SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVII. No. 23. [NEW SERIES.] NEW YORK, DECEMBER 8, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

IMPROVED FAUCET.

We illustrate herewith a new and simple form of faucet, the advantages claimed for which are that it is not liable to be injured by being screwed into or out of the cask, that it is not liable to leak, cannot be left open through carelessness or accident, and has its button protected from injury.

The portion of the device which enters the cask is tapered and screw threaded. Near its outer end is an octagonal portion adapted to receive a wrench. Beyond this part, as shown in section in Fig. 2, is a screw-threaded projection which engages with the outer portion of the device. A is the valve seated on a shoulder, as shown. The stem passes up through the casing and terminates in a button which is surrounded by the cup-shaped top. In a chamber in the casing is a a spiral spring, B, which acts against a collar applied to the valve stem. It will be evident that, by pushing in upon the button, the valve, A, will be moved from its seat, the liquid will pass it and flow out at the nozzle. On the valve stem is a shoulder, C, which, when the valve is moved from its seat, closes the orifice through which the stem passes and prevents any ilquid entering the spring chamber. Should, however, any liquid enter this portion of the device it at once escapes, by the channel shown, into the nozzle. Patented through the Scientific American Patent Agency, September 18, 1877. For further particulars address the inventor, Mr. William S. Lempert, Fort Davis, Presidio county, Texas.

Fig. 1

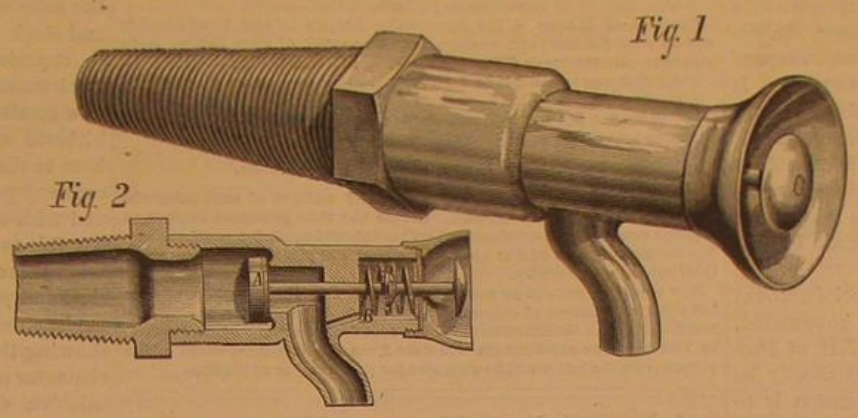
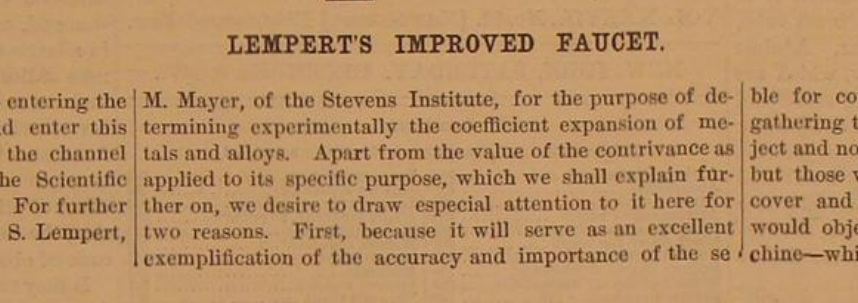


Fig. 2



LEMPERT'S IMPROVED FAUCET.

PROFESSOR MAYER'S' NEW METHOD OF FINDING THE COEFFICIENT OF EXPANSION OF METALS AND ALLOYS.

In the accompanying engraving we illustrate a new and exceedingly ingenious apparatus devised by Professor A. M. Mayer, of the Stevens Institute, for the purpose of determining experimentally the coefficient expansion of metals and alloys. Apart from the value of the contrivance as applied to its specific purpose, which we shall explain further on, we desire to draw especial attention to it here for two reasons. First, because it will serve as an excellent exemplification of the accuracy and importance of the series of articles "On the Minute Measurements of Modern Science," written by Professor Mayer, and which now are in course of publication in the SCIENTIFIC AMERICAN SUPPLEMENT. No such series has ever been published, nor has any physicist yet attempted to gather and present, in the very complete form which Professor Mayer has adopted, the refinements which now exist in the art of measuring. We need not point out of what value to every mechanic a thorough knowledge of this branch of science is. Perhaps the chief peculiarity of modern mechanism is its accuracy and perfection of fitting, and to these qualities the machine tools of to-day owe in large measure their remarkable capabilities.

