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THE CLOCK TOWER AT DELHI, INDIA.

The city of Delhi is one of the oldest in all the provinces of Hindostan, and the sanguinary fighting under its walls in the days of the Sepoy mutiny, is still fresh in the memory of most of our readers. Since the establishment of a large depot of the East Indian Railway there, many improvements in the streets and buildings of the ancient city have been made. Of these additions, the most noticeable from a distance is the new clock tower, which stands in the center of the Chandnee Chowk, opposite the own hall. Of this a photograph is given in "Professional Papers of Indian Engineering," and from the London *Builder* we extract the accompanying engraving.

This building is erected on an appropriate site at the crossing of four streets, and stands 110 feet high, exclusive of the gilt vane and finial. The lowest story is about 20 feet square externally. The materials used in its construction are brick, red and yellow sandstone, and white marble. The capitals surmounting the main corner pillars are 4 feet 2 inches wide at top, and 4 feet 6 inches deep; they are carved out of solid blocks of white sandstone, and each of them weighs about two tuns.

The dials of the clock are sufficiently elevated to be visible from the East Indian Railway station, and from other prominent points in the city. The clock is constructed to work five bells, placed in the open canopy above it; these give out a different peal for each quarter, the largest bell striking the hours.

The building was completed in 18 months, at a cost, including clock and bells, of $14,000, the whole of which amount was provided from the municipal funds of Delhi.

The tower was designed and built by Mr. E. J. Martin, Executive Engineer of the Rajpootana State Railway.

TOWER AND CLOCK AT DELHI, INDIA.

Railways without Switches, Turnouts, or Crossings.

Mr. Charles Jordan, Newport, England, proposes to stop one extensive source of railway accidents in what is certainly a thorough manner. He proposes to make the up and down main lines without the usual switches, turnouts, and crossings, the lines being continuous from end to end, and to work such road by transferring a train or trains at stations, or where shunting is necessary, or at junctions, with other railways, from the main line to the adjacent siding, by lifting the train bodily from one line to the other. The lifting will only be an inch or two, and the hydraulic apparatus as now constructed will make nothing of the weight, while as to time, Mr. Jordan calculates that a few minutes will suffice to transfer a train from one road to another without disturbing a single passenger. The whole work of a station, as regards the hydraulic apparatus, may be done by one, or, at large stations, two lads. The time saved in switching will be very great, and the risk of collision reduced.

Reproduction of Photo-Negatives.

The sensitive compound I have hitherto employed for coating the plates is made up of dextrin, 4 grammes; ordinary white sugar, 5 grammes; bichromate of ammonia, 2 grammes; water, 100 grammes; glycerin, according to the condition of the atmosphere, 2 to 8 drops.

A new, well cleaned, patent plate is coated with the sensitive chromium solution; and after the superfluous liquid has been allowed to flow off at one of the corners, the plate is dried in the dark by being placed upon a lithographic stone or metal plate, a period of ten minutes being sufficient for the purpose, with a temperature of 120° to 160° Fah.

The film being perfectly dry, the plate, still warm, is put under a negative and printed in the shade for ten or fifteen minutes. As soon as it comes out of the printing frame the plate is again slightly warmed; the brush is dipped into the graphite and applied over the surface of the image, which should be just slightly visible. The application of the powder is carried on in a shaded corner of an ordinary room illuminated by daylight. You must not press hardly upon the film with the brush, but move the same over the surface as lightly as possible; nor will it do to hurry the operation.

In proportion as the film cools so the image appears. By carefully breathing or, better still, blowing upon the film, you will be able to accelerate the process, and when the picture has attained sufficient vigor you take off the superfluous graphite powder with a clean brush.

A normal collodion is now applied; such as I use is composed of: Alcohol, 500 parts; ether, 500 parts; pyroxyline, 15 to 20 parts.

When this film has set and hardened, the margins are cut round with a knife, and the plate put into a porcelain dish of cold water. In three minutes the picture will be free from the glass, and the film may be employed in this position or reversed with a soft brush, and taken out of the water adhering either to the same glass plate or to another. A gentle stream of water falling upon the film will remove any chromium salts still remaining in it, and will also press down the loose film uniformly upon the glass surface. Finally, the plate is allowed to dry in a perpendicular position. Further treatment of the plate with varnish follows as a matter of course.

The image upon the collodion film is very thin; but you need be under no apprehension of its tearing while in the water, when it may be easily manipulated. I have to do with films of this kind measuring three feet square.—*J. B. Obernetter.*

New Antidote for Arsenic.—The only antidote for arsenic heretofore known has been hydrated peroxide of iron, which must be freshly made by mixing carbonate of soda or potash with a solution of either sulphate (copperas) of iron or muriate. A French experimenter, M. Carl, says that sugar mixed with magnesia serves as an antidote for arsenious acid.

In Europe the multiplication of photo prints is extensively done by mechanical means, with printing ink, and the copies, equal or superior to silver prints, are supplied at half the cost of the latter.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE END OF VOLUME XXX.

The thirtieth volume of the present series of the Scientific American closes with the present issue, and, completed, joins its predecessors as another milestone, recording the progress made by mankind in the path of Science during the six months which have just passed. It is hardly necessary to point out that, in the pages now finished, it has been our endeavor, as it will be in those to come, to popularize scientific knowledge, and to make the same generally available to the masses; not aiming to supply information valuable alone to the engineer, to the chemist, or indeed exclusively to any profession or calling, but rather to glean from the whole broad field of Science and Art the richest sheaves of genius, and to present, winnowed therefrom, the kernels of wisdom, unmixed with the chaff of technicality and abstruseness. That such a course has met the public approval, our increasing circulation and the many letters of which we are constantly in receipt, offering us pleasant wishes of encouragement, are the best and most flattering evidence.

In glancing back over the contents of the past volume, we feel that we may confidently assert that in no other periodical now extant is there to be found a wider range of topics, treated in popular and readable form, the perusal of which will add more largely to the stock of valuable knowledge of any reader.

In the pages now closed we have presented 258 illustrated subjects, in many cases with not merely a single cut, but with a series of engravings. These embrace the most recent mechanical inventions, patented in this country and abroad—new steam engines and boilers—new weapons of war—new tools for every variety of industrial employment—new household implements—new machinery of every kind for especial purposes—illustrations of new scientific experiments—views of new buildings, bridges, and monuments—pictures of rare and new plants, fossils, and animals—of queer freaks of Nature in the animal and mineral world—lucid diagrams, explanatory of mathematical demonstrations, and new theories of natural phenomena.

As for miscellaneous information, we would refer the reader to the columns of fine type, attached to this number, which form the index, in order to gain an idea of the number and variety of the matters he has examined.

No great discoveries have been made during the past six months; but the progress of Science has been uniform, and stopping, as we now do, for a momentary breathing spell, we can look back and see a notable advance. Professor Thurston has sent us a large amount of important and valuable news regarding the behavior of metals under stress, and how to test them—facts of the liveliest interest to every engineer and mechanic. Professor Orton has continued his letters, telling us about the little known resources of Central South America. In astronomy, we have presented our monthly notes, regarding positions of planets, times of phenomena, etc.; abstracts of Professor Proctor's excellent lectures during his late visit to this country, and also an account of Professor Wright's discovery of the cause of the zodiacal light. We have also noted the discovery of new planets and comets, announced the donation of $700,000 by Mr. James Lick, of San Francisco, for a gigantic telescope, and illustrated an ingenious plan for the manufacture of that great instrument, the device of Mr. Daniel Chapman. Our abstracts from the proceedings of the British Association, the French Academy of Sciences, and our own scientific associations, have been very full and accurate, while reducing the new topics discussed for ready comprehension by every one. Engineering subjects have been so extensively treated that it is hardly possible to particularize. We have illustrated the 1,000 foot tower proposed for the coming centennial, called attention to new processes of tunnel boring, bridge building, and railroad construction, mentioned some important works in hydraulic engineering in the West, and, in a multiplicity of articles from the pens of expert writers, considered topics of a timely and lively interest to the profession. Chemical matters have received their full share of attention, and so also the important subjects of electricity and magnetism, in which notable advances have been made.

With the end of this volume many subscriptions expire, which we hope to see speedily renewed. In accordance with our rule, the paper is not sent after the subscribed-for term has expired; so that those who have failed to remark the notice on the wrappers of the copies received lately will be warned, by the cessation of our visits, that the time has come for them once more to express their appreciation of our efforts by sending us their substantial support.

HOW TO ATTAIN HIGH TEMPERATURES.

In his recent interesting address before the *Société des Ingénieurs Civils*, M. Jordan spoke at some length of the methods now adopted of attaining high temperatures in metallurgical operations, and of the bearing of chemical principles and recent discoveries upon the subject. The learned engineer speaks of the "duel," as he terms it, between the fire on the one hand and the refractory materials used in the arts on the other, and recognizes the serious difficulties which impede the effort to utilize high temperatures, when it is possible to attain them.

The Siemens regenerative furnace and its modifications represent the most successful means yet in general use for producing extremely high temperatures, and the difficulty most frequently met is that of finding fire brick or other material capable of withstanding the heat of the ignited gases. We have known of instances in which the lining of steel-melting furnaces has been melted down like wax before this tremendous heat. Assuming, however, that we may expect to find sufficiently refractory materials to permit the utilization of still higher temperatures, the problem, to determine how to reach a higher limit, presents itself.

Under ordinary conditions, we cannot much exceed the temperature of a steel melting furnace, since dissociation occurs at a temperature supposed to be in the neighborhood of 4,500° Fah., for oxygen and hydrogen; consequently all combustion must be checked at some lower point on the scale, so long as no external force aids that of chemical affinity. The temperature of dissociation of carbonic acid is even lower than that for hydrogen and oxygen, and is shown to be not far from 2,500° Fah. Finally the presence of nitrogen in atmospheric air reduces the maximum temperature attainable, by furnishing a mass of gas which, while itself adding nothing to the supply of heat, abstracts (from the heat supplied by combustion of carbon and hydrogen) the larger amount required for its own elevation to the temperature of the furnace.

Elevation of the limit to increase of temperature of furnaces may be obtained by elevating the temperature of dissociation, and this, it has been found, may be done by producing combustion under pressures exceeding that of the atmosphere. Mr. Bessemer, the well known inventor who so nearly antedated our countryman Kelly in the invention of the pneumatic process of manufacture of iron and steel, which is generally known as the Bessemer process, has patented a method of increasing the pressure under which such operations occur. In the ordinary pneumatic process, this increase of pressure occurs to some extent in consequence of the small area of the opening by which the gases leave the converter, and it is stated that the pressure within the converter sometimes becomes double that of the external atmosphere. We may doubt if the increase ever becomes so great as this; yet there can be no doubt that it is sufficiently great to have an important influence in elevating the limit of dissociation and in giving the very high temperature which holds nearly pure iron within the converter in a condition of fluidity never observed elsewhere.

It is readily seen that the conclusions of M. Jordan, in the address to which we alluded above, are justified both by Science and by practical experience. He advises: The choice of a combustible which may be consumed in a bath of metal furnishing a non-volatile residue without injuring (*sans dénaturer*) the metal, and the adoption of a form of furnace which, heated by gas or otherwise, may be worked with an internal pressure of several atmospheres. He refers to the marvelous discoveries, recently made, relative to temperature and pressure on the surface of the sun and other heavenly bodies as affording illustrations of the possibilities in the direction of attaining high temperatures.

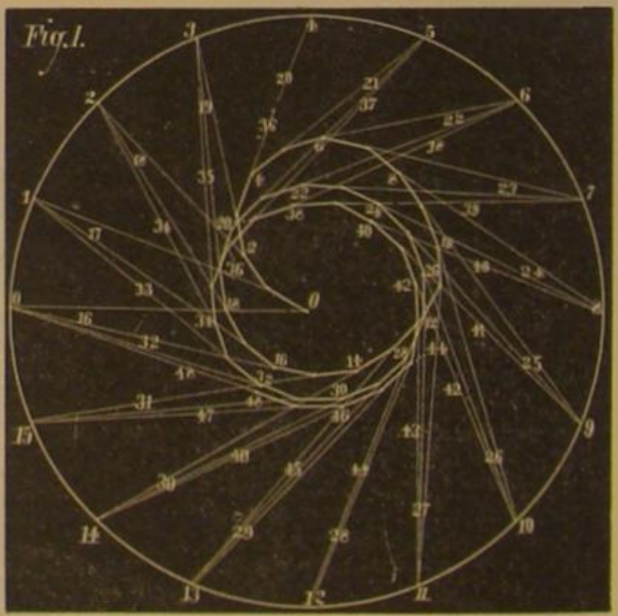
The problem presented is as interesting and attractive as it is important; and the inventor of new methods or of perfected apparatus, and the discoverer of more refractory materials than those now used, will aid greatly in its solution. Powerful intellects and ingenious minds are at work upon it; and we hope that our readers will be able to find in our columns evidence that the ingenuity which has made our people famous as a nation of mechanics, and the growth of Science which is gradually becoming so noticeable among us, have assisted to a valuable extent in effecting so important an advance in this direction. Any improvement or discovery which assists in the production and the economical application of high temperatures aids every branch of industry, and promotes our material welfare in an inconceivable number of ways.

A CURIOUS PROBLEM.

In our queries of last week's issue a correspondent, B. F. B., says: "There is a problem, which some one has found in a work published many years since, which is as follows: 'A man, at the center of a circle 560 yards in diameter, starts in pursuit of a horse running around its circumference at the rate of one mile in two minutes; the man goes at the rate of one mile in six minutes, and runs directly toward the horse, in whatever direction he may be. Required the distance each will run before the man catches the horse, and what figure the man will describe.' I hardly think it admits of a solution under the above conditions; but were they reversed, that is, if the man were running at the rate of one mile in two minutes, and the horse one mile in six minutes, what would the answer be?"

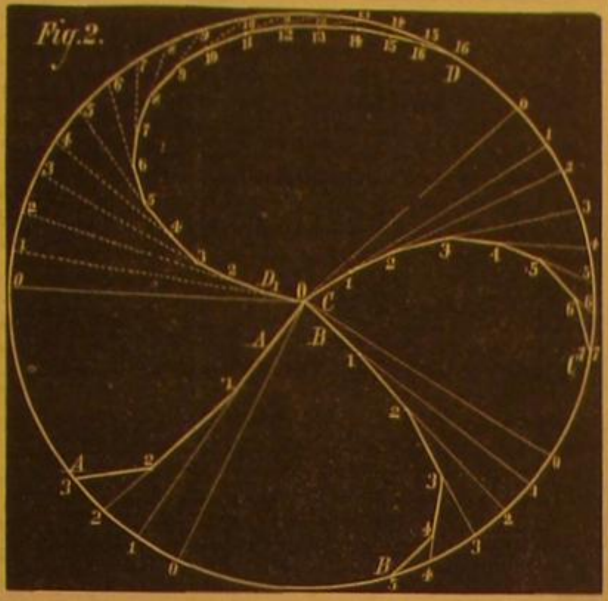
This problem gives rise to an interesting investigation of a curve, which at first sight appears to be similar to the spiral of Archimedes, but on further examination proves to be totally different. The spiral of Archimedes is the track of a point which moves with uniform velocity along the radius from the center to the circumference, while, at the same time, the end of the radius travels round the circumference. In this problem, however, the point moving from the center does not move uniformly in the direction of the radius, but more and more obliquely toward a uniformly progressing point in the circumference, giving rise to an intricate application of the differential calculus, which finally proves that the man will never reach the horse, but that the curve described by him will, after three revolutions of the horse, be nearly identical with a circle, the circumference of which he will approach more and more, and of which the radius is one third of that in which the horse moves. The most interesting fact revealed, however, is that, if the velocity of the man is half that of the horse, he will, after two revolutions, be near the circumference of a circle of half the radius of the outer one; and when he moves with one fourth the velocity he will, after four revolutions, be very near a circle of one fourth the size, and so on.

In order not to burden our readers with extended calculations in the field of the higher algebra, we have solved the problem in the graphic method. In our first figure we have



divided the circumference of the circle into sixteen equal parts, 0, 1, 2, 3, 4, etc., and taken one third of such a part and set it out on the radius from the center, 0 to 1. While the horse has moved along the circumference from 0 to 1, the man will have traveled from the center 0 to 1; while the horse is traveling from 1 to 2, the man will have traveled along the line 1, 2, 2; while the horse travels from 2 to 3, the man will travel in the direction 2, 3, 3, and so on; the only difference between our engraving and the reality being that the short lines representing the road traveled by the man will be slightly curved, instead of straight as we have represented them. By making these lines smaller, we may come sufficiently near to the reality, but the final result will not essentially differ. If the reader follows the different tracings for three revolutions, as represented here, he will see that finally the man will walk in a circle one third the size of that in which the horse moves, and will constantly see the horse in a direction tangential to the circle in which he walks; and therefore he never can reach it if he always moves directly toward the horse.

It is quite otherwise when the problem is reversed, and the man walks three times as fast as the horse. This is represented in Fig. 2, in which the track of the horse is divided into spaces each equal to $\frac{1}{16}$ part of the circumference. At A A, each part of the man's track is made equal to three times that length; and it is seen that, before the horse has accomplished three of these divisions, or one sixteenth of the circumference, the man will have overtaken him along the line, 0, 1, 2, 3. At B B, the case is represented that the man walks twice as fast as the horse; the engraving shows that,



before the horse has accomplished five divisions or one tenth of the circumference, he will be overtaken. At C C, we represent the case that the man walks one and a half times as fast as the horse, the distances from the center, 0, 1, 2, 3, being one and a half times the corresponding $\frac{1}{16}$ part of the circumference. It is seen here that the horse will have been overtaken when he has passed over seven spaces, or $\frac{1}{2}$ of the circumference. Finally, at D D, we have represented the interesting case that the man walks exactly as fast as the horse; it is seen that, after going through sixteen spaces, or $\frac{1}{2}$ of the circumference, the man will move very nearly in the circumference, but always nearly one space ($\frac{1}{16}$ of the circumference) behind the horse, without being able ever to reach him. All that he then can do is to stop and let the horse overtake him.

