. He had for his contemporaries in the palmy days of the ship building trade, among others, the father of Wm. H. Webb, the father of Henry Bergh, the two brothers James R. and George Steers, Jacob Westervelt, and Mr. Mills, who died a short time ago.

An American ship builder of more recent fame, William Cramp, head of the Cramp Ship Building and Engine Works, Kensington, Philadelphia, died at Atlantic City, July 6.

Mr. Cramp was born in Kensington, in September, 1807. He served as a ship building apprentice when that industry was carried on in its primitive stages in the yard of Samuel Grice, which was then the principal establishment in its line in Philadelphia. After attaining his majority he engaged in business for himself, beginning in a small way. During the fifty years he spent in business ship building made great strides, and William Cramp was acute in his perceptions of the wants of a progressive people.

The firm of William Cramp & Sons was composed of William Cramp and five sons. Since the works have been established there have been constructed 225 vessels of every description, including merchantmen, men-of-war for this and other governments, the steamers of the American Line, and Reading Railroad colliers. Five iron cruisers for the Russian navy have been built at the works within the past year.

The Bridgewater, built 27 years ago, and at that time the largest vessel of her class in the country, is still afloat.

The largest iron freight ship ever built in this country is now under construction at this yard. She is to be 2,000 tons measurement, and to have a carrying capacity of 8,000 bales of cotton.

A Good Sign of the Times.

One year ago this month, July, the New York Belting and Packing Company became financially embarrassed, owing to serious losses occasioned by the defalcation of an officer in the Boston Packing Company. A compromise was effected with their creditors, and notes were given for full amount, interest payable at intervals extending to October, 1881. It will gratify the friends of the company to know that they are now enabled to meet all their obligations, and to this end the energetic manager and treasurer, J. H. Cheever, Esq., requests the holders of their notes, whether due or otherwise, to present the same for immediate payment.

Fourth of July Snow.

A sudden and unusual fall of temperature was widely experienced on the afternoon of the fourth of July. At Portland, Maine, it was attended by a fall of snow. Sergt. Boyd, of the Signal Service, explained the phenomenon in this way: Shortly before five o'clock a cloud was observed rising from the south. At the same time another rose from the northwest. The current of wind which bore this along was cold, while the opposing current was warm and saturated with vapor. These two intermingled, and the effect was to form crystals of snow. The preceding heat and dryness of the day also helped to produce this result. The barometer was very low at the time, and the thermometer dropped 15 degrees in 10 minutes. The minimum temperature Friday night was 57°. This sudden change was no less remarkable than the snow-flakes.

The Mississippi Jetties Finished.

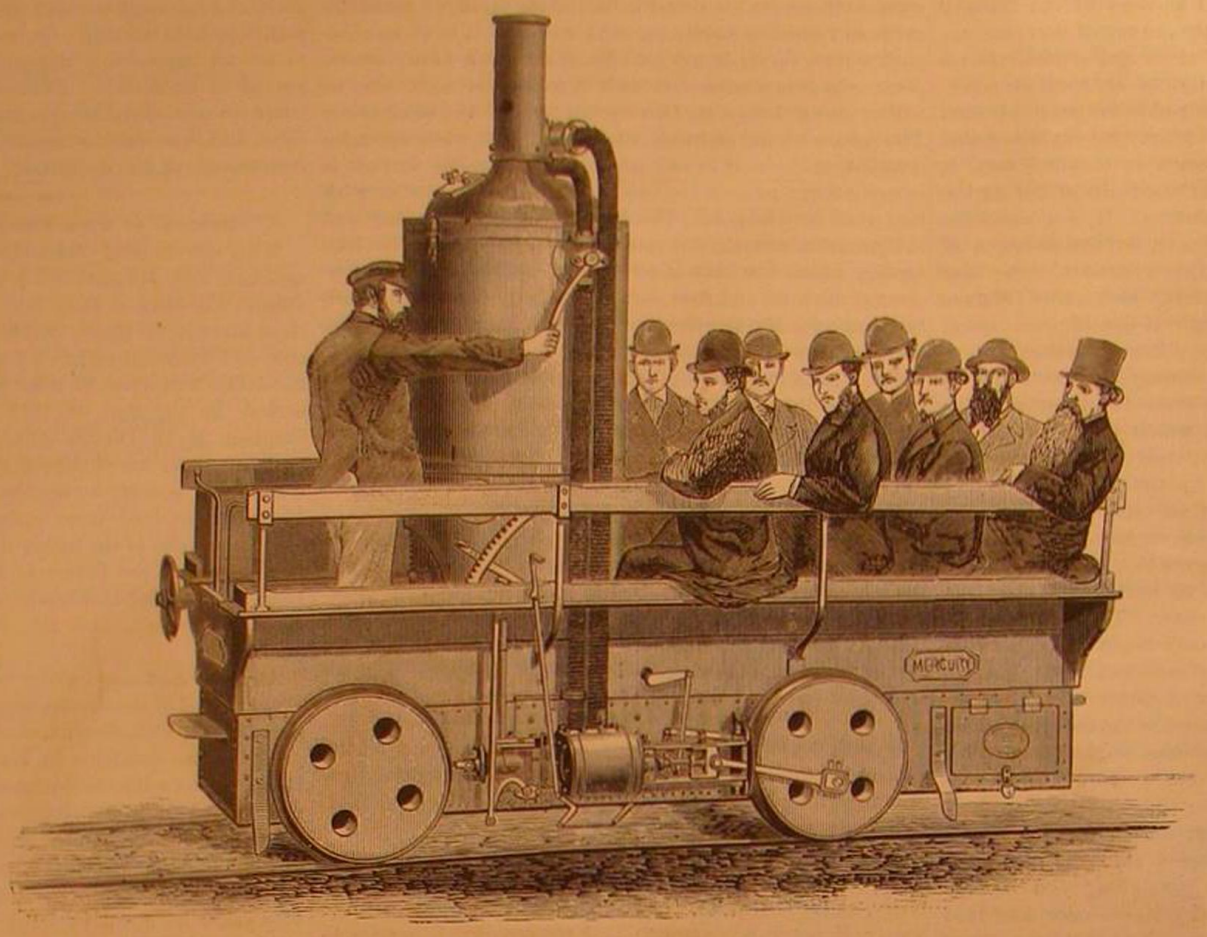
Capt. J. B. Eads reports, under date of July 10, that the greatest depth and width of channel required by the Jetty Act at the mouth, and also at the head of South Pass, has been secured. The completion of the great work was certified to the Secretary of War the same day by Captain M. R. Brown, of the United States Engineers, inspector of the work. The jetty channel is over thirty feet deep, and a good navigable channel of twenty-six feet, measured at the lowest stage of the river, exists at the head of the passes. The benefits to commerce likely to flow from this brilliant achievement are inestimable.

A NOVEL STEAM CAR.

We give herewith an engraving of a novel steam car, designed and built by Ransomes & Rapier for one of the English colonies. It is a combination of engine, tender, brake, and car, all in one, and is said to be the least expensive engine yet made for traveling twenty miles an hour. The boiler is of the vertical type, with ample grate and heating surface. The engine has two cylinders, and is provided with reversing gear and all the other fittings usual in the best locomotive work. The car is mounted on springs, and can be made either open, as shown in the engraving, or closed with roof and glass windows.

With four wheels coupled the engine will draw a load of fifty tons on a level at eight miles an hour.

The machine represented in the engraving will carry eight passengers at a speed of twenty miles an hour. It can also draw two supplementary cars, each containing sixteen passengers, at a speed of fifteen miles an hour.



NEW STEAM CAR.

Carbolized Air.

As an offshoot of Listerism, air which has been passed through liquid carbolic acid is recommended by Professor Sneller, of Utrecht, as a substitute for the carbolic spray. The method suggests itself as a good one. The object of Lister's method is to destroy the bacteria, but the acid employed for this purpose is itself a foreign matter, and, as such, must irritate to a greater or less degree. The carbolized air has the advantage of purity, and is, at the same time, free from objections to the spray. In practice, the air has been found to diminish the bleeding from a cut surface, while the spray encourages bleeding by the moisture it maintains.—*Mich. Med. News.*

A NEW BRICK MACHINE.

The accompanying illustration represents an improved brick machine made by Messrs. Boulet Brothers, of Paris. It consists of three distinct parts—the crusher, the pug mill, and the press, all combined to operate harmoniously together. An elevator carries the clay from the crusher to the pug mill, whence it passes to the cylinder press seen on the right, which forces the clay through a rectangular mouthpiece, and delivers it to the apron in the form of a rectangular prism, which is cut into the required sizes by wires carried by the frame shown at the extreme left of the engraving. Messrs. Boulet were awarded a gold medal for this machine at the Paris Exhibition.

RECENT AMERICAN PATENTS.

An improved shoe, having its upper made of but two pieces of material, opening at the back and adjusted by straps and buckles to fit any ankle, has been patented by Mr. Louis Rose, of Paris, Mo. The object is to furnish a cheap and substantial shoe that can be easily put on and off.

Mr. George E. Wickens, of Tampico, Ill., has patented an improved shirt protector, consisting of an elastic net made of rubber cords or tubes. It is to be worn under the shirt front next to the body, and is designed for keeping the shirt from contact with the body.

Mr. Ebenezer Fisher, of Kincardine, Ontario, Canada, has patented improvements in steel horse collars, which relate to the attachment of the cover or protecting piece to the flanged parts of the collar, also to an arrangement of filling pieces, and other novel features that cannot be described without an engraving.

A novel device for holding doors open has been patented by Mr. Lucian B. Leech, of Smithfield, Pa. It may be adapted to doors opening at different angles. It consists of a spring catch attached to an adjustable bar mounted on a semicircular plate to be attached to the base board.

An improved gate, which may be opened and closed by a person riding in a vehicle, has been patented by Mr. Henry Petry, of Red Oak, Ohio. It consists in a swinging gate having its top bar projecting beyond the rear of the post, and having its end forked to receive a bell crank lever, by which the latch of the gate is operated as the gate is pulled one way or the other by ropes attached to the projecting end of the top rail.

An improved oil can, patented by Mr. Edward T. Jones, of Toronto, Ont., Canada, is made so that it is hermetically sealed when not in use, so that the contents cannot escape either by evaporation or wasting when the can is accidentally tipped over.

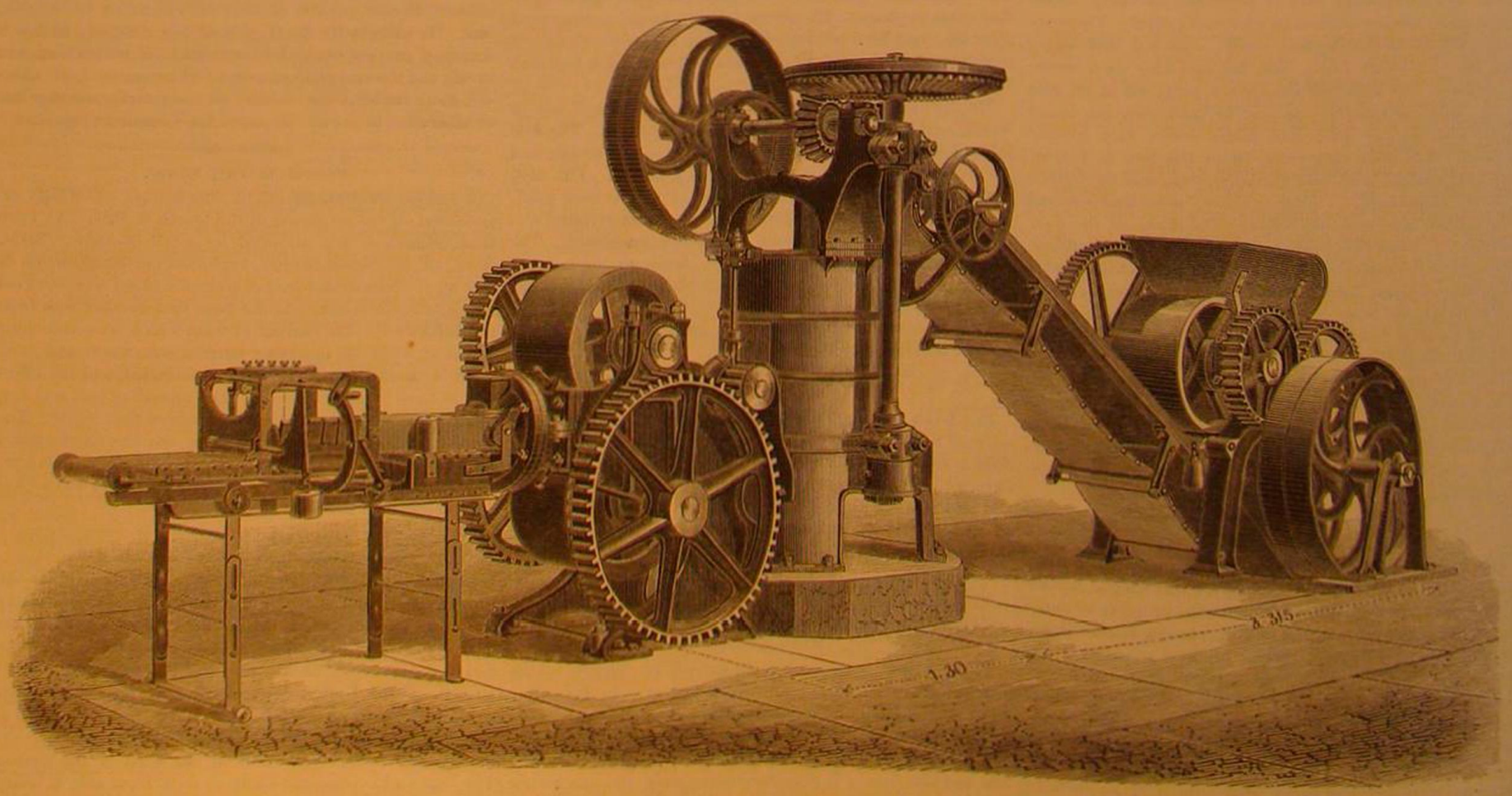
An improved vaginal syringe, in which the discharge tube is provided with a wire guard or shield, has been patented by Mr. John H. Guest, of Brooklyn, N. Y.

A novel gate, patented by Mr. Orlando F. Fuller, of Lamont, Mich., is arranged so that it is opened and closed by the wheels of a vehicle passing over cranks connected with the gate by a peculiar arrangement of chains and pulleys.

An improved apparatus for exhibiting photographic pictures has been patented by Mr. Philipp Costa, of New York city. It is contrived so that the margin of the picture is covered and is provided with a device for intereepting the view while the picture is being changed. It is also provided with stained glass screens through which colored light may be thrown on the picture.

An improvement in hatchway doors, patented by Mr. William H. Cooke, of Wilton, Conn., consists in providing the hatchways with double doors, arranged to slide to and from each other and to be operated by the elevator, which, in ascending and descending, comes in contact with levers fulcrumed in the cleading and connected with the doors, so that the door ahead of the elevator is opened and the one behind it closed simultaneously by the movement of the elevator.

A combined oven door and roaster has been patented by Mr. Henry C. Atkinson, of Franklin, Ky. It consists of a rotary cylinder attached to an oven door for roasting coffee, popping corn, etc.



BOULET BROTHERS' BRICK MACHINE.

An improved edging tool for leather working has been patented by Mr. Zenas B. Putnam, of Thomaston, Me. The invention consists in a flat cutting blade fitted to a handle, and carrying an adjustable gauge arm, to which is attached a gauge plate that acts as a guide for the knife.

A hog holder, consisting of a stout rod bent ipto a loop with crossed legs, and having hooked ends, to which is attached a cord or chain, has been patented by Messrs. John R. Wilson and Wilson M. Baker, of Urbana, O. The chain or cord is placed in the hog's mouth, and the loop is turned, forming a hitch over the hog's nose.

An improved hog ring and ringing implement has been patented by Mr. Anthony St. Mary, of Decatur, Ill. The ring in its central section is single, and it widens out toward each end into a two-pronged fork, the prongs being sharpened to facilitate penetration through the septum of the nose. The ringing implement is especially designed for applying this form of ring.

Mr. William Hart, of Berea, Ky., has devised an improved butter stamp, consisting of a cylinder containing a piston which is moved by a screw, so that the thickness of the print can be exactly gauged and its weight indicated.

An improved atmospheric churn dasher, constructed so as to confine a quantity of air while descending, and to allow it to escape and pass through the cream when it begins to ascend, has been patented by Mr. Moses Ray, of Valley Grove, West Va.

Mr. James L. Sprague, of Minneapolis, Minn., has patented an improved rotary churn, having a concave cover provided with air tubes, and having a dasher which propels the cream from the ends of the churn toward the center. The inventor claims that this dasher is much more effective than those of the usual design.

An improved milk cooler, patented by Messrs. Charles L. and Sanford P. Bacheller, of Canton, N. Y., consists in the combination of three concentric pans, provided with connecting pipes, a waste pipe, and water faucet. The pan is mounted on a pivot, so that it may be turned to bring every part of it within reach.