Our second reason for asking especial notice for Professor Mayer's apparatus is that it is a capital instance exemplifying how a thoroughly scientific investigator goes to work. There is so much dore now-a-days that is called scientific investigation which far from merits the title, that we are almost ready to credit the idea that some recognized standard, showing how a typical investigation ought to be conducted, would be valuable for comparative purposes. Such work involves the gathering together of every thread connected with the subject and not merely those that are plain and easy to follow, but those which the skill of the investigator is taxed to discover and take account of. Doubtless Professor Mayer would object quite strongly to our taking the present machine—which is only one bit of apparatus out of a long and

Fig. 1

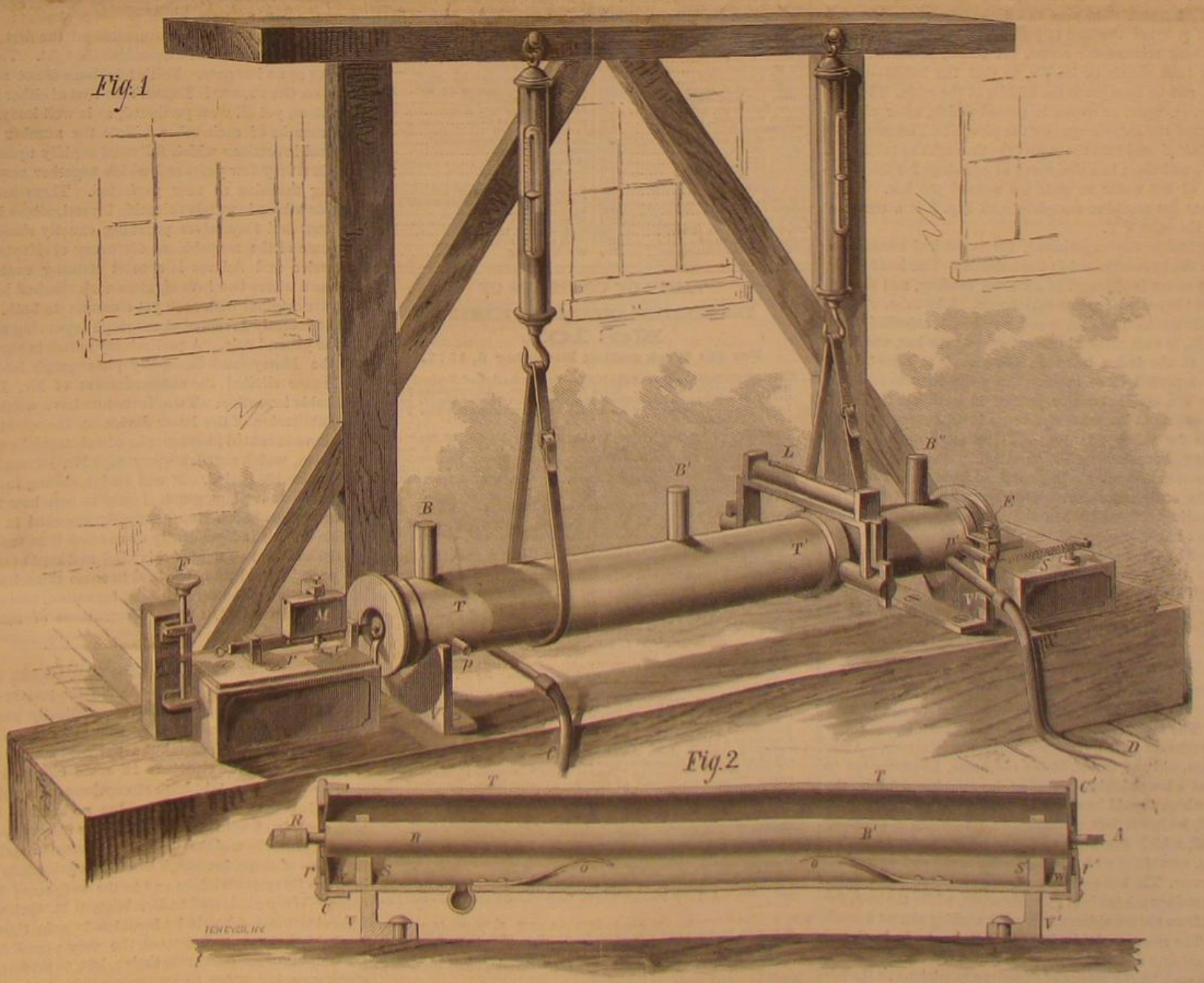


Fig. 2

PROFESSOR MAYER'S NEW INSTRUMENT FOR SHOWING THE ELONGATIONS OF METALS.

splendid series—as representative of his general mode of working; and, in fact, he himself states that there are objections to it in its present form, to eliminate which he points out the way: but, nevertheless, the apparatus may stand as a model of ingenious contrivance, showing how fertile is the mind of the investigator in devising means, and how thorough and refined these last, when placed in tangible form.

The object of the apparatus, as already noted, is to obtain the co-efficient of expansion of metals and alloys. By co-efficient is meant a factor, which serves as a multiplier; and the co-efficient of expansion of any metal is that fraction of its length which the metal elongates or shortens by the addition or subtraction of one degree of temperature. This fraction of the length of a given metal bar is expressed decimally, and hence to ascertain the absolute amount of the expansion of any given length of the metal, we multiply the given length by the co-efficient.