SOURCES OF EDIBLE STARCH.

Besides the well known cereals, the number of plants producing starch, in root, stem, or fruit, in quantity sufficient to make their cultivation profitable, is very large. The number made use of in supplying the starches of commerce is comparatively small. Not more than a dozen contribute largely, and the excellence of these is clearly due in great measure to long cultivation. With the increasing demand for farinaceous foods, and the development of agriculture in tropical countries, where starch producing plants chiefly flourish, many other starch yielders will doubtless be brought under cultivation, with as marked an improvement in their quality and productive value, we may expect, as the cereals have shown, or, more notably, the potato.

Possibly the effect upon the cultivators may be equally important. The cereals have been to a great extent both the occasion and the means of raising agriculture to its high position in temperate climes. In like manner the development of tropical and sub-tropical communities must come largely through habits of industry and thrift acquired in systematic agriculture, in which the starch-producing plants must play the same part the cereals have in colder regions.

The arrow root of the West Indies (*maranta arundinacea*) furnishes the standard quality and the common name for farinaceous products. Starch is starch the world over, and its composition is the same, whatever its source. The commercial starches are more or less impure, more or less flavored by the elements with which they are associated in Nature, and which are not perfectly eliminated in the process of manufacture. There is a difference also in the size of the granules, but this requires the microscope to determine. Arrow roots contain about 25 per cent of starch, which is extracted by a process of grinding, rasping and washing the pulp with water.

Owing to careful preparation and the purity of the water used, Bermuda arrow root has the name of being the purest and best in market; but an equally fine quality is now furnished from other localities, St. Vincent taking the lead both in quantity and quality. In Bermuda, as in most of the West India islands, the amount produced has greatly decreased of late years, the cultivation of early vegetables for our city markets offering larger profits.

In the Bahamas and other West India islands, and in Florida, a starch much resembling true arrowroot is obtained from the roots and stems of certain species of zamia. In Florida they are called *conti* roots, and the farina prepared from them *conti*. In the shops it is known as Florida arrow root. Another West Indian starch, called *tous le mois*, characterized by the relative coarseness of the granules, comes from several species of *canna*, one of which, *canna edulis*, has been largely introduced into Australia, where it yields an excellent quality of starch.

A great number of starch-yielding plants are employed for local use in South America; but for exportation the West Indian *maranta* and the native *manihots* are chiefly cultivated. There are two species of the latter (*manihot utilissima*), otherwise known as cassava root, being bitter and poisonous, the other (*m. aipi*) sweet, and largely used as an esculent, simply boiled. Both have been extensively introduced into other parts of tropic America, the East Indies, and the coast of Africa. The tubers of the bitter species, which is most extensively cultivated, sometimes attain the length of three feet and weigh thirty pounds, the milky juice being removed by pressing and the poisonous principle expelled by the action of heat. When heated in a moist state, the starch is partly cooked, forming small, hard, irregular masses, the tapioca of commerce. Like the potato, the manihot has developed a large number of varieties under cultivation, differing as potatoes do in quality and period of maturing, some coming to perfection in six months, others requiring a year or more. Farina of manihot, both in its crude state and made into thin cakes, is very largely eaten in Venezuela and Brazil, where the manihot is most cultivated, the single province of Santa Catharina having as many as 14,000 establishments for its manufacture.

The bulbous root of another poisonous South American plant, a climber, furnishes the starch called *jocatupé*, said to have important medicinal properties. Only a small quantity is produced.

The African arrow roots are of various origin. The Cape Verde islands export a considerable quantity, chiefly extracted from the Brazilian cassava root. St. Thomas, Angola, and Mozambique also yield a small amount. In Liberia, Sierra Leone, and other African colonies, especially Cape Colony and Natal, the true arrow root (maranta) has been largely introduced, and the prepared starch is beginning to be exported in noticeable quantity. Madagascar and the Mauritius likewise yield a small amount.

In 1840 the maranta was brought to Madras, and shortly afterwards to several other East Indian countries, where it thrives abundantly, developing in from twelve to fifteen months. With good irrigation, a year suffices to secure the maximum yield of starch, 16 per cent. More recently the same plant, together with the manihot, has been introduced into Ceylon, where after much persuasion the natives have been induced to cultivate them. Now the amount produced not only supplies the large local demand, but allows of considerable exportation.

What is known as *tikor*, or East Indian arrowroot, comes from the roots of a native plant, the narrow-leaved turmeric (*curcuma angustifolia*), which abounds in Ticor, Benares and Madras. A large part of the diet of the inhabitants of Travancore is the starch of another plant of this genus, while still another answers the same purpose in Berar. In Chittagong, a wild ginger plant, growing everywhere in such profusion that it is almost a nuisance, has a root loaded with starch of a good quality. The supply of the root is inexhaustible; and with a little trouble in digging and preparation, it might be made to furnish a vast quantity of cheap and nutritious food. Other less known plants supply a large amount of starch for local use in India, notably a wild arrow root which grows in the jungles. The starch is of excellent quality. In many other parts, the natives also lay under tribute for the same purpose the young roots of the Palmyra palm, which are rich in starch. At Goa, a farina is prepared from the wild palm, and in Mysore from the sago palm of Assam (*carryota urens*) which yields a sago little if at all inferior to that of the true sago palms of the Malay countries. Less nutritious and palatable sagos are also obtained from the Talipat palm in Ceylon, and the *Phœnix farinifera* which grows on the Coromandel coast.

The most generous of starch producers, however, are the true sago palms, of which two species (*sagus konigii* and *sagus lævis*) are chiefly cultivated. Though most abundant in the eastern parts of the Malay archipelago, these palms are found throughout the Moluccas, New Guinea, Borneo and the neighboring islands, and as far north as the Philippines. The yield is immense, three trees affording more food matter than an acre of wheat, or six times as much as an acre of potatoes. As the trees propagate themselves by lateral shoots as well as by seeds, a sago plantation is perpetual. Wallace shows that ten days' labor or its equivalent in money will put a man in possession of sago cakes, the principal if not the sole food of the natives, enough for a year's subsistence. A single tree contains from twenty-five to thirty bushels of pith, which, with a little breaking-up, will yield from six to eight hundredweight of fine starch.

Upwards of 20,000 tuns of sago pith are annually converted into commercial sago by the Chinese at Singapore. The finer quality, known as pearl sago, is prepared in great quantities by the Chinese of Malacca, something like 250,000 hundredweights being sent therefrom to England alone. The manufacture of tapioca is also largely carried on at Singapore and at Penang, 75,000 hundredweight being sent to England annually from the former port, and 10,000 from the latter.

Japan sago is made from the pith of a fern palm (*cycas revoluta*), which yields a large quantity of sago-like starch.

Another starch-yielding plant, now extensively cultivated in the East, is the *tacca pinnatifida*, known throughout the South Sea islands as *pia*. The tuberous roots resemble potatoes, and are largely eaten in China and Cochin China. When raw, the tubers are intensely bitter and acrid, but these objectionable qualities are removed by cooking. The starch is of fine quality, much valued for invalids, and the yield is liberal—30 per cent. The South Sea tacca grows on high sandy banks near the sea, and yields a starch equal to Bermuda arrow root, when carefully prepared.

In other Pacific islands, certain species of aurum are also utilized for starch, the one most extensively cultivated (*aurum esculentum*) being known as *taro*. The natives of Tahiti distinguish thirteen varieties, doubtless the result of artificial selection. The tubers, which weigh from two to four pounds, each yield as much as 33 per cent of starch, combined with a blistering bitter principle which is destroyed by heat. Our familiar Indian turnip, with its acrid flavor belongs to the same family of plants.

Among the other starch-producing plants, extensively cultivated for food in tropical countries, and which are destined to add immensely to the food supply of colder climates, are yams, bread fruit, and bananas, including the variety known as plantains. The last fairly rival the sago palm in affording the maximum amount of food for the minimum amount of labor. The yield to the acre is, in bulk, forty-four times that of potatoes, and the proportion of starch is somewhat greater. The fruit is also richer in other elements of nutrition, so that the meal prepared by drying and grinding the plantain core resembles the flour of wheat in food value. It is easily digested, and in British Guiana is largely employed as food for children and invalids. The cost of preparing plantain meal cannot be great, and the supply might be unlimited. The proportion of starch is 17 per cent; in bread fruit it is about the same; in yams it rises to 25 per cent, but is hard to extract, owing to the woody character of the roots.

FAILURE OF PATENT EXTENSION SCHEMES.

We are glad to be able to state that the Senate Committee have agreed to report adversely upon the application of the sewing machine monopolists, for extensions of the Wilson, Aikens and Felthausen, and Wickersham sewing machine patents.

Adverse reports are also announced on the Tanner car brake, Rollin White pistol, and Atwood car wheel.

The following cases were deferred until next session: Norman Wiard's boiler attachment to prevent boiler explosions, and Butterworth's patent burglar-proof safe.

SCIENTIFIC AND PRACTICAL INFORMATION.

RESPIRATION OF PLANTS.

Vegetables, it is well known, exhale carbonic acid in the dark. M. Deherain states the curious fact that if a certain mass of vegetables thus acting be compared with a like mass of cold blooded animals, the exhaling energy will be found to be the same in both cases. This is another of those odd coincidences which seem to level the distinction between the two great organic kingdoms.

DIFFUSION BETWEEN MOIST AND DRY AIR THROUGH POROUS EARTH.

If a partition of porous earth separates two gases of different densities, an unequal diffusion takes place across the dividing body; the current of denser gas is more abundant than the other. M. Dufour has recently investigated the question as to what takes place when two masses of air of the same temperature, but containing unequal quantities of water, are substituted for the gas. He finds that there is still unequal diffusion, and that the most abundant current passes from the dry over to the moist atmosphere. This diffusion depends on the tensions of the aqueous vapor on the two sides of the porous partition.

GAS LIGHTING BY ELECTRICITY.

A new pneumatic gas lighting apparatus, now being introduced by Mr. Asahel Wheeler, of Boston, Mass., was recently tested at Providence, R. I., with satisfactory results. A current of compressed air is transmitted from a central engine to diaphragms at the burners, the moving of which turns on the gas, which is then lit by an electric spark. Forty lights were kindled and extinguished simultaneously with great rapidity. It is stated that by this device all the street lamps in a city may be lit by the movement of a single lever, at any certain point.

BEER.

The National Brewers' Congress recently met in Boston, Mass., and from the report of the proceedings, we glean the following statistics of the industry in this country. A steady increase in the consumption of beer of a million barrels per annum shows that, the more people drink, the more the appetite for drink increases. The capital invested is stated as $89,108,230; 1,113,853 acres of land are required to produce the barley, and are cultivated by 33,753 men; 40,099 acres are devoted to hop culture, requiring the work of 8,020 people; and 3,566 hands are employed in the malthouses.

MILK FROM SWITZERLAND.

The American process of condensing milk, invented by the late Gail Borden, of Texas, has been everywhere copied in Europe. Large works have been erected in Switzerland, and cows that feed in the finest Alpine pastures now furnish excellent milk for the city of New York. The agents are Messrs. Dudley & Co., 153 Chambers street.

EVERY condition in life has its advantages and its peculiar sources of happiness. It is not the houses and the streets which make the city, but those who frequent them; it is not the fields which make the country, but those who cultivate them. He is wisest who best utilizes his circumstances, or, to translate it, his surroundings; and happiness, if we deserve it, will find us, wherever our lot may be cast.

In the proposed railway up Mount Vesuvius, the engine, which is fixed at the bottom of the plane, sets two drums in motion, round which the metallic cable is wound, by means of which the trains are drawn up and let down simultaneously.

A railway train lately arrived at Algiers, Africa, from Oran six hours behind time, the cause of the delay being that the rails were covered with a thick layer of locusts.

IMPROVED WIND WHEEL AND WATER ELEVATOR.

Irregularity of motion, oscillation of turning table and vane, unavoidable use of small wheels on the main shaft preventing the transmission of quick motion when the same is needed, liability to get out of repair, and excessive cost, are objections to the employment of wind power, which the inventor of the device herewith illustrated claims to have overcome. The fans are centrally pivoted to two circles, which constitute portions of the frame of the wheel, and the bearings for the main axle rest upon stationary posts. A is a weight attached to a rod which traverses the shaft and is pivoted in a sleeve which slides back and forth between the arms. To the sleeve are attached jointed rods which are connected with guides, at B, so that, as the sleeve passes back and forth, the rods are given an inward and outward motion. Near the outer extremity of the latter are placed systems of small rods, C, jointed together to form parallelograms, operating on the principle of lazy tongs. From each of these extend three arms, one passing through the outer circle and carrying a ball, D; the second pivoted to the inside corner of one fan, at E, and the third similarly secured to the outer corner of the other adjacent fan, at F. The rods, G, connect these fans with those next to them, so that one shifting rod, with its lazy tongs, governs a set of four fans, which move through the same space at the same time.

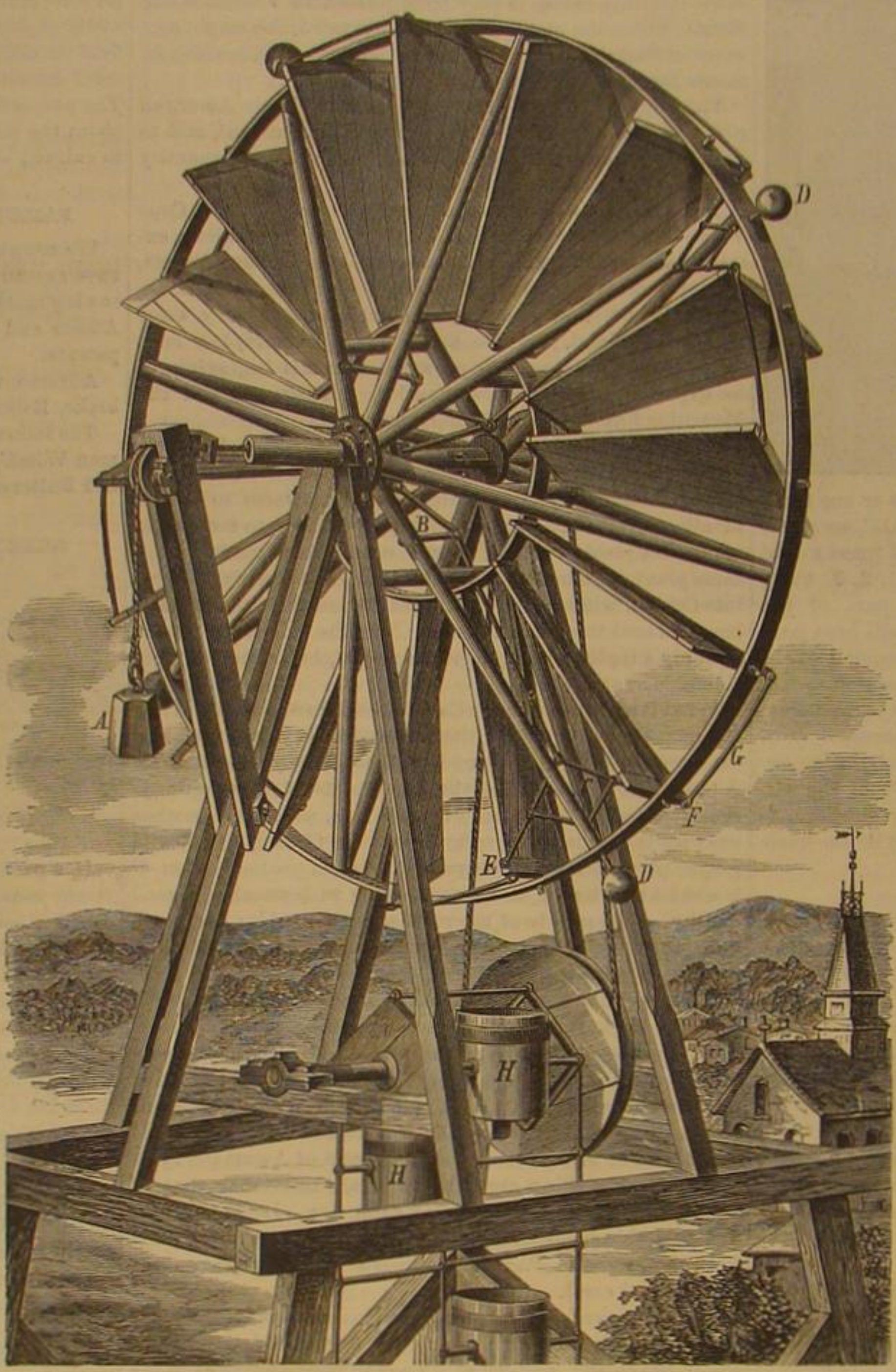
In order to stop the windmill, the weight, A, is removed, when the balls tend to bring the portions of the lazy tongs to a position at right angles with the shifting rods, and hence the fans, to a right angle with the wheel. The fans, it is stated, move with equal facility in strong or light winds, no greater force being required to operate them than is necessary to overcome the friction of the different bearings. The power is, besides, through its application diagonally across from the inside corner of one fan to the outside corner of the other, transmitted to the best advantage. For large wheels, we are informed, hydraulic pressure is used to equalize the motion.

The water elevator consists of a series of buckets, H, which are pivoted, a little above their centers, between every two links of an endless chain or band which passes over two pulleys, one at the bottom and the other above the well. The bottom of the bucket swings in, and a projection thereon takes against the upper shaft as the vessel is carried over. This causes the latter to empty, with little splash, into the conduit provided, in which the water is conducted to any desired point.

It will be seen that the construction of the apparatus denotes considerable strength, as it is built on the plan of a wagon wheel, the fans serving as spokes. The inventor states that it is almost impossible to blow it to pieces.

The machine, combined with a pump and also with the elevator described, was exhibited at the Kansas State Fair, last fall, and received five first premiums, and also commendatory notice from the State Board of Agriculture.