Mr. Gideon E. Wolcott, of De Kalb, Ill., has patented an improved riding plow, which is calculated to cut a uniform furrow in all kinds of plowing, and will turn the last furrow in finishing up the land as evenly as the other furrows. The plow is provided with two oblique furrow wheels, and is arranged so that it may be readily adjusted to its work.

An adjustable window protector and ventilator, patented by Mr. J. L. Walton, of Bolton, Miss. It may be applied to windows of various widths, and it consists of a lattice formed of bars pivoted together diagonally, and having at the ends pivoted jaws and standards to support it in the window.

Mr. George H. Hull, of Montello, Wis., has patented an improved insect destroyer, particularly intended for destroying potato bugs. It consists in a syringe and reservoir combined, so that a constant quantity of the liquid is supplied to the syringe.

Mr. William B. Brown, of Wheat Ridge, Ohio, has patented an improved ventilator for removing vapors and foul air from kitchens, school rooms, and other places. It may be adapted to the ceiling of any room.

An improved copy holder has been patented by Mr. Chas. S. Caldwell, of Wichita, Kan. It consists of a sheet metal tube provided with a longitudinal opening, through which the manuscript projects, the uncopied portion of the manuscript being contained by the tube.

An improved harness coupling, consisting of a T shaped head provided with an eccentrically grooved neck or shank, and adapted to receive and hold a suitable hook, has been patented by Messrs. Frank Reynolds & G. D. Hayes, of Shelby, Iowa.

Mr. James Stephens, of Canisteo, N. Y., has patented an improved extension table, which may be lengthened or shortened, and its leaves properly adjusted to either condition without removing them.

Mr. Jean A. Hitter, Jr., of St. Martinsville, La., has patented an improvement in printing telegraphs, in which a type writing machine, previously patented by him, is combined with an arrangement of magnets and telegraphic apparatus.

THE EXETER STEAM ENGINE.

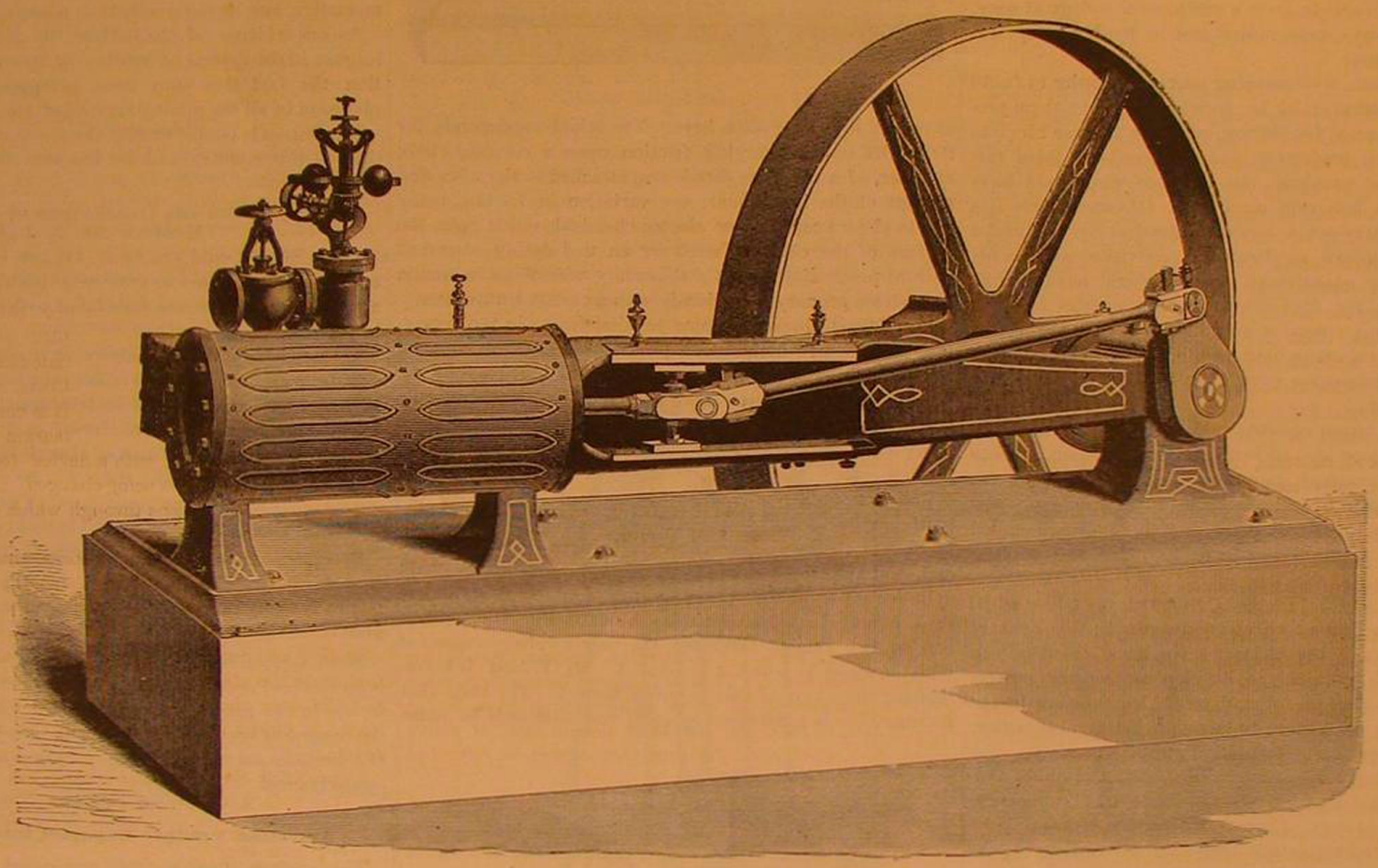
The accompanying cut represents the steam engine made by the Exeter Machine Works, and gives a good idea of its construction and general appearance. The larger engines are similar to the one shown, varying only in those particulars essential to their increased size. They are made from entirely new patterns; and the manufacturers claim that they combine all that is desirable in a steam engine.

The cylinder is accurately bored, and made of more than the ordinary thickness. It is capable of being rebored a number of times, still leaving ample strength for hard work. The cylinder is connected with the main bearing by a rigid casting, which, with the slides, forms one piece, giving the maximum strength and stiffness, and keeping the slides always "in line." The slide casting is separate from cylin der.

The piston rods and valve rods are made of steel, and move through composition bushings. We are informed that only the best of materials are used; and where it will add to the efficiency or durability of the machine steel is always used.

As regularity of speed is of the utmost importance in the economy and durability of the steam engine, especial attention has been given to this point; and the makers have provided a governor which maintains a uniform speed under varying load. These engines are very simple, economical in the use of fuel, and may be run successfully by persons of limited experience. The smaller sizes, when used in connection with the "Exeter boiler," do not require the services of a regular engineer.

Further information may be obtained from Exeter Machine Works, 50 Federal Street, Boston, Mass. The manufactory is located at Exeter, N. H.



THE EXETER STEAM ENGINE.

American Competition in England.

In a recent discussion in the House of Commons, relative to the appointment of a royal commission to inquire into the causes of the agricultural depression and how far they were created by or are remediable by legislation, all sides agree that a great cause of the depression was American competition. Mr. Chaplin said he regarded free trade as a question definitely settled, but he could not shut his eyes to the failure of many of the predictions of the advocates of free trade. He did not propose a remedy now, but only asked for an inquiry. He pointed out that the future fate of British agriculture was dependent upon the cost of production in America. If the cost of importation fell below the cost of production at home, the ruin of British agriculture was not far distant. Liberals, such as Messrs. Brassey, MacDuff, and Duff, blamed the British land system and the game laws for the depression. Their arguments were summed up in a speech by Mr. Bright, who warned the land-owners that the competition of the United States would go on increasing, and the only way of meeting it was to get rid of the stupid and mischievous legislation regulating the tenure and transfer of land. Messrs. MacIver and Bentinck advocated protective measures, but both the Marquis of Hartington and the Government—as represented by Viscount Sandon (Conservative), member for Liverpool, and Sir Stafford Northcote, Chancellor of the Exchequer—declared that no cause had been shown for such measures, which certainly would never be sanctioned. The Marquis of Hartington attributed the depression primarily to the bad season.

The anxiety felt in England with regard to American competition in agriculture is almost paralleled with regard to manufacture. An influential London journal points out that the natural inference to be drawn from recent commercial statistics is, that while American manufacturers are gradually monopolizing the whole of their own markets, and thus ousting from them English merchants, they are also attacking with not a little success the chief centers of demand in Europe. "This latter theory receives support from the fact that in 1878 the States sent abroad cotton, iron, and steel manufactures to the value of nearly £1,000,000 sterling in excess of the previous year's exports. Within a comparatively short period the markets of Europe knew no Yankee products under these heads, except a few miscellaneous 'notions,' which had no appreciable influence on current rates. True, the quantity exported still remains insignificant compared with what we ourselves send abroad. But every trade must have a beginning, and it must be confessed that Cousin Jonathan has made a very good start in foreign business. In cotton, especially, he seems determined to make the most of his advantages, for the quantity produced in the States last year was very nearly double what it amounted to in 1870, although trade was supposed to be utterly stagnant in every branch."

Phosphate of Potash as a Condiment.

Professor Galloway proposes the use of phosphate of potash as a condiment, especially where much salt meat is eaten. He points out that phosphate of potash is the principal material extracted from meat in the process of salting, and holds it evident that it ought to be replaced to give the salted meat its original nutritive value. He also suggests that phosphate of potash will be more useful than lime juice in preventing scurvy. It would be interesting to know whether the Arctic plants, which are such a specific for scurvy, are in this salt.

THE shad hatching camps on the Hudson below Albany were closed Thursday, June 19. It is said that more shad fry have been put into the Hudson this year than ever before. It is also reported that Mr. Seth Green has found a new fish parasite which preys upon brook trout and suckers, eating holes in their sides. It looks like a bat-shaped drop of jelly, and would naturally be mistaken for a little swelling under the skin.

Advantages of a Mechanical Education.

In this age of iron and steam, the young man who thoroughly understands the nature and manipulation of the former, and the scientific and practical management and application of the latter, need not long be without lucrative employment; provided, of course, he has the moral and physical qualifications for a position of responsibility and trust. While it is true that a large number of the prosperous manufacturers and contractors of this country have never had the advantages of a so-called technical education, such as is afforded by a mechanical college, yet the day is fast approaching, when, as now in Europe, our large industrial establishments, and our boards of public works, will demand a scientific and technical education of the men who direct these undertakings.

As our country grows older men will pay more and more attention to an education which fits them for some definite pursuit in life, and their entire educational course will be framed with this particular object in view. A bent for mechanical pursuits usually manifests itself at a very early period in life; the inclination of the six-year old boy to hammer and pound, to tear open toys and clocks to "see what makes 'em go," all so annoying to the careful parent, may be taken as indications of latent constructive genius, although now manifested in a very destructive form.

In the youth the mechanical bias becomes still more apparent, manifesting itself in attempts to construct wagons, boats, gig saws, small engines, etc. With such a boy a mechanical education is no doubtful experiment; talk to him about it, and he wants to go to a mechanical college at once, where he may learn to be indeed and in truth a competent mechanical engineer.

Just at this point, well-meaning parents, in order to fulfill some preconceived plan, or to do what seems to them prospective of most good for the son, endeavor to force him into some other line or profession, and thus make a third rate lawyer, doctor, or merchant, out of a boy who would have certainly made a first rate mechanic. Of course there is a vast difference between a merely whimsical tinkerer and a youth with undoubted mechanical proclivities; and an observing parent or experienced teacher would have no difficulty in making the distinction. A few queries put by a judicious technical educator would soon reveal the young man's inherent prejudices, and enable him to judge whether the candidate possessed a promising foundation for a mechanical education.

Such a foundation consists mainly in an aptitude for mathematics, a good idea of form and construction, a ready insight into mechanical movements, a positive love for machine manipulation, and a tendency to improve every possible opportunity to witness machinery in motion, coupled with a desire to see into and learn its office and applications.

The above is from *Leffel's News*, to which the editor adds:

There are numerous excellent institutions in this country in which a youth of the character we have described can get the education requisite to develop his natural powers and to fit him to fill a useful and profitable position in the field of practical mechanics; to enter the list as an inventor, or, in time to superintend important public works.

Among these institutions might be named Columbia College, New York City; Stevens Institute of Technology, Hoboken, New Jersey; Cornell University, Ithaca, New York; Rensselaer Polytechnic Institute, Troy, New York; Ohio State University, Columbus, Ohio; and Illinois Industrial University, Champaign, Ill. All of these institutions publish catalogues giving schedule of studies, terms of tuition, cost of living, etc.

Of the students recently graduated from one of the above named institutions—the Stevens Institute of Technology—one is now engaged in a steam-heating and ventilating establishment; another has a position on the Michigan Southern Railway; another is employed as instructor in the Institute; another as a consulting engineer; another in the Midvale Steel Works; another as assistant editor of a technical publication; another in the Franklin Paper Mills; another in the engineer corps of the United States navy; another in the car-shops of the Pennsylvania Railway; another in the manufactory of brick machinery; another as professor of engineering at Yeddo, Japan; another at ship-building works in St. Petersburg, Russia, and another on a survey and exploration of the Western Territories.

The course in the institution just named is somewhat exacting, as indeed it must be to turn out men capable of filling such positions as we have named, but the earnest student has the advantage of association with those who are as enthusiastic as himself, and, as he gets into the higher classes, the *dilettanti* drop out, and those who have in them the stuff out of which competent and successful mechanical engineers are made, move forward to graduation and go out to assume the duties of their vocation thoroughly prepared for their life work.

Magnesium Steel.

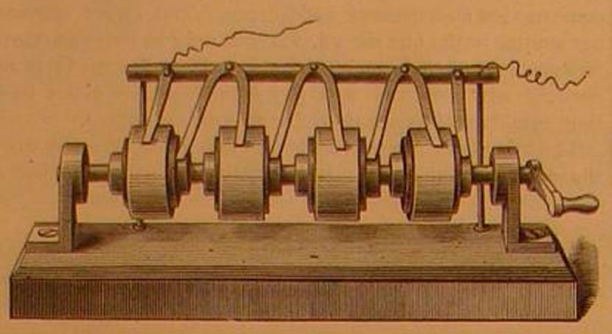
Magnesium also causes a remarkable change of strutcure in other metals. A coarse-grained steel becomes fine-grained on the addition of one-fifth per cent. of magnesium. In performing the experiments referred to, the magnesium must be introduced through a hole in the cover of the crucible after the oxygen has been first removed by the addition of a few pieces of charcoal. Without this precaution violent explosions are apt to occur.—*Ber. d. Chem. Gesell.*

PROGRESS AT MENLO PARK.

Mr. Edison has wisely kept his own counsels of late, so that very little is known outside of his laboratory as to what goes on within. Occasionally the public gets an idea through the publication of one or two of the scores of patents pending and complete; but these do not indicate the real nature of the improvements that are maturing and soon to be made known.

The electric light and the various matters pertaining to it engross the attention of Mr. Edison and the majority of his assistants; but just at present the electro-chemical or loud-speaking telephone is being made ready for the market. It is a wonderful advance in telephony. It talks as loudly as the natural voice, and repeats the words louder than they were originally uttered at the distant station. As the construction of this curious instrument was described in these columns in detail some time since,* it will be unnecessary

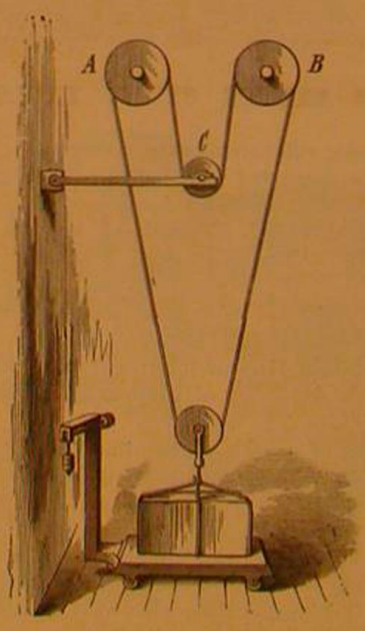
Fig. 1.



to repeat the description here. The telephone depends for its results on the varying friction upon a rotating chalk cylinder, of a platinum faced arm attached to the mica diaphragm of the instrument; the variation in friction being due to electro-capillary or electro-chemical action upon the surface of the chalk effected by an undulatory electrical current proceeding from the secondary wire of an induction coil whose primary is in circuit with a carbon transmitter.

