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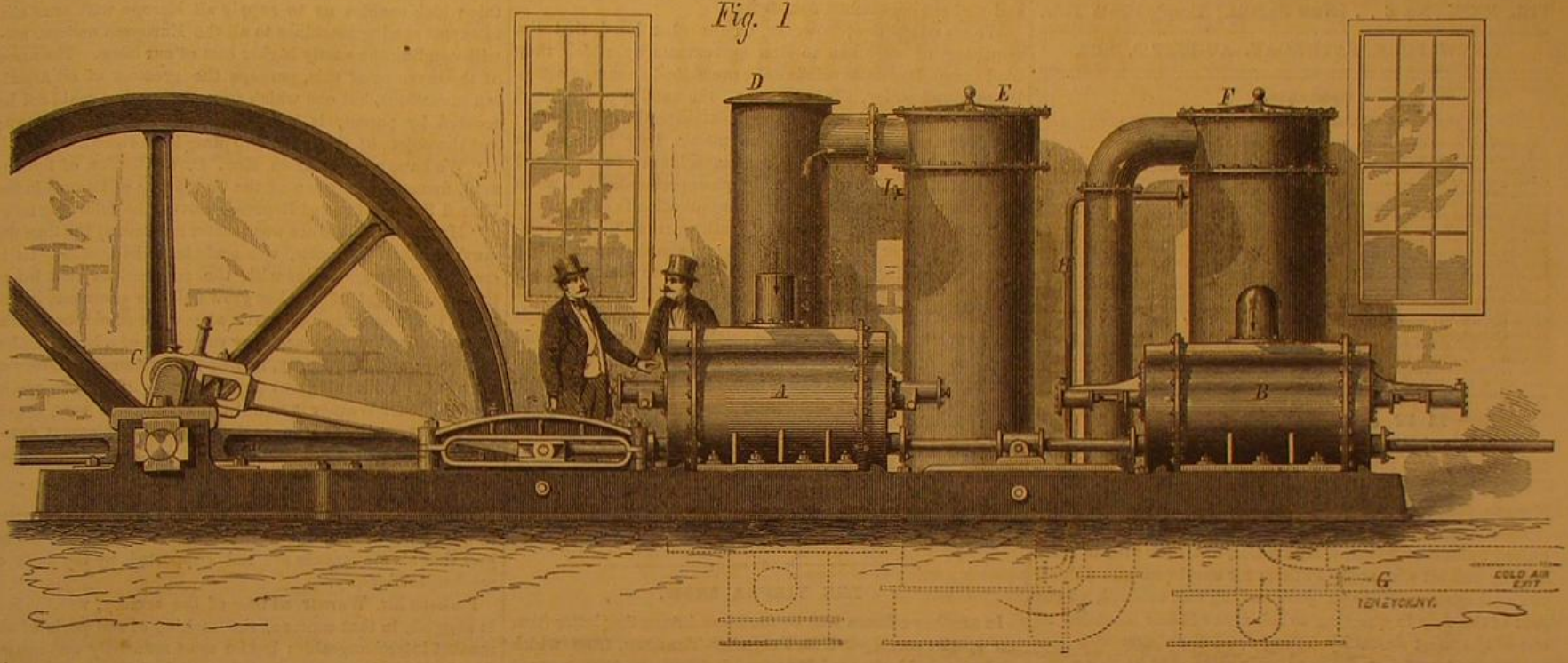
IMPROVED ICE AND REFRIGERATING MACHINE.

The various inventions which, during late years, have been devised for purposes of refrigeration, or for the manufacture of ice, may be divided into three principal classes: (1) Those in which evaporation is effected in a vacuum, the process being assisted by the use of an air pump, as in the ether machines of Messrs. Siebe, Tellier, and others. (2) Those in which air is first compressed and afterwards expanded, or, more generally speaking, those in which heat is adplied in order to ultimately produce cold, exemplified in the apparatus of Kirk of Glasgow, Mignot of Paris, and the Windhausen invention, to which the following description will more particularly refer. (3) Those in which cold is produced by the direct action of heat without the use of power, as in the case of refrigeration by the liquefaction and subsequent vaporization of ammonia, to which class belong the systems of Carré, Reece, Mort, and others of more recent date. In addition to the machines coming under the above heads, may be noted others employing freezing powders and different hydrocarbons, numbers of which, possessing various degrees of merit, exist both in this country and abroad.

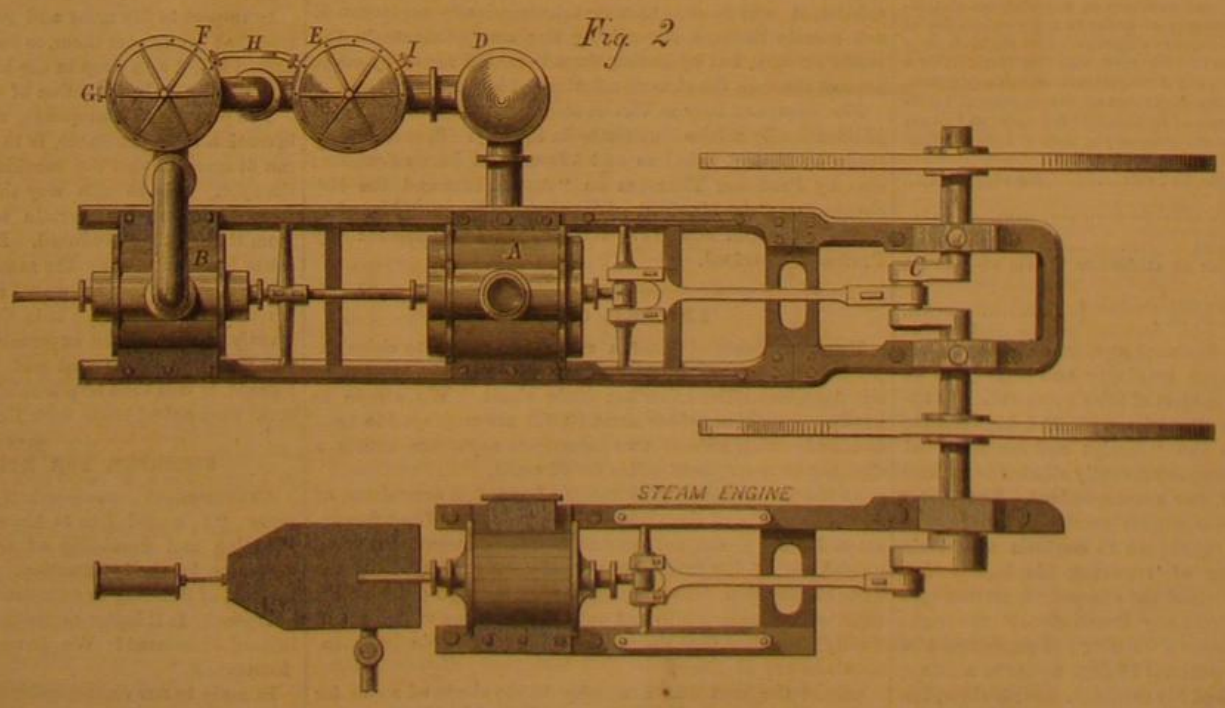
Fig. 1



THE WINDHAUSEN ICE AND REFRIGERATING MACHINE.

The Windhausen apparatus, which our engravings illustrate, was first patented in Germany; and in March, 1870, similar protection was obtained for it in the United States. It has already found general notice in our columns in connection with other devices of similar construction, and may be fairly considered as among the most successful machines of its class yet produced. The principle upon which it is based is one of the simplest in physics, namely, that the compression of the atmosphere generates heat, and its subsequent expansion, cold; an axiom too generally understood to need explanation here. The particular mode of its application in the present instance is, however, an important point; and, indeed, the entire efficiency of the device is claimed to rest upon the circumstance that, instead of cooling the air heated by compression by means of running water, and then conducting it directly to the space or apartment to be refrigerated, it is led into a chamber where dilation takes place. In brief, expansion is effected by the simultaneous action of the machine before the air is sought to be utilized.

Fig. 2



Our engravings present an elevation, Fig. 1, and plan view, Fig. 2. A is the compression cylinder, and B the expansion cylinder, both of which are worked simultaneously by power applied to the crank, C, by the low pressure engine shown in the lower portion of Fig. 2. Air enters in the direction of the arrow into the upper part of cylinder, A, which is of such dimensions that, at every move of the piston, nearly thirty-five cubic feet of air, or, as the former is double acting, twice that number, are compressed with every revolution of the engine. Thirty-six revolutions per minute, for example, compress 150,000 cubic feet per hour, and at a pressure, it is stated, of only 35 pounds per square inch, that is, reducing two and a half volumes of air to one volume. Supposing the air on entrance to be at 80° Fah., it is stated that, after compression, experiment proves its temperature to be 205°, indicating a gain, therefore, of 125°. Leaving the cylinder, A, the current enters the condenser, D, from which, in the direction of the arrow, it passes to a similar receptacle, E, thence down, as indicated by dotted lines in Fig. 1, to another cooler, F. Within these chambers, are arranged series of pipes through which the blast passes, and which are surrounded by a current of cold water which enters at G (dotted lines, Fig. 1), passes up through the cooler, F, through pipe, H, through the next cooler, and emerges at I. The effect of this water is to abstract a portion of the heat imparted by compression, reducing the temperature of the air to a few degrees above that of its natural state, the extent of this reduction depending upon the temperature of the water and the length of time the air is submitted to its action. An atmosphere is thus obtained which, although under two and a half compressions, is but slightly warmer than the ordinary air previous to treatment, while the expansive force and effect of a volume two and a half times larger is retained. Consequently, it is claimed that the 125° of temperature above noted are clearly gained.

In this condition the air enters cylinder B, where the expansion takes place under a gradually diminishing pressure, regulated by automatic valves worked by the simple expansive force of the compressed air itself. To dilate the latter to its normal volume, it is evident that the same amount of heat is required as was abstracted by the water; but this can only be partially returned by the small quantity of air within the expansion cylinder, so that a low degree of temperature is at once obtained. This is still further reduced with every movement of the machine, as the original air in the expansion cylinder becomes colder, or rather replaced by the cooled and compressed atmosphere. As the compression and expansion cylinders are simultaneously double acting, the latter receives its supply only from the former, so that the compressed air is expanded by one and the same process; hence, if 150,000 cubic feet are compressed in one hour, necessarily the same amount must be expanded in a similar time.

From the cylinder, B, the air escapes into the space to be refrigerated with great velocity, sufficient, it is stated, to be capable of conducting the current through channels two feet in diameter a distance of 300 feet from the exit aperture, the measured temperature of the air at the orifice being from 30° to 35° below zero Fah. It is also asserted that under a pressure of 35 pounds to the square inch, at 33 or 34 revolutions per minute, the machine has, with an inadequate supply of water, since its erection at New Orleans, produced a temperature of 54° below the Fahrenheit freezing point. The apparatus, it is claimed, will sustain a pressure of 85 pounds per square inch, or nearly six atmospheres, producing a most intense cold, scarcely susceptible of thermometrical measurement. Perfectly dry cold air is said to be formed, the contained moisture being condensed into snow and appearing at the exit orifice.

This machine, we are informed, has already received the

first prize at the Vienna Exposition. The apparatus now operating in New Orleans was built by Eygels, of Berlin, and was the first constructed on a large scale in Germany. The driving engine is 31x36, and works at from 50 to 55 pounds pressure. The patent right for the entire continent has been purchased by the Windhausen Ice Making and Refrigerating Association of North America. Further information may be obtained by addressing the President of the Company, Mr. J. Kruttschnitt, Lock Box 144, New Orleans, La.

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Contents.

(Illustrated articles are marked with an asterisk.)

IS IT A DASTARDLY OUTRAGE?

EXECUTIVE DEPARTMENT, INTERNATIONAL UNION OF MACHINISTS AND BLACKSMITHS.

CLEVELAND, OHIO, July 21, 1873.

MESSRS. MUNN & CO:

Dear Sirs:—Enclosed please find a copy of an oath required by Messrs. Stearns, Hill & Co., of all the men in their employ and all who apply to them for employment. I think you will agree with me in pronouncing this attempt, on the part of the firm in question, to rob men of their liberties as one of the most dastardly outrages, on the rights and prerogatives of American freemen, ever attempted in this country since the ratification of the Declaration of Independence. I admired your criticism on the Joliet (Ill.) Iron and Steel Co., and send you the enclosed, feeling confident you will do the matter justice. I remain,

Respectfully yours, JOHN FEHRENBATCH.

The following is a copy of the paper referred to in the above letter:

APPLICATION FOR EMPLOYMENT.

STEARNS, HILL & CO.

I.....make this application for employment in the manufactory of Messrs. Stearns, Hill & Co., and in all good faith do declare, that I am not now a member of, nor will I, during any part of the time I may remain in the employ of said Stearns, Hill & Company become a member of any "Machinists' and Blacksmiths' Union," or any other society or association which assumes to control or regulate the relations existing between employers and workmen in any business whatsoever; and that I will not countenance or assist in any combination of workmen having in view any interference whatsoever with the business of said Stearns, Hill & Company, and I hereby agree with said Stearns, Hill & Company, that in case I have made any misstatements in this application, or in case I shall violate any of the conditions of the agreement herein contained, I shall forfeit to said firm of Stearns, Hill & Co., any and all pay that may be due me at the time of the discovery by them of such misstatement or violation of agreement.

Witness my hand and seal at Erie, Pa., this.....day of..... 187 .

.....L. S.

Erie County, ss.

Personally comes the above named.....who being duly sworn, deposes and says: That all statements by him made in the foregoing application are true.

Sworn and subscribed before me this.....day of.....A. D. 187 .

As the above documents instance another case of the oft recurring difficulties between employer and employee, we propose to make them the subject of brief comment. At the outset, it may be noted that there is no parallel between the "application" quoted and the "receipt and contract" of Joliet (Ill.) Iron and Steel Company recently alluded to in these columns, as intimated by our correspondent. The latter was an acknowledgment for a sum received, accompanied by an agreement by the workman to conform to certain conditions in consideration of receiving his legally due wages. These provisos released the company from damages for accident to the signer from any cause, gave it the right to discharge him at a moment's warning but prevented him from leaving his situation without 14 days notice in writing, under penalty of forfeiture of his earnings, and, besides, imposed other restrictions, *ex post facto* in operation, and hence clearly oppressive and unjust. In that case the employee was obliged to yield to a disadvantage to get his money after he had worked for it, and hence a moment's thought will show the circumstances to be entirely different from those now under consideration.

Enclosed with the letter of our correspondent is a printed hand bill addressed to the public. So far as we are able to understand its purport, it consists of an answer to statements made by Messrs. Stearns, Hill & Co., in relation to matters of internal regulation of their shops, subjects which to our mind are peculiarly the business of the above firm and not at all of the public. There are also some remarks about individual difficulties and recriminations, possessing no general interest, so that, in fine, from all the evidence before us, the trouble narrows itself down to the simple fact that Messrs. Stearns, Hill & Co., for doubtless good and, to them, sufficient reasons, have seen fit to exclude society men from their works. Now, we hardly imagine that the Union to which we are indebted for the above epistle or any other association will have the hardihood to deny that the firm has a perfect right to do exactly what it pleases with its own property and manage its affairs as it thinks best, so long as its doings are legally conducted and no unjust or oppressive measures are exerted. If a concern should decide to employ only society men, to the exclusion of all others, would not a "dastardly outrage" then be committed on the latter? And is not one party, if either, as much entitled to consideration as the other? Clearly we think the employers can exclude from their establishment whatever person or persons they choose, and the remarks of our correspondent, based on this grievance, in the usual exaggerated mode of expression common to the trades union harangue, are entirely misplaced and without substantial foundation.

We are of opinion, however, on the other hand, that the requiring of workmen to sign agreements by which they bind themselves to any definite or prescribed course of action is not sound policy. It is true that the hand is not obliged sign, and that he can refuse the situation as the alternative; but documents of legal form, no matter how innocent in tenor, are, by men possessing but vague ideas of the law and its restrictions, almost invariably misapprehended, just as in the present case the above form of application is stigmatized as "bond and mortgage" and "death warrant." The relation of employer and employee is very simple and requires no such formality; the former, if he wishes to exclude society men from his establishment, should inform himself fully as regards a hand before hiring him; and after arrangements are completed, the man can be easily made to understand that his first overture toward trade union fallacies will bring prompt dismissal and disqualification for re-employment. Documents of almost any description are sure to be seized upon by unscrupulous persons as a tangible basis for unfounded assertion. The mere fact of a paper existing is enough for them to exaggerate its purport in order to work upon the passions of the ignorant, and thus foment difficulties alike prejudicial to the interests of employers and employed.

THE VIENNA SHOW.

In another column will be found an interesting letter from our special correspondent, Professor Thurston, from which we learn that he has safely arrived in Vienna and commenced his examination of the great show. His first impressions of the display are here given, and we cannot refrain from remarking how completely the statements made, as regards American exhibits, accord with the views expressed by us before the opening of the Exposition. The United States section is but poorly filled, a fact under the circumstances to be expected; but there is unquestionably an overwhelming display of American inventions coming from the workshops of foreign manufacturers. Close imitations of even our locomotives, our correspondent tells us, are to be found in the space allowed to other countries, exhibited not only as specimens of the handiwork of their makers, but as American devices, a fact cited as a means of recommendation. In spite, therefore, of the poverty of our individual exhibit, it will be seen that we are abundantly represented, not merely through advertising our own products to the world's notice, but by having them heralded for us by other nations through the sincerest flattery of imitation.

The Fourth of July in Vienna was the occasion of a colossal jollification by all the Americans in the city. Speeches were made by Messrs. Schultze and Adams, and Baron Senborn; also by Professor Thurston on "Agriculture and the Mechanic Arts;" by Mr. Hill of Massachusetts on "Manufactures in the Old and New Worlds," and on "Science" by Professor Horsford.

PROGRESS OF CABS.

The inhabitants of London and other European cities enjoy luxuries in the way of conveyances that the people of our American cities know but little about. We allude to hacks and cabs, of which some 10,000 are employed in London, and which convey two passengers anywhere within a distance of a couple of miles for 25 cents.

At the International Exhibition, London, a committee, of which the Duke of Beaufort was chairman, and Lord Somerset and other prominent persons members, recently made an official trial of the various improved cabs presented for the prize competition. The committee went through considerable exercise in jumping into and out of the various vehicles, and finally concluded that there were no very notable improvements in any of them.

One of the best was a novelty in the shape of a cab for four persons, set on very small wheels. The idea was that such vehicles may be started and stopped more easily than the large wheeled machines. The traction of the small wheels is a little more, but it was contended that the sum of the work upon the horse, in ordinary cab traffic, is less than the large wheeled vehicles.

Another improvement for two wheeled cabs was a shifting ballast box which the driver could readily move at pleasure, and thus counterbalance the weight of the vehicle in respect to its pressure upon the horse's back, to correspond with the number of passengers occupying the interior of the cab.

A GREAT UNRECOGNIZED INVENTOR.

Under this heading the *Wool Bulletin* devotes a half column to the consideration of the marvelous advantages that have been conferred upon this country and the world in general by the mechanical duplication of parts, in the manufacture of machinery; an idea which, it alleges, is of American origin. The *Bulletin* says:

"The American manufacture of implements and smaller machines owes its superiority not only to a larger use of machine tools, but to an idea more important in its results than any merely mechanical invention, and one which is unquestionably of American origin. This idea is the making each of the several parts of many different machines interchangeable. For instance, in making a lot of muskets, the manufacturer does not fabricate each musket separately, but he constructs each of the smallest pieces of ten thousand muskets, it may be, separately, and makes them so precisely alike that each will fit exactly any one of the ten thousand muskets. It is this system which makes it possible for a single factory of arms in this country to make more muskets in a day than can be made in all England in a month. It is this which enables us to supply all Europe with arms and to export sewing machines to all the European nations, notwithstanding the vastly higher cost of our labor. The name of the inventor of this, perhaps the greatest of all American inventions, but one which from its nature could not be secured by patent, is hardly known out of his own town; and the object of this note is to place it on record.

"We have received from Hon. C. C. Chaffee, of Springfield, formerly chairman of the Committee of Patents in the United States House of Representatives, the following note:

"Mr. Thomas Warner was master armorer at the time the musket, in all its parts, was made interchangeable. He is credited by his associates with the suggestions that led to the result. Out of this has grown all the enormous industry of the interchange of parts of sewing machines, watches, and indeed of all machinery composed of a large number of pieces; and, as you say, it was the 'greatest discovery of the age,' and like all great improvements it has been one of growth. Mr. Warner is now in his eightieth year, is hale and hearty, walks to the post office every pleasant day—three quarters of a mile—and is very justly proud of what he has done for mechanics."

We appreciate very highly the motive of our cotemporary in his desire to render honor to whom honor is due; but regret that his statements are not supported by the facts of mechanical history.

Perhaps Mr. Warner, as boss of the armory, was the first to suggest, in that concern, the making of the parts of the musket interchangeable; but he most assuredly was not the first inventor or suggestor of that method in respect to the manufacture of machinery in general. It was unquestionably *not* of American origin. It was a common mechanical expedient in use in the old country before Warner was born, or the Springfield Armory thought of.

How entirely at home the Yankee is in the art of self puffery! He takes to it like a young duck to the water. "It is this system," he modestly alleges, "which makes it possible for a single factory of arms in this country to make more muskets in a day than can be made in all England in a month. It is this which enables us to supply all Europe with arms and to export sewing machines to all European nations, notwithstanding the vastly higher cost of our labor." We are sorry that there is so little basis for so much of the spread eagle.

In respect to fire arms and sewing machines, while it is true that we export them, to some extent, the quantity sent abroad is but as a drop in the bucket compared to the aggregate continental production of these goods.

The practice of Europeans, when they find an American invention to be profitable, is to order goods here until they can fit up or import the machinery for the manufacture on the spot. It is in this way that a temporary exportation from this country, of certain novel kinds of mechanism, is from time to time produced. But it is only temporary, because Europeans have the same appliances that we possess, while they pay less for wages and living than the manufacturers of this country. It is therefore impossible at present greatly to extend the exportation of American machinery. But if the prices of coal and iron shall continue to rise in Europe, it will then be possible for the United States to do a great mechanical trade with England and the continent.

CONCRETE FOR BUILDING PURPOSES.

An esteemed correspondent writing from Indianaoplis says: "I would like to know something about the construction and durability of cement gravel houses, and I write you for the information. Are they durable? What is the cost of building as compared with a like quality of brick or frame? Is it better to make foundation of brick or stone instead of cement? We have an excellent gravel bed for foundation."