Patented March 17, 1874. For information pertaining to manufacturing or royalty, or relating to purchase of wheels, address the inventor, Mr. J. N. Dietz, Salina, Saline county, Kansas.



IMPROVED WIND WHEEL AND WATER ELEVATOR.

Treatment of Gold Fish.

Seth Green says this as to the proper care and treatment of gold fish: Never take the fish in your hand. If the aquarium needs cleaning, make a net of mosquito netting and take the fish out in it. There are many gold fish killed by handling. Keep your aquarium clean, so that the water looks as clear as crystal. Watch the fish a little, and you will find out when they are all right. Feed them all they will eat and anything they will eat—worms, meat, fish wafer, or fish spawn. Take great care that you take all that they do not eat out of the aquarium; any decayed meat or vegetable in water has the same smell to fish that it has to you in air. If your gold fish die, it is attributable, as a rule, to one of three causes—handling, starvation, or bad water.

Asiatic Handsaws.

Handsaws in America and England have the teeth pointed from the handle, while in Asiatic countries and in Greece they are made with teeth pointed the other way. The latter must be operated by pulling them, the former by pushing. In delicate work, and where very fine small saws are used, the Eastern saw is the best. The Orientals differ from us in setting the teeth of the saw also. They turn a group of a dozen one way, and the next group the other, while we alternate, one on one side, the next on the other.

Improvements in Bleaching.

M. Pierre Isidore David, a French chemist, has invented the following processes:

Chlorine in the gaseous state is produced in a closed receptacle by one of the ordinary methods, for example, by the action of an acid on chloride of lime diluted with water, and is conveyed by a tube into a chamber containing the articles to be bleached, the sides of such chamber being constructed of a transparent material in order to permit the entrance of light, which assists considerably the process of decolorization. After an interval, varying with the nature of the articles to be bleached, he sends into the chamber a rapid current of carbonic acid gas, obtained by any of the well known processes. The apparatus in which the carbonic acid is generated communicates, however, with a vessel containing liquid ammonia, the fumes of which combine with the carbonic acid, and are conveyed into the chamber, where the two gases neutralize the hydrochloric acid, and accelerate the decolorization of the materials contained therein. The ammonia should be contained in a vessel of such a shape that the evaporation surface of the liquid can be augmented or diminished according to the quantity of chlorine employed.

In the second process, permanganate is obtained by the action of peroxide or binoxide of manganese on lime aided by heat, preferably in the following manner: One part by weight of peroxide of manganese and three parts of quick lime in powder are mixed together and submitted to a red heat for about three hours. When the heat has been continued for one hour, however, a rapid current of carbonic acid is passed through the mixture and continued till the completion of the process, the object being to superoxidize the compound. The permanganate of lime thus prepared is placed in a closed receptacle, which communicates by a tube with the bleaching chamber, commercial sulphuric acid is gradually added, and "ozonized oxygen" is evolved. In order to accelerate the evolution of this gas, the inventor adds a vegetable acid in quantity equal to the oil of vitriol, acetic acid being preferably used.

In the third process, M. David employs phosphorus and acetic acid. The production of ozone by means of phosphorus in a moist atmosphere is well known, but the quantity thus obtained is very small. By causing air which has been previously forced through acetic acid to bubble through the water containing the phosphorus, the patentee has discovered that the quantity of ozone is considerably increased. The ozone is conveyed to the bleaching chamber in the same manner as before described, the air being forced through the liquids by means of a fan or any other of the well known methods of obtaining a current either by pressure or exhaust.

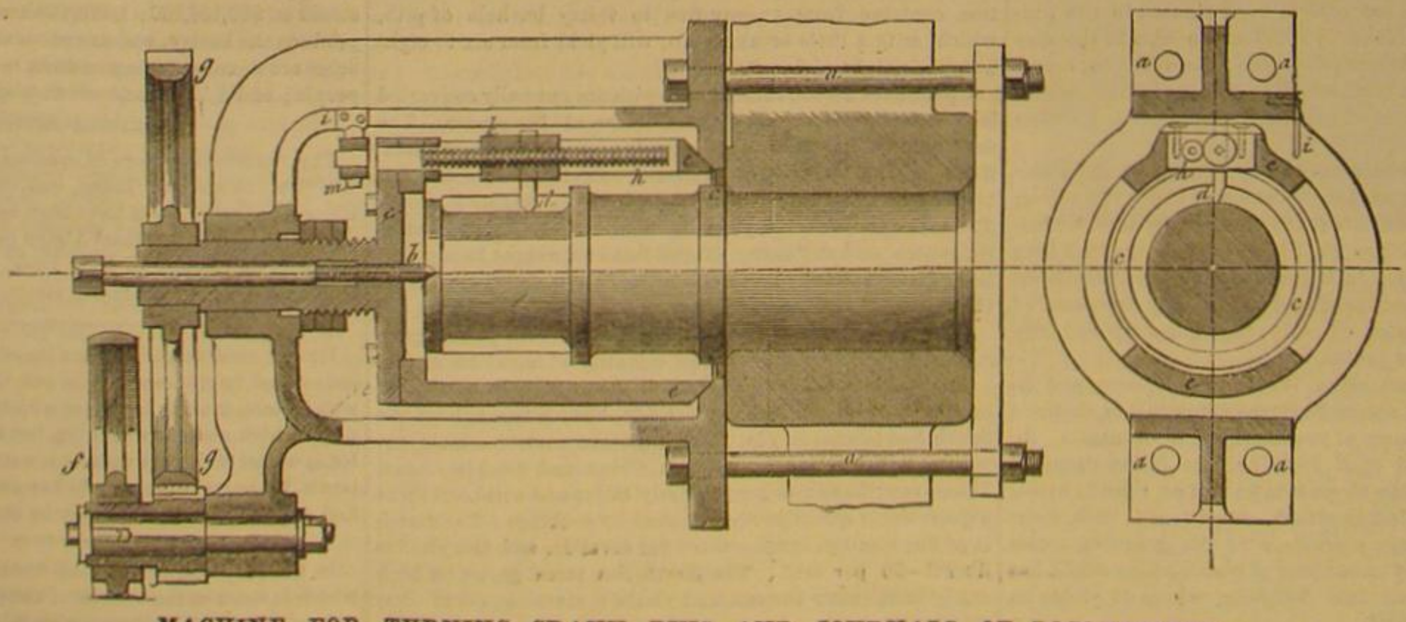
The fourth process consists in the use of chalk, alum, and sulphuric acid. A saturated solution of alum is prepared at a temperature of 140-160° Fah., into which powdered chalk is thrown, about equal in weight to the alum employed; sulphuric acid is then added, and the gas evolved is conveyed by a tube to the bleaching chamber, where it effects the desired object.

It will be seen that in three of the four processes chlorine is dispensed with, and the formation of hydrochloric acid avoided. When the articles are removed from the bleaching chamber, it is desirable to expose them for a time to the action of the atmosphere in order to remove the characteristic smell of ozone. These processes are claimed by M. David to be applicable to the decolorization of raw or worked materials, especially those which from their shape or nature do not admit of immersion in liquid; they are also specially adapted to the bleaching of books, papers, and engravings. Oils and fatty matters may be decolorized by them; alcoholic liquids may be "improved" or "aged," as it is called, by the oxidizing properties of the ozone; fermentation may be arrested and unpleasant flavors removed; and they may be speedily converted into vinegar or acetic acid. M. David asserts that his processes will be found more economical than those at present adopted.

MACHINE FOR TURNING CRANK PINS AND JOURNALS OF LOCOMOTIVES.

In this apparatus, for the engraving of which we are indebted to the Belgian *Bulletin du Musée*, the tool is fixed immediately against the pin or journal by four strong screw bolts, *a*, and is set in motion by the driving pulley, *f*, to which a belt is carried; centering on one side is effected by the point, *b*, and on the other, by the ring of the pin and the annular piece, *c*.

The tool, *d*, which acts on the cylindrical surface, is placed on the circumference of a tool carrier, *e*, which is rotated by the pulley, *f*, through the cog wheel, *g*. The advance motion of the tool, parallel to the axis of the pin, is gained by means of a screw, *h*, at the rear extremity of which is fixed a wheel, *m*. Each time that this wheel strikes a shoulder, *i*, the screw turns, and the support, *k*, advances with the tool. The working of the apparatus is readily understood from the illustration.

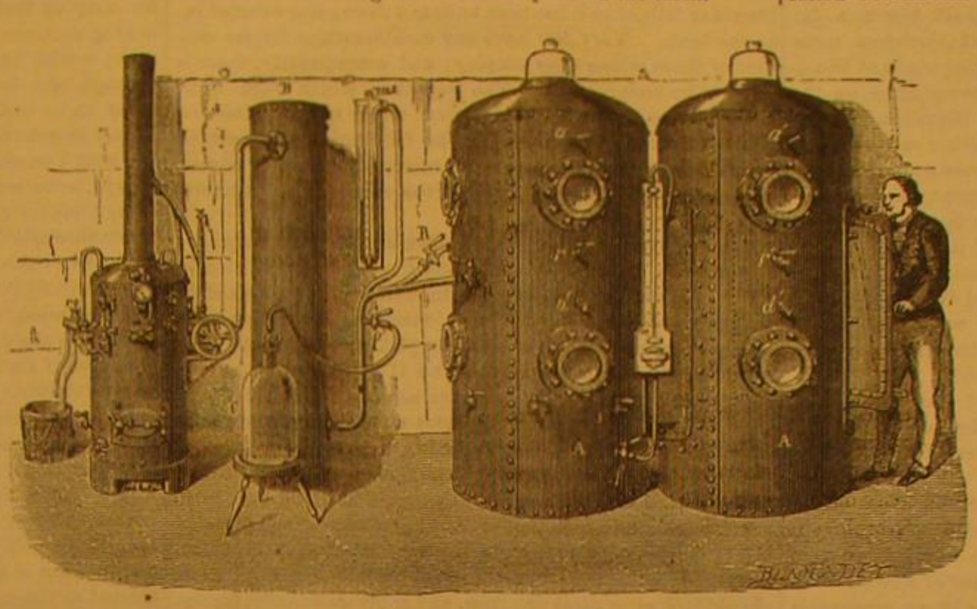


MACHINE FOR TURNING CRANK PINS AND JOURNALS OF LOCOMOTIVES.

EFFECTS OF AIR PRESSURE ON ANIMAL LIFE.

A series of brilliant and remarkable experiments have recently been conducted in France by M. P. Bert, having for their object the determination of the influence of changes in barometric pressure, either augmentations or diminutions, upon animals. The author, in submitting the results of his investigation, states that both men and inferior animals which live on elevated land are submitted to a pressure the weakness of which, in proportion to that at the sea level, cannot be without its effect upon their organizations. Important cities, in fact, exist at altitudes above 9,600 feet, and the high plateaus of Anahuac, Mexico, are populated by thousands. There are, besides, industrial pursuits which require workmen to labor in a strongly compressed atmosphere in submerged caissons, as are employed in bridge building, in the operation of sinking wells, in the descent of diving bells, and in pearl, coral, and sponge fishing.

In describing the discoveries of M. Bert, to the experimental demonstration of which we shall shortly pass, it is necessary first to remind the reader that the actual tension of the oxygen in the air which we breathe is equal to one fifth that of the atmosphere, since the gas constitutes 0·21 of the composition of the latter. Now this tension may be increased by compressing the air, so that air containing 42 per cent of oxygen will correspond to ordinary air at two atmospheres pressure, and so on, relatively, upwards. Inversely the tension of a semi atmosphere, equal to 14·8 inches of mercury, will be 10·5; of one third atmosphere, 7, and thus down.

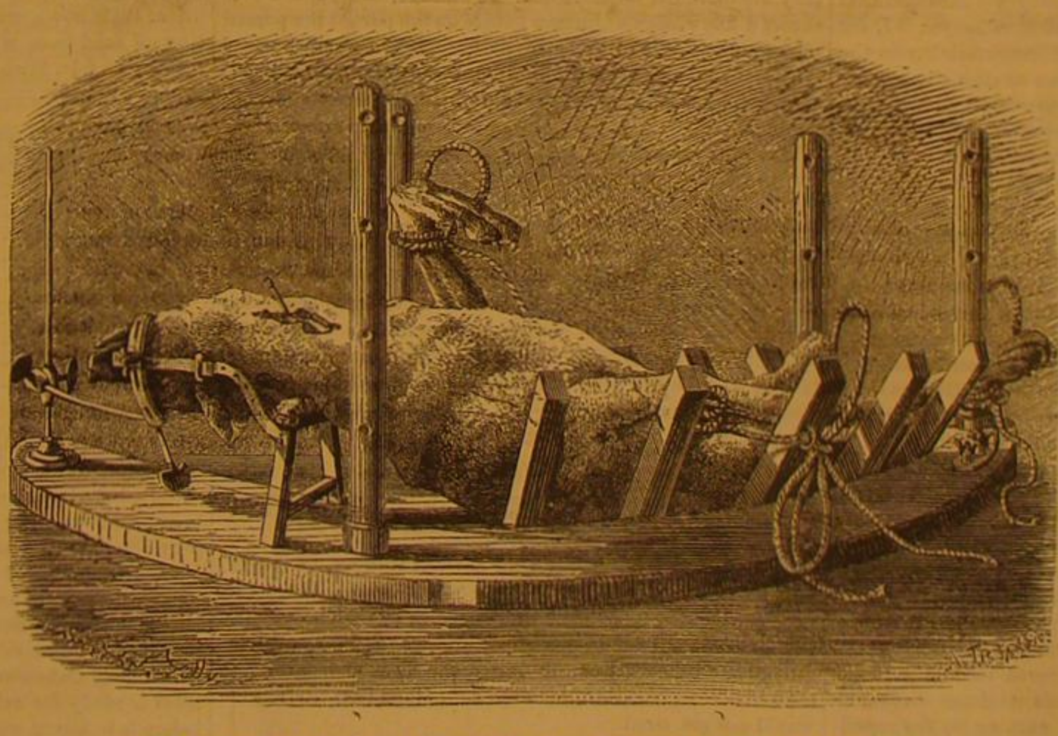


BERT'S APPARATUS FOR NOTING EFFECTS OF AIR PRESSURE.

The researches of M. Bert show that the atmospheric pressure never acts by any mechanical or physical influence, as has been heretofore supposed, but solely by causing the tension of the oxygen to vary, and hence the conditions of the combinations of that gas with animal blood and tissues. When the pressure decreases, animals and vegetables are menaced with death by simple suffocation, due to a privation of oxygen. When the opposite state of affairs occurs, death likewise supervenes. due to the poisonous effect of the excess of oxygen.

In the following description, the experiments upon the results of diminution of pressure are detailed, and in a succeeding article we shall notice the investigations bearing upon the effects of opposite conditions. In order to experiment upon large animals, M. Bert, constructed the apparatus represented in Fig. 1. A A′ are large cylinders containing heavy glass windows. B is another cylinder, in which a vacuum is formed. C is a bell glass in which, by means of B, a vacuum may be instantly produced. R R′ are cocks communicating with the cylinders; *r*, *d*, and *s* are other cocks for removing blood, etc. At *a a′* are the thermometers, and at *m m′*, manometers. The boiler shown at the left operates a steam air pump, which, in connection with the apparatus, produces low pressures of air in the cylinders.

In order to determine the gases in the blood, a dog was fixed on a sort of semi-circular frame (Fig. 2), which fitted exactly into one of the cylinders. The carotid artery being exposed, a tube was conducted therefrom and carried to the exterior of the cylinder. By suitable devices the blood could be drawn at any moment without causing coagulation or allowing the surrounding atmosphere to enter the artery. The drawing was done by the operator outside, by means of a graduated syringe, and the gases were removed from the fluid by a peculiar pump.



MODE OF PLACING ANIMALS IN BERT'S AIR CYLINDER.

From numerous analyses thus conducted, it appeared that below a pressure of 21·4 inches there was an increasing diminution of the oxygen in the blood. From 20 volumes of oxygen to 100 volumes of blood at the above barometric hight, the decrease proceeded as follows: 17·5 inches, 16 volumes; 13·6 inches, 12 volumes; 9·7 inches, 10 volumes; 6·4 inches, 7 volumes. In other words, below 11·7 inches the arterial blood is poorer in oxygen than ordinary venous blood.

A very striking experiment showed clearly that the suffocating effects were due to the preponderating influence of the tension of the oxygen and not to the almost null results of barometric pressure. A sparrow was placed under a bell glass, in which a gradual depression was produced. The bird appeared very ill at 9·7 inches, and fell apparently dying at 7·8 inches. Normal pressure was then re-established by admitting oxygen. The bird recovering, further depression was proceeded with, when the same effects did not take place until from 7·02 to 5·8 inches. Oxygen again admitted caused a second revival, and, finally, it was shown that the diminution might be carried to 2·7 inches without killing the animal.

Not content with thus proving the truth of his theories upon lower animals, M. Bert, in order to determine the sensations experienced, entered the cylinder himself. At a pressure of 17·5 inches, he experienced the sickness known as *mal de montagne* accompanied by nausea and weakness, the pulse increasing from 60 to 85 beats. At this moment he admitted and breathed an artificial atmosphere containing 75 per cent of oxygen. Instantaneously the illness disappeared, and the pulse returned to its normal condition. The investigator remained in the cylinder without inconvenience when the barometer marked 9·7 inches. This corresponds to a hight of 28,320 feet, a point above that at which Glaisher, in his celebrated ascent, fell senseless, and equal in altitude to the highest mountain peak on the earth.

It would appear, therefore, that, through M. Bert's discoveries, explorers will be enabled to ascend elevations hitherto deemed inaccessible, and aeronauts to penetrate regions of our atmosphere where life, under ordinary conditions, cannot exist.

European Ordnance.