Mr. Edison discovered some peculiar freaks in the receiving instrument which at first puzzled him; but on connecting the binding posts of the telephone with a galvanometer, he found to his surprise that the chalk and platinum rubber of the telephone formed a generator of electricity of no mean order, as it equaled in electromotive force a half of a Daniell cell. He therefore arranged four of the chalk cylinders upon a non-conducting shaft, and connected the platinum rubber of one chalk cylinder with the metallic boss of the next, the terminals being a rubber on one end, and a spring touching the metallic boss of the chalk cylinder at the other end. A series of four chalk cylinders thus mounted and connected (as shown in Fig. 1) is equivalent to two Daniell cells, but the power varies somewhat with the speed at which it is rotated. Mr. Edison is investigating the action of this peculiar battery. He finds that its resistance is 1,200 ohms when at rest, and only 50 ohms

Fig. 2.



when in motion: this is for $\frac{1}{16}$ inch metallic surface on the rubber. When this surface is increased to $1\frac{1}{2}$ inch the resistance will be reduced to 1 ohm. Whether the current is due to the decomposition of the solution with which the chalk is moistened, or whether it is due to capillarity or some other cause, has not been definitely determined.

Mr. Edison, in speaking of the electric light, says with a great deal of emphasis, that the system of lighting by incandescence is correct theoretically and practically. It is being perfected in detail, and will before long be exhibited to the public. It would seem from what is at present being done in the Menlo Park laboratory that there are hundreds of points in the problem of electric lighting that have not been considered by experimenters; among these are the proper treatment of the metal or mineral to be subjected to the intense heat required to bring it to incandescence; the insulation and protection of the electrical conductors; the meter for the measurement of the current; and the generator of electricity, which is, after all, the most vital point in the system. Much of the detail of the system has been perfected. The machine which is to supply the current has been completed, and is now undergoing a series of tests to determine its efficiency. Ninety-six per cent of the power applied to the machine is realized in the electric current, and 82 per cent of the power is made available outside of the machine. This is about double the effective exterior current realized by other machines. We hope to give our readers a description of the generator as soon as the tests are completed.

In endeavoring to measure the power required to drive the generator Mr. Edison has tried every dynamometer within reach, and condemned them all. At last, after considerable experiment, he hit upon the simple contrivance shown in Fig. 2. He claims that with this apparatus he can measure the $\frac{1}{100}$ of a horse power. The weighted box rests on the platform scale, and is provided with a pulley for receiving the driving belt, which passes over the driving pulley, A, under the tightener, C, and over the driven pulley, B. The number of foot pounds of power used will be indicated by the lifting of the box and the consequent lightening of the load on the scale. Five per cent is deducted for the angle of the belt and for friction.

Mr. Edison's dynamometer is certainly very simple and effective, but it is in principle something like other dynamometers, employing a weight as a measure of power.

As an evidence of the faith of Mr. Edison and his colleagues in the system of lighting by incandescence, we mention the fact that they have prospectors searching for platinum in all the mining regions of the country.

Mr. Edison is confident that the metal exists in large quantities in this country, and he has sent out circulars which read as follows:

FROM THE LABORATORY OF T. A. EDISON,
MENLO PARK, N. J., U. S. A.

DEAR SIR: Would you be so kind as to inform me if the metal platinum occurs in your neighborhood? This metal, as a rule, is found in scales associated with free gold, generally in placers.

If there is any in your vicinity, or if you can gain information from experienced miners as to the localities where it can be found, and will forward such information to my address, I will consider it a special favor, as I shall require large quantities in my new system of electric lighting.

An early reply to this circular will be greatly appreciated.

Very truly, THOMAS A. EDISON.

MENLO PARK, N. J.

Specimens of platinum and iridosmine sprinkled upon a card were sent with these circulars. The difference in the metals is easily detected with a microscope or magnifying glass.

Many replies, inclosing samples of platinum, have already been received at Menlo Park, and the metal has been found *in situ* in two places. Mr. Edison has a stamp mill and all the apparatus required for reducing ores of various kinds. His facilities for reducing refractory ores and metals are particularly good.

American Produce Exported into Scotland.

The landings of cattle, fresh and cured meats, and dairy produce at Glasgow, from New York and Canada, during the month of May, show, according to the London *Grocer*, a considerable falling off as contrasted with the imports in the corresponding period of last year. There were 435 live cattle and 843 live sheep brought over, being 215 cattle and 659 sheep fewer than in May, 1878. Of fresh meat there were 3,250 quarters of beef, and 650 carcasses of mutton, against 7,200 and 475 quarters and carcasses respectively in the same month last year. There were also 3,550 cases of preserved meats, 4,446 packages of bacon, 300 barrels of pork, and 1,900 tierces of beef and hams. Excepting in pork, the import of which was about one-half greater, all the other commodities aggregated not much over one-half the imports during the same month of 1878. The same may be said with regard to the imports of butter and cheese, of which there were 7,561 tubs of the former and 11,200 boxes of the latter, as compared with 10,000 tubs and 20,000 boxes in May of last year. The landings of lard and tallow aggregated 3,000 tierces last month, being a falling off to the extent of fully one-half.

The Cental System.

The Committee on Trade, in a report to the Board of Managers of the New York Produce Exchange, suggest October 1, 1879, as a suitable day for the introduction of the cental system in all transactions in produce bought and sold by weight. The committee recommend that the different trades represented in the Exchange be requested to so arrange their business that all their dealings in grain, flour, meal, provisions, lard, tallow, butter, cheese, petroleum, naval stores, oils, hay, salt, seed, dried fruit, live and dressed stock, freight, storage, and all other articles of produce that are or may be dealt in on the Exchange, and insurance thereon, shall, on and after the date named, be exclusively on the basis of weight, the unit of transactions to be the pound avoirdupois, and the multiple thereof to be the cental or 100 pounds avoirdupois.

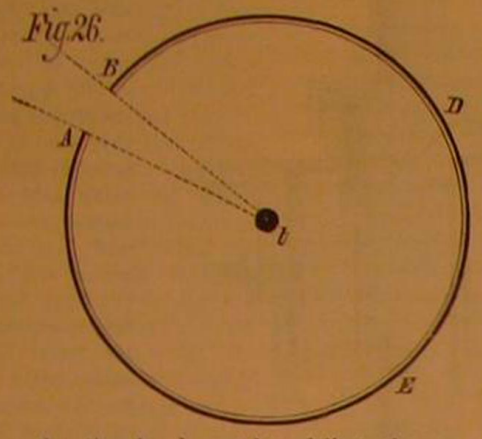
* Vol. xl., page 260, SCIENTIFIC AMERICAN.

THE SUN'S RADIANT ENERGY.

BY S. P. LANGLEY, ALLEGHENY OBSERVATORY, PA.

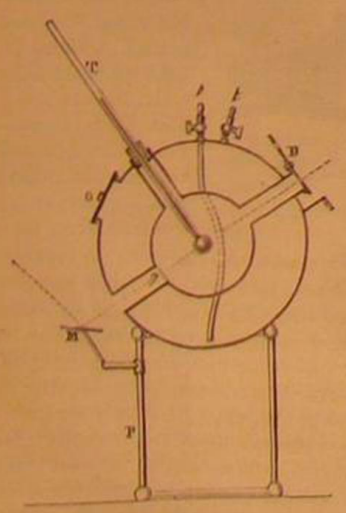
When the spectrum is allowed to fall on a sensitive plate we can, as has been mentioned, obtain a photograph of it, but, unless special means are used, not of all the lines. The photograph obtained with the salts of silver will fail altogether to reproduce the yellow part; will show something of the green and nearly all of the blue; while up in the violet end the picture is very clear, and beyond the violet, where to all appearance the spectrum has ended, a host of sharply defined lines comes out on the plate from a region where the keenest eye sees nothing whatever. This is when the instrument is directed full on the sun (not necessarily on its edge, as in a former experiment), and it would appear at first as if there must be in the white sunlight a special kind of rays, which produced not colors or vision, but chemical changes on the plate, printing there images of the slit, which were produced by something quite different from light.

Fig. 26.



If, on the other hand, we take a delicate thermometer or a radiometer, and move it into successive parts of the spectrum formed by a prism, we find little effect in the blue, more in the yellow, still more in the orange, and as much or more quite beyond the red, where, too, the eye sees nothing. Again, it seems at first that here is another kind still of radiation, causing heat, and which is distinct from that producing light, since one appears where the other does not. In some text books yet in use, diagrams even are given to show the amount of chemical, light, and heat rays in the different parts of the spectrum; but quite recently students of science arrived at a better understanding. The results of old and modern investigations are now seen to point to one conclusion. Given in general terms, this may be said to be that there is, in reality, no such thing as a chemical ray, a light ray, or a heat ray; there is nothing but radiant energy—motion of some kind, causing vibrations across space of something between us and the sun—something which, without understanding fully, we call "ether," and which exists everywhere, even in the "vacuum" of a radiometer. These vibrations are measurable with great accuracy (by processes of which an explanation would be here out of place), and are found to be extremely small in all cases, but to vary among themselves, somewhat as those coarser ones do which have been long known to produce sound. As the high notes of a piano are caused by the rapid vibration of strings, and the low notes by comparatively slow ones, but the sound, whether acute or grave, is due to one thing—motion of the air; so the miscalled "chemical" or "actinic" rays, as well as those which the eye sees as blue, or green, or red, and those which the thermometer feels, are all due to one thing—motion of the ether. Rapid motions exist, which set the molecules of silver vibrating, and are registered by the photograph. These fall also on the eye and on the thermometer bulb or radiometer, and produce some kind of mechanical effect in a minute degree, but not one which those instruments are fitted to register. The longer radiations in turn are not themselves "heat," any more than those which the retina of the eye responds to and calls "light." We have always one and the same cause—radiant energy; and we give this one thing different names: "actinism," "light," or "heat," according as the instrument which reveals its presence to the mind is some chemical substance, the retina of the eye, or a thermometer.

Fig. 27.



Section of Calorimeter.

It will appear, from what has just been said, that there are substances which respond to some of the ethereal vibrations and not to others. The substance which is most generally useful in receiving and, so to speak, absorbing them, is perhaps that which has been recently put to such remarkable use by Edison—common lampblack. Let us try to measure the sun's radiant energy by measuring all of it we can get in the form of heat, and endeavor in the process to reach some idea of the temperature at its surface. There are many ways of measuring the heat, one of which, convenient for its exposition of principles, we give here, though it is not perhaps the best in practice, returning to other methods later.

Thus, in Fig. 26, let A B D E be a large hollow sphere, inclosing a small thermometer at its center, *t*. The bulb is carefully covered with lampblack to enable it to absorb as many radiations as possible, and the inside of the sphere is blackened in the same way. Suppose the temperature of the whole at first to be that of absolute cold or at the natural zero, and that the sphere is kept at that, whatever happens. If we remove a given part of the sphere, let us say one twentieth of the surface area, A B, and fill the aperture with a piece of white-hot iron, this will send heat to *t*, and the thermometer will rise, though not to the temperature of the iron, which, for the sake of illustration, we will call 2,400°. If the whole sphere were at 2,400° the thermometer would also shortly register this (provided we could make one to stand it), but in fact it is receiving such heat from one twentieth of the sphere only, and giving it out by reradiation from the bulb to the other nineteen twentieths, that is, to the whole cold surface around it, which returns nothing. In this case, then, the temperature of the thermometer will be found by reflecting that it gives out very nearly twenty times as much heat as it receives, and that it must register nearly $\frac{2400}{20}$°, or 120°. On the other hand, suppose we, in a new experiment, find the thermometer reads 100°, and want to know the temperature of the iron. We must find what proportion the hole, covered by the hot iron, bears to the whole sphere, and multiply the 100° by this. Were the hole, for instance, in this case but one thirtieth the size of the sphere, evidently the temperature of the hot iron must have been about 3,000°. If the iron were ever so distant, provided it filled the whole aperture to an eye placed where the bulb is, no external rays could fall on *t* except from it. It is immaterial, then, in this experiment, whether the hot body is near or far, provided the hole is always kept so small that no foreign radiation enters. The reader will see the bearing of this when he reflects that if we turn the opening in the sphere toward the sun, with the above precautions, the result will be just the same as if we had plugged the aperture with a sample piece

Fig. 28.

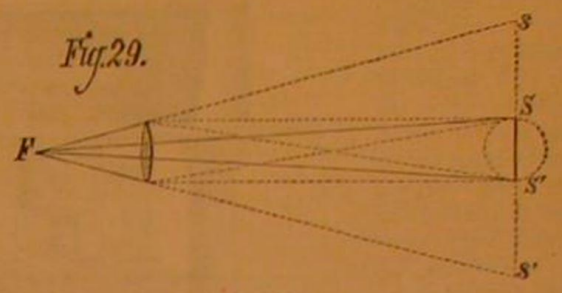
Calorimeter.

out of the sun's photosphere and of its actual temperature. We have now only to multiply the thermometer reading by the number of times the surface of the sphere is greater than the hole, and we have apparently found the real temperature there, as exactly as if we had reached across space and dipped our thermometer bulb into the actual surface of the sun.

There are many drawbacks to this plan in practice, and it is only in case radiation and temperature are proportional that it is sound in theory. Variously modified, however, it is much relied on by experimenters. Fig. 27 gives an internal, and Fig. 28 an external view of the latest construction adopted by M. Violle, of Grenoble, a distinguished recent investigator. In practice the simplicity of our first illustration is widely departed from, and the use of the instrument is much modified. T is the thermometer, whose bulb is at the center of a double sphere maintained at 0° (Centigrade) by a current of ice water circulating through tubes, *t t'*, or by ice put in at 0. D is a diaphragm with various apertures; M, a mirror, in which we view the reflected image of *g*; *g* is a piece of ground glass, on which the shadow of the thermometer bulb falls when the instrument is correctly pointed to the sun. This instrument is capable of being used to give us (according to the method just explained) the temperature of the sun, or else the number of units of heat it sends out. The latter result will be presented, however, by another method subsequently, but before we can do either accurately we must find out how much heat is absorbed by our air. To do this, M. Violle has taken his whole apparatus to the summit of Mont Blanc, and finds there the radiant heat from the sun to that below almost exactly as 4 to 3. The total heat at the boundary of our atmosphere is, according to him, something like one half greater than at the sea level, a rather larger result than one obtained by another means, to be given later.

To find the temperature of the sun from such an apparatus we virtually multiply the thermometer reading by the fraction expressing the ratio of the surface of the sun's disk to that of the celestial sphere, a ratio which is rather less than 1 to 180,000. In the observations of Soret, on Mont Blanc, the inclosed thermometer read nearly 38° Fah. above the temperature of the inclosure, and hence the temperature of the sun's surface would appear to reach at least the enormous number of 38°×180,000=6,840,000° Fah. The more prolonged and elaborate experiments of Mr. Ericsson give a temperature of about 4,000,000° Fah., and indicate that each square foot of the solar surface radiates over 200,000 units of heat per minute; in other words, each foot can furnish heat equal to that required to drive a theoretically perfect heat engine of over 7,000 horse power. There is a very fair agreement among all experimenters as to the amount of heat radiated, but a wide discrepancy as to the temperature, the very same data which above are interpreted as meaning 4,000,000° Fah. being asserted by distinguished French physicists to indicate less than 4,000° Fah. This monstrous disagreement is not due to any considerable error of measurement—all are pretty well agreed on that—but to our ignorance of the laws connecting temperature and radiation. There are two rules in use, one of which was given by Sir Isaac Newton. It says, in substance, that if a body be raised to double its former temperature, it will radiate double its former heat. The other, given by the French physicists Dulong and Petit, is in the shape of a complex formula, which virtually declares that if a body be raised to double its former temperature it will radiate more than double its former heat; in case both temperatures are high, enormously more. Proving that we get enormous heat from a limited area of the sun's surface, then, does not, in the eyes of some physicists, prove that area to be proportionately hot.

Fig. 29.

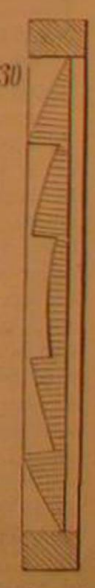


Action of Lens.

In this there is involved a very practical consideration for us, for this apparently abstruse physical question has a bearing on the duration of the human race, since that duration depends not merely on the present heat of the sun, but largely on the rate at which the sun is spending heat. Suppose some benumbed wanderer to find himself before a fire which seems as if miraculously burning for him, in a cheerless waste, where he would otherwise perish. A fire of straw may be for the moment as hot as a fire of coal; but as the first will spend its stock of heat at once and leave him to die of cold, and the second will spend it slowly and warm him for indefinite time, it is an important thing for him to know the rate at which his fire burns, and this is our own case. The human race—however it came here—finds itself before such a fire, and thus dependent upon it; for it lives on a planet whose proper surface temperature in the absence of solar radiation is variously estimated at from 70° to 273° below zero; and we are all warming ourselves at the sun, without which we should promptly die.