In reply to our correspondent, we would say that the durability of concrete walls depends upon the quality of the ingredients. If the sand and the cement are of good quality, the walls will be quite as durable as stone walls. The walls of some of the ancient buildings of Rome, such as the Coliseum and the Baths of Caracalla, were built partly with concrete and partly with stone, and the concrete remains as durable as the stone. Many buildings with concrete walls have been erected in the United States; and so far as they

have been constructed with care, they appear well. Some buildings erected with building blocks or large bricks made of lime and sand under pressure have proved worthless.

To erect walls of concrete, the essential thing is to secure good mortar in which to imbed the gravel and larger pieces of stone. The mortar should be made of cement and sand (the cement fresh from the kiln and tested as to its setting quality); and the sand should be sharp quartz perfectly clean and free from loam.

Clean sand will not soil the hand. Sand may be freed from loam by washing. Place the sand in a shallow box 4 or 6 feet square, or larger, and flood with water, stirring the sand with a hoe. The loam will discolor the water and flow off with it. Keep stirring and flooding until the water runs off colorless. The sand is then clean.

Combine the dry cement with the sand in the proportion of one measure of cement to two of sand, thoroughly mix them dry, and just before use add water enough to make a thin paste. To this paste add the gravel and small stones, and stir them about until the surfaces of the gravel and stones are all covered with the paste, taking care that no more of the stone filling is added than the paste will coat. The mass, thoroughly compounded, should be immediately carried and deposited within the boxes upon the wall, and the boxes allowed to remain until the concrete is set. The time for setting will depend upon the quality of the cement, but ought not to exceed from 6 to 12 hours. The proportions between the cement and sand should vary, in accordance with the quality of the sand, from two to five measures of sand to one of cement. There should be enough cement to coat the sand on all its surfaces.

Concrete is quite as good as stone for the foundations. The quantity of gravel used will depend upon its coarseness, usually about twice as much gravel as sand. It is better that the gravel be of various sizes. The resultant concrete will measure no more than the gravel measures; the cement and sand are lost in the interstices between the stones. The cost of concrete will depend upon the cost of the materials of which it is composed and the labor. These vary in different localities, but may be estimated from the above data.

MADDER, VEGETABLE AND CHEMICAL.

The ordinary red pigments used in dyeing and calico printing have heretofore been derived from the roots of the madder plant, cultivated in Turkey, France, and to some extent in the United States. By steeping and fermentation the roots are made to yield fine needle crystals of yellow color, termed alizarine. If this substance is administered to animals, certain peculiar results are alleged to follow. For example, the bones of pigs are made red; a red circle is produced around the iris of the eyes of pigeons; cows give reddish milk and the cream yields red tinted butter. It has been suggested that ladies who wish for red hair should swallow alizarine. But then it might also make their teeth red, and perhaps over-tinge their complexions.

The cultivation of madder is very extensive, thousands of acres of land being given up to the crops, while the preparation of the root forms an important branch of industry. But the onward march of chemical discovery is likely to effect a change, and there is every probability that the occupation of the madder root grubber will soon be gone.

Alizarine, one of the coloring principles of madder, is now extensively produced by chemical means from coal. When bituminous coal is distilled in the production of illuminating gas, coal tar comes over with the gas.

This tar, when again distilled, yields a variety of substances, which are separated by the application of different degrees of heat. For example, the light, brilliant-looking naphtha liquid known as benzole first comes over from the tar. If to this benzole nitric acid is added, the product is nitro-benzole, a peculiar red oil, having the odor of bitter almonds. Distil this with water, acetic acid and iron filings, and aniline is produced. The aniline is in turn refined, treated with preparations of arsenic and other substances, the results being the production of the magnificent series of colors known as aniline dyes. Among the last substances distilled over from coal tar is anthracene, consisting, when pure, of bluish-white crystals. A tun of coal yields about one pound of anthracene. The latter, when treated with manganese, sulphuric acid, bromine, potash and hydrochloric acid, yields alizarine, identical in nearly all of its properties with the alizarine of madder roots.

By the mixture of carbon and hydrogen in certain proportions, the chemists have artificially produced anthracene, from which, in turn, alizarine may be evolved. Thus are the productions of the vegetable world imitated in the laboratory.

The discovery of alizarine in coal tar is credited to Graebe and Liebermann, German chemists, in 1868, since which time the processes for its production, on a commercial scale, have been successfully and extensively introduced. In Germany there are at present some twelve large manufactories of alizarine from coal tar, and the product, which is rapidly increasing, is now 22,000 hundredweight per annum, valued at $2,000,000.

Germany also supplies the world with aniline colors.

THE STAR SHOWER OF AUGUST 10.

We hope that our readers will not forget to look for this well known star shower, which appears to radiate from the constellation *Perseus*. On the 10th of August, the earth annually passes for about six hours through the belt of meteors which originally formed a part of comet III, 1862, returning once in a hundred and twenty years.

It is estimated that four hundred million shooting stars daily traverse the atmosphere, adding, perhaps, a thousand pounds to the earth's mass. These bodies move in space as dust clouds or nebulæ. When they come within the sun's attraction, the nebula assumes the form of a comet, under the influence of gravitation, and the comet is gradually drawn out by the same force into a ring revolving round the sun in the same orbit and periodic time as the original comet.

The star showers bring us specimens from the remotest realms of space; sometimes meteoric irons, containing occluded hydrogen from the atmosphere in which the fragment was last heated; at other times, meteoric stones containing hydrocarbons and phosphorus.

Aerolites contain oxygen, nitrogen, phosphorus, sulphur, carbon, silicon, hydrogen, copper, iron, cobalt, nickel, manganese, magnesium, aluminum, etc., probably most if not all of the terrestrial elements. Their weight is generally inconsiderable, but varies up to fifteen tuns. The loud report which attends the fall of the larger masses is caused by the air rushing into the vacuum in rear of the projectile when it reaches our atmosphere.

PROPERTIES OF SATURATED STEAM.

We have recently received an inquiry, from one of our correspondents, as to the boiling point of water at different pressures; and we propose, in this article, to give the formula asked for, with several others. Nearly all the properties of saturated steam have been carefully investigated by M. Régnault, of France, and tables have been prepared from his researches. These tables, in very convenient form, adapted to English measures, may be found in Charles T. Porter's work on the steam engine indicator—a book which contains much useful information, in addition. The formulas by which these tables are computed are somewhat complex, but we will endeavor to render them as simple as possible, and we trust that our readers will find them both interesting and valuable.

In a previous article, we have spoken of the absolute zero, or theoretical temperature at which all heat motion ceases. This temperature is used in making calculations of the pressure of steam, because water forms vapor of appreciable tension at all temperatures except that of absolute zero. We will use the same notation in all the formulas, and will first explain the meaning of the terms: T = temperature of the steam as shown by the thermometer, on Fahrenheit's scale. t = absolute temperature of the steam = 461·2° + T, because the absolute zero is fixed by theory at 461·2° below 0° Fahrenheit. P = pressure of steam, in pounds, per square inch. p = pressure of steam in pounds per square foot = P × 144. L = units of latent heat per pound of steam at the pressure P. When water is converted into steam, a portion of the heat applied is used in the work done in producing a change of state. This heat is not indicated by the thermometer, and is called latent heat. A unit of heat is the number of degrees necessary to raise the temperature of a pound of water one degree. l = units of latent heat, in foot pounds of energy, per cubic foot of space occupied by the steam at the pressure P. The amount of heat that will raise the temperature of a pound of water one degree, if converted into work, will raise a pound weight through a distance of 772 feet; conversely, to find the units of heat that will be produced by the conversion of 1 foot pounds of energy, this quantity must be divided by 772. W = weight of cubic foot of steam at pressure P. V = number of cubic feet occupied by a pound of steam at pressure P.

We will now give the formulas, working out an example for each case.

1. To find the boiling point of water at a given pressure,

$$t = 1 \div \left(\sqrt{\frac{8{\cdot}2591 - \log.p}{396944} + \frac{(2731{\cdot}62)^2}{4 \times (396944)^2}} - \frac{2731{\cdot}62}{2 \times 396944} \right)$$

Or, to find the absolute temperature of the boiling point at any pressure, subtract the logarithm of the pressure per square foot from 8·2591, divide the difference by 396944, add the quotient of the square of 2731·62 divided by four times the square of 396944, take the square root of the sum, subtract the quotient of 2731·62 divided by twice 396944, and divide unity by the quantity so obtained.

EXAMPLE.—P = 30, p = 30 × 144 = 4320,

$$t = 1 \div \left(\sqrt{\frac{8{\cdot}2591 - \log.4320}{396944} + \frac{(2731{\cdot}62)^2}{4 \times (396944)^2}} - \frac{2731{\cdot}62}{2 \times 396944} \right)$$

= 711°.6.

Then the temperature of the boiling point, on Fahrenheit's scale, is 711·6° − 461·2° = 250·4°.

2. To find the pressure of steam, knowing the boiling point,

$$\log.p = 8{\cdot}2591 - \frac{2731{\cdot}62}{t} - \frac{396944}{t^2}.$$

Or, the logarithm of the pressure per square foot for the boiling point whose absolute temperature is t, is found by subtracting from 8·2591 the quotient of 2731·62 divided by the absolute temperature of the boiling point, and the quotient of 396944 divided by the square of the absolute temperature.

EXAMPLE.—Temperature of the steam by thermometer = 265·8°. Absolute temperature = 265·8° + 461·2° = 727°.

$$\log.\ p = 8{\cdot}2591 - \frac{2731{\cdot}62}{727} - \frac{396944}{(727)^2} = 3{\cdot}75077.$$

From a logarithmic table, we determine p = 5633·4, and the pressure per square inch = 5633·4 ÷ 144 = 39·12 pounds.

3. To find the latent heat of evaporation:

L = 1091·7 − 0·695 (T − 32°) − 0·000000103 (T − 39·1°.)

Translating this expression, we have, the number of units of latent heat in steam at the temperature T is found by subtracting from 1091·7, 0·695 times the difference between the temperature and 32°, and 0·000000103 times the difference between the temperature and 39·1°.

EXAMPLE.—T = 321°, L = 1091·7 − 0·695 (321° − 32°) − 0·000000103 (321° − 39·1°) = 890·8.

4. To find the latent heat of evaporation in foot pounds of energy, per cubic foot of space:

$$l = p\left(\frac{2731{\cdot}62}{t} + \frac{2 \times 396944}{t^2}\right) \times 2{\cdot}3026,$$

which may be thus expressed: To find the latent heat of evaporation in foot pounds of energy, per cubic foot of space, add the quotient of 2731·62 divided by the absolute temperature, to the quotient of twice 396944 divided by the square of the absolute temperature, and multiply the same by the product of the pressure per square foot multiplied by 2·3026.

EXAMPLE.—P = 79·03, p = 79·03 × 144 = 11380. The temperature corresponding to this pressure is T = 311°, t = 311° + 461·2° = 772·2°, l = 11380 × $\left(\frac{2731{\cdot}62}{772{\cdot}2} + \frac{2 \times 396944}{(772{\cdot}2)^2}\right)$ × 2·3026 = 127500.

5. To find the weight of a cubic foot at the pressure P.

Were steam a perfect gas, the pressure would vary inversely as the volume, and the weight of a cubic foot could be readily ascertained. Experimental researches in the density of steam have not been sufficiently extended to enable a relation to be established between the pressure and volume. Approximately, the pressure varies inversely as the tenth power of the ninth root of the volume. More exactly, the weight of a cubic foot of steam can be obtained, indirectly, from the latent heat, and we will give the formula for its computation in this way: l ÷ 772 = latent heat, in heat units, of a cubic foot of steam at pressure P.

$\frac{1}{772 \times W}$ = units of latent heat in a pound of steam at pressure P. But according to our notation, this is equal to L. Hence, $\frac{1}{772 \times W} = L$. Solving this equation for W we obtain, $W = \frac{1}{772 \times L}$.

EXAMPLE.—L = 916·6, l = 88740, $W = \frac{88740}{772 \times 916{\cdot}6} = {\cdot}1579$ pounds.

6. To find the space in cubic feet occupied by a pound of steam at any pressure.

$V = \frac{1}{W}$. Or, to find the volume of a pound of steam at the pressure P, divide one by the weight of a cubic foot.

EXAMPLE.—W = ·08285, $V = \frac{1}{{\cdot}08285} = 12{\cdot}07$ cubic feet. It will be observed that these formulas are progressive, the results obtained from one being needed for substitution in the next.

7. To find the hight of a column of mercury at a temperature of 32° Fahrenheit, corresponding to a given pressure per square inch.

RULE: Multiply the pressure by 2·037.

EXAMPLE.—For 30 pounds pressure, the hight of the mercury must be 30 × 2·037 = 61·11 inches.

Mercury expands 0·0010085 of its volume for every degree of increased temperature. Hence, for any temperature other than 32°, a correction must be applied.

EXAMPLE.—Suppose that, in the preceding example, the temperature of the mercury had been 80°. Then the expansion would be 61·11 × 0·0010085 × (80—32) = 2·95 inches, and the hight of the column of mercury corresponding to 30 pounds pressure would be 61·11 + 2·95 = 64·06 inches.

The results obtained in the preceding formulæ are for the case in which water boils in the open air at 212° Fahrenheit, the barometer standing at 29·913 inches.

SCIENTIFIC AND PRACTICAL INFORMATION.

COATING FABRICS WITH TIN.

According to Richard Jacobsen, linen and cotton goods may be covered with a thick and flexible film of tin, which gives to them a very silvery appearance. The method to be adopted is as follows: Ordinary commercial zinc dust is rubbed up with a solution of egg albumen to a thin paste, and applied to the goods with a brush or roller. When dry, this coating is fixed by coagulating the albumen with steam, and the fabric is then placed in a solution of bichloride of tin. The tin is precipitated upon the zinc in a very finely divided state. The stuff is then washed with water, and, after drying, put through the finishing machine, when the tin comes out with a brilliant luster. A very beautiful effect may be produced by printing different designs in this way, or applying the material with stencil plates, and its use may be extended to decorations. It is even possible that this strong, elegant, and waterproof material may yet replace tin foil for packing certain articles.

PHOSPHO-TUNGSTIC ACID.

This acid was first discovered by Scheibler. Its crystalline form depends upon the manner of its preparation, being either beautiful, regular octahedra, with strong refractive power for light and the sparkle of a diamond, very soluble in water and efflorescent in air; or it occurs in cubical crystals. Both forms of acid have a property, which is possessed also by the phospho-molybdic acid, of precipitating the natural organic bases from acid solutions, no matter how dilute. A clearly perceptible precipitate is formed in a solution of 1 part strychnia in 200,000 of water, while 1 part quinine is precipitated in 100,000 of solution. The precipitate when first formed is very bulky, but, if left a short time in the acid solution, it becomes thicker and may be filtered out and washed.

Phospho-tungstic acid is very important in toxicology and in judicial chemistry for detecting the alkaloids, since it can be safely trusted for separating them from large quantities of the liquid, and thus preparing them for further tests. It can also be used with advantage for the preparation of separate alkaloids.

A NEW APPLICATION OF SPECTRUM ANALYSIS.

We published some months since a brief notice of a lecture by President Morton on "Fluorescence," in which allusion was made to some very curious discoveries which owe their origin to an application of the spectroscope in connection with that peculiar action of light. This subject, however, possesses so much general interest that we have thought well to prepare, from various papers published by Dr. Morton, an abstract of the most important points. Assuming that, from the lecture above mentioned, our readers have been enlightened as to the meaning of fluorescence, we pass at once to the special application in hand.

As early as 1852, Professor Stokes, the real discoverer of fluorescence, had observed that, when the light emitted by certain fluorescing salts of uranium was examined with a prism, it gave a spectrum consisting of equidistant, brightly colored, shaded bands. He also observed that, in the case of two salts, the nitrate and the acetate, these bands occupied different positions. The spectroscope had not, however, at that time been invented, and no attempt at accurate measurement of these bands was made.

In 1859, the famous French physicist Edmond Becquérel, in the course of his elaborate investigation of phosphorescence, examined in a casual manner, with a spectroscope of simple form, a few of the uranium salts, together with other materials, and he gives two spectra as representing the appearances presented by these, one standing for nitrate of uranium and canary glass, the other for potassio-uranic fluoride, uranic chloride and the mineral uranite. He also figured the fluorescent spectrum of what he describes as "a hydrocarbon of the color of the uranium salts, obtained from Fritsche," who was the first to study anthracene and some of its kindred products.

So matters stood when, more than a year since, President Morton, while engaged in a general study of fluorescent phenomena, received from Professor E. N. Horsford a specimen of the last run of the still in certain petroleum refineries, which was remarkable for its strong fluorescence. A study of this material led to the elimination from it of a crystalline solid body, of a rich yellow color, and possessing the property of fluorescence in a degree quite unparalleled, and showing with the spectroscope a very characteristic spectrum. To this body President Morton has given the name "thallene," in allusion to its brilliant green fluorescence. Observing a striking resemblance between the thallene in a certain stage of its preparation and commercial anthracene, he was led to a similar special study of that body, which resulted in proving, among other things, that the hydrocarbon described by Becquérel must have been anthracene, but that the spectrum represented by him, and found with all ordinary specimens of anthracene, was due to the presence of a trace of another substance, in all probability identical with that described by Fritsche as chrysogen.

Fig. 1. FLUORESCENCE.—[From a Painting by James Hamilton.]

These and other results were mentioned in a paper read before the American Institute, March 29, 1872, and published in their transactions, 1871-2, page 910. After searching in various directions for a further supply of the thallene material, Dr. Morton detected it in some petroleum product brought by Dr. G. F. Barker, from the works of Mr. John Truax, in Pittsburgh; and from the last named gentleman, a large amount was obtained, with which a thorough study of its physical properties has been carried on.

For full details of these we must refer our readers to the *American Chemist* and other purely technical journals.

The wonderfully intense character of fluorescent action in this substance led Dr. Morton to apply it in a very striking manner during a lecture delivered by him in the Academy of Music, of Philadelphia; and, on this occasion, it so impressed Mr. James Hamilton, the eminent artist, that he made it the subject of a large oil painting, from which our artist has developed the accompanying engraving (Fig. 1). Here we see the stage set to represent a cavern with its visitas, columns of rock, and pendent stalactites, and, in the foreground, the lecturer with his electric lantern, from which issues a jet of faint blue light, whose rays fall upon a group of figures bearing banners, whose devices are painted with the new fluorescent bodies, and which, invisible in the ordinary light, blaze out as with colored fires when thus illuminated.

Having seen this substance ourselves, we were not surprised to hear that Professor Tyndall, when he for the first time witnessed its effect (during one of his own lectures, with a specimen which Dr. Morton had sent him), expressed his surprise and delight in a manner as emphatic as it was unpremeditated.

While work on the abovementioned substances was in progress, Dr. Morton naturally turned to account the same methods of examination with other bodies, and among them to the uranium salts; and in this work he was so fortunate as to secure the co-operation of Dr. H. C. Bolton, an able chemist, who had distinguished himself, among other things, by his investigations upon certain of these very uranium salts. Working together in this research, Dr. Morton conducting the physical and Dr. Bolton the chemical part of the labor, these gentlemen have attained results which promise to be of no little value, both in practical analysis and in the elucidation of obscure theoretical points.

It should be mentioned that, after this work of Drs. Morton and Bolton had made considerable progress, a new research by Becquérel, in the same direction, was published in the *Annales de Chemie et de Physique*. This, however, is so very brief and imperfect, as compared with the work of the abovementioned gentlemen, that, while of course depriving them of any claim to priority in the field, it in no respect detracts from the substantial value and importance of what they have done, which is in only a few points anticipated by anything in Becquérel's memoir.

The methods of observation, employed by Dr. Morton in all these observations, do not differ in any essential particular from those before used by Stokes, Becquérel, and others, but only in perfection of detail, and the accuracy thereby secured; and they may be briefly described as follows: The *porte lumiere*, A, Fig. 2, being attached to the shutter of a window facing toward the south, a beam of sunlight was thrown by it horizontally into the room, and concentrated by a lens of twelve inch focus placed at B. At C was placed an apparatus (Fig. 3) consisting of a circular horizontal table, adjustable up and down on a vertical rod, and turning with a click. Around the circumference of this table were eight little stalls, capable of holding test tubes or specimen bottles. By this means eight different specimens could be rapidly compared, each in succession, by the action of the click being brought into an identical position with reference to the exciting light and the spectroscope. This whole apparatus was so placed that an image of the sun was formed on the tube or bottle nearest to the lens, B. A glass tank, filled with a strong solution of ammonio cupric sulphate was placed between B and C, and to this was sometimes added a plate of violet glass. The fluorescent light emittted by the substance in C was examined by the spectroscope D.

For examining absorption bands everything else remained the same, except that the spectroscope was turned round into the position indicated at E in Fig. 4, and the stand for specimens was replaced by a plane table, D, on which the substance to be studied was supported, either in a cell of glass or in bottles. To study the optical behaviour of these substances under the influence of heat, a little oven, such as is represented in Fig. 5, was employed. In this, the substance to be examined was either placed in a small bottle, at E, surrounding the bulb of a thermometer, or between flat strips of glass. The openings through the oven were covered by a piece of thin mica kept in place by the rings, G G.

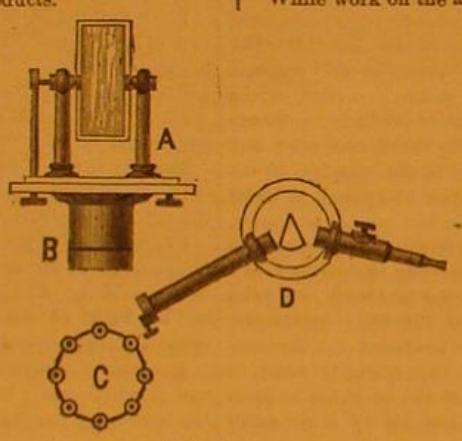


Fig. 2.

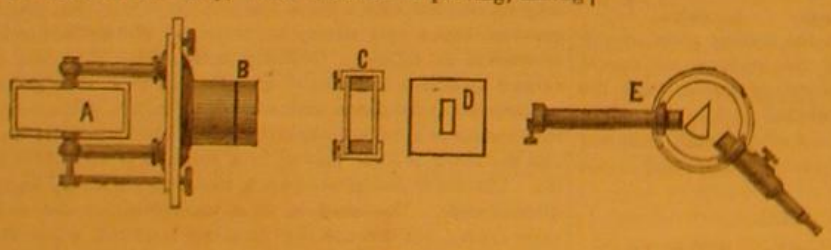


Fig. 4.