In order to measure the minute differences in length of the bars, Professor Mayer desired to use Saxton's comparator, on account of various advantages which that device offered. A complete description of that instrument, as well as a very interesting biographical sketch of its inventor, Mr. Joseph Saxton, will be found in No. XI of Professor Mayers' series of articles above referred to, in the SUPPLEMENT. It will suffice here to say that it consists essentially of a mirror, which reflects a beam of light over double the angle through which the mirror is revolved, and this beam acts as an index by being caused to sweep over a graduated scale, having for its center the center of the axis of the mirror. It will be obvious how measurements may be made by this arrangement.

We can do no more here than present a very brief account of how Professor Mayer solved the problem we have stated, as our readers will find all the details in No. XII of Professor Mayer's SUPPLEMENT series, which will shortly be published. The bar, whose co-efficient of expansion is to be determined, is supported on standards in a brass tube, which is made about ⅛ inch shorter than the bar. Against the ends of the bar are placed rubber washers, which are perforated so as to allow the ends of an abutting screw and a rod connecting with the moving mirror of the comparator to come in contact with the ends of the bar. Arrangements are provided which hold the washers perfectly water and steam tight against the ends, while the bar is perfectly free to expand or contract in the tube. Inside the tube are supporting springs, which relieve the standards in some degree from the weight of the bar.

In our engraving Fig. 1, T T' is the tube, supported on V's, V V'. Its weight is relieved by the spring balances shown. At *p* and *p'* are pins, to which springs (one of which is shown at S) are attached to pull the end of the bar against the abutting micrometer screw. A screw, E, serves to rotate the tube slowly in its V's, so that the bubble of the level, L, can be brought to the middle of the scale. Through the tube, D, water or steam is passed which, after circulating around the bar, escapes by the pipe, C. Thermometers may be introduced into the main tube through the tubulures, B B' B''; and these last also serve as openings for the introduction of hot water to melt ice around the bar. Fig. 1 represents the machine complete, and Fig. 2 is a sectional view of the tube T T.

In beginning the experiment, ice is packed around the bar, and the tube adjusted in the balances. The head of the abutting screw is adjusted to a known reading, and the end of the bar is pulled against said screw. The tube, T T', is then made level. The mirror rod, *r r'*, Fig. 1, attached to the mirror, M, is next allowed to abut against the bar, when the reading of the index beam on the scale is at once noted. This is repeated three times. The tube is now removed from its V's, and hot water poured in until all the ice is melted. Steam at known temperature is then passed through the tube for thirty minutes, and the same operation for measuring above described is repeated.

Subtracting the scale reading obtained from the bar when it was in the comparator surrounded by melting ice, from the scale reading obtained when the bar was enveloped with steam, we have for remainder the amount of scale deflection produced by the bar in expanding from the length it has at 0° C. to that which it assumes at the temperature of the steam. This scale length, converted into linear motion of the mirror rod, gives the actual expansion of the bar in fractions of an inch or of a millimeter.

A Porcelain Fiddle.

Venice is considerably excited at present over a very unusual sort of a fiddle, the only one of its kind, probably, ever made. The manufacturer of this porcelain fiddle was formerly a workman in a Saxon porcelain manufactory. After his return, old and feeble, to his old home, he attempted to carry out a long cherished project for making a fiddle, the box of which should be of china. With the aid of a boy, it is stated, he has in fact succeeded in producing a fiddle of this kind, which has a tone of rare purity and astonishing richness, combined with charming harmony and extraordinary power. The box part, or resonator, is exceedingly light, and the strings are made of metallic wires, while the bow, departing from the usual form, is curved, making almost a semicircle. The success of this clever Venetian, who had enjoyed the advantages of the skill acquired in a German porcelain factory, may be the means of directing musicians to the advantages of the clear, ringing, but fragile china and glass, for various similar uses in acoustics.

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NEW YORK, SATURDAY, DECEMBER 8, 1877.

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IS THERE A LAW OF INVENTION?

Whether we are to conclude with Buckle that there are laws governing human action which exist unknown and which only future and wiser generations will discover; or whether we adopt the theory of epidemic thought and assume that there is a bond of unconscious ideation forming some subtle link between minds pursuing like objects, the fact remains that no one can study the progress of invention without becoming impressed with a definite notion that there is some extraneous cause which impels inventors to reach similar conclusions and make like discoveries at about the same time. Of course this cause must be dependent upon antecedents, and these last are the steps which go to make up scientific progress, with which all may by study render themselves familiar, and thus may as it were place themselves under like influences. The question for speculation however is whether there even can be proved to exist a law which taking into account certain circumstances will enable us to recognize conditions when the production of a certain new and original conception is predicable.