Let us come back to the question of the sun's temperature, then, with a sense of its personal interest to us. We should know more about it if we could carry our thermometer nearer to the sun, but we can practically do so by means of a burning lens, Fig. 29, where S F S' is the real angle subtended by the sun, *s F s'* that which it is made to appear to subtend by the lens, so that the effect is nearly that which would be produced by approaching till the solar diameter filled S S'. The actual construction of the burning glass on a very large scale is not now common, as we have other ways of producing intense heat always at command. When made at present they are built up in sections, as in Fig. 30, so as to avoid the necessity of an enormously thick and expensive lens. Such a one as this, in which the lens subtends an angle of about 30', as seen from the focus, is capable of melting platinum and the most refractory surfaces; and as a great deal of the heat is absorbed by the glass or otherwise lost, if we could approach the sun till it filled such an angle to the eye, we should find the temperature even higher. It is probable that few of the materials of which the crust of the earth is composed would remain in the solid form if carried very much nearer the sun than the presumed orbit of the hypothetical "Vulcan;" and it may be remarked in passing that it is not unlikely that, in case such an intra-Mercurial planet as Professor Watson is said to have recently discovered had an orbit whose nearest approach carried it within 10,000,000 or 12,000,000 miles of the solar surface, it would prove to be heated to the point where it would be self-luminous.

Fig. 30



Section of a polyzonal Burning Lens.

The writer, some time since, made a comparison of the light of the sun with that given from the molten steel in the Bessemer converter. This was chosen as an example of the greatest temperature attained on the large scale in the arts, and it is one which is known to equal that at which platina melts. Looking down the mouth of the converter we see at one stage of the process a stream of molten iron poured into the vessel in which the melted steel is already glowing in the background. Every one knows how bright white hot (and still more melting) iron appears, but in this case the steel is so much brighter, that the fluid iron in front seems like thick chocolate poured into a white cup. The steel, just before it is itself poured, seems of sun-like brilliancy, until we come to compare it with the sun itself, which was done by means of a photometer, so arranged that the steel light shone in at one side and the sunlight on the other. When the angle subtended by each source of light was equal, the image of the molten steel was put out by the presence even of much enfeebled sunshine, and ceased to be visible as the dull flame of an alcohol lamp would be if it were set beside an electric light. The area of glowing metal exposed was considerably over one square foot, and measures made with every precaution showed that any single square foot of the solar surface must be giving out much more, at any rate, than one thousand times the light that the melted steel did.

We are not, it is true, entitled to conclude from this that the heat is in exactly the same proportion, but we are justified by inference from this, and by other experiments not here given, in saying not only that the temperature on the sun's surface is far higher than that reached in our furnaces, but that the heat is in fact so enormously greater than any furnace heat here that they can scarcely be made the subjects of comparison. Other considerations, on which we cannot now enter, give the best grounds for belief that this heat is likely to be kept up sensibly at its present rate of emission for a period which, with reference to the brief history of the human race, may be called almost infinite. These are important conclusions, whose practical bearing will be more fully developed in a concluding chapter.

AMATEUR MECHANICS.

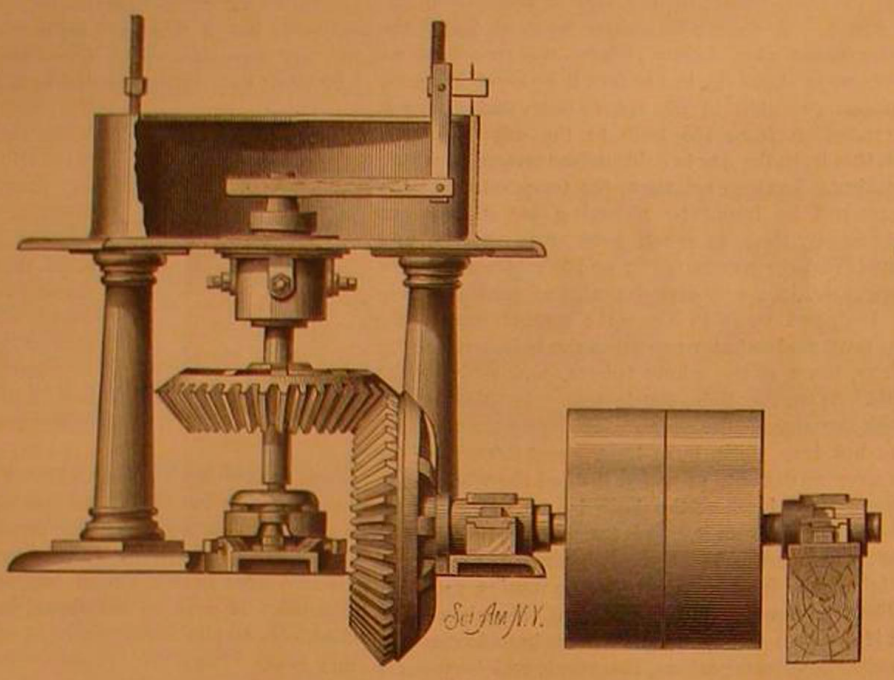
GEAR CUTTING APPARATUS.

The index plate, A,* is attached to the larger of the pulleys on the mandrel of the lathe by means of three or four screws, and the stop, C, provided with a point well fitted to the holes in the plate, is held in position on the bed plate, B, by a screw passing through a slot in the foot into the bed piece. The stop, C, is capable of springing sufficiently to admit of withdrawing the pin from the hole in the plate, and it is strong enough to hold the plate without vibration. Two standards, G, mounted on the plate, B, support pulleys over which the driving belt runs. The gear cutter head consists of a casting, D, fitted to the tool post of the slide rest, and the mandrel, E, provided with a pulley and mounted on carefully fitted centers in the casting. The casting, D, has upon opposite sides, near the upper end, ears (as shown in Fig. 3) for receiving the pulleys, *a b*, which guide the driving belt, so that the cutter may be moved across the face of the wheel, being cut without changing the tension of the belt. The extreme end of the loop formed by the belt is supported by the pulley, H, mounted on a standard rising from the lathe bed. The standard may be placed far enough from the slide rest to admit of putting the tail stock between it and the slide rest in case it should be necessary to use the tail stock for supporting the work.

The mandrel, E, is provided with a collar and a nut for clamping the cutter, F. It will be noticed that the cutter comes exactly opposite the line of the lathe centers, and that it occupies about the same position, in relation to the tool post, that the point of an ordinary turning tool does. The cutter, F, is shown in Fig. 4, enlarged. The upper view represents the side, the lower view the edge of the cutter. It has but a single tooth and is adapted to brass and similar alloys only. It may be sharpened by grinding. When iron or steel is to be cut the cutter should have several cutting edges, and the mandrel, E, should have a larger pulley, as more power will be required and the speed must be slower. By setting the slide rest at an angle bevel gears may be cut.

In a subsequent article the subject of sizing and cutting small gears will be treated. M.

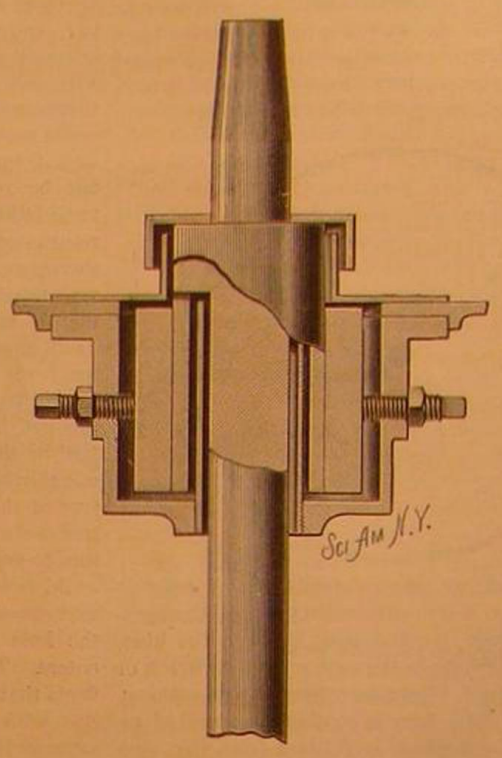
* See "Index Plates for Gear Cutting," page 20, current volume of SCIENTIFIC AMERICAN.



MUNSON BROTHERS' MILL.

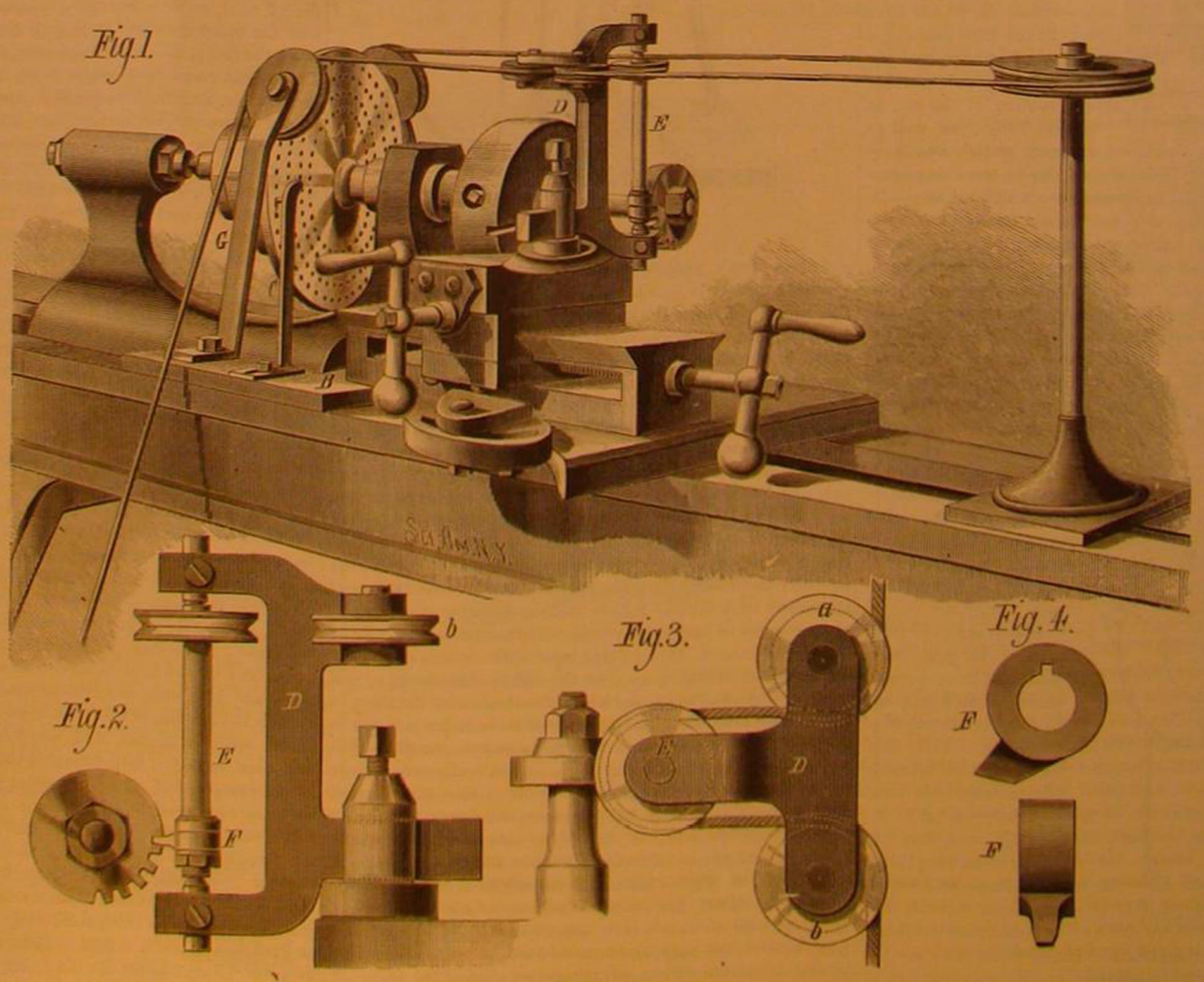
AN IMPROVED MILL.

We give herewith engravings representing some recent improvements on the Munson mill, which was described in these columns some time since. The late improvements relate to the tramming of the spindle, to a novel device for lubrication, and to other points of merit.



The manufacturers of this mill say that the so-called portable mills now being sold in the market answer very well on coarse grains and coarse grinding, but for fine work they do not meet the demands of the trade; they are constructed without regard to the tramming of the spindles or the importance of keeping them in their true working positions. The metal boxes, which are held up against the collar or the neck of spindles, are continually wearing out, and unless some provision is made whereby the spindles may be perfectly and accurately adjusted, the work performed is of an inferior quality, and the loss of power by friction greatly increased. The Munson mill is made on mechanical principles, and special pains have been taken in their construction to obviate these defects. The curb of the mill, being cast in one piece, has its inside rim turned perfectly true, and by means of a tram stick or index, as shown in our illustration, any deviation or any perceptible change in the position of the spindle, no matter how slight, can be easily detected and easily adjusted.

The spindles are made of solid wrought iron or hammered iron and are provided with inserted solid steel points ground in on a taper fit with emery and oil, making an absolutely perfect bearing, which may be easily removed when injured. The neck or collar is forged solid on the spindle and reamed out to fit within the bush; inside the bush Babbitt metal boxes are placed, which are held up against the collar by set screws. The bush is provided with a central vertical tube around which the collar works, the tube passing up between the collar and the bottom of the spindle, the collar in the bush forming the bearing surface of the spindle. The bush is covered by a cap having a circular central opening through which the spindle passes. The bush once filled with oil will keep the bearing of the spindle perfectly



APPARATUS FOR GEAR CUTTING.

lubricated until the oil is entirely exhausted or worn out, with no delays from over-heating, and with no loss of power by friction. The bearings are always cool and work perfectly. These mills are constructed with the under stone hung on a sensitive point or cockhead spindle, or they can be made with the under stone rigid and stiff on the spindle.

For further particulars address the manufacturers, Munson Brothers, Utica, N. Y.

THE ASWAIL.

The aswail, or sloth bear, is found in the mountainous parts of India, and is equally dreaded and admired by the natives of that country. Although a sufficiently harmless creature if permitted to roam unmolested among its congenial scenery of mountain and precipice, it is at the same time an extremely dangerous foe if its slumbering passions are aroused by wounds or bodily pain of any kind. As a general rule the aswail remains within its sheltered den during the hot hours of the day, as its feet seem to be extremely sensitive to heat, and suffer greatly from the bare rocks and stones which have been subjected to the burning rays of the glowing Indian sun. On one or two occasions, however, where the wounded bear had been successfully tracked and killed, the soles of the animal's feet were found to be horribly scorched and blistered by the effects of the heated rocks over which the creature had recklessly passed in its haste to escape from its enemies. On account of this extreme sensitiveness of the aswail's foot, it is very seldom seen by daylight, and is generally captured or killed by hunters who track it to its sleeping place, and then attack their drowsy prey.

The aswail is said never to eat vertebrate animals except on very rare occasions, when it is severely pressed by hunger. Its usual diet consists of various roots, bees' nests, together with their honey and young bees, grubs, snails, slugs, and ants, of which insects it is extremely fond, and which it eats in very great numbers.

Probably on account of its mode of feeding, its flesh is in much favor as an article of diet, and though rather coarse in texture, is said by those who have had practical experience of its qualities to be extremely good.

The hair which covers the body and limbs is of singular length, especially upon the back of the neck, and the head, imparting a strange and grotesque appearance to the animal. The color of the fur is of a deep black, interspersed here and there with hairs of a brownish hue. Upon the breast a forked patch of whitish hairs is distinctly visible. When it walks its fore feet cross over each other, like those of an accomplished skater when accomplishing the "cross roll," but when it remains in a standing attitude its feet are planted at some distance from each other.

These bears seem to be very liable to the loss of their incisor teeth, and even in the skulls of very young animals the teeth have been so long missing that their sockets have been filled up by nature as if no teeth had ever grown there. On account of this curious deficiency, the first specimen which was taken to England was thought to be a gigantic sloth, and was classed among those animals under the name of *Bradypus ursinus*, or ursine sloth. In one work it was candidly described as the "Anonymous Animal." Other names by which it is known are the jungle bear, and the labiated or lipped bear. This last mentioned title has been given to the animal in consequence of the extreme mobility of its long and flexible lips, which it can protrude or retract in a very singular manner, and with which it contorts its countenance into the strangest imaginable grimaces, especially when excited by the exhibition of a piece of bun, an apple, or other similar dainty. It is fond of sitting in a semi-erect position, and of twisting its nose and lips about in a peculiarly rapid manner in order to attract the attention of the bystanders, and ever and anon, when it fails to attract the eyes of its visitors, it slaps the lips smartly together in hopes to strike their sense of hearing.

When captured young it is easily tamed, and can be taught to perform many curious antics at the bid of its master. For this purpose it is often caught by the native mountebanks, who earn an easy subsistence by leading their shaggy pupil through the country, and demanding small sums of money for the exhibition of its qualities.

ASWAIL, OR SLOTH BEAR.—*Melursus Lybius.*

Lobsters for the Pacific Coast.