The United States Government, being in quest of a system of rifled ordnance, sent a naval mission to Europe four years ago to inspect the chief gun factories in the principal countries in Europe, and to report upon the systems of ordnance in course of manufacture. This has resulted in two quarto volumes, containing 640 pages of matter, the best half of which is devoted to the ordnance produced in Great Britain and the remainder to the Continent. Considerable discrimination has been shown in selecting salient points for detail, and much impartiality in describing the merits of the various systems, both of construction and of rifling, etc. Admitted to the principal factories of Europe, the American naval mission made good use of eyes and ears, and the result is a compilation of varied information which only needs an index—strange omission—to prove of great service both to the manufacturer and to the artillerist.

Amongst the factories visited in England: Woolwich, the London Ordnance Works, Whitworth's, Jarrow, Barrow-in-Furness, and Low Moor are duly honored, the system of construction at the Royal Arsenal and by Messrs. Vavasseur being carefully detailed; while the treatment of the ore at Jarrow and Low Moor, etc., is carefully described, as well as the production of steel by Firth and by Whitworth. Our gunpowder factories, dockyards, iron plate rolling, torpedoes, and naval organization are not forgotten. Our own naval men may learn from their United States brethren some important facts connected with their own weapons, which have hitherto been shut up in the archives of the War Department. It is, however, when the naval mission passes to foreign ordnance factories that interest is chiefly awakened. Little is known in this country of foreign ordnance, except that nearly every country in Europe has obtained Woolwich guns and projectiles for experimental comparison with their own, and they one and all have rejected both the construction and the rifling in favor among English soldiers. Holland does, it is true, import Armstrong (Woolwich) guns and projectiles for its few ships of war; but its army adopts the French breech loader. For a time the Austrian naval armament was divided between Krupp's breech loaders and Armstrong's (Woolwich) muzzle loaders, but the short life of the latter has led to its being discarded. France, which has fallen behind the race of ordnance construction, gave the Woolwich system a patient and exhaustive trial, with the like result. Italy is striving manfully to work out a system of its own. Russia and Germany have given themselves over unreservedly to the Krupp system.

All heavy ordnance are now built with steel barrels, this material being found best capable of withstanding erosion from the powder and indentation by the shot. But much divergency occurs in the mode of supporting the barrel by exterior layers of metal. Woolwich obtains support by coiling, round the steel barrel, bars of wrought iron. Vavasseur supports the barrel by shrinking on hoops of steel, so regulated that the first layer of hoops shall not come into serious operation until the elasticity of the barrel has been developed. Krupp, who has been gradually assimilating his construction to that of Vavasseur, first by abandoning block steel for the breech, and then abandoning it for the chase, still makes the barrel much thicker at the inner end than is found desirable in this country, and so shrinks on the outer hoops as to cripple the elastic action of the barrel. The French have adopted a system of construction which would be tolerable enough in conversion of old cast iron guns into rifled ordnance of an inferior order. but is without any merit but cheapness in new pieces. A steel half barrel is imbedded in cast iron, and further supported by steel hoops over the powder chamber. By this means the elasticity of the steel half of the barrel is crushed, and a joint with cast iron formed in the interior. The idea was, probably, taken from Parsons' system of converting old smooth-bore cast iron guns into rifled ordnance, which was tried in France with most marked success. But if so, we can hardly think the new plan an improvement on Parsons' method of inserting a full length steel barrel into the old cast iron bore, and supporting the powder chamber by steel jackets in contact with the barrel.

The Palliser conversion differs from the Parsons, chiefly in employing a barrel of wrought iron, a material too soft to endure large charges or the hammering of loose heavy projectiles. But the strangest system of converting cast iron smooth bores into rifled ordnance is that adopted in Holland, of lining the bore with bronze, a soft material quite incapable of withstanding the heat and rush of gases evolved in the combustion of large charges.

Belgium employs a cast iron barrel, supported, from breech to trunnions, by two tiers of steel rings or hoops. But as this country has no navy, it does not require very heavy ordnance, and its experience in this direction is not so great.

Next to the material and system of construction, the question of breech *versus* muzzle loader demands attention. Recent experiments have shown that an enlarged powder chamber, in permitting a reduction in length of the cartridge and thus placing all the powder more nearly equidistant to the point of ignition, improves the combustion, and adds largely to the velocity and striking force of the projectile. This enlargement of the diameter of the cartridge beyond that of the bore can only be attained by breech loading. The plan of closing the breech originally adopted in this country, having proved very faulty, the principle was discredited, and the system abandoned. But wherever the naval mission of the United States went on the Continent, they found breech loading in favor, so that of all the considerable States of Europe, England, stands alone in its use of muzzle loaders.

The difficulty of preventing the escape of gas at the breech naturally increases with the amount of gunpowder and weight of shot employed. But it would appear that the Broadwell ring [an American invention], now generally in use with the heavier breech loaders on the Continent, and in a modified form used by Vavasseur in this country, appears effectual to that end. Krupp's breech closing arrangement is free from all the objections which led to our discarding the Armstrong system, and deserves the commendation given it by the naval mission.

The real difficulty in ordnance lies, however, in the projectile. To contrive a projectile which can be driven most rapidly out of the gun, without wriggling in the bore, with its center coincident with the axis of the piece, and with the minimum of strain upon itself and the gun, while receiving the impress of a rotation proportionate to its length, has exercised many minds. Though the lead-coated projectile of Krupp has many excellences, high velocity or great penetration cannot be amongst the number, inasmuch as the drag through the barrel resists high speed, and the peeling off the lead coat in passing through armor impedes perforation. Vavasseur's copper-ringed projectile would compare favorably in both these aspects. And either would ensure a far steadier passage through the barrel, and therefore more equable powder pressures, than the balancing studs of Woolwich. France appears to have adopted copper rings on the projectiles for its new breech loaders. Objection may be taken to the overhang, unsupported at either end of these shot; but as the ring bites the grooves above as well as below, there is none of that balancing movement which is present wherever a windage shot touches the bore only at the two studs beneath and is free all round its body. If the long iron bearing and centering devices, employed in muzzle loaders by Vavasseur, Scott, Lancaster, and Whitworth, could be efficiently employed in breech loaders, we should expect higher velocities and better penetration than from any compression system of rifling. The difficulty is not insurmountable of preventing these windaged projectiles overshooting their seat when loading from the breech. Whitworth has breech loaders on his system, but of small caliber, where the difficulties are small, and we can hardly accept this evidence as alone decisive in favor of the employment of windaged shot in breech loading ordnance.

The dispassionate tone adopted by the naval mission of the United States in describing the ordnance of Europe lends weight to their impartial descriptions and very reasonable recommendations; so that, whether we adopt their conclusions or not, we cannot but listen respectfully to their suggestions. The sum of their recommendations is that the Vavasseur system of construction is the best in Europe; the Parsons system of conversion, most suitable for old guns. Breech loading cannon being universal except in England, the breech closing arrangement of Krupp, with the Broadwell ring for "gas check," is regarded as best for adoption, while projectiles should have the copper rings of Vavasseur.

The Woolwich system is honored in being made the standard of comparison with that of the civilized world, with the result, however, of being declared inferior to the Vavasseur and Krupp; and the concluding paragraph of this extensive report is reserved for a condemnation of the studded projectile in favor at Woolwich, which is the chief offending cause that has landed us in such artillery difficulties that Rear Admiral Sherard Osborn, C. B., F. R. S., says: "I, for one, do not desire to take any share of responsibility in the great gun *fiasco*, which, I fear, awaits us on the commencement of a war with a first class naval power."—*Iron.*

The Education of Artisans.

Since the application of steam as a motive power for the production of almost every commodity required by man, everything seems to be wanted in a hurry; and for smart, intelligent workman of every craft, a continually increasing demand is plainly observable. But in nearly every calling thoroughness has been hitherto sacrificed to the impatience of customers, and we seem to become the more pressing the quicker we are served. The consequence is that the mechanical arts are cut up into branches, and the artisan, who should know all about his business, is made a mere expert at one particular part. Whatever a workman is quickest at like a machine, that he is kept to; and as long as he earns a living by that one thing, it is ten to one if he ever seeks to know any more. Were he compelled to turn his hand to other parts of his business, he would have to occupy in a useful way, in order to qualify himself for the performance of task by which he earned much brain work, he is the more easily led into idle pastimes, in which he often indulges to excess. His comparative prosperity makes him consequential. If he were made his daily bread. But this being secured to him without to feel that on the completeness of his abilities depended the bread which he is in the habit of earning by the repetition of a mere mechanical performance, which through constant practice becomes of no trouble to him, his mind would receive a new stimulant with each different job, and study would be the result.

Being thus compelled to see for information, his mind would be led into the parts of true knowledge in the search, and, once fairly started on that road, he would not be long until he could discern sound argument from bombast. There is much talk at present about technical education; but before the attainment of it will bear any fruit, the system of parceling out must be changed. When a boy is apprenticed to the tailoring trade, if he proves any way smart at making a vest, he never will get the chance of making trousers; and if he be quick at the latter, he will never be asked to put a stitch in a coat. What is the use of teaching the theory of any trade in schools with such a practice in existence?

In the building trade, we have masons or stonecutters who are not expected to set the stone they have wrought; wallers who turn no arches; bricklayers who dress or set no stones; and hundreds who could not read a drawing or get out a mold by which to work. Among those who are called joiners, we have men who make sashes they could not hang, and who never saw a "mouse" in their lives. We have "fixers" who, as a rule, make nothing they put up; and "framers" who would not be able to perceive the same angle in two different positions. We have "staircase hands" who affect to despise everything else connected with the construction of a building, and who, as a rule, look upon themselves as gods of wood, although they never made a circular headed sash in the whole course of their existence. Well planned houses suffer in their erection through this practice; for the "bench hand," who has been kept for a number of years at what he can do quickest, is often necessitated to turn in with a crowd of "fixers" and scrape away as best he can.

Considering the present system, it would appear that, with most builders, profit alone is the *alpha* and *omega* of every undertaking. It looks as if they do not care whether a house stands or falls, after it has been built and their gains counted into the bank. Very few have any considerations for the welfare of those whom they employ; and consequently, there is little or no reciprocation. The workshop, which ought to be conducted on the principle of a school where technical instruction is imparted, as well as for the fabrication of an article which brings a profit, is very often superintended by a man chosen more for his driving qualities than for his information.

It is seldom that a man capable of imparting what he knows is met with in such positions, and the generality of men in charge are cross and intemperate in their language, instead of being kind and considerate. As to receiving instruction, men are left very much to themselves to pick up that which they would sooner and better understand if explained by a man competent to do so. The language used by the generality of foremen, too, is very often the most abusive and sometimes revolting, such as no man aspiring to a respectable position in society should be heard giving utterance to. The susceptible dull youth of one and-twenty is sneered at if he chance to ask the foreman a question concerning his work, and mulcted out of money, or wheeled into paying for beer, for the information which he receives from his older fellow. Capitalists should look after these practices, and apply a remedy, for one or two hours' prefatory instruction or forethought often saves a great amount of labor. Those who cannot see before them lose much time groping their way, and obviously the loss is to the employer. It is often said that the workers are not expected to be thinkers. In fact, the remark is frequently made: "You are paid for working, sir, not for thinking," addressed as a reprimand to those who gave such a reason for being caught, as the man in charge might suppose, wasting the employer's time. This is, too, without the least inquiry concerning the truth of the assertion. The result of this system is that men who would otherwise seek to become intelligent and useful in a general sense, lay down their minds to become expert at one or two things, and in many cases sharp only at what is called "shaping," that is, by their bustling about and wielding their tools juggler fashion, making people believe they are qualified for anything. To be sure, this kind of tact shows a knowledge of human nature on the part of the person who employs it, and the present system is the chief cause that leads many to resort to it; but also shows the weakness, superficiality, perhaps vanity, of those who are the victims.

If it were the practice that the foreman was bound to call his apprentices and men together once or twice a week, say for an hour, or even half an hour, at a time, and give them a lecture during working hours upon some technical subject, hundreds would be very thankful, and willing to subscribe to the expense. After working hours, very many working men do not like attending lecture halls for such a purpose, and they would be more at home in a class got up specially for themselves, and particularly when it would be taught where every practical appliance necessary for demonstration was close at hand.—*The American Builder.*

Correspondence.

Horse vs. Steam Power.

To the Editor of the Scientific American:

I see that, on page 346 of your current volume, W. F. W. asks which is most efficient, a two horse steam engine or two horses weighing 2,000 lbs., when used in an endless railway power. The answer to this query states that usually an engine of one horse power will do more work in the same time than one horse could do, with the advantage that the engine would not get tired.

I desire to state that, from numerous statistics from English and French authorities for a century past, together with over thirty years' experience in the application and use of animal power as a substitute for manual labor, and numerous and exhaustive trials with all motors, especially horses and steam power, I am satisfied beyond a possibility of doubt that any two good work horses, of two thousand pounds weight, can walk eight hours each day at the rate of about $1\frac{1}{4}$ miles per hour upon a moving plane at an inclination of from 13° to 15°, without fatigue or injury, for six days per week for their natural working life; and this, upon a well designed and constructed endless railway power, will cause them to exert an average constant power equal to about 82,500 foot pounds per minute, or equal to $2\frac{1}{2}$ horse power; from which must be deducted for friction of such power (by actual results) from 11 to 15 per cent, which reduces the force transmitted and utilized to, say, 77,550 foot pounds per minute, or 38,775 foot pounds per minute for each horse, or 1·175 horse power net, transmitted. These data are partially taken from the reports of trials by the United States Agricultural Society and the New York State Agricultural Society during the past ten years.

In regard to small steam engines, I have always allowed and deducted (for their own friction) 25, 30, 35 or 50 per cent from their rated power for six, four, two, and one horse steam engines respectively; and a long experience has confirmed in my mind the correctness of this reduction. With poorly designed and poorly constructed horse powers or steam engines, the results would be lessened, while almost invariably the expenses of operating them would be enhanced in a like ratio.

Albany, N. Y. HORACE L. EMERY.

The Mississippi River.

To the Editor of the Scientific American:

Having noticed within the past year a number of schemes to relieve the shipping of the bar at the mouth of the Mississippi river, I intend to bring before the government a plan for carrying vessels, not over but through the bar, in the following manner: I would build a propeller to draw as much water as the largest ship that will be required to be towed through the bar. She should be as short as possible, in order to be easily manipulated and not require too much ballast to get the required draft. In or near the bottom of her hold, I would place a sufficient number of immense force pumps, to be worked by steam. I would have five iron discharge pipes, of nine inches diameter, to discharge their water through the steamer's cutwater, one above the other, well down below the mud line. The two lowest pipes are to point slightly down in order that the water will pass under the boat when she is in motion. The pipes are to come flush with the outside of the boat and to be reduced to a diameter of six inches at the point of discharge, to give the water velocity. Then I would have three seven inch discharge pipes, contracted to five inches at the mouth, on each bow, one above the other, well down under the boat and pointing down and forward at an angle of 30°. Then I would have a row of seven inch discharge pipes about 10 or perhaps 15 feet apart, along the whole length of the boat on each side, well down under her sides and pointing down and forward at an angle of 30°. Those pipes are to be contracted at the mouth to five inches diameter. I propose also one six inch pipe to discharge its water down through or alongside the keel, well forward under the bow. The feed or suction pipes are to take the water as near the surface as possible, in order to use clear water.

I believe such a boat would tow any ship or steamer through the bar at the mouth of the Mississippi river with perfect ease and safety. She would have a perfect volcano under her, constantly bursting up through the mud and sand and leaving behind her an immense channel. And as she would be constantly tearing the bar to pieces, the ebb and flow of the river would in a great measure remove the bar altogether. I think there is no plan by which the obstructions can be so cheaply overcome, as one such boat will do all the towing both in and out of the river.

A powerful force pump put on board of the steamers running above New Orleans, to throw a powerful stream or two under their bows, would be a great assistance to them in getting off sand bars, where they often get stuck fast.

Presque Isle, Mich. SIDNEY COOK.

Prices of Gas.

The following are the current rates for gas paid by consumers, per 1,000 feet:

Albany	$2.50	Rochester	$3.50
Baltimore	$2.75	St. Louis	$3.25
Boston	$2.50	Syracuse	$3.25
Chicago	$3.37½	Troy	$3.25
Cleveland	$2.50	Washington	$3.56
Concord	$3.20	Hamilton	$3.00
Harlem	$3.00	Kingston	$3.50
Lowell	$2.75	London, Canada	$3.00
Manchester	$2.70	Montreal	$2.60
New York	$2.75	Quebec	$2.80
New Orleans	$3.00	Toronto	$2.50
Oswego	$3.50		

A writer in the Boston *Cultivator* finds that most of the so-called strained honey sold in bottles is composed as follows: Cane or other sugar is melted in a decoction of slippery elm bark in water. Some manufacturers use, instead of elm, a solution of gum arabic and starch, to give it consistency and save sugar; but this last does not resemble honey so much when dropped, as it lacks the stringy appearance. These mixtures, with or without the addition of a little cheap Cuban honey, are flavored with essence, and the mess is ready for sale. The only true way to obtain real honey is to buy it with the comb.

TO DESTROY MOLES.—Bryan Tyson, Washington City, gives the following method for making pills to destroy moles: Make a stiff dough of corn meal, mixing with it a small quantity of arsenic. Make a hole with a finger in the runways, drop in a lump of dough about the size of a marble, and then cover over with a lump of earth to exclude the light. After the first rain, go over the field again and deposit in all freshly made roads. I once concluded to plant a piece of sandy bottom land in sweet potatoes; but as it was much infested by moles, my success depended on first exterminating them. A few doses of arsenic given in the way described brought about the desired result, and it was a very rare circumstance to see the track of a mole in this piece of ground during the entire summer.

CHARGES FOR MACHINE TOOLS A QUARTER OF A CENTURY AGO.—The following is interesting as showing the cost of work done on machine tools twenty-five years ago. We give the charge per day for use of tools: Large boring mill, $17.50; medium boring mill, $12; large punching machine, $25; heavy lathe, $15; small lathe, $5.50; large drill, $8; medium drill, $4.50; large planer, $7.37½; medium size planer, $5.33⅓; forge (with smith and helper), $10; small forge (with smith and helper), $5. Machinists received from $1.95 to $2.15, and boiler makers, from $1.75 to $1.90.