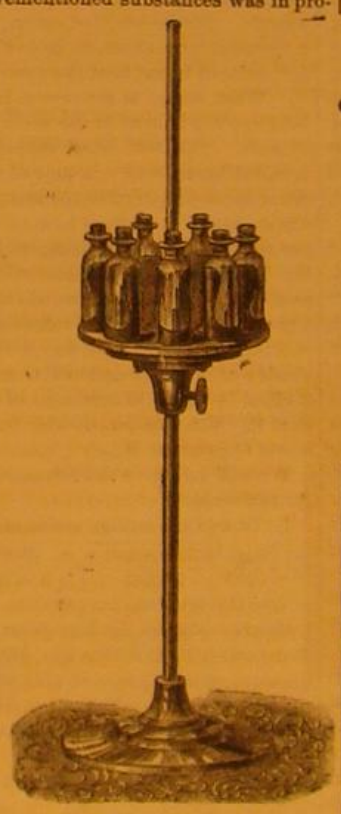


Fig. 3.

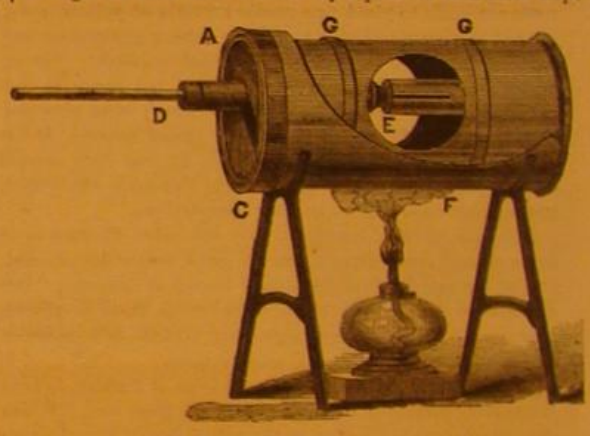


Fig. 5.

Many hundreds of specimens of uranium salts, in different states and in solution, have been examined, and numberless experiments on the effects of heat have been made, with the development already of many curious results and the promise of others for the future.

Thus, in the first place, it appeared that while there were certain points of likeness, running through the spectra of many classes of salts, which are useful as a means of recognizing their relation, yet that, either by some obvious peculiarity of character or position, many may be at once recognized and identified, while others, by their various behavior on drying or heating, may be as certainly distinguished. It thus happens that the presence of impurities in some of the commercial uranium salts were recognized and identified without so much as opening the bottles which contained them.

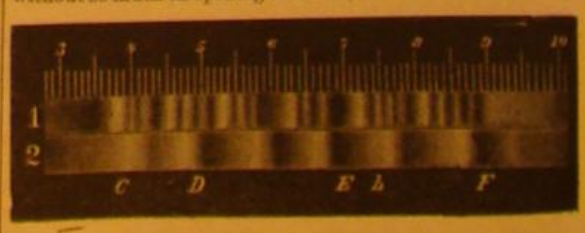


Fig. 6.

Thus Fig. 6 represents, in 1, the spectrum of the potassio-uranic oxychloride, and, in 2, that of the uranic oxychloride.

In Fig. 7, 1 represents the spectrum of the normal uranic acetate, 2 that of the same salt deprived of its constitutional water, and 3 that of the sodio-uranic acetate.

But what is far more interesting in a scientific point of view, is the fact that a change in composition or the formation of a new compound may thus be optically recognized, and the actual progress or development watched, step by step. This can be best illustrated by a relation of the instance in which this method was first applied.

Having heated for a short time some of the ammonio-sulphate of uranium, Dr. Morton noticed that, in place of its

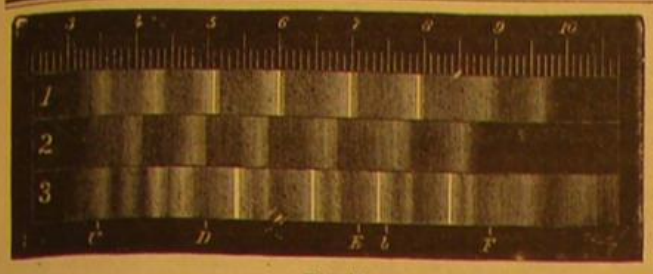


Fig. 7.

usual spectrum, shown at 1 of Fig. 5, it showed, as in 2 of Fig. 8, one in which, to the former bands, were added as many more, each located a little further down in the spectrum than its companion in the original spectrum. Now it was evident that water was being driven off from the salt in the process of heating, and therefore natural to suppose that these new lines belonged to a spectrum of the anhydrous salt which was being formed and mixing with the other. By continuing the heat until no more vapor escaped, the body was found to yield the spectrum shown in 3 of Fig. 6, which was thus probably the spectrum of the anhydrous salt; and, in fact, the salt in this state, being submitted to Dr. Bolton for analysis, proved to be the anhydrous ammonio-sulphate of uranium. But this was not all. On further heating to a

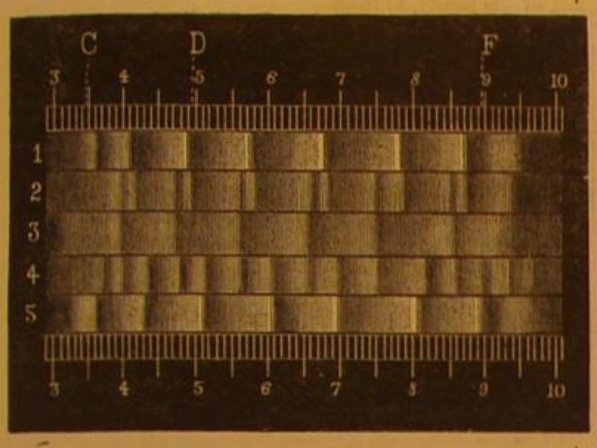


Fig. 8.

temperature approaching redness, the spectrum changed to the appearance shown at 4 of Fig. 6; fumes, evidently consisting of ammonium sulphate, being given off; and on continuing the heat until these fumes were no longer evolved, the spectrum assumed the character shown in 5 of Fig. 6. This material, again being submitted to Dr. Bolton, and analyzed by him, proved to be an ammonio-di-uranic sulphate, a salt not before known to chemistry.

Treatment, more or less parallel to the above, has developed a number of similar facts, and has shown that some of the spectra observed by Becquérel are not those of he salts named, but of mixtures of various hydrates, or even, in some cases, of different salts.

Thus, for example, the annexed engraving (Fig. 9) represents four distinct spectra, shown by perfectly pure sodio-

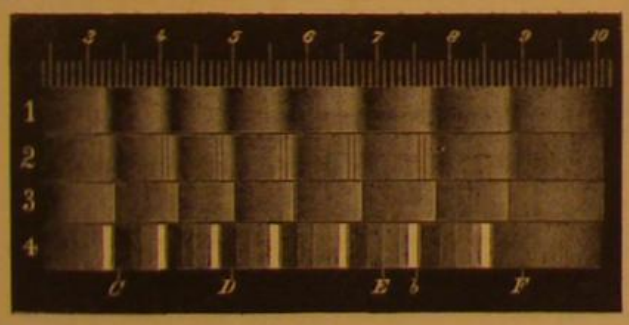


Fig. 9.

uranic sulphate. No. 1 is the spectrum of the normal salt, holding, in combination, five equivalents of water; 2 represents a mixture which was one of the first observed, and caused no little perplexity; it is now known, however, to owe its complex character to the overlapping spectra of several different hydrates. No. 3 is the spectrum of the mono-hydrated salt, or that containing only one equivalent of water; 4 is the spectrum of the anhydrous salt, or that from which all the water has been expelled.

Again, in Fig. 10, we have, in 1, the spectrum of the nor-

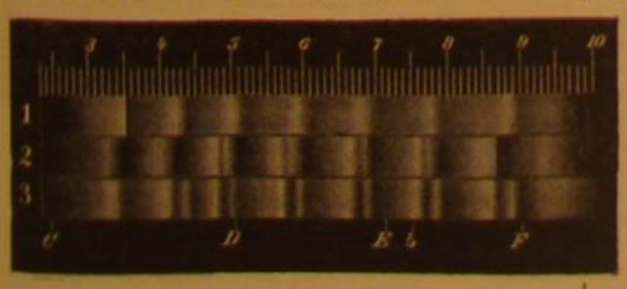


Fig. 10.

mal uranic sulphate which contains three equivalents of water; in 2, that of the mono-hydrate, while 3 is that of a mixture of the mono- and bi-hydrate into which the normal salt is apt to pass if suddenly heated, placed in a vacuum, or treated in several other ways.

Yet, again in Fig. 11, we have, in 1, the spectrum of the normal potassio-uranic sulphate, and, in 2, that of the same salt in its anhydrous condition.

One of the most remarkable developments, however, is that which has been obtained by a comparison of the absorption bands seen in various salts and their solutions; thus seventeen double acetates have been examined, and a different arrangement of these bands has been discovered in each case; but when they are dissolved in water, all are exactly alike, and are likewise identical with the solution of the simple acetate, thus seeming to prove that no double acetate exists as such in solution, but that all are reduced to the simple salt.

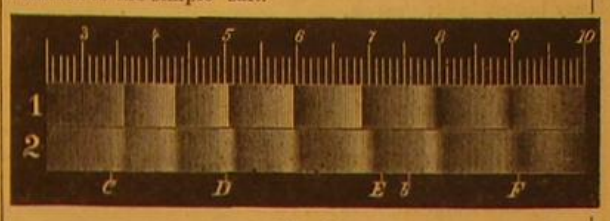


Fig. 11.

In Fig. 12, 1 represents the bands of the solid normal acetate; 2, those of the same salt when anhydrous, and 3,

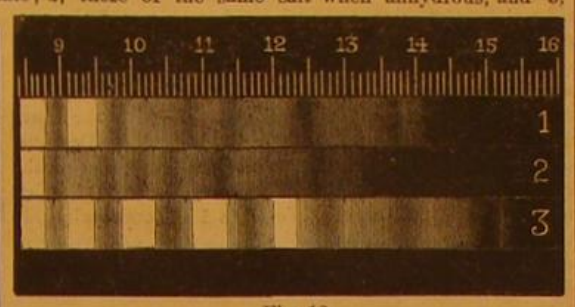


Fig. 12.

those given by a solution of the simple acetate or any of its double salts.

Another very interesting result was obtained in observing the effect of a rise in temperature upon the position of the fluorescent and absorption bands. It was found in a vast number of cases that a rise of temperature lowered the position of the bands both of absorption and fluorescence. When we remember that the heating of a tuning fork lowers its note, and that, wherever bodies change their color by heat without involving some chemical action, the tint is depressed in the spectrum, we see how this observation fits in with general theory.

There were no cases in which the displacement was opposite in direction; the exceptions were simply instances in which no displacement could be detected, and the observations were made as well with solutions as with the solid salts.

Another application of this method was to the determination of the moment at which combination in the case of double salts actually took place; and it was found that in all cases the spectrum of the simple salt changed into that of the double one only in the act of crystalization.

The effects of change of state by freezing solutions, of great pressure, and of solution in various solvents have been extensively studied; and indeed more has been done than we can well afford space to enumerate, and with results which, as we have shown, are already important and promise to be more so.

THE SHOE AND LEATHER CHRONICLE.—The already long list of contemporary journals devoted to special interests has, this week, been increased by the appearance of a well arranged and neatly printed sheet under the above title. The extent and importance of the shoe-making industry is a guaranty for its extended circulation. Mr. W. A. Van Benthuysen, of 6 Ferry street, New York city, is the editor and proprietor, who will please accept our good wishes for its success.

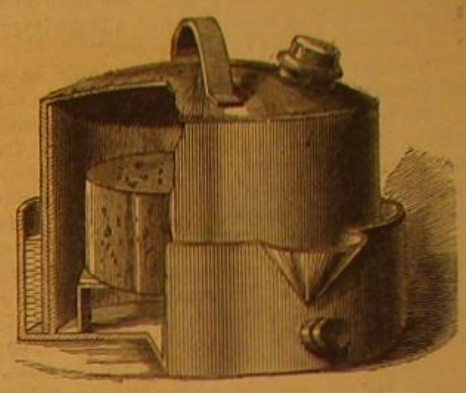
PARAFFIN GAS.—Paraffin oils are now produced at a very low price in Austria and Saxony, from peat. These oils may be used for the manufacture of illuminating gas instead of coal. The gas gives a light three times brighter than coal gas, and the apparatus for making gas from paraffin is simpler and less costly than the coal gas apparatus.

HOW TO MEASURE THE HIGHT OF TREES.—When a tree stands so that the length of its shadow can be measured, its hight may be readily ascertained as follows: Set a stick upright (let it be perpendicular by the plumb line). Measure the length of the shadow of the stick. As the length of its shadow is to the hight of the stick, so is the length of the shadow of the tree to its hight. For instance: if the stick is four feet above the ground, and its shadow is six feet in length, and the shadow of the tree is ninety feet, the hight of the tree will be sixty feet (6:4::90:60). In other words, multiply the length of the shadow of the tree by the hight of the stick, and divide by the shadow of the stick.

IN the digging of a well at Newark, N. J., the other day, the workmen struck "ile." About two barrels of good oil were pumped the first day. The owner proposes to bore deeper with proper apparatus, in the hope of finding a more abundant supply of the valuable liquid.

CHEESE SKIPPER EXTERMINATOR.

Many and varied are the devices which human ingenuity has provided for the extermination of the "creeping things of the earth." We have set forth at length the lyric effort of the inventor whose muse gushed into poesy on the inspiring theme of mechanical cockroach traps; we have alluded to the "deadly bug buster," by which the offending insects are persuaded into a hopper, placed under the influence of an anæsthetic and stabbed in the back with a pitch-



fork, or else are dosed with large quantities of laughing gas so that they meet a hilarious death in violent hysterics. Brief mention has been made of the tumbler fly trap, in which the hapless fly meets his doom in an alkaline bath; and recently, in glancing over an ancient volume of the English *Mechanics' Magazine*, we discovered a valuable recipe for poisoning bugs by a material "which they will never fail to eat while they can get it, and will as surely die; it causes them to froth at the mouth and to split in the back occasionally."

Another inventor has now joined the great army which is ceaselessly waging war upon the noxious insect tribe, and the offspring of his genius is represented in the accompanying engraving. Its object is the slaughter or, more strictly speaking, the asphyxiation of cheese skippers. The cheese is placed upon a raised grating within a circular box, the bottom of which extends beyond the sides, and is provided with a rim. The intermediate annular space is filled with water. A tightly fitting cover inclosed the entire box, its edge reaching to the bottom of the projecting flange, and is rendered airtight by the water packing. Suitable vents are arranged for obvious purposes. The unhappy mites, thus deprived of fresh air and cut off from the light of day, in the words of the patent, "all leave the cheese and drop down dead." Why they should pursue such a course, or as to the nature of the malady with which they are seized, and which invites the approach of the fell destroyer, our original researches, into the physiological constitution of the cheese skipper, are as yet not sufficiently extended to enable us accurately to determine. Suffice it that, after a period of twenty-four hours, their bodies, once so athletic and active, are senseless clay upon the bottom of the box. Mr. Caleb Green, of Osseo, Mich., patented this useful device on February 4, 1873.

IMPROVED MILK REFRIGERATOR.

This is an English invention, made by Lawrence & Co., London, who say that, by the aid of these refrigerators, the milk intended for transit, or for the making of butter or cheese, may be cooled as soon as it leaves the cow, and before any injurious change can possibly have taken place. It has long been a well known fact that milk is preserved in proportion to the rapidity with which it is cooled. Why this is so has never been satisfactorily explained, but recent scientific investigations have proved beyond a doubt that, when milk is

suddenly cooled, the infusoriæ or vital organisms, the cause of rapid decomposition, are destroyed, and the milk is consequently preserved, whereas if cooled by slow degrees, living infusoriæ will still be found in it.

By passing warm water through the refrigerator, instead of cold, the temperature of the milk may be readily raised to any degree required, which, in cold weather, is an advantage in cheese making.

The warm milk is poured into the receiver, A, whence it passes through the refrigerating box, A, in which is a coil of pipes through which cold water enters at D, discharging at E, while the cooled milk is drawn off at C.

Correspondence.

Diurnal Movement of the Earth--Is it Retarded at all?

To the Editor of the Scientific American:

In your issue of June 28, "Orthodox" claims that the two great tide waves act on the earth's surface as do brakes when applied to a revolving wheel. And he (admitting my statement that the earth is constantly revolving between two great never failing waves) asserts that "we have here an exact picture of a rotating wheel, to which a brake is applied and held in position by some external power."

Will "Orthodox" be kind enough to inform us what "external power" is pressing the tides down on the earth's surface? We have some little idea that there is an internal power forcing them up or apart from each other; for we conceive that each wave is highly charged with electricity, and is therefore repellent of the other. I would like to learn the name and origin of the "external power." If it be extra pressure on account of the extra waters, that extra pressure is destroyed by the repulsion of battery from battery or wave from wave. But even if it did exist, such pressure would not act as a brake; for the oceans of the earth, where the tides are and where they are not, do not move in opposition to the rotary movement of the earth, but are constantly and continuously moving, where not obstructed, eastwardly upon the earth's surface, the same as do the higher strata of air, far above the earth's surface. "Orthodox" talks as if the two tides were solid, frozen sheets, standing still, in a sense, and bearing and grinding hard upon the earth's surface, as she moves round between them. But this is not the case, for although the earth passes under the tides, the waters composing them constantly run before the earth, as it were; and therefore, friction, through such a cause, is impossible, absolutely impossible.

"Orthodox" supposes that "it is well known that the slow retardation of the earth's diurnal motion is an established fact in astronomy." Perhaps O. will be astonished, when I tell him that astronomy does not know, at this moment, whether the earth is retarding or the moon advancing. The latter is by far the most likely. And even if the former were the truth, still the problem has to be solved whether such retardation is the result of meteoric accumulation, of the withdrawal of matter from the bowels of the earth and piling it upon its surface, of the so called friction of the tides, of their butting against the eastern coasts of Africa and America, or of some hitherto unknown and unadvanced cause. We are perfectly willing to admit that friction, applied anywhere upon the earth's surface, will tend to stop in time the earth's diurnal motion; but we must know first about the friction, and then where and how it is applied.

Friend "Orthodox" concludes by saying: "If J. H. will station himself at the opposite celestial pole," etc. I have been there often in imagination; and among the last times I was there, I saw that upon earth there was a fierce contest going on between Old Orthodox and Young Orthodox; and I was glad to see that Young Orthodox was fast gaining the mastery. Old Orthodox had been, for thousands of years, "braking" the world, and hindering the progress of science and society by the pressure upon the world of its two mighty tide waves, ignorance and superstition; and, by this means, he (Old Orthodox) had retarded the world's progressive revolution so much that, under such pressure, the arrival of society at meridian splendor was impossible. Young Orthodox, seeing this state of things, walked boldly forward, with true scientific sledge hammer in hand; and as I see him now, he is dealing such blows upon Old Orthodox's head as will soon knock out his brains; and he is every moment lessening the pressure, relaxing the hold, and giving the world more room to revolve and rotate onward and upward to the shining day.

It was once considered "orthodox" in astronomy to tell and teach man that the sun, moon and stars—the whole universe—revolve around the earth westwardly every twenty-four hours; that God created the heaven and the earth, the sun, moon and all the stars, in six days of twenty-four hours each; that Joshua commanded the sun to stand still and it did so; that the earth was flat, and poised upon the head of a huge coiled snake; and hundreds of other things which are now proven to be entirely erroneous. And to come down to the present time: It was, a short time since, taught that the sun is moving in his orbit in "direct" movement; whereas it is now proven, beyond doubt or question, that the sun's orbital motion is retrogressive. And so it may yet be proven that the earth is not "braked" by the tides; that her diurnal motion is not hindered at all by any power; but that the moon has advanced a little in her orbit, which at least is as like truth as the other, although we cannot as yet point out how and why. But admitting that the earth is retarding: Is not such result as likely to come from a cooling and contraction of the earth (admitting that the earth is but little more than the bones and sinews of some old comet, or the extinguishing embers of an old worn out sun) as from tidal friction, meteoric gatherings, material extractions and heapings, or any other hypothetical cause hitherto offered or assigned?

If the earth be retarding, this last is the most likely to be the cause. But we conclude that there is evidence enough elsewhere to prove satisfactorily that the moon has advanced, and will advance; and so settle the question.

Gloucester, N. J. JOHN HEPBURN.

The Patent Right Question.

To the Editor of the Scientific American:

In expressing my views in regard to the first inquiry of the Secretary of State, I would consider the question of expediency, and the justice of the expedient. This question was agitated in England forty-three years ago, when it was proposed to abolish the system of patent rights; and, instead of being abolished, the patent laws were made more liberal. I hope that a similar effect may follow the investigations by the coming International Patent Congress, to be held in Vienna.

The evidence before the Select Committee of the House of Commons, in 1830, proves that many of the most useful inventions would never have been prosecuted to public advantage if they had not originally been worked under a monopoly; and it may be safely asserted that if inventors had never been encouraged in their labors by the prospect of a reward, proportionate to their success, we should be a century behind in civilization.

It is stated, in the course of the testimony, that Watt's invention and the perfection he gave to it during the operation of this act of Parliament has proved of more value to the nation than can be calculated; probably as much as the inventions of Lord Dudley for smelting iron by pit coal, in 1619, or as those of Hargrave, Arkwright, and Crompton, for spinning machinery, about the same date as Mr. Watt's. Dudley and Hargrave were not encouraged, but were persecuted, and their works destroyed by mobs; after Dudley's death, his process lay dormant during a century, probably for want of support to him. These great inventions have had a close connection, and each one has promoted the progress of the other very greatly.

The steam engine is an invention from which the nation has derived immense wealth during the last century, and increasing means of wealth for the future. After the enunciation of the principle of action had been made by De Caus, in 1615, and by Papin, in 1690, the real inventors of the engine have been: Savary in 1698, Newcomen in 1713, Watt in 1769, Trevethick in 1802, Woolf in 1804, and Fulton, in America, in 1807. Of these Watt is the only one among us who has derived any adequate advantage or recompense for his labors. Woolf's failure of a recompense was entirely owing to the want of protection by an extension of his term, for his engines came into general use in Cornwall soon after the expiration of his patent, in place of Watt's engines, and with such great advantage in economizing fuel that Mr. Woolf would have been amply recompensed if his term had been made as long as Mr. Watt's was.