A large quantity of live black and striped bass, eels, and lobsters from the Atlantic coast have lately been distributed along the California coast. This is the first time that lobsters in good condition have reached the Pacific. Their successful transportation is attributed to the unremitting attention of Mr. Livingstone Stone and his assistants, in whose charge they were. The lobsters were taken at once to Point Bonito, and liberated. On the way to the Point they were placed in a fresh supply of water from the incoming tide, which greatly delighted them. They were all females, ripe for spawning, and were estimated to carry 1,000,000 eggs. The cost of the importation was borne by the California State Fish Commission.

Railway Risks from Defective Vision.

Railway risks from color blindness have attracted much attention of late, and a system of railway signals, using bars at different angles, has been proposed as a substitute for color-signals. Dr. Garretson, of Philadelphia, calls attention to a new source of danger from such signals, arising from the great frequency of the optical defect known as astigmatism.

This condition exists in irregularities of the refracting media of the eye, and is a defect so common as to be met with very much more frequently than color-blindness, the evils of which are sought to be remedied. The eye affected with astigmatism sees bars or lines with clearness only when these are at certain planes with the horizon; lines or bars at other planes it sees dimly or not at all. An astigmatic pair of eyes, having the bar signals alone for a guide, would certainly wreck the train under their direction.

If the new system be adopted, railway officials will owe it to the community, and for the protection of the companies against damages from accidents, to submit every employé for examination by competent surgeons. Accidents arising out of such neglect would assuredly be without excuse.

NATURAL HISTORY NOTES.

A New Theory in Regard to Galls.—Insect galls, which are usually held to be excrescences, a diseased condition of vegetable tissue, resulting from the injection of some fluid or secretion by certain insects, are regarded by Mr. A. S. Wilson, of Aberdeen, in altogether a different light. He says, in a communication to *Nature*, that "all insect galls are in reality leaf buds, or fruit buds, and not mere amorphous excrescences. The vascular lines which would form leaves can easily be followed up the structure of the oak leaf galls. And in cases where the egg has been deposited in the tissue of a young branch, the cap of the gall is sometimes surmounted by a leaf two or three inches long. But in the large blue Turkish galls many lacunæ occur where the fleshified leaves have not filled up the spaces between them. If a dissection be made of one of the weevil galls on the bulb of the turnip, the second or third slice will show the outer foliations, exactly similar to those of the root buds. When the center has been reached, where the maggot will be found, there will also be found a vascular pencil running up from a medullary ray in the bulb, and bearing on its top a bud of the same description as that produced by a ray running out from a root. The insertion of the ovipositor brings a medullary ray into action, producing a tuberculated bud, and it is only the bud which the larva feeds upon. The growth of a bud is an intelligible cause of the growth of a gall, but we can infer nothing from the injection of a fluid. The analogy to leaves is further shown by the fact that various microscopic fungi are matured in the interior of imperforate galls.

Red Canary Birds.—Among the varieties of the canary bird that have recently come into fashion among amateurs is one with red plumage. These birds, according to Mr. Vander Suickt, a Belgian fancier, appeared for the first time at the London Exhibition in 1872. They were exhibited by Mr. Bembrose, of Derby. The birds received no prizes, however, as the jury had doubts as to the origin of their color, and believed them to be dyed. The following year, at the Exhibition held at Whitby, the red canaries were recognized as a new variety, and they became all the rage. In numerous controversies Mr. Bembrose had given his word of honor that the color of his bird was not due to any fraudulent processes, but had been really obtained through a special mode of feeding. But as a friend to whom he had communicated his secret abused his confidence and sold it, the author has believed it his duty to make known to the public the process which he used to obtain his results. It appears, according to him, that the birds are fed upon hard boiled eggs crushed up with the crumbs of common white bread and dusted over with Cayenne pepper. Dr. Dusch, a Belgian amateur, adds the following:

Purchase at the druggist's some of the very best quality of Cayenne pepper, ground very finely; for each meal mix some of it with stale bread macerated in well water, and press it together so that it will crumble, but not form a paste. Instead of bread the white of an egg may be used, if preferred. This kind of food should be given to the bird only before and after moulting. It is well to add that it would be a waste of time to experiment on any other canaries than those of the Norwich breed, or on birds that are not of a very dark yellow strain. This statement is made on the authority of *Les Mondes*.

Insects Destroyed by Flowers.—Mr. J. W. Slater, in a communication to the Entomological Society of London, says: Whilst it is generally admitted that the gay coloration of flowers is mainly subservient to the purpose of attracting bees and other winged insects, whose visits play so important a part in the process of fertilization, it seems to me that one important fact has scarcely received due attention. Certain gayly-colored, or at least conspicuous, flowers are avoided by bees, or if visited have an injurious and even fatal effect upon the insects. Among them are the dahlia, the passion flower, the crown imperial, and especially the oleander. That the flowers of the dahlia have a narcotic action both upon humble bees and hive bees was first pointed out, I believe,

by the Rev. L. Jenyns, in his "Observations in Natural History." He mentions that bees which visit these flowers are soon seized with a sort of torpor, and often die unless speedily removed. He quotes also a writer in the *Gardener's Chronicle*, who pronounces the cultivation of the dahlia incompatible with the success of the beekeeper. I find it also recorded that the passion flower stupefies humble bees; that bees of all kinds avoid the crown imperial and the oleander, and that the honey of the latter is fatal to flies. I cannot call to mind that I ever saw a butterfly or a moth settled upon the flowers of this shrub in Hungary and Dalmatia, where it is very abundant. It seems not unimportant to ascertain whether the above mentioned phenomena have been verified by other observers; whether any other insects in such cases undertake the functions generally exercised by bees, and whether other flowers have a similarly noxious or deadly action upon insects.

Propagation of Oysters.—Prof. Brooks, of the Johns Hopkins University, has, according to the *Science News*, been recently engaged in experiments with the object of securing the artificial propagation of oysters, and on the 20th of May his efforts culminated in success. Before these experiments naturalists were not fully conversant with the early history of this mollusk's development. A correspondent of the Baltimore *Sun*, who witnessed the process of making embryonic oysters, says in his account of it: Half a dozen on the half shell served on a plate, a few watch crystals, a small glass jar, a little water, and the microscope, constituted the laboratory. The oysters had been taken fresh from their beds and opened carefully. In this way they will live for a day or two if kept in a cool place, and all the while the heart may be seen to pulsate in its cleft next to the muscles. Close to the heart lay what is usually called the "fat," but which is really the reproductive organs. These are wrapped all around the stomach, liver, and digestive organs, the latter being the "belly" or dark part of the oyster. The flaps extending around the whole of one side of the shell are its gills, through which it breathes and separates its food. The mouth is at the butt end of the shells where the hinge connects them. Male and female oysters on the half shell cannot be told apart, and indeed one in fifty is believed to be hermaphrodite. It is claimed that oysters are females when young, and males when they become older and larger. But the facts have not been established with certainty, nor is it of importance. To produce free swimming ciliated embryos the operator pinched away with tweezers a particle of the generative part, put it into a watch crystal, and stirred it until the eggs were well shaken out. The water was now milky from the great number of eggs. The microscope determined the sex, which in the present experiment proved to be male. Under the microscope these male cells appeared to be minute dots perpetually in active motion, and each one of them being sufficient for impregnation when properly lodged. The female eggs are 100,000 larger than the male cells, but are invisible to the naked eye.

Having been washed out into separate watch crystals, the eggs are mixed with the male cells. Then viewed under the microscope the male cells are seen to attach themselves vigorously to the egg in eager crowds, but only one of the many is supposed to impregnate. The first change apparent is the disappearance of the germinal vesicle, and this is accomplished in a very few minutes. The egg then becomes spherical and remains quiet for one or two hours, when a kneading process becomes visible. A globule appears on its surface, and this is the beginning of segmentation. Then by degrees the egg becomes divided into smaller and smaller granules. This process of subdivision occupies two hours, and at the end of this time a small, transparent swimming embryo is found, which is the oyster in its infantile state. The whole process occupies from four to six hours, according to the temperature, although in the present instance it was brought to a successful issue in four hours. Prof. Brooks in his previous experiments had raised oysters till they possessed the cilia which serve to propel the microscopic animal, but they died without further revelation of the mystery of life. In the present experiment he had the satisfaction of developing the embryos until he could clearly trace their digestive organs, and he is inspired with the hope that continued watchfulness will enable him soon to see the infants begin to assume their armor of shells. It is believed that there is no specific time for the spawning season of the oyster, and that it continues throughout the summer months, though this is a point not yet definitely settled.

Correspondence.

How to Hear Lightning in Advance of the Thunder.

To the Editor of the Scientific American:

During a recent thunderstorm at this place I tried, with much success, the interesting telephone experiment suggested in your last week's paper by Mr. G. M. Hopkins. I connected one pole of the telephone with the water faucet in my room, and the other pole with the gas pipe. On applying the telephone to my ear I heard, at every flash of the lightning, a crackling or bubbling sound in the instrument, the intensity of the sound varying with that of the flash. There were also, throughout the storm, frequent minor sounds, indicating lesser electrical action in the telephone; but these minor sounds were unaccompanied by a visible flash.

The thunder sounds were heard from 5 to 30 seconds after the flashes were seen; showing that the center of electrical action was at a distance of one to six miles from my instrument. The water pipe simply connected with a cistern in the ground near my house. The gas pipe connected with the street main, ramifying through the village over perhaps a square mile, but not in the direction of the storm I have mentioned.

A. E. B.

Mont Clair, N. J., July 11, 1879.

Large vs. Small Vehicle Wheels.

To the Editor of the Scientific American:

In a late number of the SCIENTIFIC AMERICAN appeared the question whether a large or small wheel ran the easier. The answer was given in favor of the larger wheel. The principle involved is well known to the carriage builder as being based upon the law in mechanics that regulates the workings of the lever. A wheel is a perpetual lever, the weight, although it is placed upon the hub or axle, is carried to the ground by the law of gravitation in a perpendicular line with the suspension. The obstacles to be overcome in propelling a vehicle create a continuous fulcrum, being a greater or less distance from the weight in accordance with the obstacle surmounted.

To illustrate this principle we have prepared two illustrations. In Fig. 1 is shown an incomplete wheel, the spokes have been driven into the hub, but the felloes have not yet been placed in position. The wheel stands upon two of its spokes. From the hub is suspended a weight of 190 lb; this weight, although placed upon the hub, actually rests

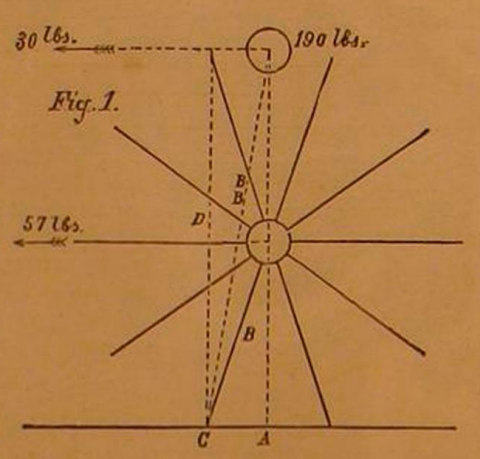
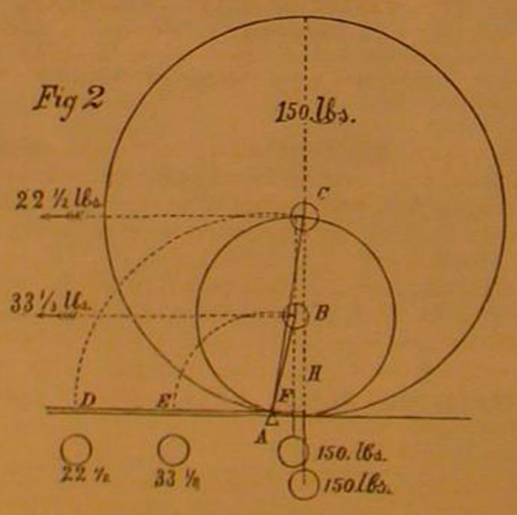


Fig. 1.

upon the ground at A; the end of the spoke, B, forms a fulcrum at C. We wish to raise the spoke, B, to a perpendicular position, shown by the dotted line, D, and in order to do so a force of sufficient amount is applied at E, or the hub, pulling in the direction of the arrow. Now as the distance, A C, is to the distance from the center of the wheel to the fulcrum, C, so is the force applied at E, or the hub, to the weight, 190 lb. We, therefore, find that a force of 57 lb. will move the 190 lb. Now, suppose that the wheel is just twice as large, and that the dotted line, B B, represents the spoke of the larger wheel corresponding with B in the smaller wheel. Applying the force at F in the direction of the arrow, we find that 30 lb. will move the weight of 190 lb.

In Fig. 2, two wheels are represented, the smaller two



feet, the larger four feet in diameter. We will suppose an obstacle is placed upon the track at A; a weight of 150 lb. is placed upon the axle of the smaller wheel, and a force applied at B in the direction of the arrow. This force will be equivalent to 33⅓ lb., while a force of 22½ lb., applied at C, the center of the large wheel, under the same conditions, would accomplish the same object. In order to illustrate the principle more fully, let D A represent the long arm of a lever, corresponding with the spoke of the larger wheel, and A H the short arm. Suspend a weight of 150 lb. at H, and another of 22½ lb. at D, and the lesser weight will balance the heavier. The same with E A F; here, however, a larger weight is required to balance the 150 lb. than with the longer arm, thus fully demonstrating the advantage of a large wheel over a smaller.

GEORGE A. HUBBARD.

New Haven, Conn.

The Old Telegraph Mine.

To the Editor of the Scientific American:

About twenty-five miles by rail, south of Salt Lake City, in the Bingham Cañon, one of the most reliable mines of Utah is located. I refer to the Old Telegraph, which has for many years been well and favorably known in this country as a producer of lead bullion. The mine is reached via the Utah Southern and the Bingham Cañon Railways, the latter road connecting with the former at Junction, a distance of twelve miles from Salt Lake City, and thence it runs to Bingham, thirteen miles distant, up a grade 200 feet to the mile. From Bingham there is a tramway running up the sides of the mountains to the mouth of the mine, more than two miles away. The ore is run down this tramway in small cars, and dumped from their elevated track into the larger cars of the railroad. The accessibility of the Old Telegraph is all that could be reasonably desired. Bingham Cañon is more in the nature of a valley than of an abrupt cañon. The slope is admirably utilized by the tramway and railroad already described, so that the attraction of gravity performs without cost what otherwise would require expensive machinery to accomplish. Thus Bingham Cañon Railroad was built to meet the necessities of ore shipments from the Old Telegraph, and it has paid for itself more than three times over.

Bingham City is also an outgrowth of this mine, and it is one of the most considerable mining towns in the Salt Lake valley. The property of the mine is about 3,500 feet in length, and the strike of the vein is nearly east and west. The average altitude of the whole mountain in which the mine is located is 6,800 feet. This is divided by deep gulches which offer convenient egress in various places for the ore.

The vein is tapped horizontally by five different levels. The first is the 460 foot level; the second is the 420 foot level, the third, the 360 foot level; the fourth, the 310 foot level, and fifth the 60 foot level. The width of the seam at the 460 foot level is 72 feet, and at the 60 foot level 60 feet. The entire length already opened is 1,710 feet, and about 1,790 feet more is virgin ground yet unopened.

The geology of the whole Bingham Cañon is of the Devonian formation, consisting of quartzite, marble, clay, and limestone. These have been rifted and twisted, by the volcanic action which reared these mountains, into multitudinous forms. The vein of ore is a true vein, of great strength, and practically inexhaustible. The upper part contains less lead than the lower, but is rich in silver. The whole vein averages from 25 to 50 oz. in silver, though in some places the yield is upwards of 200 oz. The average yield of lead is from 40 to 60 per cent. The lead ore consists of carbonate, which, when pure, contains 77 per cent. of lead, and galena, which contains 87 per cent.

The primitive vein material was galena, which was changed into sulphate, carbonate, and chloride by the action of concentrated sea water. Silver is found in the form of sulphate and chloride of silver. Ores containing much chloride of silver are seldom rich in lead, and are, therefore, not smelted, but leached out. The Old Telegraph has a leaching establishment immediately adjacent to the mine, and another one on a larger scale at West Jordan. This leaching process produces sulphate of silver, by the way of solution of hyposulphate of sodium, and precipitation by sulphite of calcium. Under the administration of Mr. L. A. Haldin, the former superintendent and manager of the Old Telegraph, the mine produced in one year $700,000. The average daily output was about 100 tons, or something over $20 per ton net profit. In the year 1876, the mine produced the sixth part of all the lead in the United States, or 10,000 tons in bullion. In 1877 it produced the eighth part, or 11,000 tons in bullion, the general yield being greater throughout the country in 1877. In 1876, 1,000 tons of the ore were analyzed at Pittsburg, by Othon Wuth, with the following result:

Carbonate of lead	50·43
Galena	15·02
Oxide of iron	3·78
Sulphate of copper	0·69
Sulphate of iron	7·37
Quartz	12·47
Clay	3·01
Carbonate of lime	3·64
Sulphate of lime	3·04
Carbonate of manganese	0·26
Water	0·19
	99·88

More recent analyses have been made with practically the same result. The Old Telegraph bullion is esteemed highly throughout the East, and is worth $5 more per ton than any other Utah bullion, because it does not contain antimony, arsenic, or zinc metals, which are noxious to the refining process; and consequently the bullion and ore of the Old Telegraph is sought by refineries and all smelting works in the neighborhood.