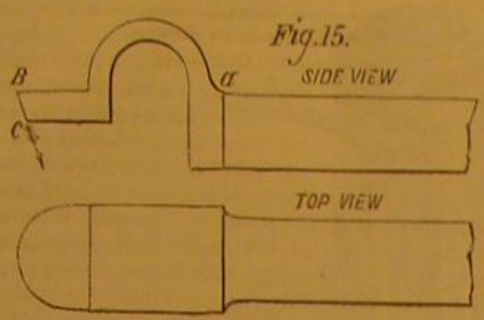
PRACTICAL MECHANISM.

NUMBER III.

BY JOSHUA ROSE.

THE SPRING TOOL.

Fig. 15 is a spring tool, which is specially adapted to fin-



ishing sweeps or curves, and may be used on either wrought or cast iron, or brass; the only difference in shape required to fit it for such various uses is to give it less top rake for cast than for wrought iron, and less for brass than for either. The fulcrum off which it springs is at the point, a, because that is the weakest part (since the cutting edge, B, is at a leverage to a); the line of spring of the edge, B, is therefore in the direction of the dotted line, C, which is away from its cut, so that it will give way to the metal rather than spring into it, which causes it to recede from the harder and spring into the softer parts of the metal, rendering its use unadvisable except for finishing curves, which it will do more smoothly and cleanly than any other tool, especially when necessity compels it to be held far out from the tool post.

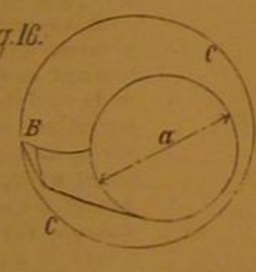
BORING TOOLS.

Standard bits and reamers have superseded the use of boring tools for all special and many other purposes, but there are numerous cases where a boring tool cannot be dispensed with, especially in repairing shops and for promiscuous work.

The boring tool is very subservient to spring in consequence of its cutting edge being in most instances far out from the tool post, and also from the slightness of the body of the tool when used to bore holes of a comparatively small diameter.

It should, when used for wrought iron, always be placed so that its cutting edge is a little below the center of the hole, in which case the bottom of the body of the tool is liable, in small holes, to bear against the bottom of the hole, unless the cutting part is made to be a little below the center of the body of the tool, rendering it rather difficult to grind on the top face; it is not, however, imperatively necessary to grind it there, since it can be sharpened by grinding the side faces; and the advantage gained by being enabled to get, into a given sized hole, a stouter tool than otherwise could be done, and, as a result, to take deeper and more nearly parallel cuts (for these tools generally spring off their cut at the back end of the hole, leaving it taper unless several light cuts are taken out) more than compensates for the extra wear of the tool, consequent upon being able to grind it upon one part only.

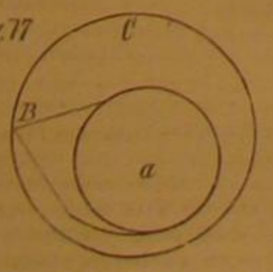
Fig. 16 represents a section of a boring tool, as above described, for use on wrought iron. a is a section of the body



of the tool; B is the cutting part, and C is the outline of the hole to be bored.

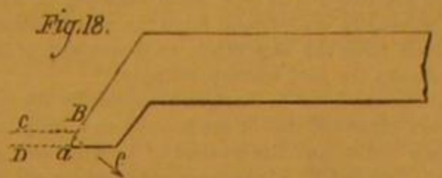
Very little bottom rake need be given to the tool, so that, when it springs from the pressure of the cut, it cannot enter the cut deeper than is intended, because of the side rake coming into contact with the side of the hole. It may, however, possess a maximum of top rake.

Boring tools for cast iron require less top and more side rake, and to be placed at the center of the work or even a little above the center. For brass, the cutting point, B, should have no top rake; and if the tool jars or chatters, as frequently occurs in cutting a groove, it must be made as shown in Fig. 17, a being a section of the body of the tool, B, the cutting part, and C the outline of the hole. B, being the



owest point of the top face, possesses negative top rake, and a corresponding tendency to scrape rather than cut keenly. The point, B, should always be above the center of the hole, so that, in springing, it will spring away from and not into its cut. Less top rake is required, if the point, B, of the cutting edge is ground so as to be used for screw-cutting than if for taking plain cuts.

When the skin of the metal to be cut is unusually hard, as frequently occurs in cast iron, the shape of the cutting part of the boring tool must be such that its point will enter the cut first, so that it cuts the inside and softer metal. The hard outside metal will then break off with the shaving without requiring to be cut by the tool edge, while the angle of the cut will keep the tool point into its cut from the pressure required to break the shaving. A tool of this description is



represented in Fig. 18. a is the point of the tool, and from a to B is the cutting edge; the dotted lines, c and D, represent the depth of the cut, c being the inside skin of the metal, supposed to be hard.

The angle at which the cutting edge stands to the cut causes the pressure, due to the bending and fracturing of the shaving, to be in the direction of c, which keeps the tool point into its cut; while the resistance of the tool point to this force, reacting upon the cut, from a to B, causes the hard skin to break away.

When a cut is being taken which is not sufficient to clean up or true the work, less top rake must be given, as a very keen tool loses its edge more quickly than one less keen. The reason for taking the rake off the top of a tool is that, if it were taken off the bottom, the cutting edge would not be so well supported by the metal, and would have a tendency to scrape, which rule applies both to inside and outside cuts. For brass work, top rake is never applied, because it would cause the tool to jar and cut roughly, bottom rake alone being sufficient to give a tool for brass the requisite keenness.

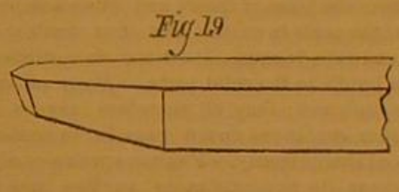
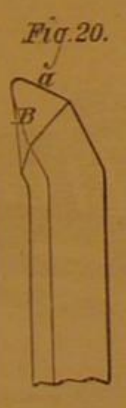


Fig. 19 shows a front tool for brass, concerning which nothing requires to be said, except that it cannot be made too hard, and that the top face must have negative rake when the tool point is held far out from the tool post.

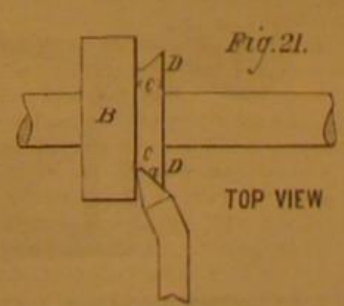
SIDE TOOLS.

Side tools for iron are subject to all the principles already explained as governing the shapes of front tools, and differ from them only in the fact that the cutting end of the tool is bent around to enable the cutting edge on one side to cut a face on the work which stands at right angles with the straight cut. A front tool is used to take the straight cut nearly up to the shoulder, then a side tool is introduced to take out the corner and cut the side face.



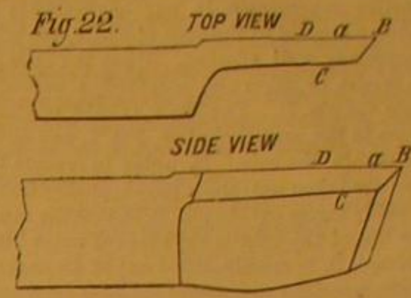
A side tool, whose cutting end is bent to the left, as in Fig. 20, is called a left-handed side tool, and one which is bent to the right, a right-handed side tool. The cutting edges, a and B, should form an acute angle, so that, when the point of the tool is cutting out a corner, either the point only or one edge is cutting at a time, for if both of the edges cut at once, the strain upon the tool causes it to spring in.

The form of side tool shown in Fig. 20 is that most desirable for all work where it can be got in: and in the event of a side face being very hard, it possesses the advantage that the point of the tool may be made to enter the cut first, and, cutting beneath the hard skin, fracture it off without cutting it, the pressure of the shaving on the tool keeping the latter to its cut, as shown in Fig. 21.



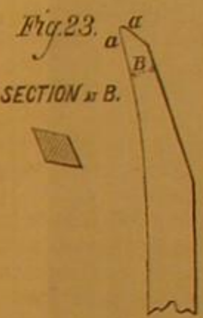
a is the cutting part of the tool; B is a shaft with a collar on it; c is the side cut being taken off the collar, and D is the face, supposed to be hard. The cut is here shown as being commenced from the largest diameter of the collar, and being fed inwards so that the point of the tool may cut well beneath the hard face, D, and so that the pressure of the cut on the tool may keep it to its cut, as already explained, but the tool will cut equally as advantageously if the cut is commenced at the smallest diameter of the collar and fed outwards, if the skin, D, is not unusually hard.

For cutting down side faces where there is but little room for the tool to pass, the tool shown in Fig. 22 is used, a being the cutting edge. Not much clearance is required on the side of this tool, the keenness being given to it by grinding



away the edge, C, so that the top face, from C to a, is an inclined plane, a being the apex. This tool should be so placed that the point, B, cuts a little the deepest, and the cutting edge at the point, D, is clear of the cut, the only consideration with reference to it is how much rake to give it on the face, from C to a, which should be less for cast iron than for wrought iron, and more when the metal is soft than when it is hard. Its spring does not affect it to any degree, since it springs vertically and in a line with the face of the cut, and not laterally and into it.

The best form of side tool for cutting brass is the diamond point, presented in Fig. 23, a a being the cutting edges. It



requires but little side rake upon either the top or side face, and, when held far out from the tool post, should have the rake taken off the top to prevent it from springing. In grinding it, grind only the end (rounding off the corner slightly), so as to preserve the bend upon the end of the tool, which is placed there to give it clearance. It will take a parallel cut equally as well as a side one, and for small work can be used to advantage for both purposes.

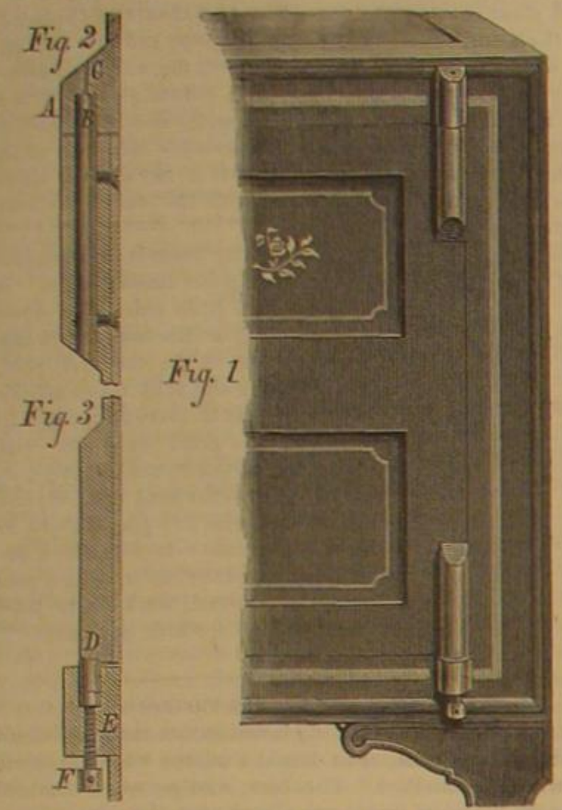
Vibrations of Liquid Surfaces.

Barthélemy has subjected to investigation the undulations which are produced upon liquid surfaces when these are thrown into vibration. The best results were obtained when the vessel of liquid was placed upon the resonant case of a tuning fork. Similar results were also obtained upon the sounding board of a piano. In this way the surface of the liquid assumed a fixed condition of elevation and depression, the result of uniform vibration over its entire area. Rectangular vessels give two sets of brilliant lines parallel to each side, formed by the ridges of the waves. Between these are less luminous lines produced by the hollows. Bright points are formed at the intersections of both. As the movement dies away, the lines parallel to the shorter sides disappear first, leaving those parallel to the longer; though sometimes components of both are left, forming zigzags diagonally across the surface. From his experiments Barthélemy deduces the following laws: 1st, the breadth of the undulations is inversely as the number of vibrations; and 2d, the distance between two lines produced by the same fork is independent of the density of the liquid. The figures given by circular masses of liquid consist of equidistant circular lines intersected by radii equally equidistant, thus giving trapezoidal forms with curvilinear bases. If the fork touches the vessel, a cross of no vibration appears, corresponding to the nodal lines of this vessel. As the vibration ceases, two opposite sectors disappear and the two alternate ones remain. By placing sand on the surface of the mercury and then covering it with water, circular lines are formed and also the cross of no vibration, the sand gathering in heaps at the vibrating parts. Triangular vessels give lines perpendicular to the sides, forming brilliant hexagons, the centers of which are the angles of fainter hexagons, having the radii of the first set for sides. As the motion lessens, only one set of lines persists, and the surface is covered with rectilinear waves perpendicular to one of the bases. Elliptical vessels give figures of exceeding beauty, the lines having reference to the two axes of the ellipse. The author calls attention to the general character of these wave surfaces. In the basin of a fountain, in the waves of the sea, these forms are recognized. Even in the sand on the sea bottom they can be traced. Certain lines thus made gave on measurement 2·6 vibrations per second. They may be seen 300 feet from the beach and at a depth of 25 or 30 feet. So, out of the water, the sand on the beach was found to have taken these forms, thus suggesting that the air itself was capable of similar vibration. So also clouds are arranged often in parallel bands, being being then considered a precursor of fine weather. Even in geology, the author thinks certain regular and equidistant foldings of stratified rocks evidence of analogous vibrations. The ventral segments of a liquid vein, M. Barthélemy thinks, are produced by the vibration of the liquid mass upon which it falls reacting upon it. And he makes an ingenious application of these facts to account for the phenomena of stratification produced by electric discharges in rarefied media.—*An. Chim. Phys.—American Journal of Science and Arts.*

L. P. S. says "I have run a piece of machinery in rawhide boxes for fourteen years without oil; it is good yet and runs at 4,500 per minute. I put it in while soft, and let it remain until dry." [We are glad to receive notes of this kind, giving results of actual practice. Nearly every one of our readers could send some information that would be valuable.]

STEVENS' IMPROVED HINGE.

The invention represented in our engraving is a hinge, which is shown applied to the door of a safe, for which purpose it is especially well adapted. Upon the casing or body of the safe is cast, or otherwise attached, a socket, A, into which passes the pin, B. The latter is held in place by the screws shown in the sectional view, Fig. 2, and which have their heads within the safe. In order to remove the door, these screws are taken out; and a punch, pushed down the oil hole, C, speedily forces out the pin, B, in case the same should stick. The top of the door is then moved out a little, when the lower hinge, D, is readily lifted out of its socket, E. F is a set screw, provided to prevent the door from sagging as the tenant of the lower hinge wears away



This invention is quite simple and easily applied, while it appears to be substantial and secure. Patented December 30, 1873, by Mr. Wm. F. Stevens, of Melrose, Mass., who may be addressed for further information.

IMPROVED PATENT GANG SAW TABLE.

This is an invention specially adapted to meet the wants of users of flooring machines, who have found difficulty in supplying material, sawn in strips from mixed widths of boards, fast enough to keep the floorer in operation. A good machine of the latter description should plane and match from ten to twelve thousand feet, broad measure, of four to six inch flooring, in ten hours; but it is hardly possible for a man to saw more than from six to eight thousand feet, into strips, in the same time and over a single saw. Hence it is either necessary to buy strips prepared at the saw mill (and these are rarely accurately sawn), have two saw tables for the floorer, or else not work the latter up to its full capacity, none of which are economical operations. Made on an ordinary saw table, strips are produced in varying sizes; and perhaps after some hours work, not enough of any one size can be sorted out to keep the matching machine at work, thus involving changing the apparatus so frequently as to prevent its performing its full amount of labor.

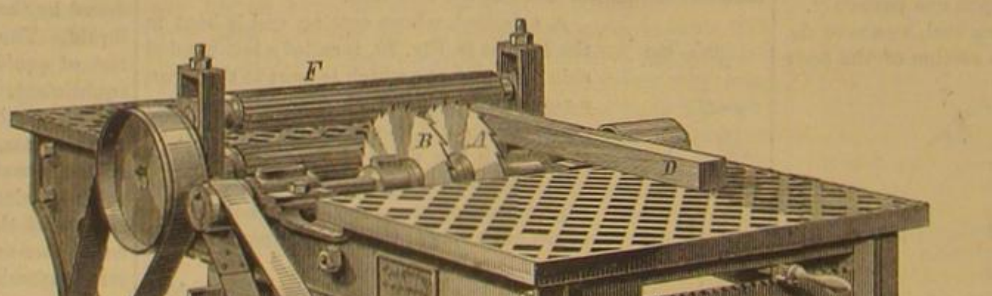
The device illustrated in the annexed engraving is claimed to meet the requirements above indicated. It is able to provide a supply sufficient to keep two matchers constantly at work. Two saws are used for slitting the lumber into strips of suitable width, one of which, A, is secured upon the arbor rigidly, and the other, B, is attached to a sliding and revolving sleeve and collar. This sleeve is provided with grooves to receive Babbitt metal, and works within a journal box which slides with it, and, besides, has a longitudinal channel to receive the feather by which it is made to revolve with the shaft while still sliding freely along the same. The lower part of the box is provided with a downwardly extending arm, at the end of which is an eye to receive a guide rod, which extends transversely across the machine. A mortise is made through the arm, between the box and the eye, to receive a lever which is pivoted at one end to the frame and terminates at the other with a handle, C, convenient to the operator. By means of this lever the arm, and with it the sliding sleeve and saw, B, is moved nearer to or further from the fixed saw, A, in order to govern the distance between said saws, and hence the width of the strip. At D is a gage which may be adjusted to any desired distance from the screw, A, by means of the hand lever, E which communicates with a sliding sleeve traveling on a guide rod, which sleeve is suitably connected with the gage.