I think that the quotations above referred to are more than sufficient to settle the question of expediency in the adoption of a liberal policy toward inventors. If the principles of justice only were taken into consideration, those who devote their time and energies to the study of new improvements would be entitled to a compensation for their labors and expenses even in case of failure, and in case of success they would be entitled to a recompense proportionate only to the labor, ingenuity and expense they have bestowed upon their invention. But as the rights of individuals are subordinate to the interests of the community, it becomes expedient to encourage men to study improvements by the prospect of a future reward, adequate, not to their labors or expenses, but to the usefulness, to the value, of their inventions. The grant of a patent, in certain cases, may not repay the actual outlay of the inventor; in other cases it may prove an extravagant reward when its value is compared with the origin of the invention. I can cite an instance of a patent, originated in a dream, being sold afterward for thirty-six thousand pounds sterling. The inventor in this case received a reward to which he had no claim on the grounds of justice, while Hargrave, Arkwright, Crompton, Woolf and many others derived no profit from their inventions, although they obtained patents from their government.

A monopoly, whether held by the State or by private individuals, being, in any case, an infringement of equal rights, is contrary to justice; therefore the grant of exclusive property, even for a limited period, of a new improvement to the inventor cannot be considered as an equitable means of recompense. LAURENS E. DE WARU.

Baltimore, Md.

To the Editor of the Scientific American:

I cannot drop this question where your reply to my former letter leaves it; for I am even more assured that inventors have a right which you do not recognize. It is a personal, individual title, which is superior to any claims of society, and one of the many for the protection of which society is organized: the same inherent, sacred and inviolable right which a parent has to the possession of his children. The government which does not recognize this is of a necessity weak and unstable, because it has not the full support of the individual. The same law of justice which applies to the one has equal force for the other; hence, it is as much the duty of the State to support the individual in the maintenance of those rights as *vice versa*. And I have yet to learn that the State can take from me either my property or liberty without, in the one case, rendering an equivalent, and, in the other, except as an act of self preservation. If my land is wanted, damages and benefits are assessed, and I am recompensed; if my liberty, because the protection of public and individual rights demand it; if my life, because I have forfeited that which I, as one member of society, was bound to maintain; but the condition which elicits forfeiture, according to your theory, is that in which every member of society exists, thus assuring him of no security except as the whim of society may direct. This is nothing more nor less than despotism, and is contrary to the spirit and principle of a government which is preëminently "from the people, by the people, and for the people."

It is of course expedient for the State to offer premiums for inventions, discoveries, improvements, etc.; but I certainly do not understand that it can, by any "law of justice or natural right," appropriate to its own use an invention until certain conditions are fulfilled. If it could, civil government would be a failure, and progress would be retrograde. Now, although an invention is, in one sense, an offspring, it assumes the character of transferable property, which makes it marketable, and its price is the exclusive ownership and consequent enjoyment of its benefits for a term of years. Hence my reason for regarding a patent simply as an official statement to the world that the inventor is the sole owner, and that it is, or should be, subject to the laws which govern other property until the term of years has expired, when it then belongs to the State by virtue of the compact entered into between the State and inventor, at the time when the patent was issued. In the end, it amounts to the same thing as if it originally belonged to the State, and its monopoly by the inventor was tolerated for a season, eventually to be seized by the State, as you say; but it is degrading the office of the inventor if we say "it belongs to us; you found it, but it is not yours." For if the Giver of all has given to him light which He has not to others, it is manifestly his by an inalienable right until such time as he shall make mankind the recipient of what it is in no wise the claimant; thus following out the law that every man must, by the exercise of his own abilities, first provide for himself, and after that comes the privilege and duty of giving, of his plenty, to those who are less fortunate than himself. J. E. WILSON.

Bridgeport, Conn.

To the Editor of the Scientific American:

It seems to me that it would be a lamentable thing for inventors to accept what you state in reply to the questions asked by the State Department, on pages 7 and 8 of your current volume. A patent is a private monopoly just as any other species of property is, and it is surely a disguised form of communism to speak of it as a tyranny and an infringement of equal rights. Inventors are comparatively few and poor, and it is easy to be blinded to the truth in regard to their rights; but if they were a large and wealthy class, such as the manufacturers and other classes of wealth-creators among us, the very assertion that their products are by natural right the property of their fellow men, without compensation, would refute itself.

Of course every man is "bound to contribute his best powers of mind and body to promote the common welfare;" but that does not abrogate his individual right to the property he may acquire while doing so. It is, in fact, the strongest guarantee that he shall be protected in its enjoyment. Society is the offspring of individual compromise; and, in consideration of its protection to us, we give over to it the control of ourselves and our property, so much as may be necessary for the mutual benefit of all.

You say that "patents are granted upon the ground of expediency, not of justice;" but I am sure that the official patent is only the authorized public evidence of an invention, and that the right to the invention existed before the public issue, which is only the guaranty. Therefore it seems to me that the converse is true, that patents should be granted upon the ground of justice, and that governments after a time (with the consent of the patentee, given in the fact of application) do not resume but, upon the ground of expediency or necessity, seize upon the invention for the free use of all. The supposed discoverer of bread should, therefore, not have had a monopoly of it to the detriment of all. His right existed, but necessity compelled the State to take possession, that is, to refuse to protect. So it is with patents; when the invention is made, it, by right, belongs to the inventor, and it can only be taken away by the sovereign power of the State, exercised for the protection of its citizens. If it would benefit the nation to exercise this power, let it be done, and let the patent laws be repealed, so that all may comprehend the matter; but in the name of human progress, do not put our noble army of inventors in the position of suppliants for favor at the expense of justice and the rights of their fellow men.

The view advocated by you is held by many; but it is surely wrong, and I hope soon to see the day when the SCIENTIFIC AMERICAN will take its place, as the mouthpiece of American inventors, upon the side to which natural justice, material prosperity and private interest inevitably lead. I have written this article because I sincerely feel that this heresy, as I believe it to be, must be met, or it will fasten itself upon legislation to the blight of the spirit of invention at home, and to its repression, where it is less able to speak for itself, abroad. J. W. HEYSINGER.

Philadelphia, Pa.

Hatching from Cold Eggs.

To the Editor of the Scientific American:

Having taken interest in the articles published in your paper on "The Egg," particularly in a communication signed I. H. P. in your number of June 14, in which the writer supposes that the eggs, which were cold for four hours, would hatch, I cannot refrain from relating an incident, which occurred under my immediate notice, which I think is much more remarkable than the one before mentioned.

A hen having left her nest for two days and a night, after setting within two or three days of the time of hatching, and the eggs being perfectly cold, out of curiosity I determined to try an experiment. I removed them to a garret room, which was very hot, the thermometer in the coolest part of the house being at the time 95° Fah. On the third day from the time the eggs were left by the hen, they hatched by themselves, and the chickens are now running about the yard quite strong and hearty. I would like to know if any one ever met with such an incident. H. E. H.

THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 4.

VIENNA WELT-AUSSTELLUNG, JUNE, 1873.

On arriving in Vienna, after passing the *douane*, the stranger finds himself confronted by a most important problem, namely, to determine where he shall find accommodation during his stay. Experience teaches that a week's notice may be insufficient to secure rooms at an hotel; and, although we had taken this precaution when in London, we were compelled to drive from one hotel to another until we finally found refuge in a queerly arranged old building, whose lofty and once finely decorated rooms had probably been the scene of many interesting events in earlier days. The oddly caparisoned bedstead in our sleeping room, the great and ancient porcelain stove towering up in one corner, the antique furniture, and the absence of all modern improvements, indicated that the wealth of the family which had erected this pile of buildings had long since taken to itself wings. Neither the place nor the price suited us, and we moved into one of the modern hotels (of which a dozen or more have been recently erected in Vienna) at the earliest possible moment. After becoming fairly settled in our new quarters, and recovering somewhat from the fatigue of the journey, a visit was made to

THE WELT-AUSTELLUNG.

As we rode up the central avenue of the Prater, as the Viennese call the noble park in which the exhibition is located, we caught sight of the industrial palace, and, above it, the great dome of the rotunda. The first sentiment was one of disappointment, for its unusual size is, to some extent, concealed by the lack of surroundings with which to compare it, and its somewhat ungraceful shape and peculiar proportions do not aid the mind in the effort to realize that this is the largest dome in the world. Like all very large objects, it requires time and repeated visits to enable the spectator fully to realize its magnitude, and to appreciate it as a triumph of architectural construction.

The first visit to this wonderful exhibition of the products of all nations is bewildering and fatiguing in the highest degree. The visitor comes away confused and dissatisfied. He can hardly remember whether the splendid silks and satins he has seen are the product of the looms of France or China; whether the dazzling collections of gold and silver ornaments and of precious stones are exhibited by oriental or occidental nations; and even which continent excels in the exhibition of the products of the metal industries remains undetermined. Our first impression in regard to the display made by the United States was decidedly confirmed, however, by more systematic and leisurely subsequent examination. In quantity, we are far behind every civilized nation, and, even in some important departments, we are excelled by some uncivilized countries. Many of our most important and characteristic industries are entirely without representation, and those which are represented at all appear only partially and in disjointed divisions.

Other countries exhibit very complete and thoroughly well arranged

MINERAL AND METALLURGICAL COLLECTIONS,

illustrating their natural resources. In the United States show, excepting Professor Cox's excellent collection of Indiana minerals and productions, and two or three other similar local exhibits, there is little to indicate that we possess more extensive, more valuable, and more accessible mineral resources than any country on the globe, and that we are earnestly and intelligently working at developing them as rapidly as we can earn or borrow the capital requisite. Rock drills and mining tools are not exhibited in our section. Had they been placed here in competition with their European rivals, they would have readily carried off the premiums, and would have readily entered the foreign markets. The Burleigh drill is exhibited by Germany, and seems to be well and favorably known. Of

TEXTILE PRODUCTS

we exhibit but few samples; and, although those are excellent in quality, the stranger who may compare our department in this group with those of other nations would be led to believe that the United States is far behind other, and far less important, countries in the extent and variety of textile manufactures. We exhibit a good collection of leather, and a few manufactured leather goods. Our great India rubber industry is practically without representation, although it is one of our peculiarly American, and markedly successful, manufactures. Our manufacturing jewellers do not exhibit, and, of manufactured iron and steel products, many single firms, of nearly every other country, present far more extensive and far more interesting collections than appear in the whole of the space apportioned to the United States.

Similar remarks will apply to every other group in the official catalogue, except, perhaps, Group XIII, which includes machinery; and, even here, our exhibition is by no means what it should be. Our collection of

SEWING MACHINES

is exceedingly extensive; and the elegance in design, the beautiful finish and the fine work done by our best makers excite universal admiration.

The exhibition of mowing and reaping and similar agricultural implements from the United States also stands unrivalled in extent and in quality, but Great Britain is far ahead of all nations in the heavier classes of portable engines, steam plows, and road locomotives. We have sent none of these. Our wood and metal working tools are, at least, well represented, and Whitney's pail making machinery and the small collection of shoe manufacturing machines, from New England, with several single machines, represent, in an interesting manner, the peculiar talent possessed by our mechanics in designing machines for special purposes.

We have in our section no representative of our standard drop cut-off engines, with regulation by the adjustment by the governor of the point of cut-off; although the fact that nearly every other manufacturing country exhibits engines of the Corliss pattern may enable us to claim the credit which is due to our inventors in this field. Of the smaller and less complex classes of engines, we exhibit several superior examples. We find but one or two exhibits of cotton or woolen machinery in our section, although here, and in woodworking machinery, our mechanics are represented by creditable copies from almost every other country.

Not a locomotive appears from the United States, but close imitations of the standard American types appear elsewhere. Copies of our sleeping cars and other railroad stock are shown by several European builders.

Indeed, American mechanics are universally copied, and their genius finds its illustration in every section of the machinery hall. They are more fully represented, in many departments, by the exhibits of foreign countries than in that of their own. So patent is this latter fact that it is a subject of general remark among those visitors, of whatever nationality, who are familiar with our position as a nation of mechanics. Every product of American inventive genius, from the sewing machine to the steam engine, is imitated, and the copy appears here, while the original frequently, indeed generally, remains at home. Some of these imitations and copies are exceedingly creditable, and, in some cases in the British section, they even excel the original in some respects. In many cases, the imitation is declared in the circulars of the foreign manufacturer, and they are usually perfectly willing to acknowledge their indebtedness to us. They seem to look upon the fact as one of the strongest recommendations of their work. Jury work will soon bring these instances more fully under observation, and in succeeding communications they will be noted as they appear.

Excursions are proposed into the neighboring country, which promise to be enjoyable, as well as instructive. One of these excursions was made a few days ago to

KOLIN,

in Bohemia, where the party spent the day with the venerable Ritter von Horsky von Horskysfeld, who has had the boldness and the enterprise necessary to break down the conservatism which impedes progress in this country so seriously; and who, by the introduction of agricultural machinery, some of it imported and some of it his own invention, has increased threefold the income from his great estate, 6,000 acres in extent. A special train left Vienna, late on Friday evening, carrying the party, among whom a half dozen of us were "*aus Amerika.*" After riding all night, we breakfasted at Kolin, at 8.30 next morning. Our meal, which consisted of a glass of *bier* and the beautiful bread for which this country is justly celebrated, was quickly despatched; we re-entered the train, and were soon at Karolinenhof, entering the place through a beautiful deer park, evidently greatly to the consternation of the beautiful animals whose home it was. They had never before seen a railroad train, for the rails were laid expressly for our accommodation; and we caught occasional glimpses of the does scampering off as rapidly as the less fleet motion of their pretty fawns would allow. The masculine members of their family, being unimpeded, were all out of sight long before our train could bring us near their resting places.

The party were received and entertained with characteristic hospitality by the host, and, after an inspection of the farm buildings, which were remarkably well built and well arranged, and after examining his singularly heterogeneous collection of old and new, rude and creditable, farming tools, the cattle were presented for criticism. Many were of Hungarian stock, long horned, large framed and muscular, excellent for draft but of little value for other purposes. The remainder were of Swiss and other breeds, smaller and better filled out, sleek and well kept.

A *gabel frühstück* followed: a more pretentious meal than the preceding, but at which the absence of meats and of plain bread was not compensated by the abundance of native wines and of beer, excellent although they were, nor by the variety of cake presented. Before breakfast was over, the carriages, which had been collected from neighboring domains for miles around, had been brought up, and the party was soon comfortably seated in ninety-six of them, and those remaining unoccupied were sent home again.

THE FIELDS,

through which the long procession passed, were in fine condition. The principal crops seemed to be wheat, rye, and beets. The latter were the sugar beet, and a large proportion of the cultivated land was devoted to its production.

We were given an opportunity to witness the operation of all the agricultural implements used by our host, and also of the Fowler steam plow. Some of the latter are in use in our own country, and the time cannot be far distant when the steam plow will supersede the ordinary apparatus on all the large farms of our Western prairie districts. The manufacturers of the Fowler apparatus in England are building up a splendid business. At one point, we were shown the

ROPE TRAMWAY

in operation, transporting clay a long distance across the farm to the compost heaps, where it was used to correct the sandy character of the soil under cultivation. The wire rope was about five eighths of an inch in diameter, running over pulleys of thirty inches diameter and a hundred feet apart, at the rate of about four miles per hour. In such situations, this method of transportation affords many advantages over any other, from its cheapness of construction, its adaptation to every variation in the character of the country over which it is led, and its low cost of operation. Roebling & Sons, of Trenton, N. J., have been the pioneers in the introduction of wire rope transmission in the United States.

An inspection of a well arranged

SUGAR MANUFACTORY,

where the sugar beets raised on the farm are worked up, a visit to the American elevator, as it was called, where the grain is all cleaned, dried, and winnowed, and finally an excellent dinner, with speeches and congratulations in all languages, were the closing events of this most interesting excursion.

R. H. T.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of May, 1873:

During the month, 1,237 visits of inspection were made, and 2,386 boilers examined, 2,017 externally and 754 internally; 168 were tested by hydraulic pressure. The defects in all discovered were 1,062, of which 218 were regarded as dangerous. These defects were in detail as follows:

Furnaces out of shape 29—8 dangerous; fractures, 59—23 dangerous; burned plates, 34—18 dangerous; blistered plates, 133—32 dangerous; deposit of sediment, 173—25 dangerous; incrustation and scale, 197—16 dangerous; external corrosion, 62—10 dangerous; internal corrosion, 18—9 dangerous; internal grooving, 12—4 dangerous; water gages defective, 58—7 dangerous; blow-out defective, 17—1 dangerous; safety valves overloaded, 14—2 dangerous; pressure gages defective, 180—24 dangerous; without gages, 135—8 dangerous; deficiency of water, 9—3 dangerous; braces and stays broken, 29—12 cases placed the boilers in dangerous condition; boilers condemned as unsafe to run, 8. The defects enumerated in the above report are sufficient to show the importance of good care in the use of boilers. The tendency is to run boilers too long, and inspectors are often asked if they cannot "fix things up for another year, six months, or even one month." We are sorry to say that, in some instances, those who have used boilers for years do not (or will not) understand that an overworked, worn out boiler is unsafe, even when the evidences of weakness and insecurity are most shockingly visible. There is a disposition to "patch up and run along" a little longer, and so the matter often goes until accident and disaster put an end to such recklessness. If any persons pursuing such a course read this article, we desire to say to them that the kind of economy they practice is not infrequently attended with great loss of life and property.

A Preventive against Hot Journals

We have received a sample of a new elastic waste, which, from its appearance and the statements made as to its merits, seems superior to cotton or wool for the packing of journal boxes. It is composed of cow hair, sponge, and asbestos, and is quite elastic, a quality, we are informed, which effectually prevents its caking in the receptacle. The agents, Messrs. W. E. Allen & Co., of No. 4 Great Jones street, in this city, submit many testimonials as to the value of the compound from railroad officials by whom the article has been in use.

The advantages claimed are that the material is composed of incombustible and lubricating substances, wears longer than cotton or woolen waste, does not grind into mud, requires less oil, saves several brasses per annum in each journal, reduces friction and hence economizes traction power, and, lastly, effectually prevents the heating of journals. The invention, which has recently been patented, is known as Devlan's Patent Elastic Waste.

Meteoric Iron from California.

The analysis made by Mr. F. A. Cairns, assistant in the School of Mines, Columbia College, of this city, is as follows:

Iron	81·480	Calcium	0·163
Nickel	17·173	Carbon	0·071
Cobalt	0·604	Silicon	0·032
Aluminum	0·088	Phosphorus	0·308
Chromium	0·020	Sulphur	0·012
Magnesium	0·010	Potassium	0·026
	Total	99·987	

Of the twelve elements quantitatively determined by this analysis, aluminum, calcium, and potassium have been rarely observed in meteoric iron—meteors free from silicates—while the absence of copper, tin, manganese and sodium will be noticed.—*American Journal.*

PNEUMATIC SCREW VENTILATOR FOR CARS.

It is no very difficult matter to promote currents of air in railroad cars by means of the ordinary tubes and funnels, properly arranged; but to prevent the entrance of smoke, cinders, and disagreeable fumes with the incoming draft is a difficulty to obviate, requiring more efficient apparatus than the common devices above alluded to.

The improved ventilator, which forms the subject of our illustrations, aims to remedy most existing evils in quite a novel and ingenious manner. To a common spindle a wind wheel, A, of four or more paddles and a screw are attached, B. The screw, driven by the wind wheel, revolves in a cylinder, C, set upon the roof of a car, or connected with it sideways by an elbow pipe, D. A perforated cylinder is set on cylinder, C, and supports a plate which protects the opening, and forms a support for the portion around which the turret or hood revolves. The wind wheel and the sides of the perforated cylinder exposed to the current of air are protected by the turret, which forms a shield around the open part, and moves independently of the motion of the wheel and screw, following that of the vane, E. In the direction of the vane the upper half of the turret is perforated on the right or left, as the case may be, the openings being slightly larger than the paddles. This arrangement is of importance, because the returning paddles meet with little resistance, being shielded by the other closed half of the turret; the wind wheel consequently revolves at a high velocity and with it the screw. The latter is of peculiar construction; it is a double half spiral, winding from right to left and left to right around the spindle. It is made of thin sheet metal, and its diameter corresponds nearly with that of cylinder, C, leaving only room enough for play. This form of the screw is claimed to secure an excellent ventilation with a lower velocity than is required for fans.

It is evident that, with every revolution, the air before the spirals is pressed out of the way, upward if moved to the right, downward if to the left.