About the first of the present year a wealthy French company purchased this valuable mine, and since the 8th of May have been in possession of the property. The management is now taking out over 100 tons of rich ore per day. This operates the tramway to its full capacity and keeps four out of the five furnaces of the smelting works in blast. One hundred men are constantly employed, and preparations are making to increase this number, with additional facilities for a much larger output of ore. It is proposed, at no distant day, to put up three new furnaces, and when this is done the owners of the Old Telegraph will be able largely to command the whole silver smelting of Utah; for there is no good lead in the territory to smelt the silver with except that of the Old Telegraph; consequently, rather than sell their ore to smelt that of other neighboring mines with, they will buy all other ores and smelt them in their own furnaces. This is the true policy of the present company, which they undoubtedly appreciate. The company being one of large resources, the shareholders will not press the management for immediate large dividends, but will be content to wait for more permanent and equally beneficial results.

Being in Salt Lake City for a few days, I was invited to join a party of ladies and gentlemen who intended looking through the mines of Bingham Cañon. This gave me the opportunity of examining the Old Telegraph, with the foregoing results. At the present time the quantity of ore in sight is something over 2,000,000 tons in the open space.

I saw a body of ore with a face 300 feet long, 56 feet high, and over 100 feet thick. This was in the 310 foot level, in one spot only; and was nearly virgin ground. The temporary agent and manager who represents the French company has introduced many good reforms, such as putting in the waste and saving the timber, while his energy and zeal find indorsement on all hands. He proposes soon to introduce the system of contracts with the workmen which prevails in Europe. He has expressed himself as favoring high wages to good workmen, and this new system of paying by the piece will guarantee this result.

It may be said generally of the Old Telegraph Mine that the temperature is agreeable, the metal easy of access, and readily worked. There is no water in the mine; blasting is not necessary, nor hoisting. But the metal is run down shoots in the inside of the mine from the higher to the lowest level; and outside of the mine down the tramway and railway to the furnaces and concentrating works, being a continuous falling until the ore is changed into bullion.

H. S. W.

Salt Lake City, Utah, June 26, 1879.

CURIOUS DISCOVERIES IN REGARD TO THE MANNER OF MAKING FLINT IMPLEMENTS BY THE ABORIGINES AND PREHISTORIC INHABITANTS OF AMERICA.

At the last meeting of the Anthropological Society at the Smithsonian Institution, Mr. F. H. Cushing, who has made an original and experimental study of aboriginal processes in the manufacture of pottery, stone axes, and flint arrow heads, using only the tools which were within the reach of the aboriginal manufacturers, gave an interesting description of the manner in which flint implements, especially arrow and spear heads, were made by the prehistoric inhabitants of this country and Europe, previous to the discovery or introduction of iron.

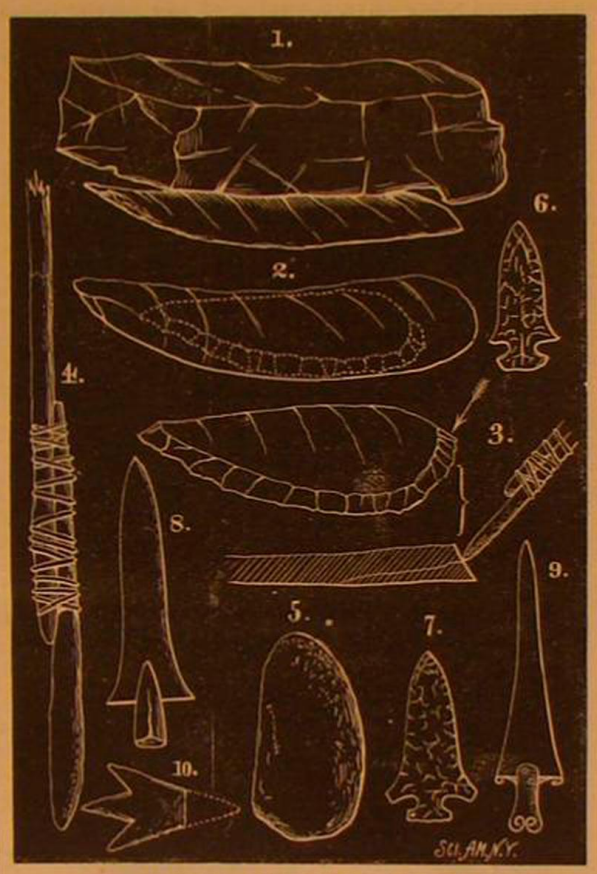
It is the popular impression that flint arrow heads were all chipped into shape by striking off fragments with a rude stone hammer, and this was the method first tried by Mr. Cushing. He found, however, that it was impossible to imitate in this way any of the finer and more delicate specimens of Indian arrows, and that three out of four even of the coarser forms were broken in the process of manufacture. It was evident, therefore, that the Indians had other and more delicate processes. After many unsuccessful experiments, he accidentally discovered that small fragments could be broken off from a piece of flint with much greater certainty and precision, by pressure with a pointed rod of bone or horn, than by blows with a hammer stone. The sharp edge of the flint would cut slightly into the bone, and when the latter was twisted suddenly upward a flake would fly off from the point where the pressure was applied in a direction which could be foreseen and controlled.

To this process Mr. Cushing gives the name of flaking to distinguish it from chipping produced by percussion. And its discovery removes most of the difficulties which previous experimenters had met with in trying to work flint without the use of iron. Spear and arrow heads could, in this way, be flaked even into the most delicate and apparently fragile shapes with a certainty attainable in no other way, and with a greatly lessened probability of breakage. Mr. Cushing then described with the aid of blackboard illustrations all the steps in the manufacture of an arrow, beginning with the striking off of a suitable flake from the mass of material selected, trimming it roughly with a pebble into a leaf shape with a beveled edge, Fig. 2, scaling off surface flakes by repeated blows with a hammer stone upon this edge at right angles to its plane, Fig. 3, and finally finishing, pointing, and notching the arrow head with the bone flaking instrument previously referred to.

Surface flaking, which is the thinning of the unfinished arrow by the detachment of flakes running from the edge to the center, is the most difficult part of the whole process. Arrows upon which no signs of it appear were always the work of beginners. It may be produced either by direct blows with a hammer stone, by pressure with a flaker, or by a combination of the two methods, the hammer being used with the flaker as if the latter were a stone chisel. Each of these methods leaves its unmistakable mark upon the finished implement, so that it is easy to determine by simple inspection of the chipped article to what degree of perfection the art had come at the time when it was made. Thus it can be proven that the marvelously chipped axes of the Danish shell heaps were produced by using a horn flaker as if it were a stone chisel, by striking it with a hammer stone, while the beautifully finished daggers, arrows, and spear heads from the same region had been flaked by a combination of the latter process and pressure, and that when the paleolithic flint implements found in the drift were made, the art of using the flaker in either of these methods had not yet been discovered. Hammer stones, however, which bear marks of having been used for chipping, are found everywhere where arrow or spear heads occur, showing that savages universally pursued the method followed by Mr. Cushing, of first blocking out the implement with a hammer stone, whether they afterward used a flaker to finish it more perfectly or not. Since, therefore, all the specimens found in the great "deposits," or *cachés*, throughout this country bear marks of the hammer stone, but not of any other instrument, they may be definitely regarded as unfinished articles laid by for future completion.

The various processes and implements used in chipping and flaking had grown out of the difference of material to be worked. Where the latter was tough, as was the case with the hornstone of Western Arctic America, it could not be flaked by pressure in the hand, but must be rested against some solid substance, and flaked by means of an instrument the handle of which fitted the palm like that of an umbrella, enabling the operator to exert a pressure against the substance to be chipped nearly equal to the weight of the body. Thus the T-shaped wooden-knife flaker of the Aztecs was the outgrowth of the easily worked obsidian; and the slender horn flakers of California and the Southwest, of the fragile chalcedony and jasper of that region.

Material often contained small masses of harder or tougher substance. Where these occurred the ordinary flaking was likely not to remove them, in which case they formed objectionable protuberances on the unfinished arrow point. When nearer one edge than the other, their removal was attempted by chipping into that edge, thus making the arrow head onesided. The almost invariable occurrence of traces of such protuberances on the edge most chipped of these unequal specimens was evidence that this, the so-called "knife type," was of accidental origin.



THE MAKING OF FLINT IMPLEMENTS.

1. Mass and flake; 2. Leaf form; 3. Surface flaking; 4. Flaker, upper end wood, lower end horn; 5. Chipper (pebble); 6. Bell-shaped Stone age spear; 7. Bell-shaped spear; 8. Bronze age spear; 9. Modified bell-shaped dagger, bronze; 10. Example of accidental chipping.

Most if not all of the so called "turtleback" implements which had been regarded by archæologists as designed for special purposes, were really articles never finished because of the presence of such prominences on the center of one side or the other.

Where these irregularities appeared on the middle of the side of a specimen of choice material, or on which much labor had been expended, its removal was undertaken by the chipping down of both edges, thus resulting in the bell-shaped outline of spear head, Fig. 6, so much admired by archæologists, which being recognized by savage manufacturers as ornamental, was afterward purposely produced, and even survived in the weapons of the bronze age, Fig. 8, or that period immediately following the age of Stone.

The difficulty of making long narrow surface flakes made it much easier to form narrow and delicate points than the larger, though even ruder forms on which much surface flaking was necessary, and the slender fragile perforators which had been regarded as inimitable by any existing race were really the most readily and rapidly made of all.

In flaking a large arrow or spear head in the hand it was necessary to hold it alternately by the point and by the base. As the grasp by the base was much firmer, the pressure was greater, and hence the flakes scaled off further toward or over the center, and as this unavoidably happened on opposite edges of the specimen, a twisted and even at times distinctly beveled point was the result when hard material was flaked. This not only accounted for the beveled type of spear head so common in Tennessee, but also indicated that wherever this type occurred the method of flaking was by pressure in the hand and not as among the Esquimau and Kjockkenmoedding people.

Mr. Cushing added that since all specimens of this kind were found to be twisted one way—from right to left—the inference was unavoidable that the aborigines who made them were, like ourselves, a right-handed people, and that wherever this form occurred the method of flaking by pressure in the hand must have prevailed.

Prof. Mason here mentioned that he had seen two examples beveled from left to right, indicating, of course, an occasional left-handed individual.

Mr. Cushing then explained how it could be known on examination whether an imperfect arrow had been broken during the process of manufacture or by use.

He then referred to an archæological publication recently (1868) printed in Spain, on the covers and title page of which appeared the figure of a three-pointed arrow. This had been regarded as one of the most important archæological discoveries of that year, and its figure adopted as the seal of the book. But had the members of that Spanish society and the author been practically familiar with flint chipping, they probably would not have regarded as so rare the inverted base of a common barbed and stemmed arrow head, from which the point had been removed by accidental chipping (Fig. 10).

Arrow flaking was accompanied by great fatigue and profuse perspiration. It had a prostrating effect upon the nervous system, which showed itself again in the directions of fracture, and it was noteworthy that, on an unimpressible substance like flint, even the moods and passions of centuries ago might be found thus traced and recorded.

Mr. Cushing then closed his remarks by calling attention to the use of the study and practice of the art of arrow making in establishing the groundlessness of all archæological classifications of chipped articles, based on diversity of form alone, or of attributing distinct or definite uses to types of form thus established, which these investigations proved to be the results only of constantly or imitated recurring accident.

Photography by the Electric Light in a French Court of Justice.

The question whether the Vander Weyde system of the application of the electric light to photography is or is not public property, is one which is just now forcibly occupying the attention of the photographic world in France. And there is much reason for this, for the question possesses more than one interesting aspect: There is, in the first place, the point of law as to what rights are attached to a patent taken out in France, and then there is the doubt as to the line of conduct to be pursued by photographers who desire to work the electric light in their own studios.

Naturally there was some excitement at the thought of the advantages which operators by the electric light would be able to possess, once it was completely established that by a new process really practical results could be obtained. It was remembered that the ill success of the first attempts to introduce the electric light into photographic work had caused them to be quickly abandoned, and that since then they had never been renewed. In the English Department of the late International Exhibition at Paris there were shown some photographs taken by the Vander Weyde system, and professional photographers were astonished, for all the artistic conditions which were formerly wanting were now combined in them. Thanks to the special organs of the press, in which the *Photographic News* was one of the most active in bringing before the public the merit of the invention, it was learned that the technical requirements had been satisfactorily complied with by the new process, and that the employment of the electric light in photographic operations would henceforth be feasible; arguments—or, rather, proofs—not to be refuted were forthcoming. Some time ago, it is true, photographs had been taken by the electric light; the fact that this peculiar manifestation of energy could be successfully substituted for daylight was well known. But the apparatus used only allowed a pencil of rays to be emitted in a confined space, and the result was not what in photographic language is called "clean work." The great problem to be solved was that of the diffusion of the light, and this was successfully accomplished by M. Vander Weyde. According to the *Times* of the 25th of December, 1877, in an article containing an account of this valuable invention, M. Vander Weyde took out his patent in England on the 1st of February of the same year.

In France the discovery was only honored from afar. People rejoiced at the idea that photographers would henceforward be independent of the changes of light, and would be able to work at any hour and during any kind of weather. There were, indeed, some who, before the Vander Weyde discovery, had rendered the assertion possible—and, indeed, even before electricity had been thought of at all for the purpose—placarded the startling absurdity, "*Dull weather is the best*," in large brilliant letters illuminated by gas; but it was merely a means of advertisement, and gave occasion for many a laugh among professional photographers. Business men, whose time, during the hours of sunlight which were propitious to the operator, is fully occupied, were prohibited from even going to the photographer, however desirous they might be of having their portraits taken; ladies could not realize their wishes of being represented in evening dress unless they put it on in daylight; actors and actresses, whose costumes are intended to produce an effect by the illumination of the foot-lights only, were compelled, much against the grain, to endure their finery in the full glare of the sun. In France, then, we have been content to stand on our old lines, though we still tried to emulate the photographic feats of the electric light in England.

All the advantages of the process, however, much as the French photographers appreciated them, they could only hope to realize by the employment of an electrical apparatus giving a sufficiently diffused, and at the same time intense,

light to produce a photograph. This was well known, and yet the old misleading ways were followed. At length the patent right for France of the Vander Weyde system was bought by M. Liebert, who, of course, supposed that he had purchased also the right, not only of working the process for his own profit, but also of granting licenses to others to do so. He therefore inaugurated sittings for the press, and gave a splendid fête—a description of which appeared in the *Photographic News*—in order to give publicity to his new system, which certainly was deserving of all the honor that he showered upon it; in short he made as much noise as he possibly could, as is the case with every adventurous speculator or fashionable artist. But, on the other hand, M. Pierre Petit has done all this without having purchased anything. At the grand fête held on the 8th of June last, at the Paris Opera House, on behalf of the sufferers by the Szegedin inundations, M. Petit exhibited the whole process. It struck him that it would be an excellent occasion for killing several birds with one stone. He would give those who attended the fête the opportunity "*faire sa photographie à la l'électricité*," as says a curious song just now popular at the Alcazar; he would be largely aiding the charity; and he would be advertising the new process so as to benefit himself. But M. Liebert, who had bought the sole right of taking photographs by the Vander Weyde system in France, was not one to allow what he considered an infringement of that right. He therefore applied to the President of the proper tribunal, and having explained that M. Pierre Petit had not acquired the necessary license for working with an apparatus for producing the electric light, which was a mere copy of that of M. Vander Weyde, he obtained a legal injunction, and the services of an officer to watch and see that nothing was done by night or day in preclusion of the rights of M. Liebert. In consequence, the officer of the court, accompanied by a police officer, and carrying an officially-stamped slip of paper, presented himself at the Opera at the height of the fête. This *coup de theatre* in a place whose frequenters are accustomed to similar *contretemps* did not give rise to so much disturbance as might have been expected. Fortunately for the success of the philanthropic work, for whose benefit the operations had been undertaken, the operations were not interrupted, so that the charity was no loser.

Up to this point nothing extraordinary had taken place. All that had occurred was in regular order. The owner of the patent had obtained an injunction against a rival whom he had accused of infringing it. This may be seen every day, only, perhaps, not generally at a charitable fête in the Opera House. But the unexpected part of the affair came afterwards: M. Pierre Petit, in reply to his opponent, acknowledges that he operates with an electrical apparatus diffusing light by means of a converging pencil of rays, but he asserts that he has wronged no one, for, the system employed by him being public property in France, he had a perfect right to make use of it. For the very reason that he believed himself to have that right, he did not think it necessary to pay for it, as M. Liebert had done. In a word, he laughs at the English patents of M. Vander Weyde.