The carrying or guide rollers, shown at F, grasp the sawn strips and carry them forward, thus acting also as feed rollers to guide the strips truly through the machine. The upper roller is made yielding by the application of the weight, G. It will be observed that no feed rollers are used to hold the lumber before the same reaches the saw; and by such arrangement, the operator is enabled to see, when the end of the timber is placed upon the table, whether the sliding saw or gage should be removed, so that all the material in the plank may be utilized.

The arrangement of two rows of notches, into which the hand levers are dropped to hold them securely in any position, will be readily understood from the illustration. The feed is driven from the saw arbor, so that a slip of the driving belt checks the feed correspondingly.

Though the machine is designed especially for planing mills, we are informed that it can be used as a strip machine in small saw mills, and the method of holding and moving the movable saw can be advantageously used on all the different makes of gang edgers. The gage can also be applied to the ordinary single saw table. The speed is from 2,500 to 3,000 revolutions per minute, and we learn that over 20,000 feet of dimension stuff can be made in a day from miscellaneous lumber, and a much larger amount from stock boards.

Patented August 12, 1873. For machines address the Erie City Iron Works (sole manufacturers of the apparatus for the United States), or George Carroll & Brother, Erie, Pa. For right to manufacture in Canada, address John McIntosh, Toronto, Ontario.



CARROLL'S PATENT GANG SAW TABLE.

The Welding of Iron.

When two pieces of ice are rubbed against each other, fusion take place between the surfaces of contact, at a temperature below zero. As soon as the pressure ceases, solidification is again produced and the pieces are welded together.

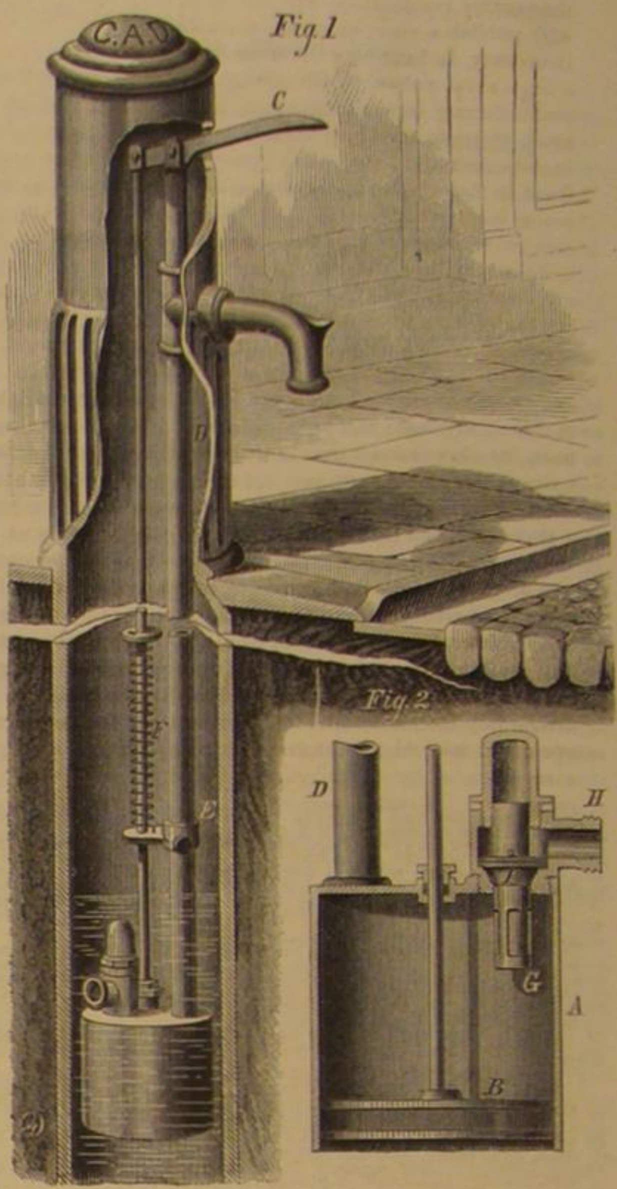
It seems to me that the welding of iron is a phenomenon exactly similar. The two pieces of iron are brought to a white heat, that is to say, more or less near to the fusing point. The repeated blows of the hammer, or the pressure of the rolls, lowers the point of fusion and causes a superficial liquefaction of the parts in contact, and thus welds the masses together; and this, because, like water, iron dilates in passing from the liquid to the solid state. Many other metals are similarly endowed; they all therefore may be welded like iron, if other conditions do not come in to oppose the manifestation of this property. Platinum welds easily at a white heat because its non-oxidizable surface, like that of ice, takes on a superficial fusion. To weld iron successfully, it is necessary that its surface should be clean, that is, free from oxide. Iron containng phosphorus welds more easily than pure iron, because its point of fusion is lower. Steel, which is more fusible still, welds at a lower temperature than iron, but the process is a more delicate one. Silver, too, like iron and platinum, has the property of expanding when it solidifies; but as it melts at a cherry red heat, it is easier to form it by casting than by welding. Bismuth and zinc are always included in the same class; but they are so very brittle near their fusing points that no one would think of attempting to weld them either by hammering or pressure. Iron in welding, therefore, only follows the example of water.

The fibrous state of iron is not a normal and regular one All crystaline iron, if the crystals are not too hard, breaks with a fibrous structure, if time be given, in the breaking, for these crystals to be drawn out into fibers. Iron which is fibrous is only iron in which the primitive crystals, surrounded by very thin films of slag—and thus separated from each other—have not been welded together during the rolling, but have been elongated into wires. A bar of such iron resembles a bundle of wires in its resistance to fraction, but it breaks with a granular fracture when exposed to a transverse blow, suddenly applied.—*M. Jordan.*

FOR a marking fluid, use coal tar dissolved in naphtha.

DAVIS' IMPROVED HYDRANT.

The hydrant represented in the annexed engraving is claimed to prevent freezing and waste of water. It is of durable construction, and is self-closing. The valve is not liable to become choked with dirt, as the passage of the water



serves to clean the orifice, while the pressure of the fluid keeps the valve down.

A is a cylinder or chamber, sunk in the well and provided with a piston. B, the rod of which connects with the handle, C. D is the eduction pipe, having a suitable discharge nozzle, as shown. To this pipe is attached a guide plate, E, Fig. 1, which may be adjusted to various elevations by means of a clamp screw. On the piston rod is a fixed disk, between which and the plate, E, a spiral spring, F, is extended. The latter, being stretched when the hand lever is depressed and the piston, B, raised, will retract and throw down the piston into place as soon as the force on the lever is remitted. G, Fig. 2, is a gravity valve, having a subjacent slotted tube and an upper head working in a guide. As the piston rises, the valve is carried up until the slotted tube receives, through the inlet pipe, H, a supply of water, which is then forced up through the eduction tube, D, and discharged. The chamber, A, is thus kept always in a condition to receive the water that may be left in the tube, D, after the flow has ceased from the spout.

I is a leather or flat flexible ring that is secured to the valve by a metal ring or pin, and which acts, in case of gravel or other obstruction settling between the valve and its seat, as an auxiliary valve, being forced by the pressure of the superincumbent water to cover any crevice made and to form a watertight joint.

Patented through the Scientific American Patent Agency, April 28, 1874. For further particulars regarding sale of patent rights, licenses, etc., address the inventor, Mr. John T. Davis, 1,212 Eleventh street, Southeast, Washington, D. C.

WIRE WORMS.—These are found in the greatest quantities in fresh new loam, just brought from the field, and such soil, when used for valuable plants, should be carefully examined, and the wire worms crushed; their brownish red bodies are easily seen. Mr. Tillary writes to the *Garden* that slices of potatoes or lettuce stems will likewise entice them where they are numerous. The slices should be placed under ground, and then frequently examined. He saved a bed of seedling gladioluses that were planted in some new loam, which, he found afterwards, swarmed with wire worms, by placing slices of potatoes and lettuce stalks in the ground after he found that some of the plants were flagging.

THE ROYAL GARDENS AT CASERTA, ITALY.

Most of our readers are familiar with the chief features of the Italian school of landscape gardening, the broad plateaus, the artificial lakes and waterfalls, and especially the formality of shape shown in trimming the edges and rows of trees. Of the pleasure grounds attached to the palace of Caserta, the country residence of the late King of Naples, we herewith publish a view, extracted from *The Garden*. Our contemporary, in describing the scene, says: "You enter through a huge royal palace, which seems admirably suited for accommodating several regiments of life guards, when the scene depicted in the illustration meets the eye—the huge cascade facing a distant hill covered with evergreen oak. Good as the engraving is, it can give little idea of the enormous length of these garden waterworks, long and well constructed stone reaches of deep clear water, broken here and there by falls, which are embellished by a rich display of sculpture and statuary. But, before reaching the waterworks, we have to traverse a very large space by habit called a garden, but which is simply a huge expanse of turf, on which stands clumps and squares, and avenues of trees. We have to approach these closely to see what they are composed of, for all are either clipped or mown, or in some way mutilated, till they lose all individual character, and merely form irregular walls of vegetation. Under one of the falls, there is a vast covered way, with well constructed rocky walks and walls, and here the maiden-hair fern grows everywhere as freely as meadow grass; it ventures out from the moist and shaded grottoes, and creeps into the eyes and ears of the spouting sea monsters outside in the sun—the only trace of life or Nature near. The distressing effect of all this gradually passes away, for one of relief, as the base of the great irregular (but also artificial) cascade is reached, till the eye dwells happily on the hills around, densely garlanded with evergreen oak. All this kind of art comes from allowing the space intended for a garden to be converted into an open air gallery for the exhibition of architecture, sculpture, etc., mostly of a mediocre, and often of a feeble or ridiculous character. Let us not, however, delude ourselves into the belief that, in creating such scenes, on either a large or small scale, we are making a garden. There is at Caserta, however, an example of one phase of real gardening which will repay the visit. It is what is called the English garden, a large piece of diversified pleasure ground, with many trees allowed to assume their natural development. Towards the end of the last century this garden was planted, and with a very happy result. The great geometrical district, so to say, gives one an idea that the region is not a fertile one; this is at once dispelled on entering the English garden. The cedars, cypresses, and deciduous trees have attained great size and beauty, and grow in stately groups, with open spaces between, so that their forms may be seen. Here is the first camellia ever introduced into Italy, where the plant is now so abundantly grown, and whence we get most of our new varieties. It is a specimen of the single red, now in full bloom, and about 20 feet high and 15 feet through. The camphor tree is seen in fine health here, in specimens nearly 50 feet. The garden is enriched by some grand cork trees, which may give many visitors a fair idea of what a noble tree this oak is when fully developed. The trees are huge in stem, picturesque in their branching, and about 80 feet high. Some of the scarcer pines attain much perfection here, as, for example, the Mexican (*p. Montezuma*), which is 60 feet high.

The Possibilities of Future Discovery.

A striking illustration of the popular lack of scientific reasoning is to be found in an editorial which recently appeared in the New York *Herald* as follows:

"The wildest imagination is unable to predict the discoveries of the future. For all we know, families in the next century may pump fuel from the river and illuminate their houses with ice and electricity. Iron vessels, properly magnetized, may sail through the air like balloons, and a trip to the Rocky Mountains may be made in an hour. Perhaps within fifty years American grain will be shot into Liverpool and Calcutta through iron pipes laid under the sea. By means of condensed air and cold vapor engines, excursion parties may travel along the floor of the ocean, sailing past ancient wrecks and mountains of coral. On land the intelligent farmer may turn the soil of a thousand acres in a day, while his son cuts wood with a platinum wire and shells corn by electricity. The matter now contained in a New York daily may be produced ten thousand times a minute, on little scraps of pasteboard, by improved photography, and boys may sell the news of the world printed on visiting cards, which their customers will read through artificial eyes. Five hundred years hence a musician may play a piano in New York connected with instruments in San Francisco, Chicago, Cincinnati, New Orleans and other cities, which will be listened to by half a million of people. A speech delivered in New York will be heard instantly in the halls of those cities; and when fashionable audiences in San Francisco go to hear some renowned singer, she will be performing in New York or Philadelphia.

In the year 1900 a man may put on his inflated overcoat, with a pair of light steering wings fastened to his arms, and go to Newark and back in an hour. All the great battles will be fought in the air. Patent thunderbolts will be used instead of cannon. A boy in Hoboken will go to Canada in the family air carriage to see his sweetheart, and the next day his father will chasten him with a magnetic rebuker because he did not return before midnight. The time is coming when the *Herald* will send a reporter to see a man reduce one of the Rocky Mountains to powder in half a day. Skillful miners will extract gold from quartz as easily as cider is squeezed from apples. A compound telescope will be invented on entirely new principles, so that one may see the planets as distinctly as we now see Staten Island. Microscopes will be made so powerful that a particle of dust on a gnat's back will appear larger than Pike's Peak. And marvelous progress will be made in psychological and mental sciences. Two men will set in baths filled with chemical liquids. One of them may be in Denver and the other in Montreal. A pipe filled with the same liquid will connect the two vessels, and the fluid will be so sensitive that each may know the other's thoughts. In these coming days, our present mode of telegraphing will be classed with the wooden ploughs of Egypt, and people will look back to steamships and locomotives as we look back to sailboats and stage coaches."

MEDICAL NOTES.

Cholera.

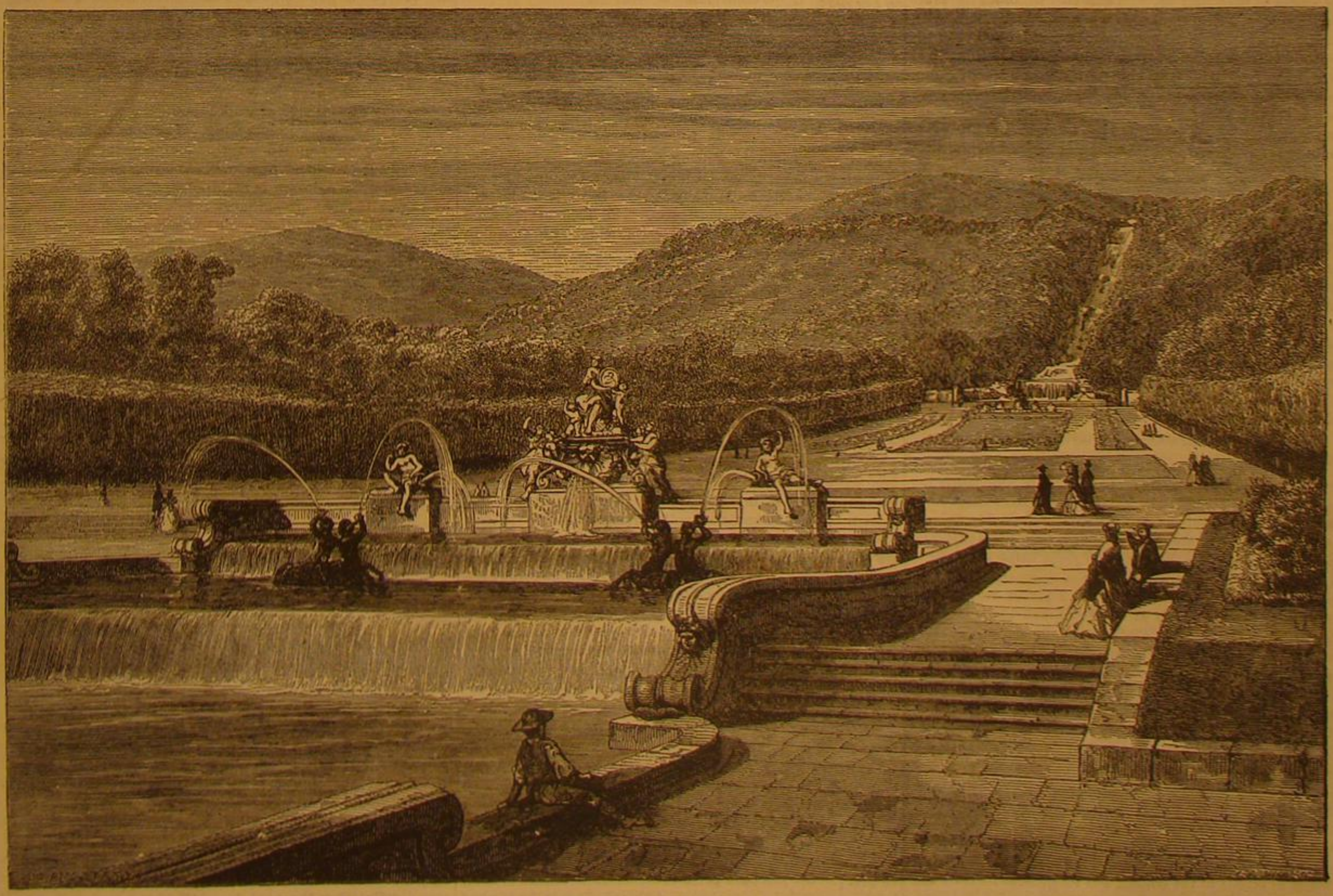
There may come another cholera scare this year; certainly there will come one before many years. Some doctors think the scare worse than the disease. At any rate, the nervous depression produced by reading and hearing alarming stories is a well proven semi-cause of death, by diseases which affect the nervous system, whether alone or conjointly with other disorders; and sometimes light ones are aggravated to the bitter end by imaginary fears. Knowing the force of this fact, as all experienced people do, it seems a happy thing to find an antidote, as far as cholera scares are concerned, in the following statement: Dr. Blakiston says, in the London *Medical Times and Gazette*, that it has been fully proved in the Paris hospitals that cholera is not communicable by the breath of the patient, or by contact with his body during life or after death. Most of the "stiffs," as they are called in technical vulgarity—that is, the subjects of dissection—were for many months victims of cholera in Paris, and yet no doctor and no student caught the disease. Therefore let no timid person have any fear about the infection of air or touch, but remember that the germs of cholera have been proved to be propagated through the *dejecta* (voidings in any way) which come in contact with water or food, possibly with air much breathed, though this is not fully shown.