Analogies in this regard are by no means wanting. In the case of artificial selection, horticulturists, agriculturists and stock breeders the world over are constantly engaged in experimenting under every imaginable combination of circumstances and conditions with the object of reaching new results which it is hoped may be superior to any hitherto obtained. The constant study of mankind has been to discover those circumstances under which the human race enjoys the highest point of mental and physical culture; and with such success has this been attended that it is quite possible to conceive of an ideal man, the product of present attainable conditions, who in all his attributes, certainly physical and probably mental, would be a far superior being to modern men. There are many instances which can be cited showing that occurrences seemingly of the most fortuitous character are subject to definite fixed laws. The number of suicides, of murders, of marriages, of letters posted unstamped, and so on through almost every imaginable event in a large community, is nearly invariable; the great business of life insurance rests upon the law of probabilities, and finds its stability in the hypothesis that out of a given number of policy holders the ratio of deaths may be definitely forecast. The entire onward march of scientific investigation is toward the formulation of these laws. The highest effort of original investigation is the grand general deduction, the establishment of a theory on the basis of a multitude of observed facts.

It may not therefore be unreasonable to suppose that, some day, laws governing invention will be revealed. No great or striking invention, not even one moderately out of the common run, appears, but that others similar to it at once come to light, not as improvements on the first announced but as the outcome of independent thought. Take the telephones as an instance. Bell's telephone is not an improvement on Gray's, nor is Edison's on that of either of the other inventors, yet all were produced, as is well known, within a few months of each other. Note the number of entirely original inventions which followed rapidly upon each other within a very few years and which together resulted in the sewing machine as now perfected. There are abundant records where in purely scientific investigations independent students find themselves pursuing exactly similar objects. The case of the magnificent discovery of Neptune by both Leverrier and Adams is a most striking example of an instance where two investigators each reached his aim in a manner original with each yet common to both.

The recently invented phonograph is proving no exception to the general rule. A preliminary notice in these columns of the Marey and Rosapelly phonograph lately devised in France elicited the announcement of Mr. Edison's remarkable invention. Two inventors have written us since the publication of the latter device to the effect that they also have invented phonographs of substantially similar construction, which antedate (they say) Mr. Edison's device by a considerable period. It will be interesting to watch the progress of the phonograph if only to note how many other inventors have been simultaneously engaged in its investigation or have independently discovered it in various forms. Statistics based on data of this kind and kept over a reasonable period would probably lead to some remarkable conclusions relative to the conditions of invention, and possibly, as we have intimated, to the discernment of some general laws.

UNITED STATES COINAGE AND THE GREAT PYRAMID.

Some one who fails to see wherein the benefit of importing obelisks from Egypt exists sarcastically proposed not long ago that Yankee ingenuity should astonish the world by floating, not an obelisk but a pyramid across the Atlantic, and erecting the structure in some city park. The satirical proponent might have strengthened his scheme if he had added that while this nation has no bond of connection with obelisks, it actually has something in common with the Great Pyramid—and that we have a direct national interest in that mass of stone, inasmuch as a most curious analogy exists between its measurements and in the weights of our several coins. We are indebted to Dr. Watson F. Quimby for the following letter, wherein he ingeniously points out this remarkable linkage, and suggests the very plausible idea that the weights of our coins owe their origin to no fortuitous circumstance, but rather to customs established at a period dating back beyond history. Dr. Watson says:

"In the admirable work of Professor Piazzi Smith, entitled

"Our Inheritance in the Great Pyramid," it is shown that the Great Pyramid of Egypt contains in its interior standards of inch measure, while the exterior gives the same standards in the sacred cubit of 25 inches. One of the most important units of measure is the length of the so-called king's chamber, which is 412·5 English inches, and its breadth 206·2 inches. Now our silver coinage corresponds to these numbers, as the "dollar of the fathers" weighs 412·5 grs., the half dollar 206·2 grs., and the quarter dollar 103·1 grs., which last is a very important pyramid number. On inquiring at the mint why the silver dollar was made of this weight, I was informed that it was the weight of a coin that would readily pass current in the Eastern Asiatic trade. It is therefore a traditional coin, by whatever name it may have been known, for thousands of years.

"But not only does the silver coinage correspond to the inch standard of the pyramid, but our gold coinage corresponds to the cubit measure. The height of the pyramid in sacred cubits is 232·5, and our gold eagle, the unit of gold coinage, weighs 232·2 grs., and the half eagle 116·1 grs.

"The relation of these numbers is such that 'the area of a square having 103.03 on the side, is equal to the area of a circle having 116·26 for its diameter.' (Phillips.) Now as there are 360 degrees in the circumference of a circle, its diameter in terms of seconds is 412529, and its circumference is 1296000. Then the number 412·5 is the thousandth part of the diameter of a circle in terms of seconds, and 1296, the number of square inches in an English square yard, is the thousandth part of the circumference of a circle in terms of seconds. This at once connects English with pyramid measure, and may indicate the origin of both.

"From the standard square yard all the rest of our measures may be deduced. The old English gallon contains 231 cubic inches, which is a number intermediate between the height of the pyramid in cubits, 232·5, and the height of the king's chamber in inches, 230·89. The diameter of a circle is to the side of a square of equal area, as 9 to 8 very nearly.

9 : 8 :: 116·023 : 103·132.