Now what will M. Vander Weyde do in this case? Will he be satisfied to be considered as having invented nothing? Will he submit to the imputation of having illegally accepted payment for licenses to work an invention the right to which up to the present no one has dared to deny him—an invention for which he had received the applause of all the world, and the honors and profits for which were thought to be legitimately his due? As may be seen, the question is a complicated and a difficult one. The courts of law are called upon to settle it, and their judgment—which, of course, will cause all rights legally acquired to be respected—is awaited with impatience.—*K. Versnaeyen, in Photographic News.*

ENGINEERING INVENTIONS.

A device for moving cars by hand, consisting of a lever having a hook for attachment to the axle and a dog pivoted to the lever and arranged so that it will engage the flange or rim of a car wheel, has been patented by Mr. William B. Newlon, of Fremont, Neb.

Mr. Stoddart Howell, of New Orleans, La., has invented an improved wharf for rivers, harbors, and lakes. It consists in the combination of metal straps with the mortised cross pieces and stringers of a wharf, and other novel features of construction, which render it possible to build wharfs of any desired length and size in a shop or inclosure and afterward to put them up very quickly.

An improvement in windmills has been patented by Mr. Francis M. Wilson, of Tekamah, Neb. It has an arrangement of an eccentric and double crank shaft, by which it is claimed a much larger percentage of power is realized than in the ordinary mills.

An improved press for baling cotton and other substances, patented by Mr. Innes T. McIntyre, of Carrollton, Miss., consists in the combination of two pivoted movable followers and two levers coupled together, and provided with tackling for moving them both in the same direction. This movement moves one of the followers up and the other down, so as to compress the bale which lies between them.

Mr. Daniel Palacios, of New York city, has invented an improved oscillating pump. The pump cylinder is connected at its lower end with a hollow rock shaft or pipe, which communicates with the pump valves. The piston rod is connected with a crank on the pump driving shaft.

Mr. George Corbett, of Petrolia, Pa., has devised an improvement in oil, gas, and salt well apparatus. The improvement relates mainly to the construction of the framework that supports the moving parts of the machinery, the object being to make the framework stronger and more convenient to erect and adjust.

Mr. Francis J. Wehner, of New Orleans, La., has invented an improved compressing apparatus, the object of which is to compress semi-fluid substances, or substances of a granular character, and especially for crushing slabs of ice and forcing the pieces into a solid mass.

An improvement in pumps, patented by Mr. Cornelius E. Drake, of Avoca, Iowa, consists of a cylinder having its edges recessed to receive the packing rings, the rings being arranged so that they are kept in contact with the inner surface of the cylinder by the pressure of the water.

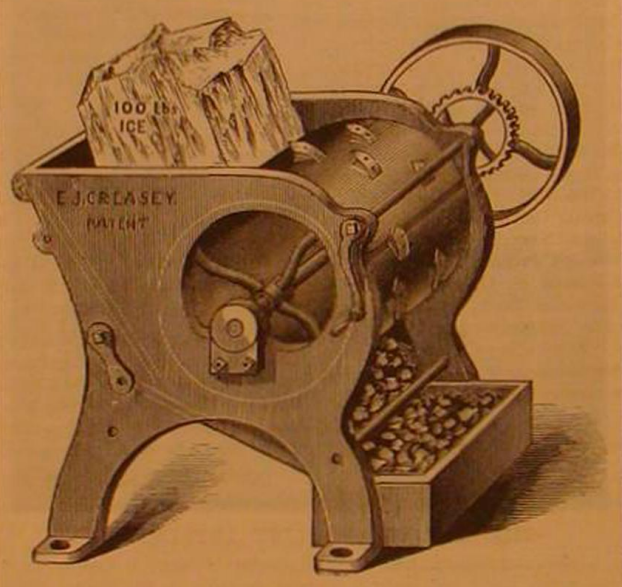
Mr. Samuel G. Munn, of Chicago, Ill., has patented an improved feed water heater, which consists of two water reservoirs connected by pipes running through a steam chamber insulated from the external air by a double shell or jacket. Pipes are provided for supplying and exhausting the water from the reservoir.

An improvement in steam packing rings has been patented by Mr. George C. Phillips, of Silver City, Nev. It consists in making segmental packing rings with recesses in their periphery, in which the water from the condensed steam collects and thus prevents them from over-heating or fusing under the heat of the steam.

Mr. William Redmond, of Greenville, S. C., has patented an improved rotary valve, consisting of two tubular valves fitted in concave seats at opposite ends of the steam chest, and communicating with the steam pipe through the side of the chest.

NEW ICE BREAKER.

The accompanying engraving represents a cheap and simple ice breaker, which picks the ice without breaking or crushing it. The size of the cut may be varied without stopping the machine. The machines are made in different sizes to suit different trades; the larger ones may be run by hand or power.



CREASEY'S ICE BREAKER.

The construction of the machine will be readily understood by reference to the engraving. The picks, which are of the best steel, are placed in a revolving cylinder or drum, and may be readily removed or replaced.

Further information may be obtained by addressing the Novelty Machine Works, 1608 S. Front street, below Tasker, Philadelphia, Pa.

Advantages of Fancy Farming.

The *Scientific Farmer* has a very sensible article on the advantages to a rural neighborhood, of having merchants and other well-to-do city people purchase homes in their midst. These people, says the writer, buy a suburban or more remote farm, bring to it of their wealth, remodel the old house or build anew, tear down or improve the old barns, and build from designs of a city architect who understands more of harmonies than uses, stock with improved breeds of cattle, the latest style of implements in endless variety, and the most expensive novelties from the seed stores, and spend, perhaps without hope, certainly without prospect, of adequate returns. Wherever fancy farms abound, there may be observed continuous improvement in their vicinity. They serve to change the habits of life of the farmer and his family. The old inconvenient methods of housekeeping give place to a more convenient system. The water from the well is brought to the house, instead of being fetched in a pail from the distant well or spring; the wood-pile is placed under a shed or into a compact pile, instead of being heaped in the door-yard; the surroundings to the buildings are "slicked up"; flowers appear, perhaps, in the door-yard; the cattle are better fed, the fences better repaired, new crops and new markets are sought, and expenditures are increased as the income grows larger and is derived from more varied sources. All this comes from the influence of the example of the finely but expensively maintained farm, whereon neither expense nor income is much considered, and which, judged from a business stand-point, must be considered a failure; judged from influences on others, is to be looked upon as a public benefaction.

There is too prevalent a feeling of jealousy towards the fancy farmer on the part of the actual farmer, and too little appreciation of the benefits which may be and are derived from his presence. It is to this leisure class of farmers that agriculture must look for that progress which results from unrest, abundance of means, and a strong enthusiasm towards a pursuit. This man can experiment, when the poorer man cannot afford to depart from the beaten rut until better results from a departure become demonstrated. This class encourage inventors and dealers by furnishing opportunities for the trial of new things which promise well, and when through costly failure an improvement is secured, the working farmer can secure the perfected article. This class import foreign cattle and test their adaptation to our needs. They introduce new fruits and improved vegetables, which, if found deserving, soon find distribution throughout the neighborhood. They extend a knowledge of the arts of culture, and tend to distribute a practical knowledge of hotbeds and forced crops; and in addition to these more obvious benefits, contribute largely, through taxation, to the public necessities, and relieve in this way the burdens on others.

How Typhoid Fever may be Propagated.

In a recent number of the *Popular Science Monthly*, Ely Van De Warker, M.D., of Syracuse, N. Y., under the title "Typhoid Fever Poison," reports seventeen cases of the fever in an isolated suburb of the city in which there were but fourteen houses. The first case was imported; thence through the overflowing of the privy in which all the excrement of the patient had been thrown, a well became contaminated. All the persons who were taken ill used this well. It was the constant or occasional source of supply of seven of the fourteen families. No cases occurred in the households who did not drink from this well. Some cases were developed in every family who drew water from it. The families who escaped were exposed to every other influence but that of this particular well; their own water supply was the same, less the privy contamination. It is not unlikely that their own wells received some of the overflow from their own vaults, but as these were free from typhoid poison, no ill results ensued.

About eight years since, Dr. Flint, who has studied and written a great deal on the subject, became satisfied that a source of typhoid fever existed which was little dreamed of, and which at first thought would seem impossible. This source, as he then enunciated it to his home medical society (and not to his knowledge having been before suggested), is found in *ice*. If this idea is thoroughly investigated, it will not appear to be very problematical. In the first place, the poison is not destroyed or impaired by freezing (some one long ago remarked that ice often masks or conceals what it does not kill). Now, whence comes our ice supply? Often from shallow reservoirs in the midst of neighborhoods of large towns purposely made to receive surface drainage from all around, under the erroneous idea that no harm will ensue, as freezing is supposed to purify and render harmless what might otherwise be objectionable. Great quantities of ice are taken from canals, from creeks, from stagnant ponds, and from streams that are either the natural or artificial recipients of surface drainage, of the outpourings of sewers, and of uncleanliness from various sources. The danger from ice taken from improper places is not only from that which is drunk, but from its use in refrigerators and preservatories, where milk, butter, fruits, vegetables, and meats are subjected to its saturating influence as it vaporizes. Several instances have fallen under the doctor's observation where the disease, by the most careful investigation, could not be traced to any other source; and if we accept as a fact the statement positively made by Budd in the London *Lancet*, in July, 1859, that it never originates *de novo*, but proceeds from a special and specific poison, which is capable of diffusion to a great extent, and which preserves its noxious qualities for a long period, even if buried for many months, we cannot reject the hypothesis of ice infection; and it is hoped that it will be made the subject of very thorough and careful investigation.

How Business is Now Done.

The old methods of doing business are fast passing away, and whether the change is for the better or not, those who wish to achieve success must abandon the old and fall into the new. A revolution has been wrought in such matters, and the old methods are daily becoming obsolete. One hundred thousand commercial agents or drummers are now employed to travel the length and breadth of the country in the interest of their employers, and in this fast age no one, unless he holds a monopoly of some good thing, can afford to wait for customers, so great is the competition in every line or branch of business. As pertinent to this subject, the Boston *Post* says: "The ways of traffic are not the old ways; wooden ships are going out of date, and sailing vessels are giving place to steam; currency is superseded by commercial credits; the cable and telegraph have brought markets close together; railroads derive their freight profits from the perfectness of their terminal facilities; men buy and sell by sample before products and manufactured stocks are moved; prices and rates change oftener now in a day than they used to do in a week or a month; everything tends to economy of business friction, to bringing things down to the finest point by the shortest way, to the performance of the most work by the least machinery."

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.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Tomo IV., Nos. 4 and 5. 1879.

We have already had occasion to call attention to the great scientific value of the papers read before the Geographical and Statistical Society of the Mexican Republic, and to the excellent style in which they are issued. The current number (a double one) of the Society's "Bulletin," recently received, maintains the high character of those that have preceded it, and contains, in addition to a record of the "Proceedings" for July, 1875: A Resume of Recent Discoveries in European and Asiatic Archæology, by Senor Brackel-Welde; Altimetric Data, by Senor Reyes; A Memoir on a Means for Improving the Canalization of Mexico, by Dr. de Belina; A Report on the Cultivation of the Mulberry and the Rearing of the Silkworm in Colima, by Senor Moreno; A Paper on the Origin of Belize, by Senor Carrillo y Ancona; Facts relating to the Discovery of the New Mineral Barcenite, by Senor Ramirez, wherein the author, while claiming for his countryman, Senor Mendoza, the priority of discovery of the new species, grants that the honor of making the first quantitative analysis of it belongs to Professor Mallet, of Philadelphia, and that the name "barcenite" given to it by the latter should be accepted; A Memoir on the Moon and Meteorology, by Senor Reyes; Influence of Altitude on the Life and Health of the Inhabitants of Anahuac, by Dr. de Belina; and The Law of Periodicity of Rains in the Valley of Mexico. In addition to the foregoing memoirs, there are several unsigned papers and translations; and, altogether, the collection is one of considerable scientific interest.

REVISTA GENERAL DE MARINA. Cuaderno, 5. May, 1879: Madrid

This ably edited Review, now in its fourth volume, is a monthly periodical of about 75 pages, most excellently printed and copiously illustrated, and devoted to the interests of the navy exclusively—being in fact the sole organ of that branch of the Spanish service. We cannot give the reader a better idea of the scope of this interesting and valuable publication than by enumerating its contents, which, in the number before us, are as follows: Santa Cruz (Teneriffe) and the Fisheries of the African Coast, by Captain Galiano; Reflections on the Formation of the National Navy, by Captain Manganos; Brief Notes on the Recent Progress in Portable Firearms, especially in France, by Lieutenant Toca; Description of a New Hydraulic Dock; The Archer and Clark Stanfield System of Raising Sunken Ships, by Lieutenant Pastorin; and "Various Notes," under this heading being included short accounts of the most recent discoveries and improvements in matters appertaining to the navy.

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.

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.

(1) C. E. A. asks: 1. Can a boat be propelled by letting steam direct from the boiler through a nozzle under the boat pointing toward the stern? A. Yes. 2. If so, at what speed can a flat bottomed skiff, sharp at both ends, 15 feet long, 2 feet wide at bottom and 3 feet wide at top, with an upright boiler with 10 feet heat surface, with 120 lb. of steam, be propelled? A. If with the stream, the speed would be perceptible, but if against it, the stream would have the advantage. 3. Does a bullet thrown from a rifle cut with a gaining twist increase in revolutions after it has left the gun? A. No. 4. Why does a ball thrown from the same rifle make a larger hole in an animal at a long distance than at a short distance? A. Because at the short distance the substance is cut before it has time to yield.

(2) J. N. writes: Having occasion to use compressed air, and storing as large quantity as possible in a vessel containing 5 feet, if I pump air in so as to have a pressure of 15 lb. to the inch, how many feet can I discharge through a gas meter; or, in other words, how many feet of air can I pump into the vessel to make a pressure of 15 lb. to the inch? A. A quantity equal to the capacity of the vessel.

(3) "Young Mechanic" asks: 1. What branches of school study are the most necessary for a person intending to become a first class mechanic to be well versed in? A. Chemistry, physics, and mathematics. 2. What is the best book on mechanics for him to study first? A. The class books used in high schools and universities.

(4) F. W. S. asks: Which of two journals will wear the most, one running in wooden boxes and the other in metal ones, other conditions being equal? A. Those that run in wood; the wood holds dirt and grit, and all the wear falls on the journal.

(5) C. C. W. writes: I am building a small steam launch of the following dimensions: Length, over all, 18 feet, beam amidships, 4 feet 6 inches; draught aft, loaded, 18 inches; Clinker built, sharp lines, 2 plain valve engines, 2x4 inches, set on the quarter. I intend carrying 40 lb. steam and speed 200. What size screw do I need, and what pitch to do the best possible work? Please explain the principle of the injector. A. 22 inches diameter and 2 feet 8 inches pitch, you will get a moderate speed. For an explanation of the action of the injector consult Bourne's Catechism of the Steam Engine."

(6) E. P. asks. 1. Is water compressible? Is the water compressed to an appreciable extent at great depths in the ocean, 4 or 5 miles? A. Practically, no. 2. Would a wreck in sinking in the deepest part of the ocean reach a depth where it would remain stationary, owing to the density of the water, before touching bottom? A. If its specific gravity is greater than that of water it will go to the bottom.

(7) W. V. asks how lime can be removed from water pipes in a dwelling house. They have only been in use two years, and all soft water which passes through them becomes so hard as to be useless. A. The lime salts cannot be removed by chemical means without doing injury to the iron pipes. Carbonic acid water (soda water) would probably dissolve the greater part of the salt with the least injury to the iron.

(8) S. S. S. asks how to separate lead from silver on a small scale. A. To separate the silver from a rich lead expose it in a large cupel (a porous dish made of bone ash, to a strong red heat, in a muffle open at both ends so as to admit of the passage of air over the melted metal. Under these circumstances the lead gradually becomes oxidized to litharge, which is absorbed by the porous dish, leaving a nearly pure button of silver and gold behind. On a larger scale Keith's new electrochemical process gives very good results.

(9) J. J. W. asks how much tannic acid it would require to be used in a seventy-five horse power boiler. We use water slightly impregnated with lime, and forms a slight coating in about a month. What effect would the acid have upon the water distilled from boiler when the acid is used? A. We cannot recommend the use of tannic acid in a boiler under these conditions. Use ¼ ounce of soda to the barrel of feed water instead, and use the blow out every day.

(10) H. J. K. asks: Do you know of any substance, flexible, elastic, and at the same time transparent, to be used in place of wire in constructing a small machine? It must be of sufficient strength to sustain the weight of an ounce. A. Make a solution of fine gelatine in an equal weight of hot concentrated glycerine. If properly prepared and cooled slowly the resulting substance is nearly as flexible and elastic as caoutchouc, and semi-transparent.