Valerian in Diabetes.

Dr. Bouchard says extract of valerian is a powerful agent in diminishing the elimination of urea and waste of tissue seen in diabetes. He adds a curious fact, observed in long practice among the Indians of Lower California. The warriors, before entering on an expedition, go through a course of valerian regimen for a month, to get themselves into a fatigue-supporting condition. This fact suggests another, concerning the Peruvian Indians, who are able to go without food for five days, under a burdensome journey, when well supplied with the juice of the plant, so extensively used in that country, called coca. It seems to us that coca and valerian might be used in thickly settled countries as articles of medical nutrition, to say nothing of their possible value as substitutes for food of the common sort among the very poor.

Poisoning by Hydrate of Chloral.

In the case of a man who took six drams of chloral to commit suicide, electricity was first used to induce regular



THE ROYAL GARDENS AT CASERTA, ITALY.

breathing, and then subcutaneous injections of nitrate of strychnia to stimulate the heart's action. Finally the patient awoke, quite refreshed, thirty-two hours after swallowing the chloral.

A Good Disinfectant.

A very weak solution of permanganate of potash is an excellent disinfectant for light purposes, such as rinsing spittoons, neutralizing the taint of diseased roots, cleansing the feet, and keeping the breath from the odor of tobacco smoke. Permanganate is not poisonous.

A Preventive for Lead Poison.

Any soluble salt of lime (if plaster of Paris or gypsum is used, there should be added a little saltpeter or sal ammoniac) in the most minute quantity prevents the oxidation of lead in contact with water. Therefore it would be well to put a little chalk into wells which have leaden pipes, also in leaden beer pipes and other conduits, if people will use them. Perhaps it would be better to dip leaden pipes in a moderate solution of sulphuric acid (oil of vitriol) before using, and to dip the common soldered tin cans for fruit in the same, in order to form an insoluble coating of sulphate of lead. For, all wiseacres to the contrary, every good chemist knows that lead is easily oxidized by pure water, and still more so by water containing carbonic acid; and since lead is a cumulative poison, a very little of it at a time, taken into the system for weeks, months, or years, will be sure to produce some ugly disease, like neuralgia, painter's colic, hardened liver, or paralysis, the frequent foe of the aged.

Improved Mustard Poultice.

The *Medical Brief* says: In making a mustard plaster, use no water, but mix the mustard with white of egg, and the result will be a plaster which will draw perfectly, but will not produce a blister, no matter how long it is allowed to remain.

Anæsthesia.

At Bellevue Hospital, bromide of potassium, 30 grains previous to administering sulphuric ether and the same dose as soon as the patient can swallow after the administration, is now regularly resorted to. The effect is to prevent the vomiting which so commonly follows the use of ether.

THE CONVENTION OF THE CIVIL ENGINEERS.

The sixth annual convention of the American Society of Civil Engineers was recently held in Tammany Hall in this city. About 100 delegates appeared, representing the principal cities in the country. Colonel Julius W. Adams, President of the society, presided; and in the course of the proceedings, a memorial was adopted urging upon Congress the necessity and importance of a series of complete tests of American iron and steel. We give below abstracts of the papers read.

Captain James B. Eads said that

UPRIGHT ARCHED BRIDGES

can be more economically constructed for railroad purposes than is possible with the suspension system, no matter what the length of span may be. He said that it is entirely practicable to brace the upright arch more effectually, and with equal, if not greater, economy, than is possible by any known method of stiffening suspension bridges. By any method of girder construction hitherto known, it is impossible to span a clear opening of 500 feet with less than three times the dead weight of the arch in the proposed system, with equal strength of girder and with the same material and allowable strain.

The objection to the combination of wood and iron in bridge construction, owing to the difficulty of repairing the bridge, does not exist in this method. In all others, the wood is either under tension or compression, and therefore difficult to be removed without endangering the stability of that arch, or of any other one of the series; for it is plain that, if any temporary weight were placed on the floor which would equal the weight of the cords to be removed, the equilibrium of the whole series would be undisturbed by their removal so long as the whole bridge remained unloaded. In repairing, it would never be necessary, however, to remove any one cord entire at once, but only to replace such pieces as were found defective.

Mr. Francis Collingwood read a paper on the

ANCHORAGE OF THE EAST RIVER BRIDGE.

The front face of the Brooklyn anchorage is 930 feet back from the center of the tower. The length of the base is 132 feet, and extreme width, 119 feet 4 inches. It consists of a timber platform of three feet thickness, thoroughly bolted. Below this platform are bearers, placed longitudinally with about nine feet spaces, the bottom of these being at the level of high tide in the East River. The extreme size of the excavation at the bottom was 122 feet 4 inches wide at the rear, 112 feet and 4 inches at the front, and 135 feet long. This space had to be excavated entirely to a uniform level before the foundation could be started; and the problem was to so support the banks as to effectually prevent damage to surrounding property, and at the same time not have the bracing interfere with the free movements of workmen, or with lowering or placing the timber and stone in position.

All materials for the anchorage had to be brought 1,000 feet through crowded streets from the dock at the river, and it was also desirable to transport the same from the excavation to the yard at the pier for storage.

The form of the masonry throughout is in plan the same as that of the foundation, the stone work being set back 18 inches all around from the edge of the platform. There are a series of offsets at the bottom, but its general form in elevation is that of a truncated pyramid with sides battering above ground half an inch per foot rise. The top of the masonry is also the grade line of the bridge, and has an elevation of 89 feet at front, and 85 feet 9 inches in the rear. The front portion is divided into three parts. The central of these will support and contain the two central anchor chains. Between this and the two exterior walls are spaces arched over to support the roadway above. Since diagonal braces could be used, this determined the use of two lines of through longitudinal bracing and six lines of through transverse bracing. At the intersections of the main lines, square timber piles were driven, before the excavation was begun, to a depth of about three feet below tide. The excavation was then started at the highest point, and the first stringer, etc., put in. After this was well under way, the second range of sheeting was started on the opposite side and ends, and before the pressure had become severe the braces between the heads of the piles were put in in each direction. In this way the work was carried down progressively, the excavation in the central portion being in every case the last removed.

THE EXCAVATION.

In driving the lowest range of sheeting, great difficulty was found in penetrating the fine, compacted sand below the water line. After trying several devices, it was decided to use a water jet. For this purpose a small rubber hose was provided, having a three quarter inch jet from pipe four feet long for a nozzle. This was attached to the city works, and by its use the planks were forced down very readily. Six inches below tide was the average depth driven. To overcome the last two feet of the excavation, it was necessary to pump the water out of the pit; and the question arose as to the size of pump required. To solve the question appropriately the following experiment was tried: A piece of 18 inch sewer pipe was set down into the sand at the bottom of the pit. The sand was then removed from the interior and the water bailed out. The time and depth below and top was then noted, and when nearly filled the time was again noted, together with the increase in hight. The average head under which the water entered did not exceed six inches, and it was thought that this would probably be as great as it could ever be around the sheeting, and, taking the relative perimeter of the two as a basis, to be pumped about 80 gallons per minute. At a time afterwards, when the pump was in regular working, the amount discharged was found to be 60 gallons per minute. This method would no doubt be safe in similar cases where no springs in the bottom were to be apprehended. The maximum pressure upon the sand underneath, caused by the complete structure, will be about 4 tuns per square foot.

The only remaining point of interest was the method taken to lower the four anchor plates into the pit. These were massive castings, $17\frac{1}{2}$ feet by 16 feet and $2\frac{1}{2}$ feet deep (over all), and weighing 53 tuns each. For this purpose, an excavation 20 feet wide, with slope of two to one, was made in the rear, and a hole cut through the sheeting. In this timber ways were laid, and two sticks were also bolted to each of the plates, for sliding pieces. They were then lowered by tackle without trouble.

Abstracts of several other interesting papers will be given in our next.

Metallic Bedsteads.

The works of Mr. S. B. Whitfield are situated in Watery lane, in the Coventry road, Birmingham, Eng. They are called the Gladstone works, and occupy about 3,000 square yards, of irregular parallelogram, and are built on three of the sides.

First, we go into the cutting shop. Here the angle iron, round irons, and rods are cut into the lengths required for the parts of the bedstand. As many as 200 or 300 different lengths are required for the various parts. The rods are brought in bundles, and are cut by a machine worked by steam, as many as five rods being cut by one movement of the cutting press. These are for scrolls and other ornamental parts of the bedsteads. When the angle rods have been cut, they are then stamped straight by hand-worked presses. They are next passed to lads by whom they are studded, and on these studs the laths are put when the bedstead is made up. All these processes are executed with great precision, as all the parts of the same kind of bedstead are interchangeable, and the greatest exactitude is required in every part of the work.

From the cutting shop we pass to one of the galleries, of which there are two overlooking the casting shop. In the first gallery the rods, having been cut and studded, are brought to be bent into the various forms required by the pattern. This process is exceedingly simple. The pattern for the scroll or other design is placed in a vice and the rods are placed around it, the iron lengths used being either plain or bended, according to the design. In this gallery the iron is bent into shape for the bands or the bottoms of the bedsteads. In every case the work has to be done with great nicety, as every one must correspond with the rods with which they are to match. This department is very properly named the bending gallery, and every visitor will be struck with the beauty of many of the curves produced, and the elegance of many of the designs and patterns.

After having been bent, the various parts of the head and foot are taken into the casting shop, which is, of course, on the ground floor. These are placed on a frame, and the end of each of the parts is placed in a chill; in some elaborate patterns more than twenty chills are used. Into these chills is poured the molten metal, and from the pattern cast in them is produced the flowers, knobs, and other ornaments which are seen at the various points of jointure. As soon as this process has been performed, we have a head or foot, as the case may be, completely produced. This is the method of casting all the parts together, the invention of which produced quite a revolution in the trade. As soon as the metal is poured in, the chills are opened, and the work is ready for chipping. This process is done by hand, and by it the casting is cleaned of all superfluous bits, and thus made ready for the next operation. In this part of the premises all the casting is done. The sockets, into which the dovetails and ends of the angle iron are placed, are cast on the corners of the posts. This is done while the parts are still in the frame. The furnace is funnel-shaped in the inside, and is charged with coke and pig iron in the proper proportions, and the metal is taken from it in pots and carried to the various parts required by the casters. The casting finished, and the work chipped of the bits of metal which are left by the casting, it is ready for japanning and painting.

Before passing to this part of the works, we visited the stock room. This is not so called from its containing the stock in the ordinary name, but in a technical sense. A stock in a bedstead manufactory is a die or pattern, for producing the ornaments for the tops of the pillars and other parts of the bedstead. In fact a chill may also be called a stock, as both are patterns and dies by which the ornamental parts are produced.

In the top gallery, folders, chairs, and cabinet bedsteads are made. Here we saw some which would either serve for a chair, a sofa, or a bed. As a chair, you can, by adjusting a small check, obtain any inclination you wish. By a very simple arrangement, you can unfold it and make it into a bed. Having used it, it can be folded up into so small a space, and is withal so light and portable, that a not very strong man could carry his chair and bed about with him wherever he pleased.

PAINTING AND JAPANNING PROCESS.

We now pass into the japanning and painting. This work is carried on in separate shops, each mode of decoration requiring stoves of a different temperature. The common, or black japanning, is done on the ground floor. The bedsteads are taken from the casting shop, and then covered with a coating of black japan and placed in large stoves, or rather heated iron rooms, where they are subjected to a temperature of 250°. In the second or upper room, a better kind of work is done, and a green, a maroon, and other colors are employed. In this work the heat required for fixing purposes is still very intense, but much less so than for black japanning. In the top room the more artistic painting and ornamentation is done, and a still lesser temperature is required, often not exceeding 100°. This is a very pretty process. The designs in metal are made on slips of paper, which are fastened on the scroll, or pillar, or rail, to be ornamented. The pattern is then washed, and the paper comes off, leaving the design in gold and colors on the bedstead. The ornamentation is in gold and colors, and some of the designs are very beautiful and elaborate. Some of the work is decorated by hand. After the painting, the parts are placed in the oven to fix the colors.

From the painting and japanning rooms, the articles, now finished, are taken to the wrapping rooms. The best goods are wrapped in paper, the head and the sides and laths being made into different parcels. The inferior work is only partly prepared, and then banded up with straw, and sent away to various destinations. The more delicate work is packed in skeleton cases. Every bedstead is put together and tested before it leaves the works.

One very careful kind of work is stamping the holes in the laths for making the iron racking. These are flat slips of iron cast to the required length. The hole at one end is stamped out by a hand press. In stamping the hole at the other end great accuracy is required, and it has to be done by gage. If this were not most carefully executed, the result would be that the latter would not fall into the studs on the sides or angle irons. They invariably do so, however, so nice is the adjustment of the parts. This done, the stud has only to be screwed down, and the bed is made, no keys being used in putting up metallic bedsteads.

From the wrapping rooms we passed to the fitting shop, in which also all the stocks and chills are made. This is one of the most important departments of the works. Here the design for the pattern of a stock is made in wax, then the model is taken in plaster of Paris, and from this the stocks are made. The utmost care is required in planing, turning, and cutting the various parts of a stock; for unless everything is made to fit and work into the nicest exactitude, the stocks will not close on the ends of the different parts which are to be joined together by casting. It is in this shop, in fact, that the bedstead is made. The various parts of a head or foot are placed on a frame, and then the stocks are tried, and every defect removed, until each one is in perfect working order. Here also are made the molds in which are cast the dovetail joints for the corners. In this room the nick in the top of the studs is cut, and the machine employed in this work acts with such facility and ease that the work is done by a girl.

TREATMENT OF BRASS FOR BEDSTEAD WORK.

Up to this time we have been engaged with the manufacture of iron bedsteads; we now turn to brass work, which is a distinct part of the trade. It is most interesting to witness the various processes through which this work passes. The framework of the bedstead is of iron, and the pillars, tubes, rails, and other parts are covered with a brass casing of not more than 1-64 inches in thickness. Some of the ornaments of the brass work are exceedingly elaborate and beautiful. A preceding writer has somewhat minutely described one part of this work: and as any account would be only a repetition of his words, we prefer to quote them. He says: "Entering the yard from Watery Lane, we find, in an open shed facing us, one stage in the manipulation of or namental brass work. A number of finely formed vases o excellent design have just been delivered from the bras foundery. They are, however, the reverse of sightly being of a dull, spotty, copper color. The workman has a number of bundles of them strung on wire, and is treating them to a series of baths of diluted aquafortis. The vases are first immersed in a weak solution, which removes earthy matter and the outer skin. They are then moved to a stronger solution, in which the liquid, while the brass is in the bath, bubbles violently, giving off a strong vapor of sulphuric acid gas: it is then moved to the third bath, and, after a few alternate plunges, is ready for drying, a wonderful transformation having taken place during the process, the final dip giving the article a beautiful but evanescent color. The precipitate in these baths is copperas, which is readily salable. Following the vases we have been referring to, we find that they are thoroughly dried in heated sawdust, when they are ready for the burnisher.

BRASS BURNISHING.

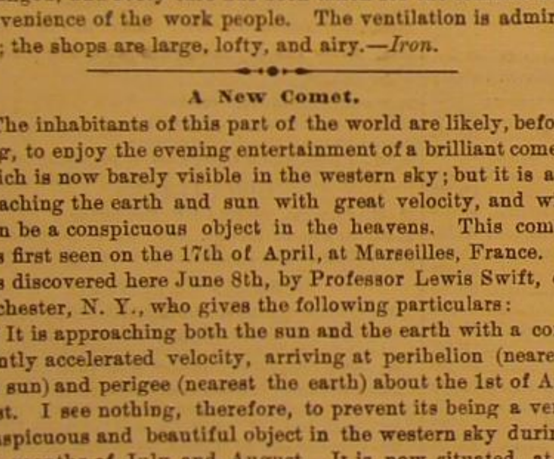
While the vases are being dried, we notice that some boys are very deftly filing the edges of brass castings, and learn that hundreds of boys are engaged at this work in Birmingham. One of the vases having been thoroughly dried is passed to the burnisher, who rapidly enhances its beauty greatly, by burnishing the shields and other projecting parts of the ornaments. His appliances are his burnishing tool, a Chartley Forest stone upon which to polish it, a solution of soda to keep his hands free from grease, and gall in which to dip the tool and help its slipping action. Gall is a very valuable commodity in Birmingham. From the burnisher the work is conveyed to the lacquering room. This part of the work is done very neatly and effectively by women, and is necessary, as may be known, to the preservation of the color of the metal and to the preservation of the surface indeed. Quick drying is essential here as in the painting room; and to provide this, the room is furnished with large flat-topped stoves, heated by gas, which obviates the smoke and dust that would be produced by stoves heated by coal. Brass tubes are lacquered upon an iron tube through which a jet of steam is passed. Any depth of tint can be given to the lacquer, but whether deep or light all brass work receives a number of coats. In this room we noticed a variety of brass bedsteads of very charming designs in twisted, taper, and plain pillars, with ornaments of great beauty."

About 200 people are employed by Mr. Whitfield in all the departments of the trade, and from his works bedsteads of every form and pattern, and of widely different prices, are sent to all parts of Great Britain. The works are admirably arranged, and every care has been taken for the comfort and convenience of the work people. The ventilation is admirable; the shops are large, lofty, and airy.—*Iron*.

A New Comet.