"It thus appears that in the weights of the quarter dollar and the half eagle, we have had the squaring of the circle problem typified without knowing it."

NOTES OF PATENT OFFICE DECISIONS.

The Commissioner of Patents, in deciding the interference case of Martin *vs.* Bogle *et al.*, awards priority of invention to Martin, who first perfected the operative device in interference, although Bogle was the first to apply it in series, in the manner designed for use. The reason for this is that, while the arrangement in series may be more satisfactory and permit nicer adjustment of subordinate mechanism, yet it proves operativeness no more than the test of the single device itself.

The Commissioner also holds that the fact that in one instance a claim is for a single device, and in another for a series of them, does not constitute difference of invention. The state of the art, and the Office latitude in allowing claims, may level the distinction. He also holds that the preliminary statement must be rigidly adhered to, where there is a substantial departure therefrom in the interference contestant's testimony.

The Acting Commissioner, in the interlocutory appeal in the matter of the application of Siemens for a re-issue of letters patent, decides that the applicant may include, on re-issue, matter which was neither described nor claimed, but which was actually contained in the original invention; and that the failure to describe such matter in the original patent is no bar to doing so in the re-issue application within the limits of the invention.

SHOOTING STARS.

The phenomena of shooting stars and of star showers have, undoubtedly, existed since the formation of the solar system. On any clear evening, a watchful person may see, on an average, two shooting stars every five minutes, and on certain nights of certain years, and on certain hours of the night, they appear in such vast numbers as to receive the name and deserve the title of star showers. Other meteors do not fall in showers emanating from certain constellations, but move in all directions, and from every part of the sky. Such meteors, though, as far as known, differing in no particular from those which come in showers, are called "sporadic." In their normal condition, that is, before visibility, these vagrant bodies are called meteoroids, and only while self-luminous from excessive heat by friction and arrested motion in our atmosphere, are they called shooting stars or meteors. It is important that this distinction be borne in mind, for, if true, then can no meteoroids ever be seen from the earth. In their natural condition they are circum-solar bodies, obeying the laws of motion and gravitation as rigidly as do the planets, and must be treated as such, though more numerous than the leaves of summer. The velocity with which they plunge into our atmosphere is very great, probably about 48 miles per second. The length, in arc, of their visible path varies widely. Occasionally one flashes up, and, increasing in size and brilliancy, disappears, without seemingly having moved a particle. The motion of such a meteor was exactly towards the observer's eye, and consequently it ought not to have any apparent motion. Another observer 20 or 30 miles distant may have seen the same with a path several degrees in length. Their paths may be considered to vary from zero to 90°, or even more. The length of their real paths, that is, in miles, also varies greatly, but the average is about 42 miles. By the time this distance is accomplished, unless the meteoroid is a large one, it is heated, melted, evaporated, and extinguished, all within the period of not over one second of time. The height at which they are heated to visibility is sometimes as great as 200 miles, but the average is about 75 miles, and at extinction, about 50 miles.

The above assumed rate of motion at which they enter our atmosphere is the result of the sum of the orbital motions of both the earth and meteoroid, but, owing to the earth's attraction, this motion is really very much greater than 48 miles per second, especially for those which move retrograde.

We are now prepared to understand why they are burned up, and so quickly vaporized. The heat thus generated, though all produced where the atmosphere is inconceivably rare, is estimated to be equal to three million degrees Fahrenheit. No known substance, unless of considerable size and density, like the meteoric stones which occasionally reach the earth, can long withstand such a degree of heat, unchanged in form and structure. Before the above facts were known the height of the earth's atmosphere was usually considered to be about 45 miles, but that it is, at least, five times, and probably ten times that distance, is clearly proved by the researches in meteoric astronomy.

When it is considered that, accordihg to Professor Newton, four hundred million shooting stars are daily burned up in our atmosphere (including those that are telescopic), it would seem that the earth must constantly be increasing in weight and size from this cause, and such, no doubt, is the case in fact as well as in theory. Unfortunately the data for arriving at any very exact value as regards their size and weight rests on insufficient evidence. Professor Harkness, of the Naval Observatory, who has made a thorough discussion of all accessible evidence bearing on the subject, has arrived at the astonishing conclusion that their average weight does not exceed one grain. If we assume that those which are wholly telescopic are not larger than sand grains, and probably they are not, those that are visible to the naked eye as conspicuous objects, and especially those that are seen over a radius of 150 miles and fill several cubic miles with smoke must contain several ounces, and perhaps pounds, of meteoric matter, whatever that may be. Suppose we base our calculation on the estimate of ten grains for each meteoroid, this would equal 4,000,000,000 grains, or 290 tons a day, or 106,000 tons a year, sufficient, if distributed equally over the earth's surface, to form, in 4,000,000 years, a stratum equaling in thickness the paper upon which this journal is printed. The moon, as she revolves round both the earth and sun, must also meet with these all-pervading meteoroids, but, having no atmosphere to arrest their motion, they cannot be heated. They must strike on its surface and be instantly converted into the finest powder. This meteoric dust, from excessive attenuation, must be of a light color, perhaps a pure white, which may go far to explain the cause of her reflection of so much light, the which, when her size and distance are considered, seems out of all proportion.