(11) D. A. B. asks: If a chain suspended by both ends from above, the bight passing around a sheave below, to which a weight is attached, say 10 tons—is there more than 5 tons strain, on any section of chain: if so, where is the breaking point? A. No; the breaking point will be in one of the parallel sides.

(12) W. J. R. asks: Would a pair of engines, 8 inches bore and 9 inches stroke, give good results at 200 revolutions, working steam at about 30 lb. mean effective pressure? What would be a better proportion? A. It would not be economical; you had better get same speed of piston by longer stroke and less revolutions, if your work will permit it.

(13) J. J. F asks what is the heat conducting power of terra cotta, and what is the conducting power of iron? A. Taking the conducting power of gold at 1000, iron is 374, terra cotta 11.

(14) J. J. S. asks for the simplest and best method of making a lightning arrester for acoustic telephones. A. Surround the wire for a distance of three or four inches with a copper tube having a number of internally projecting points, which come very near the wire but do not touch it so as to interfere with its vibrations. The copper tube should be connected with a ground wire having good ground connections. See p. 395 (26), current volume.

(15) J. M. L. asks: What is the matter with a Blake transmitter when it loses its force? Is it the fault of transmitter or of the battery? If in the battery how can it be corrected? A. The trouble probably lies in the Leclanche battery. Put a small handful of sal-ammoniac in the jar and add a little water. If this does not remedy the difficulty you should write to the manufacturers.

(16) J. W. S. asks: 1. How large should the steam supply pipes be to make the pressure on the piston the same as that in the boiler? How large should the steam supply and ports be in proportion to the engine? A. It depends upon the pressure of the steam and velocity of the piston; usually ¼ the diameter of the cylinder is sufficient for the steam pipe, but with high speeds it should be larger. 2. How do you change the lead in an engine? A. By shifting the eccentric. 3. How much lead should an engine, 11x20, with a small fly wheel, have? A. If running at usual velocity, from 1-16 to 1-8 inch will answer.

(17) S. B. M. asks: Which requires the most power, to run a piece of machinery with cog gear or belting? A. If a large power is to be transmitted at a slow speed, the belt; if a small power at high speed, gearing.

(18) C. S. writes: I am running a cider mill and press. Would like to know which is the best, canvas or cloth, through which to press the finest ground apples? A. Fine haircloth, with a backing of strong unbleached muslin, is generally preferred, we believe, where a sand filter is not used.

(19) J. B. Z. asks what to use in steam boilers to keep them from rusting, and also what is the best article to paint the outside with. A. Fill them entirely full of water and close them up tight. Keep the outside coated with a good oil paint—brown oxide ground in pure linseed oil.

(20) J. A. M. asks: Are glass insulators indispensable or not in putting up lightning rods on buildings, for protection against the electric current? Some parties have been putting up rods here without insulators, using only strips of zinc to hold them to walls and roofs. Our people are ignorant on the subject, and would be glad to see a full explanation in your valuable scientific journal. A. Insulators should not be used. The rod should be fastened directly against the building. But the most important precaution is to make sure that the bottom end of the rod has a large conducting surface in contact with the earth. Better have no rod than simply to stick the end a few feet down into dry earth; the proper way is to solder the bottom end of the rod to a metal water pipe or gas pipe in the ground. If there are no pipes, then make a long trench and put in some good conducting material, such as fine charcoal, or hard coal dust, iron ore, or old iron, making a good connection between the bottom end of the rod and this conducting material.

(21) N. W. asks what thickness of iron to use to make the shell of a small steam boiler, about 18 inches high and 10 inches in diameter, steam pressure about 50 lb. to the square inch. A. 1-16 inch, if of good iron and well made, but we would advise not less than 1-12 of an inch.

(22) L. S. asks: What size keel would be suitable for a cat rigged boat, 12 feet long, 4½ feet wide? A. 1½ inch by 3 inches deep would probably answer, but one or two inches deeper would be more weatherly.

(23) C. C. asks: 1. Will one cubic foot of iron swim in the water if the water is 20 miles deep? A. It will sink. 2. It is said that the wall of a cistern should be built a little distance from the dirt wall. Is this correct? A. To sustain the wall, keep the earth packed close to it.

(24) C. M. writes: On page 330, present volume, Professor Wilder is made to say: "For acid poisons give acids." 1. Is this a mistake? If not, in what cases would acids be antidotes for acid poisons, and in what cases would they be harmful or dangerous? A. The statement of Professor Wilder about acids—"*similia similibus*, etc.," may well be questioned by the correspondent. Where poisonous doses of acids have been taken, the best antidotes are calcined magnesia, chalk, lime, magnesia carbonate, etc., exhibited with plenty of cold water. Every effort must be speedily made to excite vomiting. Acids are never exhibited as antidotes for acids? See "Horsely on Poisons," and Marbal's Toxicology, p. 34. 2. What is the remedy for arsenious acid? A. We believe there is no specific antidote yet known for this poison. Perhaps the most effective antidote, if administered at an early stage (otherwise remedies in this connection are rarely attended with success), is recently precipitated moist ferric hydrate, or a mixture of this with magnesia. It is most advantageously exhibited in the form of a mixture of solution of ferric chloride (liquor or tintura) with sodium carbonate—two to three ounces of the former to one ounce of the crystals of the latter. Instead of the sodium carbonate, a quarter of an ounce of calcined magnesia may be used. These quantities will render at least 10 grains of the arsenic insoluble. No chemical antidotes should ever supersede active evacuent treatment by emetics and the stomach pump.

(25) E. L. W. asks what to apply to the wooden bottom of an aquarium to render it waterproof. A. Linseed oil, 3 oz.; tar, 4 oz.; resin, 1 lb.; melt together over a gentle fire. If too much oil is used the cement will be too soft. This may be corrected by adding tar and resin, or by allowing it to simmer for a longer time. Apply warm, and do not use the aquarium for several days.

(26) J. D. asks: 1. If height of water be 17 feet, overshot wheel be 13½ feet, gate 4 feet wide and opened 1½ inch, and discharging the water 3½ feet below the surface (or at a height of 13½ feet); and again, if the height be 16 feet and all the rest be the same, what is the actual horse power in each case? A. If you have stated your case correctly: Under 16 feet fall, the power would be with wheel 4½ feet face, 11·8 horse power; under the conditions given, the power with 17 feet fall would be no more, as the water is to be delivered under the same head, viz., 3½ feet; but if this is an error, and with 17 feet fall you intend to deliver the water under 4½ feet head, the power of the wheel would be increased to about 13·4 horse power, provided the wheel and buckets are so proportioned as to receive the increased quantity of water without waste. 2. What is the number of cubic feet of water that will pass through in 1 minute in each varying height (17 feet and 16 feet)? A. 306 feet under 3½ feet, and 347 feet under 4½ feet head.

(27) I. J. M. writes: In your answer to T. E. W., No. 35, volume XL., No. 24, you decide against him. Are you not wrong? We are taught that bodies at the center of the earth weigh nothing; if so, they can certainly have no momentum. As they approach the center, gravity decreases, until at the center the attraction is equal on all sides, and having no momentum, come to a state of rest. A. We think not; the accumulated work or momentum must be expended. Gravity cannot vibrate a pendulum when hanging vertically, but draw it aside and let it swing, and the accumulated work carries it past the center line, and it continues to vibrate until friction and the resistance of the atmosphere have destroyed or used up the momentum.

(28) W. E. C. asks: 1. How can I mould a porous cup for a Bunsen battery? A. They are unglazed porcelain, and cannot be made to advantage except by a potter. 2. What solution is used on the outside of the porous cup? A. Use a saturated solution of common salt or water 15 parts, sulphuric acid 1 part. 3. How many ¼ gallon jars would be required to work a telegraph line ¼ mile in length? A. Without knowing the resistance of your line we cannot tell; try two. The gravity battery is much better adapted to telegraphy than the Bunsen.

(29) W. G. W. writes: 1. If 100 cubic inches of air were pumped into a hollow ball, and this ball would just hold up a given weight in the water, say 10 lb. and no more, would pumping 200 cubic inches in the same ball cause it to hold up any more than 10 lb. on the water? A. No, not so much by weight of air. 2. If three cubic inches of water be converted into steam, will the steam weigh as much as the water did? A. Yes. 3. If one gallon of water was converted into steam and confined in the same measure, what pressure per square inch would it have? A. You cannot convert water into steam and confine it in the same space; it will still be water, and can only change to steam by giving it room to do so.

(30) S. B. M. asks: 1. Can I make a simple and cheap battery, using copper or zinc, or both, without mercury? A. Yes. 2. If so please tell me how. A. See SUPPLEMENTS, Nos. 157, 158, and 159, Batteries. 3. To insulate copper wire for an electro-magnet, will common wrapping twine do? A. No, it makes the covering too thick. Use a fine floss. 4. In wrapping wire on an electro-magnet, what do you mean by "layers?" Is it the number of times the wire is wrapped around it? A. It is the number of coils, counting from the core outward.

(31) G. B.—See Professor Wilson's paper "Hygiene of the Hair," in No. 110, SCIENTIFIC AMERICAN SUPPLEMENT.

(32) C. D. W. asks: Would not one paddle or bucket have the same propelling power swept through the water a distance of twenty feet, as twenty paddles or buckets on an endless chain one foot apart, the chain revolving on wheels twenty feet apart—the paddles the same area, and the same power applied to the single one and to the twenty? A. It will depend upon the velocity at which the paddles are driven; if so slow that the water can fill in perfectly between them, the increased number of buckets or paddles will do the most work; if, on the contrary, the speed is so great, that the water cannot fill between the buckets, then the single bucket will do the most work.

(33) H. C. M. writes: In answer to S. C. C., April 10, (13), you said that when a train of cars are rounding a curve the greater weight is on the outside rail; please explain. A. The centrifugal force of the train round a curve acts to overturn the cars upon the outer rail, as the center of gravity of the mass is some distance above the top of the rail.

(34) G. T. C. asks: Does an overshot water wheel, when exercising a steady power by means of a crank attached to its shaft, exercise, or is it capable of exercising, more power at one point of revolution than at another? A. More pressure, but not power; the difference in pressure is owing to the different positions of the crank, not to any variation in the power of the wheel.

(35) E. A. W. writes: We would like to know from what height and into what liquid the copper is dropped to make it assume the granulated form, and if a tumbling barrel is afterward used? A. Pour the fused copper in as thin a stream as possible from a height of about a yard into a tub filled with cold water. A trace of sulphuric acid may be added to the water, but this is not essential. Dry the copper in sawdust, by tumbling or otherwise. Consult Larkin's and Overman's "Founder's Guide."

(36) W. F. L. asks: 1. Is it possible to line pulleys so that the belt will run horizontal and be quarter twist without the use of guide pulleys? A. Yes. 2. If so should they (the pulleys) be lined the same as in answer to A. W. D., SCIENTIFIC AMERICAN, of January 11, 1879? A. Yes. 3. I use well water in boiler, and notice in blow-off cock, which leaks some, a dirty looking scale, of which we send sample; do you think it will prove injurious to boiler? A. The incrustation consists chiefly of lime, iron oxide, silica, and alumina. If such an incrustation is permitted to increase there will be danger of overheating the plates. A small quantity (a few ounces) of carbonate of soda may be introduced daily with the feed water, and the blow-off used regularly every day, if possible after the contents of the boiler have remained quiescent for a time. Care should be taken that the water does not run low.

(37) E. C. L. writes: A discussion having arisen among some of our shipbuilders and ship owners regarding the capacity of iron and wooden ships (that is, our spruce ships) to carry dead weight, a great difference of opinion arose on this matter, and it was proposed to refer the question to you to be answered in your columns. Say a ship of 1,000 tons register, same proportions, one built of iron, the other of spruce, which would carry the greatest amount of dead weight cargo? A. It is generally estimated that iron ships will carry from 20 to 25 per cent more dead weight than an oak built ship, and it would probably be from 10 to 15 per cent more than a soft wood ship.

(38) G. M. F. asks: What is the most practical way of protecting Swiss drawing instruments against rust? A. Coat the warm metal with a very thin lacquer of shellac dissolved in alcohol.

(39) S. F. writes: Suppose a hollow globe to have the air exhausted from it, thus containing a perfect vacuum, will it then weigh more or less than it will when filled with hydrogen? A. Less.

(40) G. A. H. writes: A late number of the SCIENTIFIC AMERICAN contains the following question and answer: "What is it that carriage makers use for setting the boxes in the hub, with some kind of cement? A. The boxes are usually secured by wedges. We do not know of a cement that will answer the purpose." The "cement" used is white lead and oil mixed about the consistency of paste. A box set properly in this cement, provided the oil used for lubricating the axle arm does not penetrate the hub and thus soften the cement, will remain perfectly tight until worn out, and cannot then be forced out from the hub only by means of a powerful press, without breaking the box. Wedging the boxes by manufacturers of the finer grade of carriages, is looked upon with disfavor. With the common axle box (of which very few are now used), the shape necessitated wedging. The most improved patterns now made require no wedging for the purpose of tightening the box, wedges being used only for "truing" the box, so that the rim shall not present a wabbling appearance when the vehicle is in motion. Even this is now found to be unnecessary when the best hub boring machines are used, provided the rim of the wheel has not been forced out of true in setting the tire. Sometimes, and especially with a cheap grade of wheels, the smith is unable to set the tire without bringing the rim out of true, for the reason that proper care has not been observed in selecting the spokes. The same grade of timber is not used in all, therefore some spokes will be stiff and less flexible than others. The result being that the more flexible spokes dish more than those which are stiff, producing a rim out of true, and requiring that the box shall be trued in order to remedy the fault. When the rubber cushioned axle (now the most popular) was invented, it was found to be impossible to set one of the boxes by driving, therefore a press was made that answers the purpose of forcing in the box. The practice followed of forcing the boxes of other grades of axles, until now it is considered to be the easiest, safest as regards breaking, and the most durable method for setting a box; proper care being observed in forcing, the necessity of truing the box is obviated.

(41) J. M. writes: A says that printing is done on cylinder presses from ordinary movable type set in a cylinder which revolves. I say it is not. Which is correct? A. R. Hoe & Co. make a rotary press having one large cylinder on which the movable types are placed. The impression cylinders surround it; they vary in number in the different presses, 2, 4, 6, 8, and sometimes 10 cylinders are used. Fine printing is done on cylinder presses having flat reciprocating beds for receiving the movable types.

(42) T. Q. asks: What can I use to harden the tips of my fingers? Through daily practice on the violin they become very tender and sore, so that I have to cease playing. A. Continued practice will do it. A strong solution of alum in water, or the tincture of white oak bark applied occasionally, may be beneficial.

(43) M. R. asks how the brine is made in which eggs are packed to preserve them. A. Dissolve rock salt to saturation in water and add about 5 per cent of niter.

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

Buffalo Gap.—57. The fossil is too badly damaged to admit of proper classification. 120. A magnesian limestone. 143. Argillaceous limestone. 146. Argillite containing partially decomposed orthoclase, iron, and copper sulphurets. 133. Argillaceous limestone containing small quantities of chalcopyrite. 127. A fossiliferous clay slate containing a small amount of lime phosphate. 144. Consists chiefly of lime carbonate and phosphate, and clay. 123. Marcasite, an iron sulphide. The other (unlabeled) samples consist chiefly of argillaceous and ferruginous limestones containing small amounts of organic matters.—E. C.—1. Silver bearing galena (lead sulphide) associated with hematite and iron sulphide in quartzose and doleritic rock. 2. The amount of carbonaceous matters in the shale is small. Its color is chiefly due to iron oxide.—J. F. S.—The sample is kaolinite containing a small quantity of undecomposed orthoclase and sand. As it is almost entirely free from iron it may prove valuable in the manufacture of white "stone china," etc.—W. S. H.—It consists chiefly of charcoal saturated with partially decomposed alkaline thiosulphate. The quantity sent was insufficient for confirmatory tests. Charcoal and the alkaline sulphites are excellent antiseptics.—J. R.—The rock contains nothing of any practical value.—The sample of fire clay in unlabeled tin box (Lawrence's patent) is of fair quality value, about a dollar a ton in New York.—O. B. McN.—Quartz pebbles of no value.

COMMUNICATIONS RECEIVED.

Complexity vs. Simplicity. By G. F. W.
On Consumption. By D. F.
Boat Rig. By G. A. C.
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[OFFICIAL.]

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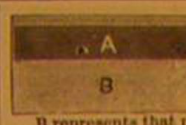

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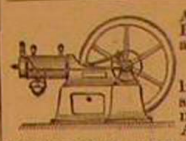
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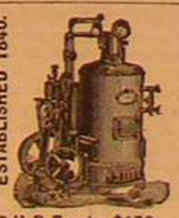
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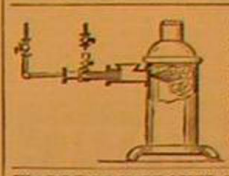
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