The inhabitants of this part of the world are likely, before long, to enjoy the evening entertainment of a brilliant comet, which is now barely visible in the western sky; but it is approaching the earth and sun with great velocity, and will soon be a conspicuous object in the heavens. This comet was first seen on the 17th of April, at Marseilles, France. It was discovered here June 8th, by Professor Lewis Swift, of Rochester, N. Y., who gives the following particulars:

"It is approaching both the sun and the earth with a constantly accelerated velocity, arriving at perihelion (nearest the sun) and perigee (nearest the earth) about the 1st of August. I see nothing, therefore, to prevent its being a very conspicuous and beautiful object in the western sky during the months of July and August. It is now situated, at 1



o'clock in the morning, directly beneath the polar star, and about twenty-five degrees from it, and is just visible to the naked eye. With an opera glass it can be easily seen as a hazy nebulous mass, with a bright point a little to one side. Through my telescope of four and one half inches aperture, six feet focus, it presents a, tail filling the whole field, with a low power of thirty-six. So directly toward us is it moving it seems almost to stand still, its slight deviation from it giving an apparent motion toward *β Ursæ Majoris*. It is now visible all night, but will soon be so only in the early hours of evening, setting in the northwest.

If at the time of its nearest approach to the earth the moon should be absent, we may expect, from present indications, to be treated with a cometary display which may rival the transit of Venus in popular as well as in scientific interest. The comet will be brightest on the evening of August 3, being then 245 times as bright as at the time of discovery, while now it is only 5½ times as bright; and as the moon will be absent, it will be subjected to spectroscopic analysis under circumstances more favorable than may occur again in many years. It will then be about 5° from Denabola, the brightest star in *Leo*."

To assist those of our readers who are not versed in astronomy to find the comet, we give a diagram showing the seven bright stars forming what is commonly known as the Dipper, from which the observer will carry imaginary lines down to three smaller stars below the Dipper, thence obliquely to the right, where the comet will be found. Just at present a spyglass or an opera glass will be needed to assist the vision; but in a few days the comet's tail will stand out clearly, and a special search will be unnecessary.

Three Thousand Five Hundred Miles by Railway.

The new route between San Francisco and New York is thus composed:

	Miles.
Central Pacific—San Francisco to Ogden	878
Union Pacific—Ogden to Kearney	835
Burlington & Missouri River, in Neb.—Kearney to Hastings	40
St. Joseph & Denver City—Hastings to St. Joseph	226
Hannibal & St. Joseph—St. Joseph to Hannibal	206
Hannibal to Louisiana	25
Chicago & Alton—Louisiana to Chicago	275
Michigan Central—Chicago to Detroit	284
Great Western—Detroit to Suspension Bridge	230
New York Central—Suspension Bridge to New York	447
Across the Continent	3,446
TO BOSTON.	
San Francisco to Chicago	2,485
Chicago to Albany	818
Albany to Boston	201
	3,504

THE cheapest articles of which we have lately heard are alligators. A correspondent from the South says that you can buy them five feet long at Perry, Ga., for one dollar a piece.

ALUMINUM SILVER.—The following alloy is distinguished by its beautiful color, and takes a high polish: Copper 70 nickel 23, aluminum 7, total 100.

Recent American and Foreign Patents.

Improved Watch Escapement.

George H. Knupp, Wapakonetta. O., assignor to himself and Harvey Brokaw, same place.—To prevent overbacking, the notched end of an escape lever with curved arms is so arranged as to guide the pin of a balance wheel back into a notch when the trouble occurs.

Improved Children's Carriage.

A C spring is attached to the front axle, and extends back over the hind axle, to which it is also attached, and then springs by a large curve around the body, which is suspended from it. The body of carriage is provided with a portion which may be made to serve both as a dash and a table.

Improved Hoof Trimmer.

Frederick R. Sutton and William G. Sutton, Wellington, Ill.—This invention consists of a pair of side bars pivoted to a toe piece, and connected, at the heel, by a right and left screw, constituting a frame, to be clamped upon the hoof by screwing the side pieces against it. On the frame is a cutter fixed in slots in the aforesaid side pieces, and provided with a cranked screw for forcing it up to the toe piece, to shave off the bottom of the hoof. At the toe is a gage, to regulate the amount to be shaved off, and on one of the side clamping pieces is a contrivance for quickly releasing the clamping frame from the hoof in case the horse becomes restive.

Improved Cross Cut Sawing Machine.

David R. Carter, Rockport, Ky., and Thomas H. Carter, Bremen, Ky.—This invention relates to a mechanical contrivance whereby a cross-cut saw may be operated by hand mechanism to so much advantage that one man may be made to do the work of six, the whole device weighing but about one hundred pounds, and being conveniently portable to the timber.

Improved Carriage Door.

F. Herman Jury, New York city.—This is a door pull handle and a holder for the sash-holding strap, combined in one device, and so arranged that both purposes are subserved by the one device better than by the separate devices as commonly arranged. The invention also consists of a novel contrivance of the device for connecting the strap holder, which holds the sash-holding straps up out of the way of the door when it closes to said strap.

Improved Feeder for Grinding Mill.

John Phillips and John E. Bradford, Scranton, Pa.—This invention consists of a hopper of two or more compartments, and a feed shoe, with a special compartment and regulating gate for each compartment of the hopper, all so arranged that two or more different kinds of grain, meal, or other material may be fed separately from different compartments into the stones at the same time. The object is to mix different kinds of grain substances more regularly and with less labor than they can be in the ordinary way of first mixing them and then feeding them together.

Improved Mowing Machine.

Frank H. Bryan, Troy, N. Y.—This machine may be reversed at each end of the field for cutting forward and backward along one side, for side hills and other places where it is not convenient to go around the field. It is also designed to effect the changes merely by turning the horses and the truck around without requiring the manipulation of any part by hand, except the raising of a catch pin.

Improved Level.

Dr. John Thornley, Charlottesville, Va.—This invention relates to an improvement in the class of levels provided with a hinged base bar for indicating different grades by the adjustment or angle to the body of the level proper. The improvement consists in arranging the block or prop piece to slide between the hinged bar and an inclined plane formed on the base of the level, so that the bar will be adjusted at an angle to the base corresponding to the distance it moves over the inclined plane. Means are provided for clamping the sliding block at any desired point, and the base is graduated to indicate the grade. The block is also connected with the base and hinged bar by a screw and dovetailed groove.

Improved Grave Mound.

Joseph R. Abrams, Greenville, Ala.—This invention relates to means whereby the dome of a grave mound is adapted to graves of different lengths and sizes by fitting thereto successively increasing elliptical pieces.

Improved Cheese Mill.

Abraham C. Brinser, Middletown, Pa.—This invention consists in a cheese mill in which are combined a vessel having a partially perforated bottom and rotary grinder, whereby cheese or smearcase may be ground and delivered free of lumps and in a uniformly granulated condition

Device for Registering the Slipping of Locomotive Wheels.

James W. Boyle, of New Texas, Pa.—This invention consists of a couple of wheels or disks independent of each other, driven synchronously, one by the truck axle and the other by the driving wheel axle. They are arranged with a cam and ratchet mechanism, so contrived that, in case the driving wheel slips, and thus turns one of said pulleys faster than the other, the pawl mechanism will be caused to move the recording apparatures one degree for each turn of one wheel more than the other, and thu record the slip.

Improved Wheel or Vehicles.

Michael Mickelson, Ashland, Oregon.—By this device, a tire may be tightened without removing it from the wheel. The invention consists in the pieces or caps in combination with the tongue and socket blocks formed upon the ends of a cut tire, and with the wedge or key that draws said ends together.

Improved Grading Scraper.

Jonathan C. Smith, South Solon, Ohio.—This invention consists of a road, ditch, or grading scraper, having the front portion, which carries the blade, jointed to the body portion, and provided with springs and pushers adapted to tilt the blade down so as to run into the ground when the scraper is drawn along the surface. Latches and levelers are combined with the said jointed front part and the handles, to turn the blade upward to run out of the ground when a load has been obtained by pressing the handle downward. Cams throw the latches into connection with the levers so that the blade may be turned up when the handles are pressed down. The handles pass down below the spring catches, to be fastened to the body by the latter to raise the rear end to dump the scraper by causing it to ro over on the front end.

Improved Boiler Flue Cleaner.

John Dykeman, Green Island, N. Y.—This invention consists in the combination of three toothed rollers, whether made solid or of toothed disks springs, and levers with each other, and a box for cleaning the outer surface of flues; and in the combination of a loose arm and a set screw with a box that supports the toothed rollers, the springs, and the levers, to adapt the machine to be attached to the tool rest of a lathe. In using the machine, the levers and roller are turned back, and the flue to be cleaned is placed upon the rollers, and its end is secured to the chuck of the lathe The roller and levers are then turned down upon the flue, the necessary pressure is applied by the weight or spring, the lathe is set in motion, and the machine is fed forward with the feed screw, cleaning the flue thoroughly.

Improved Spring Brace.

Sidney T. Bruce, Marshall, Mo.—The brace is connected to the carriage body adjustably, by means of a slotted or grooved plate. The front half of this plate is bent downward to accommodate the pin above it. Thus the bottom and top of the front spring being both fastened to a common point behind, whatever depresses the body of the vehicle similarly depresses the free end of an inflexible bar, which cannot go forward so as to enforce a perpendicular motion of the carriage body. The bars being fastened to the springs at the top and bottom in front, and to each other a the center, no force can project the springs, either front or rear.

Improved Movable Head Light.

Horatio G. Angle, Chicago, Ill.—By suitable construction, as the truck of the locomotive turns in passing around a curve, the head light is also turned, so that the stream of light may always be thrown upon the track. The light from the lamp may also be thrown more or less from a straight line to adapt it to the curvatures of the road.

Improved Kettle Scraper.

Samuel A. Potter, Emaline Potter, and John Potter, Fowler, Ill.—This is a scraper plate with a round or otherwise shaped rear handle at one side and a pocket guard for the fingers at the other side.

Improved Apparatus for Making Torpedo Envelopes.

Mahlon Chichester, Shelter Island, N. Y.—The paper bags for torpedoes have been made, one at a time, with the aid of a piece of board having holes and a hand pin. The present invention consists in an improved apparatus whereby a number of bags are simultaneously made, the paper being cut with one motion, and pressed into the holes by another motion, for any desired number.

Improved Fare Box.

Joseph J. White, New Lisbon, N. J., assignor to himself and Howard White, Tullytown, Pa.—This invention relates to apparatus for collecting passenger fares on rail cars, and consists of a cash box supported from the waist or shoulders of the conductor, to which is attached a flexible tube, having at its end a hand piece or receiving box containing an endless carrier, which is arranged on pulleys, so as to be moved, by means of a ratche and pawl operated by a spring lever, by the conductor. The conductor carries a hand piece in his hand, and, by virtue of the flexible tube and belt, he is enabled to pass it round among the passengers to receive the fares.

Improved Furnace for the Manufacture of Iron and Steel.

Edgar Peckham, Antwerp, N. Y.—This is a new method and apparatus for manufacturing steel blooms directly from the ore. It consists in the furnace patented by the same inventor, June 24, 1873, improved so that it has two series of ore chambers instead of one, so as to treat the ore at different degrees of temperature to remove sulphur and phosphorus, and so that one series may serve for a flue to heat the ore in the other series when the coal is impure.

Improved Hatchet.

Guilford Norton, South Boston, Mass.—This is a combined claw hammer and hatchet. The bit has projecting threaded studs, by which it is connected with the hammer portion, so that, when worn out, it may be removed and a new one substituted.

Improved Folding Desk.

David H. Pierson, Fort Rice, Dak. Ter.—This desk is made in sections which are hinged together and so arranged that they fold together and form a compact body, resembling in shape and proportion an ordinary field desk.

NEW BOOKS AND PUBLICATIONS.

A TREATISE ON BRACING, with its Application to Bridges and Other Structures of Wood or Iron. By Robert Henry Bow, Civil Engineer. With 156 Lithographed Illustrations. Price $1.50. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is an excellent and very explanatory book on the whole question of arranging the parts of any construction so that they shall be as little as possible affected by variation in the strains to which the erection is subjected. As a matter of course, the building of bridges is very extensively treated, and the examples explained and illustrated show that the author is a writer of considerable knowledge and very varied experience.

THE INTERNATIONAL OR METRIC SYSTEM OF WEIGHTS AND MEASURES. By J. Pickering Putnam. Price 50 cents. New York: Hurd & Houghton, 13 Astor Place.

A very able *resume* of the recent progress of the metric system in popular favor. Although many of the arguments used by the advocates of the method are well known, and are generally deemed irrefragable, they will bear repeating till the world has adopted this most simple and rational arrangement of weights, measures, and coinage, which, it must be now everywhere admitted, is only a question of time.

THE KEYSTONE BRIDGE COMPANY'S ILLUSTRATED ALBUM, embracing Iron Bridges, Roofs, Columns, Chord Links, and Shapes, with a Description of Long Span Bridges Quality of Materials, and Principles of Construction Pittsburgh, Philadelphia, and St. Louis: Keystone Bridge Company.

An elegantly printed and illustrated volume, which contains not only a full and interesting description of the large means and business operations of the extensive firm who issues it, but also much explanatory and statistica information, formulas, etc., of great value to the engineering profession to whose notice we cordially commend it.

[OFFICIAL.]

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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:

29,760.—Hammer.—R. Boekler, August 5.
29,785.—Sewing Machine.—D. Haskell. August 12.
29,789.—Cultivator.—E. S. Huff. August 12.
30,415.—Gas Regulator.—J. G. Leffingwell. Sept. 30.

EXTENSIONS GRANTED.

28,469.—Horseshoe.—R. A. Goodenough.
28,479.—Making Tube Joints.—S. J. Hayes.
28,482.—Cooking Stove.—J. C. Henderson.
28,482.—Coal Stove.—J. C. Henderson.
28,483.—Seeding Machine.—S. T. Holly.
28,488.—Rattan Machine.—J. Hull.
28,495.—Skate.—J. Lovatt.
28,512.—Car Wheel.—S. P. Smith.
28,517.—Stock Car.—L. Swearingen.
28,537.—Paper Bag Machine.—S. E. Pettee.

DISCLAIMERS.

28,482.—Cooking Stove.—J. C. Henderson.
28,495.—Skate.—J. Lovatt.
28,537.—Paper Bag Machine.—S. E. Pettee.

DESIGNS PATENTED.

7,452.—Faucet Handle.—J. G. L. Boettcher, Br'klyn, N. Y.
7,453.—Finger Rings.—F. Bohnenberger, N. Y. city.
7,454.—Drawer Pull.—J. Girard, New Britain, Conn.
7,455.—Fur Cloaks.—C. Hülster, New York c
7,456.—Stove.—J. S. Perry *et al.*, Albany, N.
7,457.—Statuary.—J. Rogers, New York city.
7,458.—Salt Box.—F. Schneider *et al.*, Chicago, Ill.
7,459.—Buckle.—S. G. Sturges, Newark, N. J.
7,460.—Moldings.—J. Nonnenbacher, New York
7,461.—Cook Stove.—J. R. Painter, Reading, Pa
7,462.—Ruches.—A. A. Rockwell, New York city

TRADE MARKS REGISTERED.

1,800.—Wringer.—Empire Wringer Co., Auburn, N. Y.
1,801.—Moss.—Ferguson & Haber, New Orleans, La.
1,802.—Watches.—Lingg & Bro., Philadelphia, Pa.
1,803.—Matches.—F. Mansfield & Co., St. Louis, Mo.
1,804.—Shirts.—Neustadter & Co., New York city.
1,805.—Grinding Mills.—Straub Mill Co., Cincinnati, O.
1,806.—Oil from Petroleum.—Standard Oil Co., Cleveland, O.
1,807 to 1,810.—Shirtings.—Wamsutta Mills, N. Bedford, Ms.

COMMUNICATIONS RECEIVED.

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

On Army Ants. By J. S. D.
On the Boiler Explosion at Philadelphia. By C. and G.
On Doubling the Value of the Currency By J. H.
On Botanical Scraps. By S. C. Y.
On the Insurance Question. By F. A. M.
On an Ear Trumpet. By J. E.
On Engineering Tables. By W. Z.
On Sun Stroke. By E. S. G.
On White Ants. By T. H.
On the Westinghouse Brake. By F. G. W.
On Bullets Impacted in the Air. By H. A.

Also enquiries and answers from the following:

I. X. L.—L. M. B.—J. H. J.—W. M. R.

Correspondents in different parts of the country ask Who makes a hoisting apparatus to be run by water supplied by city waterworks? Who makes portable canvas boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the Scientific American.

INDEX.

ILLUSTRATIONS.

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

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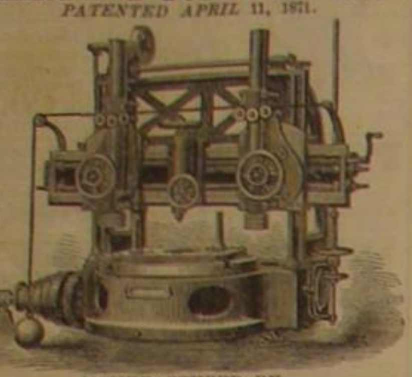

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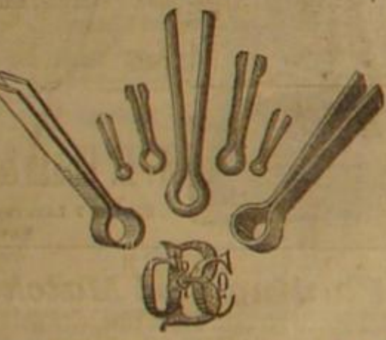

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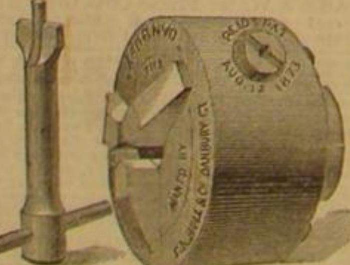

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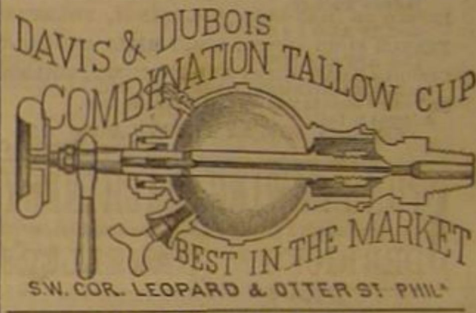

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