While the writer was observing the memorable star shower of November, 1867, he witnessed a phenomenon which will linger long in his memory. A brilliant meteor from *Leo* passed in a westerly direction, leaving a luminous train of some forty degrees in length. Its head seemed to increase in size and brilliancy as it progressed, when, as suddenly as though it had struck a target, it vanished from sight. Soon a cloud formed, assuming a variety of fantastic shapes, several being perfect delineations of letters of the alphabet. Twice in its peregrinations was the letter N thus formed, these changes occupying some fifteen minutes. Finally, gathering to itself its scattered particles, it became a round symmetrical disk, probably a sphere, which centrally occulted the nebulous cluster in called *Cancer* the Beehive. For almost two minutes it was, from this cause, lost to view. After the occultation it continued visible for ten minutes longer. During its visibility, which was twenty-five minutes, it drifted about fifteen degrees to the north, confirming by observation the truth of the theory that the heated air of the tropics flows to the north through the upper regions of the atmosphere.

ADAM SCOTT CAMERON.

It is with regret that we announce the death of Mr. Adam Scott Cameron, of New York, who undoubtedly was personally known to a great many of our readers. He passed away on the 14th ult., of an attack of acute pneumonia; his illness was sudden and painful, but of short duration.

As a manufacturing engineer and constructor of steam pumps he had a wide and excellent reputation; and as a business man of sound principles, his loss will be felt in the many circles where he was prominent.

Mr. Cameron was a native of Scotland, but came to this country when eight years of age. During his youth he evinced a strong desire for acquiring knowledge and an aptitude for self-culture. He attended public day and evening schools, and soon became sufficiently proficient to keep books for a New York firm. He was observing, thoughtful, and industrious, entered into business with indomitable pluck, energy, and perseverance, and studied with assiduity the questions of capital, labor, and finance. The greater part of his life was spent in the construction of the well known Sewell and Cameron steam pumps. Before he was twenty-one years of age he was taken into partnership with his brother, and to the time of his last illness applied himself to business with great success. He was a friend and counsellor to the workmen in the employ of his firm (Cameron & Co.), and a member of some excellent associations for the advancement of mechanical science. At the commencement of a small pamphlet issued to his employees in 1869, proposing the system of co-operation as a practical business movement, the following sentence occurred: "To assist a person in improving his condition by his own efforts is to make a man of him." Other pamphlets on such subjects as "The Necessity of a Bureau of Mechanics," "The Eight Hour Question," "An Address to the Intelligent Workmen of the United States," were written by him, and widely circulated.

During the spring of 1873 Mr. Cameron was elected president of the Bull's Head Bank of the city of New York; and although the youngest president of any bank, at least in New York city, he displayed wonderful tact and sound judgment in arranging the complicated affairs of the institution; he had suits set aside, obtained subscriptions for new capital, re-opened the bank, and put it in a prosperous condition. This transaction was commented upon by the London *Times* as a notable one, from its having been the first of the kind, and the setting of an example which has since been followed in several instances. The last and recent public utterance by Mr. Cameron closes with these significant words: "Until we return to the old-fashioned habits of honesty, industry, and frugality, our sins will rest upon us. If our *virtues* will not, our *necessities* must bring us back to prosperity. Then we shall be envied among the nations of the earth." At the age of thirty-three Mr. Cameron closed a busy and useful life, in which integrity, generosity, and benevolence were always conspicuous.

THE DISTANCES OF THE PLANETS FROM THE SUN.

Sir George Airy, the British Astronomer Royal, has recently published a report on the telescopic observations of the transit of Venus of 1874, made by the English expeditions. Pending the appearance of the deductions to be made from the complete measuring of the photographs, the results reached must be regarded as provisional only. The mean solar parallax determined is 8·764", and this is one tenth of a second less than has been given by the most reliable previous investigations upon different principles. From Professor Newcomb's calculations, now adopted in most of our ephemerides and based on observations of Mars, the lunar equation of the earth, the parallactic inequality of the moon, the transit of Venus of 1769, besides Foucault's experiments on light, it appears that the mean distance of the earth from the sun is 92,393,000 miles. According to Sir George Airy's determination this distance must now be considered as increased to 93,321,000 miles.

For purposes of comparison and also to correct some errors which were present in our recent article on "how our world looks from other worlds," which we translated from the French of M. Flammarion, the well known astronomer, we append the following statement of correct distances of the planets from the sun. Mercury, average mean distance, 35,392,000 miles; Venus, 66,134,000 miles; Earth, 93,321,000 miles; Mars, 139,311,000 miles; Jupiter, 475,692,000 miles; Saturn, 872,137,000 miles; Uranus, 1,753,869,000 miles; and Neptune, 2,745,998,000. As regards the fixed stars, the distance of α Centauri, probably the nearest, is about twenty billions of miles, and light occupies about 3½ years in traveling from that star to the earth.