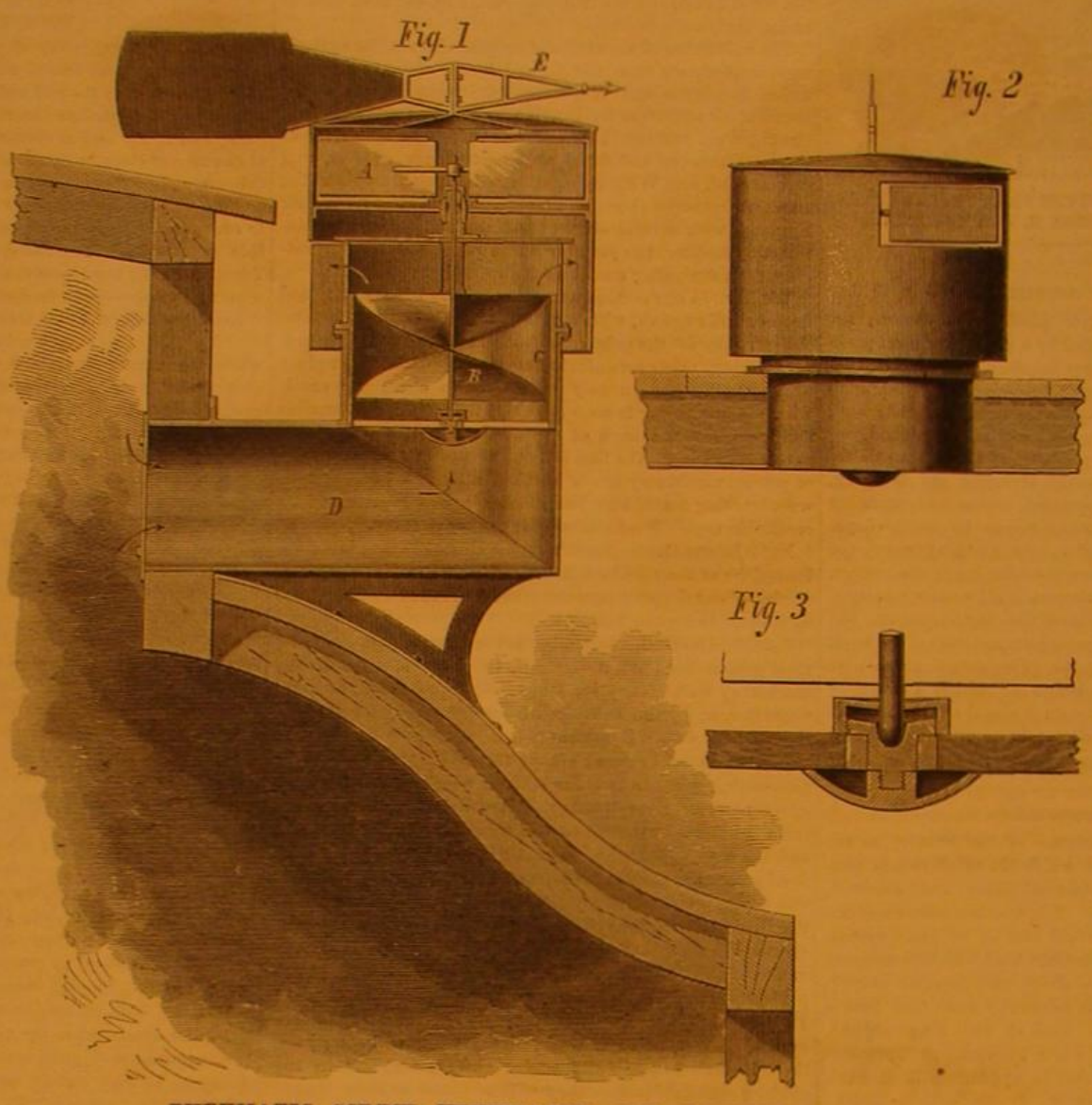
The inventor states that actual trials on a running train have proved that the screw will make at least from 500 to 600 revolutions in a minute; and consequently three ventilators, of 8 inches diameter of screw and 5 inches high, will remove the volume of air in a passenger car in about 15 minutes when running at the above speed. No drafts are produced, and the air changes constantly, the effect being not at all disagreeable to the passengers. Smoke and gases and fine dust also disappear rapidly.

The principal operation of the invention is suction, to bring away the foul and vitiated air, openings for introduction of fresh air being easily provided; or when a still more vigorous ventilation is required, the apparatus, with a slight alteration of the turret, can be set to forcing air into the car.

Fig. 1, in section, shows how the device can be attached to the skylight in the raised roof of a car. Fig. 2 shows the mode of attaching the ventilator to the flat roof, and also how the opening, in which the screw revolves, is protected against wind, dust and rain, the aperture for the exit of air from the car being on the opposite side. Fig. 3 is a section of the socket for the spindle, lubricator and hanging cup. If the lubricator be filled, re-oiling will not be needed for months, friction, it is claimed, being reduced to a minimum. The hanging cup serves to catch any oil that leaks out. A circular register may also be attached to the bottom of the cylinder to open or shut, for graduating the ventilation at pleasure. In Fig. 1, doors like those now in use will answer the purpose.

This entering draft, it is suggested, may be conducted around the stove so as to warm the interior during cold weather.

Patented December 31, 1872, by Philip I. Schopp, C. E., who may be addressed for particulars at No. 445 W. Jefferson street, Louisville, Ky.



PNEUMATIC SCREW VENTILATOR FOR PASSENGER CARS.

Safety Valve Levers.

An esteemed correspondent, J. M., of Cal., says: "I notice that some of your correspondents are puzzled how to compute the effective pressure that a taper safety valve lever adds to the load on the valve. Take the weight of the lever and make a mark on the side of the lever on line with the place where the lever rests on the center of the valve spindle, or at exactly one distance from the fulcrum. Make a loop of wire, slip it on the lever to the mark, hook a spring balance on to the wire, and raise this balance till the lever floats clear of the valve spindle; the number of pounds indicated on the face of the spring balance will be the weight that the lever adds to the load on the valve." This seems to be a simple and easily accessible device.

ABBE'S PATENT BOLT FORGING MACHINE.

It has long been a conceded fact, that, in forging bolts the four or six sides of the head should be acted upon by the forging dies without moving the bolt blank from the position in which it is first held, and that the forging dies should be wider than the bolt head, so as to leave no fins on the corners of the head. The object of the inventor of the herewith illustrated machine has been to produce a tool which should combine these advantages with all the requirements of every class of bolt forging. Four dies are used, and the bolt is held firmly and securely in one position until finished, always, it is claimed, producing a bolt, under the head, just the size of the rod, with the sides of the head in parallel lines with the body. All classes of bolts and shapes of head desired are made, especially the fish joint or T headed bolts, which, we are informed, cannot be made on machines where the bolt is turned to receive the action of the forging dies. The production of the apparatus varies, with the size of the bolt to be forged, from eight to sixteen perfect bolts per minute; and changing from one size of bolt to another, or from one shape of head to another, it is stated, requires hardly a moment's time, especially adapting the device to the use of railroad shops.

Among the points of advantage claimed are, first, simplicity; every bolt and joint being dispensed with except those which produce the result of working the four dies, while there are neither gears, cams, nor springs about the machine, thus saving to the user both the expense and the time occupied in making necessary repairs. The slides are all gibbed so that any trifling wear can be readily taken up without removing the slides to put on a thin strip of iron. The sliding surfaces are always running in oil, as they are placed above the water and cinders. The machine is provided with a cupboard for its tools, a new feature in this class of devices.

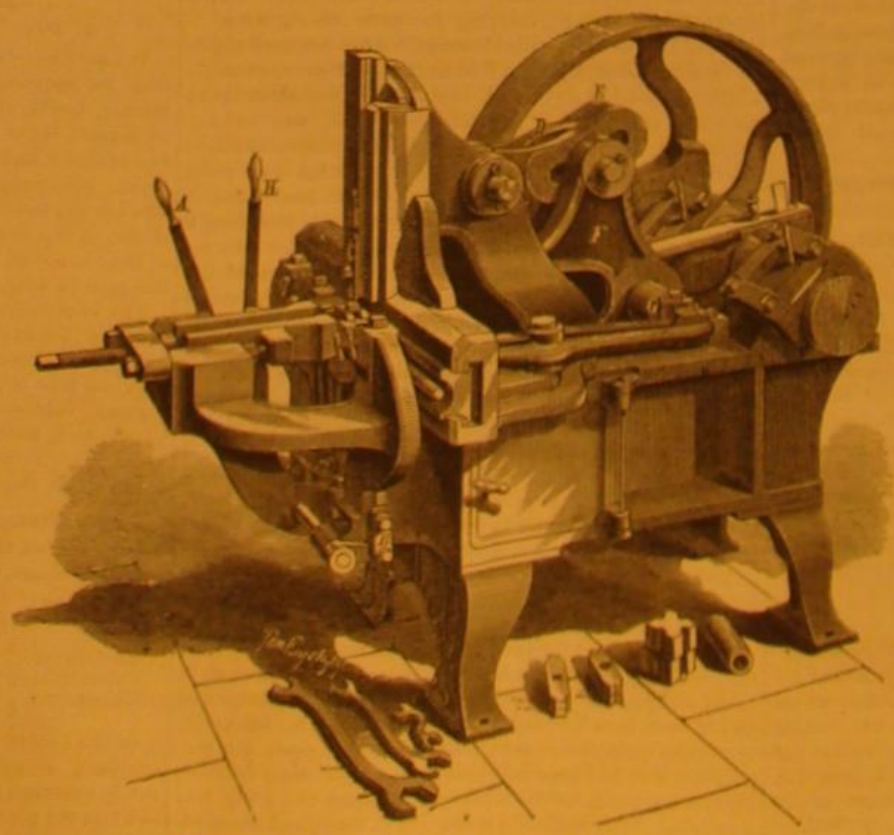
The holding vise is operated by a handle, A, attached to the cross shaft. On each end of the latter are the arms, having links, B, attached to work the sliding frame, which open the radial arms that carry the holding dies. These holders are backed up by a filling-in piece, adjusted forward by means of the screws. The length of the bolt is gaged from one inch upward by adjusting the end screw. The driving wheel is in operation all the time: the machine only when it is forging the bolt. The long slide carries the bottom die on its lower end. The top slide die, C, works on the face of the long slide, which is actuated by two levers, D, E, having curved slots, the top die slide having one lever with reverse curve, all working on the same pin. The pin in the upset carrier, F, passes through the curved slots, and as it acts back and forth moves them in opposite directions. The side dies have their motion by means of links, G, attached to the upset carrier.

When the bolt blank is placed in the holders and clamped tightly by means of the handle, A, the handle, H, clutches in the driving wheel with the shaft, the upset carrier advances by means of the connections to upset the iron, the forging dies being all open. As the upset carrier recedes to half stroke, the side dies compress the sides of the head, and at extreme end of stroke the top and bottom dies act upon the other two sides of the head, and so continue to do until the bolt is finished, which is done in four revolutions of the driving wheel.

Two sizes of these machines are now being manufactured, one for both large and small bolts, and the other more particularly for the smaller sizes.

Two patents have been granted for this header, bearing date of May 1, 1870, and June 6, 1871, respectively, while a third is now pending.

For further particulars address the inventor, John R. Abbe, or the manufacturers, S. C. Forsaith & Co., Manchester, N. H., at whose works the machines can always be seen in practical operation.



ABBE'S PATENT BOLT FORGING MACHINE

NEW PLASTIC COMPOSITION.—A new plastic composition, said to be capable of very pretty effects, consists in mixing finely divided mica with liquid shellac. A paste or putty is made of these substances, and then pressed by means of dies into any desired ornamental form.

From the Fourth Annual Report of Charles V. Riley, State Entomologist of Missouri.]

THE CECROPIA SILKWORM.

Attacus [*Platysamia*] *Cecropia*, Lin.—(*Lepidoptera, Bombycidæ.*)

The Cecropia silkworm is common, and its great size and beauty attract general attention. It is also more easily obtained, for the cabinet, than most of our other large moths, because its cocoon is always fastened to a twig where it remains all winter, a conspicuous object. The ground color of the wings is a grizzled dusky brown with the hinder margins clay yellow; near the middle of each of the wings there is an opaque kidney shaped white spot, shaded more or less on the outside with dull red, and edged with black; a wavy dull red band, edged inside with white, crosses each of the wings, and the front wings next to the shoulders are dull red with a curved white and black band, and have near their tips an eye like a black spot with a bluish white crescent: the upper side of the body and legs are dull red; the forepart of the thorax and the hinder edges of the rings of the abdomen are white, and the venter is checkered with red and white. There is considerable variation in the ground color of individuals, some being quite dark and others quite light, but the female differs from the male in nothing but her larger abdomen and much smaller antennæ or feelers.

FIG. 1.—THE CECROPIA MOTH, MALE.

The genus *attacus*—meaning elegant—was founded by Linnæus, and our moth received its specific name from the same author.

During the winter time, the large cocoons of this insect (Fig. 2) may be found attached to the twigs of a variety of trees. I have found them upon the apple, cherry, currant, barberry, hazel, plum, hickory, blackberry, elderberry, elder, elm, lilac, red root, maple, willow, and honey-locust. It has also been found on the pear. This cocoon tapers both ways, and is invariably fastened longitudinally to the twig; it is formed of two distinct layers, the outer one, which is loose, wrinkled, and resembles strong brown paper, covering an inner oval cocoon composed of the same kind of silk, but closely woven like that of the mulberry silkworm.

FIG. 2.—Cocoon of the Cecropia.

Inside of this cocoon will be found a large brown chrysalis.

In the month of May, in the latitude of St. Louis, and earlier or later the further north or south we go, our Cecropia moth issues from its cocoon, and there can be no more beautiful sight imagined than one of these gigantic fresh born moths with all its parts soft and resplendent. The uninitiated would marvel how such an immense creature had escaped from the small cocoon which remains at its side, retaining the same form which it always had, and showing no hole through which the moth could escape. The operation—so interesting and instructive—can be witnessed by any one who will take the trouble to collect a few of the cocoons and place them in some receptacle which has sufficiently rough sides to admit of the moth's crawling up, to hang its heavy body and wings while they dry and expand. The caterpillar has the wonderful foresight to spin the upper or anterior end of its cocoon very loosely; and when the moth is about to issue, it is still further aided in its efforts by a fluid secreted during the last few days of the chrysalis state, and which is a dissolvent of the gum which so firmly unites the fibers of the cocoon. This fluid is secreted from two glands, which open into the mouth, and as soon as the chrysalis skin is split open on the back, by the restless movements of the moth within, the fluid flows from the mouth and wets the end of the cocoon, dissolving the gum and softening the silk to such an extent that, by repeated contractions and extensions of the body, the moth is at last enabled to separate the fibers, and to thrust out its head and unbend its front legs; after which it rapidly draws out the rest of its body, the mouth of the cocoon afterwards closing by the natural elasticity of the silk. At this moment the body of the moth is much swollen and elongated, the wings are small, folded, and pad-like, and the whole insect is soft and moist; but, attaching itself to the first object at hand where it can hang its heavy body and clumsy wings, the latter become expanded in about twenty minutes, and the superabundant fluids of the body sufficiently evaporate in a few hours to enable the insect to take wing.

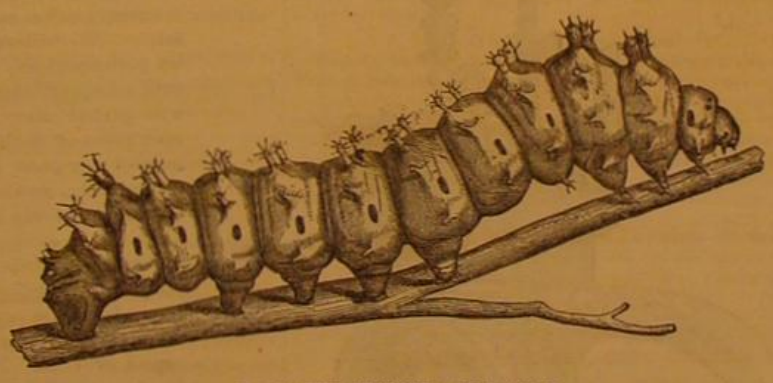


FIG. 3.—THE CECROPIA SILKWORM.

The eggs of the Cecropia moth are 0·09 inch long, sub-oval, flattened, and of a pale cream color, shaded with light brown; and they are deposited in small patches on the plants which are to form the food of the future larvæ. They are deposited in June, and hatch in from six to ten days thereafter.

When first hatched they are entirely black, with the tubercles placed in the same position; but are larger at the base and with a narrower stem than in the more mature individuals, the upper and smaller end being crowned with a whorl of conspicuous stiff black bristles. After the first molt, the body is of a deep orange color, with the tubercles and head black, and with longitudinal rows of black dots running between them. After the second molt, a still greater change takes place; the body acquires a beautiful yellowish green tint, the tubercles on the back are blue on joints 1, 12, and 13, coral red on 2 and 3, and yellow with black spines, with a black spot on the inside and outside of the stem, on 4—11; those at the sides are blue, and the head is of the same color as the body. After the third molt, the black spots, except a row below the stigmatal row of tubercles, disappear; the tubercles themselves lose all black except the spines, and the head and body become delicate bluish green rather than yellowish green, as formerly. After the fourth and last molt, the red tubercles near the head frequently become yellow, and when full grown, the worm measures over four inches, and presents the appearance shown in our engraving (Fig. 3), the tubercles being respectively of the most delicate yellow and blue.

Two weeks after the worm first begins to spin, it changes to a chrysalis, and, as already stated, passes the winter in this form, there being but one brood each year.

The cocoon of this insect is often found to contain a kernel of corn, a grain of wheat, or even an acorn; and the first time I found a corn kernel in one of them, I was sorely puzzled to comprehend how it came there, and imagined that it must have been accidentally dropped, by some bird, into the meshes of the cocoon while the latter was being formed. But the kernels are found in the cocoons altogether too frequently to admit of any such chance coincidence, which must necessarily be of very rare occurrence. There is every reason to believe, therefore, that these foreign materials are placed there, for safe keeping, by some bird; the loose end of the cocoon admitting of their being forced in, even after it is completed. Dr. LeBaron thinks that this bird is very likely the blue jay, which is known to have the habit, in common with other *coreidæ*, of pilfering and hiding in holes and crevices any small object that attracts its attention. One of my correspondents from Geneva, Ill., who has found no less than five of these cocoons containing kernels of corn, thinks the chickadee (*parus atricapillus*, L.) uses them as a storehouse, as well as the blue jay, and, indeed, inclines to believe that the former is the sole proprietor. He has seen it, with corn in bill, searching about apple trees for such a storehouse, and has witnessed it deposit a kernel in the crack of a board fence.

The Cecropia worm, as may be inferred from its size, is an immense feeder, and a small number will soon defoliate a young apple tree. It has, on a few occasions, been found numerous enough to do injury in this way; but as a rule, natural enemies keep it so thoroughly in check that it can hardly be classed as an injurious insect. The same may be said of the other large and native worms which I include with the silkworms, and which on account of their silk-producing qualities may with propriety be treated of rather as beneficial insects, though their products have not yet been utilized. Their great size and conspicuity not only renders them a ready prey to their natural enemies, but enable us to easily destroy them by hand picking whenever they happen to become unduly multiplied on any of our fruit trees.

PARASITES OF THE CECROPIA SILKWORM.

THE LONG-TAILED OPHION.—(*Ophion macrurum*, Linn.)—This large yellowish brown ichneumon fly (Fig. 4) is often bred from the cocoons in place of the moth which one expects. It is one of the most common parasites of this large insect, and the females appear to be altogether more common than the males. The female, according to Mr. Trouvelot, deposits from eight to ten eggs upon the skin of her victim, and the young larvæ soon hatch from them and commence to prey upon the fatty parts of the worm. But as only one of the parasitic larvæ can find food sufficient to mature, the rest all die from hunger, or else are devoured by the strongest one which survives them.

After the Cecropia worm has formed its cocoon, the parasitic larva, which had hitherto fed on the fatty portions of its victim, now attacks the vital parts, and, when nothing but the empty skin of the worm is left, spins its own cocoon, which is oblong oval, dark brown, inclining to bronze, and spun so closely and compactly that the inner layers, when separated have the appearance of goldbeater's skin. If we cut open one of these cocoons soon after it is completed, we shall find inside a large fat legless grub (Fig. 5), which sometimes undergoes its transformations and issues as a fly in the fall, but more generally waits till the following spring.

FIG. 4.—Ophion.

FIG. 5.—Grub of the Ophion.

THE CECROPIA TACHINA FLY.—(*Exorista leucaniæ*, Kirk. var. *cecropiæ*, Riley.)—The ichneumon fly last mentioned usually causes a dwarfed appearance of the worm which it infests, and parasitized cocoons can generally be distinguished from healthy ones by their smaller size. The larvæ of this tachina fly, which is also parasitic on the Cecropia worm, seem to produce an exactly opposite effect, namely, an undue and unnatural growth of their victim. This fly differs only from the army worm tachina fly (*exorista militaris*, Walsh) in lacking the red tail entirely, or in having but the faintest trace of it, and I consider it but a variety of that species.

THE MARY CHALCIS FLY—(*Chalcis mariæ*, Riley).—I received from Mr. V. T. Chambers, of Covington, Ky., numerous specimens of the beautiful large chalcis fly figured herewith (Fig. 6), which he had taken from the cocoon of the Polyphemus moth, which is quite common, and issues as early as the middle of February in that locality. He says, "I was satisfied that the cocoon did not contain a living Poly-

FIG. 6.—Mary Chalcis Fly.

phemus, and therefore opened it. It contained so little besides these insects and their exuviæ as to suggest strongly the old idea that the caterpillar had been metamorphosed into them (as in a sense it had). There were forty-seven of them, of which twenty-three were females. As all the males and some of the females were dead when I opened the cocoon, I think it likely that the former never do emerge, and perhaps few of the latter, otherwise Polyphemus would soon be exterminated."

I can very well imagine that most of these chalcis flies would die in their efforts to escape from the tough cocoon of the Polyphemus, but it so happens that these same parasites have been found by Mrs. Mary Treat, of Vineland, N. J., to prey upon the Cecropia worm, from the cocoon of which they can more easily escape.

This fly is of a yellow color, marked, as in the engraving, with black.

THE CECROPIA CRYPTUS—(*Cryptus extramatis*, Cresson).—Another ichneumon fly (Fig. 7) often infests the Cecropia worm, the larvæ filling its cocoon so full of their own thin

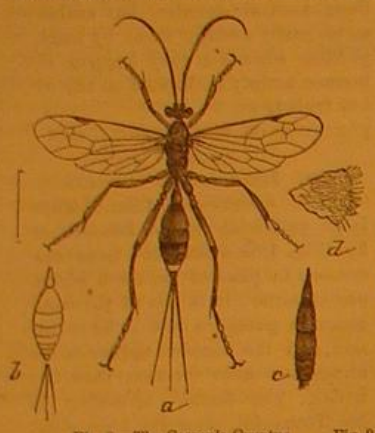


Fig. 8.—The Cecropia Cryptus.

Fig. 9.—Cocoons of the Cryptus.

parchment-like cocoons, that a traverse section (shown in Fig. 8) bears considerable resemblance to a honeycomb. The flies issue in June. The wings have a smoky appearance, caused, as may be seen when viewed under a microscope, by innumerable littleh ooks regularly arranged over their surface.