The New Steamship "City of Washington."

If comparison is made between capacity and strength, this steamship, just placed on the New York, Havana, and Mexican Mail Steamship Line, appears to be undoubtedly the strongest mercantile iron vessel ever built in this country. She was constructed by Messrs. John Roach & Son, at Chester, Pa., and is of superior model and plan. The plates of the hull are ½ inch and upwards in thickness. There are three decks, the two upper ones being mostly of iron. The length of this vessel is 323 feet; beam, 38 feet; depth, 37 feet 6 inches; draught when loaded, from 21 to 22 feet; tonnage, 2,618 tons. She can carry 10,000 boxes of sugar, besides light freight, and her outward passage capacity in bulk is 2,500 barrels. The saloons and staterooms are attractive for their comfortable appearance and elegant fittings. The engines are of the compound type, and have a high pressure cylinder 40 inches in diameter; low pressure cylinder 74 inches in diameter, with a stroke of 6 feet. The pressure of steam carried is 80 lbs. The condenser has 4,000 square feet of condensing surface. Diameter of propeller is 16 feet, with a mean pitch of 26 feet. The engines are constructed with steam valves on the Corliss principle, and are reversed quickly with little manual exertion. Steam is supplied by two vertical boilers having square bases. There are eight furnaces in each boiler, and altogether about 3,000 tubes, 2 inches outside diameter and 7 feet long. There 370 square feet of grate surface and 1,400 square feet of heating surface. The engines are rated at over 2,000 horse power, and with 63 revolutions per minute, an average speed of 14 knots per hour is attained.

F. Alexandre & Sons, the owners, state that the City of Washington will make the voyage between New York and Havana in less than four days.

COFFINS from Norway, says the *British Trade Journal*, represent the latest phase of foreign competition, a cargo of several hundred having been landed, ex steamer Cambria, during the past month. In this lugubrious branch of home industry America is also competing, and in a warehouse almost within a stone's throw of our office may be inspected a stock of 2,000 American coffins and caskets.

THE ABANDONMENT OF THE CLEOPATRA AT SEA.

We have already noted the particulars of the somewhat eventful voyage of the famous obelisk Cleopatra's needle, from Egypt to its destination in England, which last it does not seem likely to reach for some time to come. In the annexed illustration is represented the scene of the abandonment of the obelisk vessel at sea in the Bay of Biscay during a severe storm. A heavy sea struck the craft, broke some of her rail ballast adrift, and left her with a strong list to starboard. Fearing that another sea would swamp the vessel altogether, her captain signaled for assistance and a boat's crew was sent to her, but the boat and all on board were lost. Further efforts were then made to take the Cleopatra's crew from their perilous position, which in the end proved successful, and the towing steamer Olga left the obelisk to its fate.

Within two days' time the Fitzmaurice, a vessel bound from Middlesborough for Valencia, sighted the wanderer in lat. 44° 53' N., long. 7° 52' W., took her in tow and carried her to Ferrol, Spain, where the obelisk now is and will remain until the legal questions relative to the matter of salvage are settled.

CIGARS are now being made at the Cape of Good Hope, but only for local consumption.

Glue for Polished Steel.

The Turks glue diamonds and other jewels to their metal settings with a mixture made as follows: Dissolve five or six bits of gum mastic, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In another vessel dissolve in brandy as much isinglass, previously softened in water, as will make a two ounce phial of strong glue, adding two small bits of gum ammoniac, which must be rubbed until dissolved. Then mix the whole with heat. Keep in a phial closely stopped. When it is to be used set the phial in boiling water. This cement perfectly resists moisture, and it is said to be able to unite effectively two surfaces of polished steel.

Prevention of Fire Damp Explosions.

The London *Lancet* offers the following suggestion for the prevention of fire damp explosions in mines: "Let tubes of small calibre be so laid throughout the mine that the atmosphere of every part may be brought under observation in a laboratory at the pit's mouth. A small exhausting pump would draw a current of air through the tubes rising from the several parts of the mine. These continuous currents should, in their course, feed each a distinct chamber containing a flame, the behavior of which would instantly indicate the condition of the air coming from the particular part of the mine with which it was connected. The flame, as is well known, would change color, elongate, and finally become diffused in proportions as the air is charged with gas. The different lamps could be exposed side by side in a frame, so that a difference of color or form would be instantly detected. By means of electrical alarm bells, or by the telephone, the miners could be at once warned of the presence of danger. Even in the event of a sudden escape of gas there is generally time to escape if notice is at once given. One man watching the flames at the top of the mine would be sufficient to prevent all possibility of accident. This apparatus might at first seem too costly, but the value of life and ruin caused by explosion far outweighs any such considerations."

BLUING IRON AND STEEL BY BOILING.—If iron or steel articles be boiled in the following mixture they will take a fine blue tint: Dissolve 4 ozs. hyposulphite of soda in 1½ pints of water, and then add a solution of 1 oz. acetate of lead in 1 oz. of water.