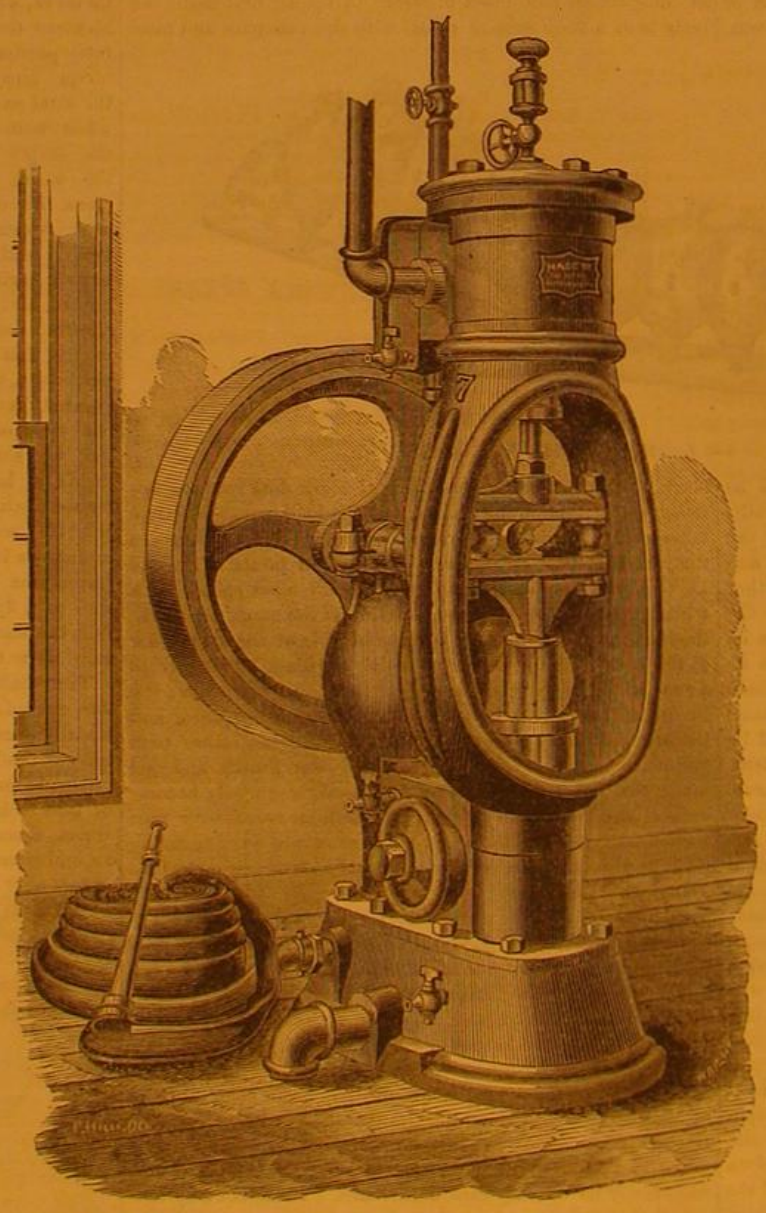
DOUBLE-ACTING BUCKET PLUNGER STEAM PUMP.

The fire pump illustrated in our engraving is of a form and manufacture doubtless already familiar to many of the readers of our journal. It is therefore not a new invention, but rather one which, during the three years that it has been before the public, has been made, from time to time, the subject of useful improvements; so that, in presenting it now, it is desired not merely to call attention to the advantages claimed for its peculiar mode, but also to the success which it has encountered from the period of its introduction.

The points to be noted consist in the arrangement of the bucket plunger and its method of operation. About the steam cylinder and valve there is nothing peculiar, unless it is the entire absence of complicated valve gear. The bucket plunger is composed of two cast iron cylinders, the larger one being below and packed with composition packing rings. The water cylinder in which it operates is made twice the area, in comparison to the steam cylinders, of the ordinary forms of double-acting steam pumps, the object being, it is stated, to dispense with half the number of water valves, as the quantity discharged on the upward stroke is, as will be explained hereafter, thrown out through an opening in the top of the pump cylinder, and does not pass through the valve opening. Water is drawn in, on the up stroke, through a suction valve near the bottom of the cylinder, filling the latter. The downward stroke forces the contents out through the discharge valve, one half the quantity passing into the air chamber, and the other half flowing up into a passage and thence into the upper part of the cylinder encasing the small part of the plunger. The reason that one half of the water is forced out is that the small part of the plunger takes up that proportion of the interior space of the cylinder. On the next upward stroke, the water around the plunger is forced out through a passage and into the air chamber, thus filling up the pump, the same stroke replenishing the cylinder as before. Thus, it is stated that, after the pump has made a few strokes, a steady stream is kept up, as the quantity of water taken into the cylinder through the suction valve on the up stroke is just double that forced out through the passage from the upper end of the cylinder on the same stroke. It will be observed that there is another reason for constructing water cylinders in the proportions above noted, from the fact that, while a large portion of power is required to discharge water, but little is needed to draw it through the suction valves.

The fly wheel is operated by a crank, sliding block and cross head; to the latter, the steam piston and bucket plunger are attached by their piston rods. The pump barrel and steam cylinders are in line with each other.

The working advantages are claimed to be ready taking of water, facility of running with greatest rapidity without jarring or thumping, and strength and durability in material and construction. Pumps of this description have been exhibited at the recent Fairs of the American Institute in this city, one of them receiving a medal and being rated first in order of merit at the exhibition of 1870. Numerous testimonials as to the successful operation of the device, from many leading firms, are also submitted by the makers. Patented by Mr. William Wright, of New York, March 8, 1870. For further particulars, address the manufacturers, the Valley Machine Company, Easthampton, Mass.



WRIGHT'S DOUBLE-ACTING BUCKET PLUNGER STEAM PUMP.

Lake Okeechobee.

This is the Indian name of a large lake in the southern part of the peninsula of Florida, distant 45 miles inland from Jupiter Inlet on the Atlantic coast, and 200 miles south of St. Augustine. The lake is 65 miles long and 30 miles wide, surrounded by extensive marshes which render it difficult of approach, and hence but little is known of its precise character. It contains several large islands, which we believe have never been carefully explored. A recent number of the New York *Herald* contains an account of a visit to this great lake by G. K. Allen, of San Marie, Florida, and four companions. It was with extreme difficulty that they made their way through the swamps and over quicksands, but they finally gained the edge of a bayou which floated them to the lake; and once upon its bosom, no further obstacles to progress were encountered.

From the first two or three miles out from the shore, they were terribly annoyed by mosquitoes and flies of various kinds, from which they could only in part protect themselves by thick veils over faces and hands. But at eight miles distance, the insects were no longer troublesome. Three miles from the shore they found shallow water—five feet—and sundry low islands inhabited by immense alligators. At a distance of eighteen miles from the shore, the water became clear and bottom was found at 170 feet. Here they discovered a group of three islands; the largest about six miles long, and four miles wide. The northern portion of this island was a barren, rocky waste, which extended back from the shore nearly a mile and a half, to the base of a line of rocky cliffs, about one hundred and fifty feet high, which extended across the whole width of the island. To the south of these cliffs is a magnificent forest, composed chiefly of large mahogany, palmetto and laurel magnolia. Many of the latter trees, being in full bloom, presented an enchanting scene. This forest extends over the whole of the southern portion of the island, except to within a few hundred yards of the shore, which at every point is sandy and covered with rocks.

The island next in size is about one fourth of a mile west of this large island; it is about four miles long and a mile and a half wide, and is covered by a forest like that on the large island. The third is quite small, being only about one mile long and from a half to three quarters of a mile wide. Very few animals of any kind, and none of a savage nature, were found upon these islands.

In the forests spiders of a gigantic species were found. One was seen which was fully two feet long. It had long and very strong looking limbs, and would have weighed three or four pounds. In its head, which was jet black, were several eyes, each surrounded by a bright yellow and scarlet circle. The body was encircled by bands of scarlet, yellow and black. Altogether the spider presented a very brilliant appearance

Upon the largest island, north of the cliffs, the explorers were surprised to find heaps of stones, lying in such a position as to resemble ruins of some kind of structures. None of the ruins were extensive, and the structures must, therefore, have been of small dimensions. Similar ruins, if such they were, were found in great numbers upon the small island, north of this one. Upon the summit of a cliff which stands upon the eastern shore of the large island, the party found a large heap of stones lying in a semicircular form, and facing to the east.

The length of these ruins was nearly two hundred feet. In front of this semicircle, and about fifty feet from it, was a large heap of stones, nearly twenty feet square. The ruins found on the plain below, and upon the small island, were much smaller than those found upon the cliff, being only from five to ten feet square.

One Hundred Miles an Hour.

The highest railway speeds in the world are attained in England, and the highest railway speed in England is attained on the Great Western Railway, and this speed may be taken roundly as fifty miles an hour. There is a tradition in existence that Brunel once traveled from Swindon to London at eighty miles an hour; but we have never been able to obtain a shadow of proof that this speed has been reached under any circumstances or at any time whatever on a railway. Mr. Stirling has run with one of his great outside cylinder express engines and a train of sixteen carriages at seventy miles an hour on the Great Northern, on a level or with a slightly falling gradient; and we know that the Yarmouth express on the Great Eastern sometimes has reached a speed of sixty-four miles an hour down the Brentwood bank. On two occasions, some years ago in Ireland, we ran 14 miles in sixteen minutes with a powerful engine and a train of but two carriages. Much of the run was done at over 65 miles per hour. On the Boston and Albany road, United States, the 54 miles between Springfield and Worcester were run by an engine with 16 inches cylinder, 22 inches stroke, and 6½ feet driving wheel, in fifty-eight minutes.

Much of the run was done at nearly seventy miles an hour. On a first class line there can be no question, therefore, but that a speed of sixty-five to seventy miles an hour may be available with safety. We believe that it would be possible to lay permanent way so well, and to maintain it in such excellent order, that trains might travel on it with perfect safety at 100 miles an hour. Miles upon miles of such track are to be found now on most of our great main lines, but it is not to be disputed that nowhere can 100 consecutive miles of permanent way in perfection be found; and as a chain is no stronger than its weakest link, so a few hundred yards of bad track would spoil for the purpose of traveling at 100 miles an hour a whole line. It would not be impossible, however, to maintain a line of such rails from London to Liverpool or York. The really important question is, given the line and the carriages fit for it, what shall the engine be like, and is it possible to construct an engine at all which, with a moderately heavy train, will attain and maintain a velocity of 100 miles an hour, on a line with no grade heavier than, say, 1 in 300. The first points to be settled are, how much power can a locomotive of a given size develope, and how much power shall we require to haul a train which will suffice to satisfy the demand of that portion of the public wishing to travel at 100 miles an hour. At 60 miles an hour on an ordinary line, and making due allowance for contingencies, the resistance to be overcome cannot, according to experiments carefully carried out both in France and in this country, be much under 40 lbs. per tun. At 30 miles an hour the resistance is about 20 lbs. per tun; at 47 miles an hour the resistance reaches 32·5 lbs. If the resistance goes on increasing in this proportion, then the resistance at 100 miles an hour cannot be less than 75 lbs. per tun; but it may be very much more, and it would not, we think, be safe to take it at less than 120 lbs. per tun. Now a speed of 100 miles an hour is 146·5, or in round numbers, 146 feet per second, or 8,800 per minute. This, multiplied by 120 and divided by 33,000, gives, say, 32 horse power. Therefore each tun moved at 100 miles an hour will represent 32 horse power. The "Great Britain" broad gage Great Western engine, with its tender, in running order represents a weight of about 64 tuns, and a heating surface of 2,100 square feet. This engine has indicated over 800 horse power. To run such a machine and a train weighing 35 tuns, or a gross load of 99, or, say, in round numbers 100 tuns, at 100 miles an hour would require 100 × 32, or 3,200 horse power, or just four times more power than the most powerful high speed locomotive that has ever been built could exert. To run the engine, weighing 38 tuns, alone would require a power of 1,216 horses, assuming that the engine resistance was identi-

cal with that of a carriage. These figures suffice to prove that it is absolutely impossible to obtain a speed of 100 miles an hour on a railway if the resistance is anything like 120 lbs. per tun.

It is little more than waste of time to discuss any other question connected with the matter, such as safety and working expenses, until it has be settled whether it is or is not possible so far to reduce resistance that it will become possible to construct an engine of sufficient power to fulfil the intended purpose.

If it can be shown that the resistance could be brought much below 120 lbs. per tun, then it may be possible to attain a velocity of 100 miles per hour.—*The Engineer.*

THE *Daily Graphic* says that the individual who styled himself Professor La Mountain, and who was lately killed in Michigan by a fall from a balloon, was an imposter who traded on the name of the real La Mountain. The latter died six years ago, and was one of the most distinguished aeronauts.

J. H. P. says: My brother and myself are in mechanical pursuits, and we owe half our success to your journal.

DECISIONS OF THE COURTS.

United States Circuit Court--Southern District of Ohio.

PATENT ROTARY BLOWER.

P. H. AND F. M. ROOTS *vs.* WILLIAM G. HYNDMAN.

EMMONS, *Judge:*

In an action for injunction to restrain infringement of reissued letters patent, granted P. H. & F. M. Roots, for cases for rotary blowers, dated July 27, 1869, wherein the inventors were complainants and William G. Hyndman respondent, in the United States Circuit Court for the Southern District of Ohio, before Justice Swayne and Judges Emmons and Swing, the following opinion, upon final hearing, was delivered June 11, 1873:

The four claims of the patent which were in controversy are as follows:

"1. A rotary blower case, the interior of which is rendered true and accurate by means of plaster of Paris, or its described equivalent, applied substantially as described.

2. A rotary blower case, the ends or heads of which are rendered true and accurate by means of plaster of Paris, or its described equivalent, applied substantially as described.

3. A rotary blower case, the concaves or arcs of circles of which are rendered true and accurate by the use of plaster of Paris, or its described equivalent, applied substantially as described.

4. A rotary blower case having concave arcs B B, in combination with end plates I I, arranged so as to admit of the abutments being introduced or removed without requiring the case to be taken apart, substantially as set forth."

The Court appears to have held the following:—

A patent for a rotary blower case, of which the interior and certain specified parts are rendered true by means of plaster of Paris, "or its described equivalent," and which describes as an equivalent a material capable of being made plastic when applied, and becoming hard in a suitable time, is infringed by the use of litharge and glycerin for the same purpose.

The novelty of the device is not impeached because a pump was before known lined with molten metal.

Nor because others have, by means somewhat similar, made the abutments in such a machine true, those not being specified in the claims.

A claim for "a rotary blowing case having concave arcs, in combination with end plates arranged so as to admit of the abutments being introduced or removed without requiring the case to be taken apart," held to mean so much of the case as incloses the operative parts, and that it was infringed by a case cast in two parts, of which one included only the legs and such portions as performed none of the functions of the machine, and on removing it the abutments could be introduced or removed.

James Moore, for complainant.
Wood & Boyd, for respondent.

United States Circuit Court--Southern District of Ohio.

THE UNION PAPER BAG COMPANY *vs.* NIXON & CO.

In this case, Judge Emmons, in his opinion given April 16, 1873, held as follows:

A specification is not fatally defective because it does not mention such modifications as practical use would readily suggest in order to render the machine efficient, such as employing a weight or a spring, or changing the dimensions of the parts.

Nor because it does not mention a cam on the main shaft, and the arms and connecting rod, which are all necessary to give the proper reciprocating movement to the pasting rollers on a paper bag machine, they being devices which any mechanic would introduce of his own accord.

Nor because the office of giving motion to the pasting rollers is attributed to another cam on the shaft, which is incapable of performing it, since any mechanic would know that another cam is necessary for the purpose, as well as its form, and where it should be placed.

Drawings of the bags indicated in the patent of a paper bag machine by which they are produced may be annexed to a reissue of the patent, although they were not to the original.

Because other United States Courts have decided that certain words constitute, under the circumstances, a claim to a principle, they are not necessarily to be so construed in all cases.

Claims which can be construed to embrace meritorious combinations and devices will not be construed to embrace a principle, and to be therefore void, though they are capable of being so interpreted.

Where the bar on which the tube is supported in a paper bag machine has the lower side extended beyond the upper, so that the lower side of the tube will be cut off with a lap to form the bottom of the bag, a claim for a combination of several of the devices employed, which enumerates among the rest "machinery for cutting the tube slantwise, as specified, while it is on the former or holder, and machinery for pasting or cementing the said tube near its front end, and bending or lapping the end of the tube on the cemented part so as to form the bottom of the bag," was held to embrace the extension of the lower side of the bar.

Such a claim is infringed by the use of such a supporting bar, although turned upside down, and made with its rear end smaller than the rest, and without the cutting edges or the rollers that carry forward and paste the paper.

A claim for "arranging the pitch line of the feeding gear in, or about in, the prolongation of the axis of the shaft of its crank, whereby we obtain intermittent and variable motions of the paper, as described," held to be a combination claim, and to include the roller which works in the supporting bar and the devices for carrying forward the paper, and giving it tension while it is severed, though they are not specified.

A patent for making the frame of a paper bag machine adjustable upon its bed by means of a slot and screw, is infringed by making the frame so heavy as to be held in place by its weight.

A claim for creasing rollers in a paper bag machine, in combination with other devices, is infringed by rounded bars or hooks working in a similar combination with the same effect.

An alternate claim to only one or the other of two things, but to neither positively, is void; but a claim to each of two things, whichever is used, is valid.

James Moore, respondent's counsel.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 4 to July 10, 1873, inclusive.

BOOK SEWING MACHINE.—A. M. Loryea, Portland, Oregon.
CARTRIDGE BOX.—S. McKeever, Mobile, Ala.
CUTTING GEMS.—C. M. Field, Boston, Mass.
DYEING MACHINERY, ETC.—C. G. Sargent, Graniteville, Mass.
FLUID METER.—J. O. Johnson, New York city.
MOTIVE POWER.—P. Protheroe, Baltimore, Md.
PREPARING HIDES.—J. Davis *et al.*, Pittston, Pa.
PRESERVING FABRICS.—S. W. Torrey, New York city.
PRINTING YARN.—J. H. Lorimer, Amsterdam, N. Y.
ROTARY ENGINE.—W. H. Eayrs *et al.*, Boston, Mass.
SAIL AND DRAG.—T. M. Fleetwood, Savannah, Ga.
SEMI-STEEL, ETC.—C. J. Cammon, New York city.
SEWING MACHINE.—T. Hall, Northampton, Mass.
SHOE FASTENER, ETC.—J. Wulf (of New York city), London, England.
WINDOW GRATINGS.—T. Hyatt, New York city.
WOOD PULP, ETC.—T. B. Armitage, New York city.

Recent American and Foreign Patents.

Improved Street Railway Switch.

John E. Pattison, New Orleans, La.—This invention is an improvement in the class of switches which are operated by the weight of the draft animal applied to a tilting or oscillating platform. By the arrangement of a reciprocating piston rod in connection with two narrow platforms, the switch can be adjusted from the main track to the side track, and *vice versa*, as required, whether one or two animals are used for the car. The animal whose weight is not required passes over the space between the platforms.

Improved Beer Strainer.

Charles M. Powers, Ridgewood, N. J.—A vessel similar in form to an ordinary beer tankard is divided into two compartments by a vertical sliding partition. This partition slides in grooves on the sides of the vessel, and extends from near the cover to near the bottom. A horizontal stationary strainer is in one compartment, and another strainer in the other compartment is hinged to the partition so that it can be withdrawn with the partition for cleaning, when necessary. The beer to be strained is introduced into the one part through the opening and passes through the strainer and finds its way into the other compartment. It then ascends and passes through the horizontal strainer and through the perforated side of the vessel, and is discharged from the spout, clear and free from froth.

Improved Middlings Purifier.

Joseph W. Wilson, Pawtucket, R. I., assignor of one half his right to John W. Vose, of same place.—This invention consists in using a fan blower and exhaust fan, in connection with a sieve so fine as to allow the passage of no middlings therethrough while being cleaned. By suitable construction, as the middlings are fed into the machine intermittently, each portion is subjected to the blast from the fan blower, which causes the fine woody fiber, dust, and all other impurities, to rise into the upper part of a chamber, where they are subjected to suction from, and are drawn off through, the exhaust fan. The other parts of the middlings pass down to the coarse cloth where they are separated.

Improved Cotton Cultivator.

Charles Zocher, Augusta, Ga.—This invention has for its object to furnish an improved sweep for cultivating cotton and other crops. The upper arm of the foot or shoe is secured to the standard of the stock, and its lower arm is designed to rest upon the ground, and thus give steadiness to the sweep when at work. The wings of the sweep are made solid in one piece, and the middle part fits upon and is bolted to the foot. The wings project and slightly curve rearward and outward, and the lower parts of their forward sides are made with offsets, which break up their edges, and thus cause them to readily discharge the grass or weeds that may collect upon said edges. Each offset is formed by cutting away the edge of the sweep both upward and backward, while the portion of the edge between the offsets slopes or is inclined to the line of draft so that the soil or other substance with which it may come in contact will readily escape or be turned off. It is thus an improvement on the plow share of L. M. Reed, patented in 1869, No. 85,533.

Improved Turn Table.

William H. Burch, Port Gibson, Miss.—This invention has for its object to furnish an improved turn table for railroads. The center or step plate rests upon a bed of brickwork, and carries a cast steel socket to receive the center balancing screw. At the end of the track are secured the bearings of two wheels in such positions that they may be directly beneath the end of the track of the turn table when in position for the engine to pass to or from said table, The wheels are designed to take the weight off the circular track, upon which the table revolves, when an engine is passing to or from said table. The stringers to which the rails are attached are bolted to each other. Each is made in two equal parts, which are strengthened at the joints and bolted at the centers to the center cross beam. To the stringers at the inner sides of the end cross beams are bolted the truck frames. To the under side of the center cross beam is bolted a cast iron plate, which plate is made sufficiently long to receive the bolts that secure the splice bars to said central beam. Through the center passes the pivoting screw, the bearing for which is lengthened by a boss formed upon the lower side of said plate. The said screw can be securely locked in place, and may be turned one or more revolutions, so that the table may be accurately adjusted. The table is locked, with the rails in line with the rails of the track, by the V shaped locking bar, attached to the shaft which works in bearings attached to a suitable support, which is worked by a lever. The free end of the V-shaped locking bar enters a groove in the catch block, one of which blocks is attached to each end of the track of the turn table. Suitable stays prevent vibration and hold the table securely and firmly under counter strains.

Improved Cultivator.

Philip F. Wells, Milford, Mich., assignor to himself and D. Webster Wells, of same place.—The invention consists in the improvement of cultivators. The longitudinal bars of the framework are connected with the tongue by an angle plate, to which they are securely bolted. The latter is made with a vertical and a horizontal flange, to strengthen it against the strain in the different directions in which it is exposed to strain. The plow standards carry the cultivator teeth or plows, and the draft strain is sustained by the draft bars, the forward ends of which are attached to longitudinal bars, and the rear ends to the said standards. The rear ends of the draft bar are connected with the standards by means of wooden pins, so that, should the plows strike an obstruction, the pins may break and allow the standards to swing back without being broken. The upper ends of the standards are connected with the bars by bolts, so that the said standards may swing back upon them, wedge-shaped washers being interposed, when required, so that the standards may be parallel with the draft line while being attached to inclined bars.

Improved Muff Lining.

Charles F. Butterworth, Troy, N. Y.—The lining of this muff is composed partly of fur and partly of elastic leather. The outer pieces are fur, and are blocked or crimped so that the lining part and the end part are at about right angles to each other. The former part extends into the muff so as to inclose the wrists after the hands are admitted, which the natural elasticity of the fur permits. The middle part is of material which readily expands and gives the required room.

Improved Butt Hinge.

Somers Van Gilder, Knoxville, Tenn.—This invention relates to the construction of hinges for hanging doors and for other purposes; and it consists in a divided leaf and in a pintle pin fast in the other part of the hinge. The pintle is stationary, and each part of the divided leaf bears its own portion of strain whichever end of the butt may be up; and the butt may be reversed as may be found convenient, so that making the butts in pairs or rights and lefts is not necessary.

Improved Clothes Washer.

George J. Terrell, North Blanford, Mass.—This apparatus is placed in the ordinary wash boiler, and is designed to fit the inside thereof, with its outer rim resting on the bottom, and form a false bottom itself. A tapering tube is attached to the center, which extends to near the top of the boiler, having upon its end a removable T-shaped exhaust pipe. The outer edge of a lining rests at its ends upon the bottom of the boiler, but its sides are raised up so that the water readily passes beneath it to the bottom of the boiler. The lining is arranged a short distance below the false bottom, leaving an open space between the two, and is held in position by means of a short tube. Holes are made through the false bottom. When water is placed in the boiler, it at once finds its way to the bottom. Heat being applied, steam is generated, and the water, or steam and water combined, is forced upward by the pressure through the tube through the agency of the conical imperforate lining which prevents the flow or escape of the same laterally. The clothes to be washed are placed in the boiler, resting on the false bottom, and the water thus raised is discharged through the T pipe on top of the clothes, and percolates by its own gravity down through the clothes; passes next through the holes, and thus enters the space between the false bottom and lining, whence it flows downward to the bottom boiler. A circulation of water is thus kept up through the clothes, the rapidity of which is according to the quantity of steam generated.

Improved Wash Boiler.

William J. Thomas, Frederick City, Md.—In the end parts of the boiler are formed tubular chambers, in which are formed transverse slots, through which the steam and water are discharged upon the clothes. The bases of the tubes project inward a little above the bottom of the boiler. In a false bottom are formed two rows of holes, one row upon each side of the central line and about half way between said central line and the side edges of said bottom. The holes are covered upon the upper side of the bottom by strips, which prevent the clothes from being forced into the holes by the pressure of the water. In using the boiler, the pressure of the steam when generated presses hinged plates up against the lower side of the bottom, closing the openings in said bottom until the said plates are again forced down by the pressure of the water, thus establishing a current.

Improved Fireproof Roof.

John B. Cornell, 129 Center street, New York city.—This invention consists of light iron beams or rafters, covered with sheet iron, corrugated with dovetail grooves, which is secured to the rafters or beams by metal brackets riveted to it, and hooked under the rafters. A top covering of fire and waterproof cement, and a mortar coat on the inside, are applied and plastered on the sheet metal, and secured by the dovetail grooves and ribs; the whole constituting a light, durable, fireproof roof, which is not subject to the dampness on the inside common to the metal-lined fireproof by the condensation of moisture on the iron.

Improved Apparatus for Pitching Barrels.

George Sichler, New York city.—This invention has for its object to furnish an improved apparatus for rolling beer kegs after they have been pitched to keep the pitch spread over the inner surface of the kegs until they have become so cool that it will not flow. The kegs are placed upon the forward or upper end of an upper skid, down which they roll and pass upon another skid which is pivoted and balanced by a weight. The kegs overbalance the latter and tilt the skid until the forward ends of its side bars come in contact with the upper side of the rear end of the lower skid along which the kegs roll to the forward end of the machine, where they are raised and again placed upon the upper skid. In this way a number of kegs may be kept in motion at the same time, the only labor required being to raise the kegs and place them upon the upper skid.

Improved Electrical Thermostat.

John H. Guest, Brooklyn, N. Y., assignor to Augusta Guest, of same place.—The object of this invention is to construct a reliable instrument for closing the circuit of an electric fire alarm as soon as the temperature of the surrounding air has reached a certain degree of heat. It consists of a bulb with an expansion tube surrounded by an outer vessel, which is closed hermetically by a suitable liquid, cork, and sealing wax. The end of the wire passes through this outer vessel and the bulb into the mercury, being in continuous contact with it, the action of the instrument being thus not disturbed by the changes of temperature and consequent access of air. Whenever the temperature will rise to the degree to which the thermometer is adjusted the mercury will rise in the expansion tube, and, coming in contact with the wire therein, establish the circuit and produce the alarm.

Improved Gyroscopic Toy.

Archibald C. Würtele, New York city.—This invention is an improved toy, which is so constructed that, by giving a rapid motion to a wheel suspended in it, it may be made to revolve in various positions and directions.

Improved Paint Compound.

Horatio Nelson, New York city.—This compound is claimed to possess antiseptic properties, which render it more desirable than other paints where such properties are not found. It is composed of plumbago, clay, silicate of potash or soda, and oil.

Improved Sofa Bedstead.

Charles F. Grundin, Boston, Mass.—The object of this invention is to construct an improved sofa or armchair bed, which can be thrown open in such a manner that the seat or back of the sofa is not used at all for the bed and consequently less worn, retaining its form and appearance. Any spring bottom can therefore be used for the bed part, and the whole be placed on casters, to be easily moved as sofa or bed. The invention consists of four parts, two for the back and two for the seat, hinged together to be swung open by disconnecting the arm top pieces from the arm braces, which form the legs of the front part of the bed. The sofa back and seat form the outer side, a spring bottom the inner and bed part of the sofa bed.

Improved Medicine Spoon.

James L. Colby and Le Roy B. Thomson, Saxonville, Mass.—The object of this invention is to supply a spoon for the nursery by the use of which the administering of medicine to children is greatly facilitated, without spilling the medicine. It may also be manufactured in larger sizes, and be placed on suitable supports on the bed table, so that the medicine may be filled into it before the actual time of taking has arrived. To the body of the spoon is attached, at the connecting point between bowl and handle, by means of hinges, a convex cover of the same size as the bowl, and resting edgewise upon it. A crescent shaped opening at the foremost part of cover serves, when the same is thrown open, as a rest for the vial, to steady the hand for counting the drops of the medicine; when closed, for the purpose of allowing the contents of the bowl to flow freely into the mouth of the patient. To the lower side of the bowl are connected supports for sustaining the spoon in such a position that the medicine is level in the bowl and does not spill.

Improved Mode of Constructing Wells.

Asahel Curtis, Bastrop, La.—This invention relates to a new and useful method of forming wells with less brick for the curbing than has heretofore been used. The ordinary wooden earth box, sharpened at the lower end and having bands at top and bottom, is intended to receive the bricks that are usually superposed thereon, while the wall and the box gradually sink lower and lower as the wall is built. A cylinder placed about the box is gradually raised as the work progresses, and is removed at its termination. This not only enables wells to be constructed with great evenness of the wall bricks, and with perfect perpendicularity, but also enables one to economize the number and expense of the bricks themselves, especially in country places, to which they are hauled from a long distance.

Improved Cotton Press.

William W. Patrick, Midway, S. C.—The object of this invention is to construct, for the use of cotton growers and others, a powerful press for packing the cotton in bales, which, on account of its plain construction, can be furnished at very moderate price. The invention consists of a frame of strong timbers, carrying the packing box and a windlass. Two levers are pivoted to the upright posts of the frame, the lower one with semi-circular head carrying the pendent follower block, the upper or king lever pressing on the lower and packing thereby the cotton in the box. By pulleys and ropes at the end of the levers, in connection with the windlass, the power is obtained.

Improved End Gates for Wagons.

Stephen F. Robertson, Rockford, Ill.—This invention has for its object to improve the construction of wagon boxes. To the inner surface of the side boards, at their ends, is attached a plate of malleable iron, which is cast with two flanges upon its outer side to form a groove to receive the end of the end board. Upon the lower end of the plate is cast a bolt which passes down through the bottom board, and through the cross bar placed beneath said bottom boards, and has a hand or lever nut screwed upon it. Upon the outer flange of the plate, near its upper end, is an eye to receive the hook cast upon the malleable iron cleat attached to the end board. A bolt attached to the end board passes down through the bottom board and the cross bar, and has a hand or lever nut screwed upon its lower end. By this construction, the parts of the wagon box will be much more firmly held together than when the ordinary wooden cleats and cross rod are used.

Improved Seed Planter.

William Call, Jr., Haverstraw, N. Y.—This invention has for its object to furnish an improved machine for planting seeds. A clutch which slides upon the axle is pressed out against the wheel by a spring, and is held by a pin to the axle. Upon the axle are secured star cams by which the dropping slides are operated. The main frame consists of two long bars, connected by three cross bars, while the auxiliary frame consists of two long bars connected by short bars, having sockets that enable the frame to slide upon the bars of the main frame. On the front bar is pivoted the seed-dropping slides of the hoppers. By suitable construction the hoppers and furrow openers may always be adjusted to rows of different distances apart.

Improved Chair.

William T. Doremus, New York city.—This invention has for its object to furnish an improved chair, so constructed as to yield, as a person sits down in it and as he leans in either direction, thus avoiding the rigid resistance experienced in sitting in an ordinary chair, and which at the same time adjusts itself to the weight of the person, and thus operates equally well with a light and with a heavy person. By suitable construction, when a person sits down in the chair, his weight compresses rubber blocks more or less, so that the said blocks will always adjust themselves to the weight they may have to support.

Improved Hinge.

James W. Wood, Conshohocken, Pa.—The object of this invention is to furnish an adjustable hinge, by means of which the doors can be easily set to any position desired on the shrinking or swelling of the door frame and door, or adjusted up and down to prevent dragging or catching at the sill or top frame. The invention consists of a flange cast to one wing or leaf of a common butt hinge, to slide and be adjusted by set screws in a metallic socket mortised into the jamb and secured firmly therein by wood screws.

Improved Dog for Circular Saw Mill.

James Taber, Rockford, Mich.—This invention has for its object to furnish an improved dog for securing the log or other timber upon the carriage in circular saw mills. By suitable construction the engaging ends of the dogs are thrown forward and inward, to enter the log, by moving the free end of a lever downward, and are thrown back and outward by moving the free end of said lever upward. The lever when moved upward moves along a spring to keep it from dropping down when released. By raising the free end of another lever a block will be drawn forward, causing the engaging ends of the dogs to project, to enable them to take hold of a rough, knotty or crooked log. By lowering the free end of the lever the dogs are drawn back to their former position. The sliding plate and its attachments may be raised, to adapt it to dog a larger log, and again lowered at will.

Improved Medical Compound.

Aaron Fuqua, Woodville, Ky.—The object of this invention is to furnish a remedy for diarrhœa and similar diseases of the bowels; and it consists in a compound composed of red oak bark, sweet gum bark, blackberry root, cloves, pimento, cinnamon bark, extract of logwood and refined sugar.

Improved Thrashing Machine.

Frederick R. Sutton and William O. Sutton, Wellington, Ill.—The crushing rollers are arranged directly in front of the upper edge of the concave so as to deliver the flax and grain to it. There is an endless roller or apron arranged on a feed table in front of the rollers for delivering to them. The lower roller is mounted in stationary bearings, but the upper one is arranged in movable bearings to slide up and down in a yoke; and springs of elastic rubber are arranged in yokes above them, so as to allow the upper roller to rise, as required by the flax or grain passing under it, and to keep the press down thereon, no matter how much or little it may be. The apron works over rollers, the latter bearing at the outer end of the table, and provided with adjusting screws, by which the requisite tension may be maintained on the apron. The beater blades of the thrashing cylinder are arranged upon projections of the arms of the cylinder beyond the head, and they are screwed by hook-shaped angle bars, which engage the bars of the cylinder at one edge, and are clamped by the clips, which engage the other edge, and are held by hook bolts.

Improved Till Alarm.

John F. Baldwin, Nashua, N. H.—The object of this invention is to furnish improved means for detecting fraudulent attempts to gain access to money drawers or "tills." The case consists of front and side plates attached to the bottom and end of the till. Keys are pivoted to the front plate, and act as levers, the back motion being produced by spiral springs. There are several bolts which work through a swing bar. The lower portion of each bolt extends down from the foot piece through a flange, and has the spiral spring around it, which spring rests upon the flange and presses the bolt upward with a constant pressure. The lower edge of the swing bar is forced forward in contact with the keys by a spring. On the inside of the swing bar is a small lug for each bolt, and each bolt is made with a shoulder which catches under this lug and holds the bolt down when it is not in use for locking. The openings in the top of the swing bar, through which the bolts work, are broad enough to allow the bolts to be forced one side, or into an inclined position, and when so forced one side and pushed down the shoulder catches under the lug of the swing bar. When the bolts are not required for locking they are not disposed of in this manner. The locking bolt or bolts may be changed, and one or more brought into requisition, as may be desired. When the bolts are thus pushed down and held the toe of the key (when the finger piece is pulled) slides down on the face of the bolt and thereby pushes back the swing bar and gives the alarm. When the bolt is up (as when used for locking) the toe of the key passes by the side of the bolt, and the angle of the key strikes the foot piece and draws down the bolt. When the drawer is closed a catch plate will be raised by the end of locking bolt; but when the bolt has passed behind, it drops down and secures the drawer. A small spring presses the plate down with a constant pressure. A spring rod keeps the drawer in position when it is closed. The alarm is given whenever the swing bar is pushed back, and this is done whenever a key is made to operate upon a silent bolt, or a bolt not employed in locking.

Improved Railway Frog.

John Woodville, Washington, Ind.—This invention consists of a turn out for mining railways, constructed with particular reference to the cars used in mines, in which it is necessary to have the wheels revolve on the axles, on account of the short curves necessary on such roads, and which said wheels, in consequence of so working, have considerable lateral play. The invention comprises improvements in the form or construction of points of switch rails. The peculiarities of these points are: The pointed end of one switch point terminates at such a point in the line of the outside rail of the branch track that the gage is increased on a radial line about one and a quarter inches; and the pointed end of the other point is so arranged that the gage on another radial line is increased about an inch and a half, so that notwithstanding the lateral play of wheels on the axles they will be switched off on the curve with certainty in case the car is pulled by the team to the left. In some cases, where the turn out is not very short, so that the team will not naturally turn out enough to pull the car over into the switch, it is desirable to employ a movable tongue, which is pivoted at the concave end of one switch point by a pin extending down through the wing plate, and having an arm fixed on it, and extending outside of the rail a suitable distance, and connected with levers and weights for holding the tongue open or closed, as may be desired, the weight being put on one arm to hold it open, and the other to hold it closed. It is proposed to have a cord or rod extending along the track each way, so that when it is desired to have the car take the course which the tongue would, under the influence of the weight, prevent it from taking, the driver can shift the tongue while riding on the car by reaching out and pulling the cord.

Improved Harvester.

John Werner, Jr., Prairie du Sac, Wis.—This invention has for its object to improve the construction of that class of harvester platforms that convey the grain longitudinally along the platform, and raise it into a receptacle to be conveniently taken by the binders and bound. The invention consists in the improvement of platform conveyers. When the cut grain falls upon a harvester platform it usually falls with its heads inclined toward the elevator, and is carried forward in that position to the elevator, when an ordinary conveyer is used. With this improved conveyer the heads of the cut grain fall upon the platform, and its butts upon the belt or belts, so that the said heads will lie still, and the butts will be carried forward until the grain lies straight across the platform when it will be carried forward by the slats to the elevator.

Improved Coffin Plate.

George Brabrook, Taunton, Mass.—This invention relates to coffin or other plates intended to receive an inscription; and consists in providing a tapered body with a circumjacent flange at the bottom, and a detachable beveled border.

Improved Meat Chopper.

Hoge P. Rankin, Allegheny, Pa.—This invention consists in a novel mode of combining a rotary table and a series of chopping knives; also, in a peculiar mode of constructing the knives, so that, when the edge of a knife loses its exact horizontal line by sharpening, it may be still adjusted on the stock so as to strike horizontally; and, finally, in a novel mode of preventing the mechanism from being broken by the contact of the knives with bones or other hard substance.

Improved Clay Molding Machine.

Charles A. Fisher, Baltimore, Md.—This invention relates to molds for making earthenware plates, engraved or otherwise, for stoves, flooring, or other purposes; the same being made in two parts, hinged together at one end.

Improved Curtain Fixture.

Lloyd J. Earll, Union City, Pa.—This invention consists in suspending a curtain from the cornice so that it can be adjusted with respect thereto and at different distances therefrom. It also consists in a suspended wire frame, provided with bearings, in which rotate the curtain roller. It also consists in providing a novel detachable journal for the roller, whereby if a journal is injured or impaired it can be easily replaced.

Improved Toy.

Albert R. Batchelder, Newburyport, Mass.—This invention is an improvement upon the toy for which letters patent were granted to E. L. Morris, June 25, 1872, No. 128,399. The improvement consists mainly in suspending balls from the handle by flexible cords or strings. The object is to increase the difficulty of operating the toy, and to enable a series of beautiful parallel curves to be described about the handle in various planes.

Improved Button Hole Cutter.

Casper Van Hoosen, New York city.—This invention consists in arranging a cloth gage within a circular slot of one scissor blade, which is shouldered, and a stop screw on the other slotted blade, which acts against the shoulder. When adjusted, a stop will prevent the blades from closing beyond the required point, so that all the button holes will be of exactly the same length. The part of the scissors upon which the stop slides is provided with a scale of division marks for convenience in adjusting said stop.

Improved Shutter Worker.

Hervey S. Phillips, Wilmington, Del., assignor to himself and Robert Blair, of same place.—The object of this invention is to provide improved means for opening and closing window blinds and shutters. A bar of irregular form, or zigzag in shape, having offsets therein, is attached to the inside of the shutter at its ends. A lever is attached by a pivot screw to the window sill, so that it may be made to swing horizontally. The opposite end of this lever is curved, and has lugs projecting upward, between which the bar is placed. When the lever is moved outward the bar slides between the lugs, but there is sufficient play to allow the offset to pass without binding, and when the lever is held at rest without the lug in the angle of one of the offsets, the shutter is held immovable, while, by a movement of the lever one lug slips from the angle, and another lug pushes the bar outward. The blind or shutter may be securely held by the lever when either open or closed, or in three, more or less, intermediate positions. The lever is operated by means of a curved or circular bar, which is moved horizontally through the casing above the window sill from the inside.

Improved Ant Trap.

Leander Rubarth, Davilla, Texas.—This trap is for catching burrowing insects, but is especially adapted for exterminating a species of large ant which infests portions of the Gulf States, and is very destructive to vegetation. The trap is in the form of a hollow truncated cone, and has downwardly projecting annular flanges or "overhangs" applied to the inner and outer tubes, and made detachable to enable the ants to be discharged from the trap when necessary. The ants reach the inner chamber by crawling up the inclined outer sides of the trap or up the vertical inner tube. Thence their escape is prevented by the aforesaid "overhangs" or flanges.

Improved Fruit Jar.

Mrs. Ella G. Haller, Carlisle, Pa.—This invention consists in forming a groove for the packing on the outside of body, while the cover is constructed with a lip or flange that overlaps the groove and packing, allowing each to be blown in a single piece; whereby the liability to fracture, which exists where the neck is blown separately and applied in a plastic state, is entirely obviated; and whereby a jar of much greater simplicity and efficiency is produced.

Improved Egg Beater.

John W. Condon, Logansport, Ind.—This invention consists in providing a suitable vessel with beaters and scrapers rotating in opposite directions, so that the material adhering to bottom and side of vessel will be thrown out by scrapers and into the path of the beaters. It also consists in the means for operating the beaters and scrapers.

Improved Churn Power.

Elijah Barrett and Geo. W. Fenimore, Franklin, Tenn.—This invention consists in an arrangement of a supplementary driving shaft, so arranged as to be brought into and out of gear with the main shaft for the purpose of changing the rapidity of reciprocation of the dasher. It also consists in an attachment whereby a brush is caused to move over the top of the churn to keep away flies, etc.

ANSWERS FROM CORRESPONDENTS

C. H. S.'s query as to blue paper is a business question. For waterproof paper, read articles on pp. 129 and 177, vol. 28.—T. is informed that the four world's fairs were held in London, 1851, Paris, 1855, London, 1862, Paris, 1867, the 1851 show being the first that ever took place.—A. B. S. can blacken his iron bands or other articles by following the directions on p. 203, vol. 28.

F. E. T. asks: 1. How can I distil water so that I can get it in large quantities quickly, and at little expense? 2. Can powdered silica be found in market, and where? It is used in white for the complexion, and is composed of white sand and anhydrous soda. 3. Where can I get the white sand? 4. Is Herr Artus' recipe, on p. 73, vol. XXVI, for paste or liquid blacking? Answers: 1. You may make it in large quantities and quickly, by the use of a large still; but unless you are using heat for some other purpose, it will not be very cheap. 2. You can prepare very finely divided silica by precipitating a solution of water glass with muriatic acid, and igniting. Electro-silicon is infusorial silica. 3. Fine white sand can be obtained from the beach. 4. Liquid.

N. W. questions our reply to F. B. who asked as to the efficacy of the forked stick in discovering hidden springs of water, and refers him and us to the Patent Office report for 1851, part 2, "Agriculture," for evidence as to the error of our views given on p. 282 of our volume XXVIII. Answer: The statement in the report is merely an assertion in a letter to the Commissioner of Patents, and is unsupported by independent testimony.

F. P. C. asks: How can I remove the oil from white lead? How can I know that the oil has been properly removed? I have tried commercial (188 per cent) alcohol, and find that pure white lead and zinc, treated in this way, give a gray precipitate. I have also placed some of the lead and zinc in a porcelain dish and placed it on charcoal; I find a dark brown residue after treating with dilute nitric (C. P.) acid. In a mixture of lead, zinc, and baryta, I find (after burning) that the precipitate is very dark, almost black, having all the appearance of baryta except the color. Can I precipitate the zinc, after precipitating the lead with sulphuric acid? Answer: You can free white lead from oil by agitating it with successive portions of common ether in a closed bottle. The lead is free from oil when it appears dry and its particles do not stick together. You can separate barytes (sulphate of baryta) from a mixture of white lead, zinc and barytes after the oil is removed by treating with dilute nitric acid. This will dissolve the lead and zinc, while the barytes will remain undissolved. Sulphuric acid added to the solution of nitrate of lead and zinc formed will throw down the insoluble sulphate of lead. By adding carbonate of soda, to the solution of sulphate of zinc remaining, until effervescence ceases, zinc oxide will be precipitated. A careful ultimate analysis, however, to determine the quantity of lead, zinc, and barytes in a given mixture, will cost $10.

I. W. asks: Is a lead vein, with its wall rocks well defined, (for instance, limestone on one side and sandstone on the other) a sure indication of a valuable lead mine; and if *so*, is a large sized vein or medium sized one the most profitable? Answer: We should judge from your description of the occurrence of the galena that it was a veritable lode. Galena often occurs in limestone, as in the counties of Northumberland, Derby and Durham, England, in veins which traverse compact limestone. In Kentucky, at Millersburg, in Virginia, Wythe county, and in Maryland, near Baltimore, it occurs in limestone. In Pennsylvania, on Perkiomen creek, 23 miles from Philadelphia, galena has been mined. Here there is a shaft 170 feet deep, with a horizontal drift of 300 feet entering the shaft 80 feet below the surface. The ore found here is in the old red sandstone formation. The value of a mine can only be approximately estimated before working. Of course the larger the vein and the nearer the surface, the more valuable the mine.

S. W. asks: How can I remove inkstains from linen? Answer: Dissolve a teaspoonful of oxalic acid in a gill of water. By means of a sponge or cloth dipped in the solution, soak the stain thoroughly, and afterwards rinse or wash with water. Throw away, or keep in a bottle labeled "poison," the oxalic acid solution.

J. S. C. says: In an engine running from 150 to 200 revolutions per minute, can an expansion of one quarter of the length of the cylinder be used to advantage? A mechanic of good ability and long experience says the engine will pound itself to pieces. Will expansion make any difference in the pounding of an engine? Answer: The best point of cut-off depends upon initial pressure, clearance, etc. But you can cut off the steam at the point mentioned, with perfect safety, and all shock can be prevented by giving a proper amount of exhaust cushion.

M. R. S. asks: 1. What effect does a hot blast have on wrought iron when used in a common blacksmith forge? Does it injure the iron or not? If not, does it save fuel enough to pay for itself? 2. Is there any known cheap compound that will make an intense heat for 30 or 40 minutes without replenishing? Answers: 1. The hot blast will cause the iron to be heated more quickly, and will not injure it. Under ordinary circumstances it would hardly pay to introduce the hot blast in a common forge, if much trouble or expense were involved. 2. We do not know of anything except a heavy fire and strong blast.

W. F.—White gunpowder is granulated in the ordinary way.

W. W. O. asks: What acids and in what proportions are used for brightening German silver or brass, and how are the articles cleaned after dipping in the acid? Answer: Brass is cleaned with oxalic acid. The acid must be washed off with water, and the brass rubbed with whiting and soft leather. A mixture of muriatic acid and alum dissolved in water imparts a golden color to brass articles that are steeped for a few seconds in it. Vinegar and common salt may be used instead of the acid. For cleaning silver and Britannia ware, we have seen zinc white (first quality) recommended.

J. D. asks: What can be used effectually to coat the inside of cider cisterns, to prevent them from leaking? I have made 12 cisterns of Norway pine, and the cider seems to ooze right through the wood. Answer: Paraffin is not acted upon by alcohol or acids. Soluble water glass will also answer your purpose, if not too expensive. Pitch and bitumen are the cheapest substances you can use.

J. B. says, in reply to T. W. S., who asked what would keep flour paste from fermenting: I have an excellent paste composed of 3 parts of gum tragacanth, 1 part of gum Arabic, and a small portion of mercuric bichloride; will alcohol or carbolic acid prevent it from souring? Answer: If a sufficient quantity of mercuric bichloride (corrosive sublimate) is added, that alone ought to prevent decomposition. That is the only object in putting in this poisonous substance. If that does not do, carbolic acid will. Alum is also sometimes used to prevent paste souring.

J. A. M. asks: What other (if any) ingredient is used with starch, and how is it applied, to produce the fine polish on linen as it comes from the laundry? Answer: A small piece of pure paraffin, added to the starch when hot, and well incorporated, will give a brilliant gloss to starched linen. Add a piece as large as a hickory nut to an ordinary bowlful of starch.

W. F. M. & Co. say: We have several hundred gallons of neat's foot oil; its lubricating qualities are good; but when hot in the journal or in boring, it emits an odor very offensive to the workmen. Is there any process by which we can refine it so that it will lose its offensiveness without destroying the lubricating property? Answer: Filter the oil through freshly burnt charcoal, or boil it for 15 minutes with a little water and calcined magnesia.

W. F. asks: Can you inform me of any simple process for softening the water in a well? The bottom of the well is rock. Answer: You can soften the water by adding a solution of carbonate of soda, known as washing soda, as long as the water turns milky. After settling, draw off the clear portion. If the hardness of your water depends on the presence of limestone dissolved in it, simply boiling it and allowing the mineral matter to subside will soften it.

A. B. W. says: We make the gas to light our building in iron retorts, from what is known in the trade as "residuum." It is the black tar-like oil from refined petroleum; it makes good gas, but is quite expensive on account of the high heat required, and the amount of fuel (coke) it requires to get up the heat. Is there anything we could use that would not require so great a heat and that would be equally as free from danger in using? The high heat soon burns out the retorts and new ones are quite expensive. Answer: Try the ordinary gas coal or cannel coal, which, as you mention coke, ought to be within reach. You can then make your own coke.

M. G. S. says: A Leffel 56 inch water wheel was set for a 6 feet head, going at 60 revolutions, giving with an open gate 36¼ horse power. Under this head we only used a ⅜ open gate, showing, we think, that it requires ⅝ of 36 or 24 horse power to run our machinery at the required speed. During low water, our main shaft decreased in revolutions from 175 to less than 140 with an open gate. Our hydraulic engineer says that by changing the set of the wheel from a 6 feet to a 4 feet head, we could obtain the required speed with a ⅝ open gate. He is now setting it for a 4 feet head (49 revolutions) and enlarging the main driving pulley to counterbalance the decreased speed of the wheel. We claim that, instead of running at 49 revolutions, the wheel will decrease its speed, that the surface of the enlarged pulley will have the same velocity as before, that the main shaft will still run less than 140 revolutions, and further that, by no possible means under the circumstances stated, can the required speed be obtained. Answer: By decreasing the head, the power of the wheel will of course be decreased. And your assertion, that "by no possible means under the circumstances can the required speed be obtained," is correct. It can only be done by a sacrifice of power.

A. B. asks: 1. Where should an engine 8 x 24 inches take steam to give the most power when run at full stroke, when the crank is on the center, or a little before it reaches the center? 2. Is there anything that will prevent lime collecting in my boiler? 3. Are you printing a paper called the *Patent Report* or some similar title? Answers: 1. Set the valves to admit steam when the engine is on the center; and if you need cushion, obtain it from the exhaust. 2. Try tannate of soda. 3. The paper you refer to is published at the Patent Office, Washington, D. C., and is called the *Patent Office Official Gazette*.

W. W. A. asks for an explanation of a literary allusion to the dust of Cæsar stopping a beer barrel. Answer: Read Hamlet's meditations on the skull of Yorick: "Imperial Cæsar, dead and turned to clay, may stop a hole to keep the wind away," etc.

J. J. B. asks how to get rid of red ants. Answer: Try common salt.

C. W. B. says: I have a thresher which I wish to level at each setting with an ordinary spirit level. The sills to be leveled are 4 feet long; the distance between the wheels is 4 feet 10 inches. Can you give me a rule by which I can determine just how much to raise or lower one side to compensate for any given deviation of the level? Answer; Place the level on the sill in the direction of its length, and measure how much the level itself requires to be raised or lowered at one end; and then raise or lower the corresponding end of the sill a distance equal to this amount multiplied by the length of the sill, and divided by the length of the level. Suppose, for instance, that the level is 2, and the sill 4, feet long: and that when the level is placed on the sill, one end requires to be raised one sixteenth of an inch, to bring the bubble to the center. Then applying the rule, multiply one sixteenth by 4 and divide it by 2 and thus obtain ⅛ of an inch as the distance the corresponding end of the sill must be raised to render it level.

W. B. F. asks how to obtain the sulphate of soda resulting from the action of sulphuric acid on carbonate of soda in the manufacture of carbonic acid gas for soda water. "I use about 25 lbs. soda per week, Will it pay to try and save it?" Answer: The reduction of sulphate of soda to the carbonate is a difficult operation, and cannot be carried out on a small scale. Leblanc's process for making soda ash accomplishes this by mixing the sulphate of soda with chalk and fine coal, and fusing the mixture in a reverberatory furnace. Can you not employ muriatic acid instead of sulphuric, and thus produce common salt? Sulphate of soda is, however, used in the arts, and you should try to sell it to a glass house, if there be one in your neighborhood.

M. asks for a material that is both flexible and transparent, which may be folded up without destroying its transparency. Answer: Try tracing paper or tracing cloth.

C. O. S. says: We have a steam cylinder for drying purposes, placed about 100 feet from the boiler, and fed through an inch pipe direct from the boiler. Does it make any difference, in the drying capacity of the cylinder, whether the steam goes through fast or is confined so that just enough passes out of the exhaust pipe to keep it clear from water? In other words, does steam lose its heat by passing through pipes as long as it remains steam? Our fireman insists on a strong current of steam passing through, which we would like to save, if possible without loss of heat, for drying. Answer: You will probably obtain satisfactory results by the method you propose. Suppose that you try it one day by your plan, and the next by the engineer's, and compare the results. We would be glad to hear from you, in case you make the experiment.

D. B. T. asks in what ratio with the pressure the friction of water increases in its passage through an iron pipe of a given size and length, that is, what is the difference in friction between one and ten atmospheres pressure? Answer: The resistance due to friction will be about 10 times as great in the second as in the first case, increasing nearly as the pressure, or as the square of the velocity. See article on "Friction in Pipes," on page 48 of this volume.

D. C. asks how to make nickel solution for plating iron or other metals by galvanic process. Answer: The nickel solution may consist of ¼ lb. of the double sulphate of nickel and ammonia dissolved in a gallon of water, or of ¼ lb. of the double chloride of nickel and ammonia in a gallon of water. The main condition of nickel plating lies in these points: (1) to have the solution always kept neutral, it is necessary to test the liquid frequently by means of litmus paper; and if it be acid, to add sufficient caustic ammonia to make the liquor perfectly neutral; (2) to have the materials to be plated always perfectly clean, which, if the goods are of iron, can be done by dipping them in a mixture of muriatic acid and water. The surface of the nickel anode should in no case be less than the surface to be coated, and may be much greater. See also page 197 of our volume XXVIII.

A. D. C. says: In pumps of the same size of barrel and length of piston rod, does the length of the column of water under the piston valve (whether 15 or 20 feet) make the pump work easier or harder? The pump is under 33 feet long. Answer: The shorter the length of the water column, the easier the pump will work. The weight lifted is proportionate to the length of the column.

A. B. asks: What is the customary rule for measuring charcoal? How many inches are a bushel, or how many cubic feet are a hundred bushels? Answer: Charcoal is measured and sold in New York by the barrel, the size being that of a flour barrel, which holds 3 bushels or 5¾ cubic feet. A barrel of charcoal is sold here for $1.

F. W. asks: Will some one give me the different degrees at which water boils, under different pressures? Answer: See editorial pages of this issue.

H. P. asks: 1. Would it be practicable to raise water by means of a beam similar to a beam engine, a float being attached to one end and a vessel for raising the water at the other, and the float operated by the tide? 2. How high does the tide rise at New York? 3. A friend says that, by placing rubber inside of a wheel hub around the axle, the shock to the wheel will be much less when striking against obstructions than when nothing is used, the momentum being the same in each case. What is your opinion? 4. Can attraction be accounted for otherwise than supposing some sort of a vacuum? 5. Will a magnet have any attraction, being detached entirely from any connection with the earth? Answers: 1. Yes. 2. From 8½ to 35½ feet. 3. We think the rubber would help to prevent injury to the wheel. 4. Yes. 5. Yes.

C. B. says: I have built a small slide valve horizontal steam engine, cylinder 1½x2 inches. What power would such an engine have? Answer: About two tenths of a horse power.

J. S. T. asks: Why is it that a screw can be driven more easily and farther into wood with a long driver than a short one, the handle and everything else being equal? Answer: Because the screw driver is held at an angle, and the long driver affords greater leverage than the short one. If both were secured so as to be at right angles to the face of the screw, there would be no difference in their action.

S. W. says: In SCIENTIFIC AMERICAN of July 26, page 59, you speak of oil of rhodium as if it were a name without a reality. I have bought an essential oil so named. Dunglison's "Medical Dictionary," under "rhodium," says that "rhodium is the wood or root of a tree supposed to be the *genista canariensis* of Linnæus, of the family *leguminosæ*. The essential oil is a perfume (of a rose-like odor, we may add) and possesses cordial and tonic virtues. Its smell is attractive to fish, rats, etc." The *Encyclopedia Americana* says of rosewood that the tree (*amyris balsamifera*) yields an odoriferous balsam.

S. G. Jr. says: Suppose I take 20 gallons of hydrogen gas, and compress it to 10 gallons, would the 20 gallons of gas while under pressure lift twice as much as the 10 gallons of free gas? Answer: 10 gallons of free, uncompressed hydrogen gas will lift about 1½ ozs. By compressing 20 gallons of hydrogen into 10 gallons, you double the density, and consequently double the weight of the compressed gas. Therefore 10 gallons of free, uncompressed hydrogen will lift twice as much as 20 gallons of hydrogen compressed into 10.

D. asks: Is there any way to restore meat that is musty or tainted? We packed some of it away in wheat bran and rye after it was smoked, and the wet spring caused the rye to sprout, thus giving the meat a musty flavor. Answer: Pack the meat in freshly burnt powdered charcoal for a few days.

F. D. B. asks for a good recipe for making birdlime? "The only recipe for it that I can find contains white holly bark, and this is not procurable in this country." Answer: If you cannot obtain holly, use mistletoe or other parasite with a gummy or glutinous resin in it which does not dry.

Y. E. says: 1. I am running a 12 horse power vertical engine; it is not as large as we want and we cannot sell it to any advantage. How would it do to connect another engine of the same size to the other end of the shaft? Twenty-four horse power is all we want. 2. Our boiler is ¼ inch shell, 16 feet long and 42 inches in diameter, with two 14 inch flues. Could we make it drive two 12 horse power engines? 3. How much steam pressure would it bear with safety to the square inch? It is nearly new. 4. What is the "Science Record" worth, and where can I get a copy of it? Answers: 1. The plan you propose would give you 24 horse power, but probably the shaft is not strong enough to stand the increased strain. 2. We do not think the boiler would be large enough to drive both engines. 3. About 50 pounds per square inch. 4. Two volumes of the "Science Record" are published, either of which will be mailed to you from our office on receipt of two dollars.

J. G. asks: In raising weights, if the upper pulley has two grooves with notches where the links fit in, and there are 20 notches in one groove and 21 in the other, the lower pulley being much smaller, with but one smooth groove, and the chain being continuous: if both grooves in the upper pulley had an equal number of notches, would it hoist faster, supposing the chain on both constructions was pulled at the same rate? Answer: The amount the weight rises in one revolution of the upper pulley is equal to the difference of their diameters, and if both were of the same size, the weight would be stationary.

H. F. B. says: I want from 6 to 8 horse power, and have a plain slide valve engine, 10 inches cylinder and 12 inches stroke; I have thought of getting an 8 horse power boiler for it. Would the arrangement be as economical as regards fuel as an 8 horse engine of the same class with the same boiler, and if not, about what difference would there be in favor of the smaller engine? Answer: If the engine you have is in good order, it would hardly pay to get a new one, as, by arranging it to work with high steam and short cut-off, it could probably be run very economically.

T. J. J. asks: Which will produce the greatest amount of heat, a cord of green wood, or one of wood dried or seasoned in the open field for, say, four or six months before using? Which contains the largest amount of carbon, and what is the relative amount of heat of the different kinds of wood? Answer: Green wood contains about the same amount of carbon as dry, and the chief difference is in the amount of water in the green wood. From careful experiments on the total heat of combustion of different kinds of fuel, it is found that a pound of dry wood, containing 50 per cent of carbon, will give out about 7,000 units of heat in its combustion, while a pound of the same wood, containing 20 per cent of moisture, will give out something less than 6,000 units of heat. Taken bulk for bulk, the amount of heat given out by the combustion of each quality would probably be the same. In ordinary practice, dry wood is the best, because it can be most easily consumed; though, where combustion is very rapid, there might not be much difference.

S. C. H. asks: 1. Which is the best way to feed the boiler of a feed steamer? 2. Can it be done with a small force pump? 3. Should the water be hot before entering the boiler; and if heated by passing through the furnace flues, what should be the position of the valves? In feeding from an elevated barrel, the pressure of steam must be as great in the barrel as in the boiler, making it slow and unsafe. Answers: 1. Continuously, near the bottom. If but a little feed is required, it could be managed with a vessel arranged on the principle of an equilibrium oil cup. 2. Yes. 3. Yes. If a pump is used, draw cold water through the pump, and force it through the heater, into the boiler, placing the check valve between the boiler and heater.

J. A. says: You tell G. van H. to place his pump 20 feet from the level at which he is sure to always have water. Will this answer for wells of all depths, say from 24 feet to 200 feet or more? Why should he place his pump within 20 feet if the water will rise 32 feet after a vacuum is produced in the pump barrel? Why not place it 32 feet from the water and save lifting the additional column of 12 feet of water? Answer: It is difficult to give a universal rule for the best position of a pump, but in general it should not be placed further than 20 feet from the surface of the water. If it is placed further than this, it is somewhat difficult to keep the pump in good working order. But the more important reason is that it is necessary to have a surplus of vacuum, in order to give the necessary velocity to the water If nearly all the vacuum is used up in lifting the water there will be very little to give a head to the entering water. The water will therefore enter slowly, and if the pump makes many strokes, it will run away from the water. In practice, it is found that it is cheaper to force water to an elevation, than to lift it by a vacuum.

J. H. B. says: 1. Would a glass water gage for a high pressure boiler be strong enough if it had twice the present inside diameter (I think it is now ⅝ inch) and were made of the same thickness and strength of glass as at present? 2. Are there any now in use that are larger? 3. Is the present size made with reference to the size of the two pipes supplying it, or only to the necessary strength? Answers: 1. Probably not. 2. Yes, up to one inch outside diameter. 3. Generally with reference to the size of the pipes. Glass tubes, if well annealed, could stand much more strain than is ordinarily put upon them. They are usually broken by sudden changes of temperature.

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

J. W.—The specimen is not corundum, but felspar. You had better advertise your mica, asbestos, plumbago, etc., in our columns.

COMMUNICATIONS RECEIVED.

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

On Explosive Projectiles. By J. T. F.
On Medical Practice in Early Times. By P. H.
On Sailing Faster than the Wind. By H. B.
On Retrogression of the Sun. By J. A. B. and by J. S. P.
On Constructing Large Lenses. By F. H. R.
On the Patent Right Question. By J. S. P.
On Deep Sea Soundings. By T. H.
On the Zodiacal Light. By H. B.
On Testing Steam Boilers. By W. S. K.

Also enquiries from the following:

A. B.—T. F. M.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

July 8, 1873,

AND EACH BEARING THAT DATE.

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Meat chopper, O. Gardner	140,686
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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

25,726.—BLIND WIRING MACHINE.—B. C. Davis. Sep. 24.
25,767.—CUTTING & PANNING CAKES.—J. H. Shrote. Sep. 24.
25,814.—SLEEPING CAR.—J. Danner. October 1.
25,843.—CULTIVATOR.—T. McQuiston. October 1.
25,867.—COVERING SADDLE TREE.—J. Maclure. October 1.

EXTENSIONS GRANTED.

15,661.—NUT MAKING MACHINE.—W. E. Ward.
24,734.—PAPER MAKING MACHINE.—W. Goodale.
24,748.—PAINT CAN.—J. W. Masury.
24,755.—OPERATING WINDLASS.—P. Philip.
24,772.—POWDER KEG.—J. Wilson *et al.*
24,773.—HOLLOW AUGER.—A. Wyckoff.

DESIGNS PATENTED.

6,746.—ADVERTISING FRAME.—M. M. Burnham *et al.*, Syracuse, N. Y.
6,747 to 6,752.—CARPETS.—R. R. Campbell, Lowell, Mass.
6,753 to 6,756.—CARPETS.—J. M. Christie, Lowell, Mass.
6,757.—TABLE CUTLERY.—J. D. Frary, New Britain, Conn.
6,758.—CARPET.—H. F. Goetze, Boston, Mass.
6,759.—CHAIN CHARM.—W. B. Hamm, Philadelphia, Pa.
6,760.—RAILWAY STATION.—J. W. Hoyt, Springfield, Mass.
6,761.—PRINTING TYPE.—A. Little, New York city.
6,762.—CEMETERY FENCE.—T. Pitbladdo, Brooklyn, N. Y.
6,763.—SWORD HILT, ETC.—V. Price, Woodside, N. Y.
6,764.—BOLT THREADING MACHINES.—S. W. Putnam, Jr., Fitchburg, Mass.
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6,769.—PRINTING TYPE.—R. Smith, Philadelphia, Pa.
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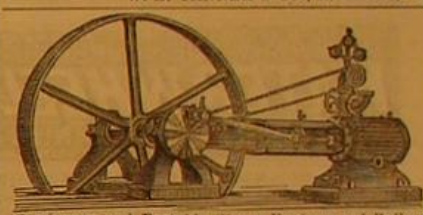

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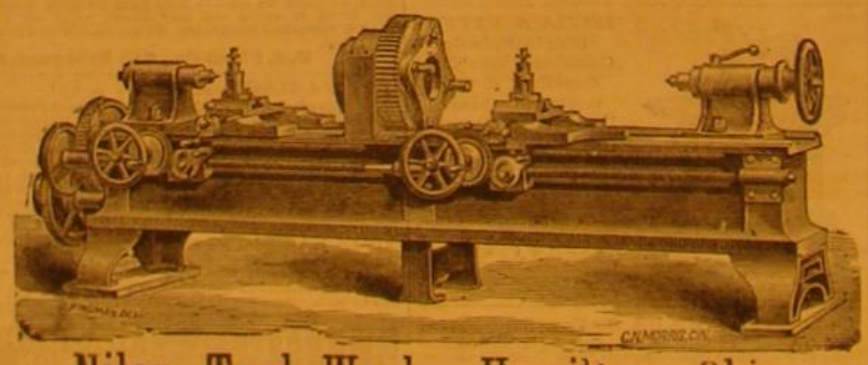

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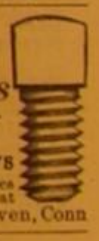

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