SOME interesting researches on the specific heat-conductivity of several substances have recently been made by Herr. J. Stefan, of Vienna. Taking the heat-conducting power of copper at 1,000, that of iron is given by him as 0·17, ice 0·0057, water 0·0015, hydrogen 0·00037, hard india rubber 0·00026, and air 0·000055.



THE ABANDONMENT OF THE OBELISK AT SEA.

HOW TO PAINT MAGIC LANTERNS.

The colors used for painting magic lantern pictures on glass must be either transparent or semi-transparent. The former include Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, crimson lake, and ivory black; the latter, raw sienna, burnt sienna, cappah brown and Vandyke brown, are semi-transparent. By combinations of these almost any desired tint can be produced. No particular mixing of the colors is requisite, but if oil colors are used megilp is the best thinning material. Water colors for first washes should be laid on with a hot solution of trans parent gelatin. Camels' hair pencils are preferable to sable for painting on glass, as their elasticity is less and the trouble of working out the brush marks, which must always be attended to, not so great. Dry colors may be mixed with varnish, in which case the glass must be covered with a coat of turpentine which must be allowed to dry. The simplest way of producing the picture on the glass is by using a series of stencils, as represented in our engravings. Fig. 1, for example, is the picture to be reproduced. The artist places over this a piece of oiled paper, and on this he traces the outlines of all that portion of the picture which is to be tinted with yellow or in which yellow enters in the compound tints. This portion of the design is represented in Fig. 2. Next, on another piece of paper, the red portions are traced as in Fig. 3. On a third piece are traced the green parts; and lastly, on a fifth piece of paper, are drawn the blue parts. The colors on these bases to be used would be gamboge, carmine, verdigris, and Prussian blue. Next, with a sharp penknife, the portions of the several papers included in the various outlines are carefully cut out, so that each piece of paper becomes a stencil. It only remains to apply the stencils, in the order already named, to the glass, and rub the color over them, in turn to produce the picture, the different colors being superposed, and consequently combining. When the paint is dry it is coated with colorless varnish and the edges of the glass are surrounded with strips of strong paper.

Fig. 1.



Fig. 2.

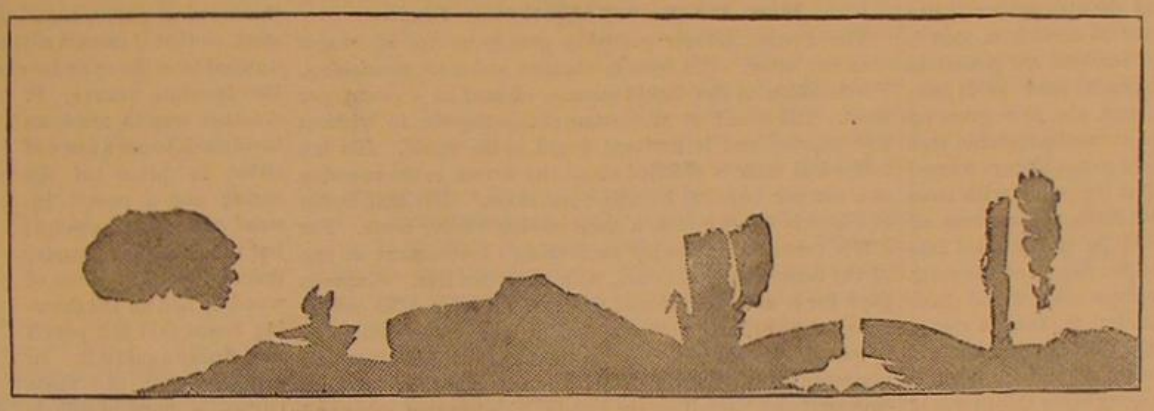


Fig. 3.



Fig. 4



Fig. 5.



METHOD OF PAINTING MAGIC LANTERN SLIDES.

Real Antiquities.

If one wishes to see the oldest parts of the world let him go to Trenton Falls, and, after visiting the excavations made by the natural action of a mountain torrent into the ancient rocks, go to the hotel and see the collection made by the landlord, at an expense of ten thousand dollars, of specimens which prove the record of a geologic age so remote that no imagination can grasp it. Professor Agassiz declared that the land reaching from Trenton Falls to Saratoga was the first that appeared above the sea on the creation. Here are the trilobites in great variety, all modeled in black marble, so perfectly preserved in form that the multitudinous lenses of their eyes are as apparent under the microscope as are those of a living fly. Millions of years before man walked the earth these creatures lived their life, the limestone took on their forms, and here they are! What are *scarabæi* and ancient *intagliі*, or any other engraved or modeled semblance of the old life, compared to the trilobites? These creatures not only lived, but had become everlasting stone millions of years before there was a living man to see them.

The old hotel keeper is enthusiastic over his treasures and proud of the distinguished visitors who have been attracted by what he has to show them. Dr. J. G. Holland reports in *Scribner's Monthly* that he said to him, with a touch of pardonable pride, "I shall have Tyndall, Huxley, and Darwin here altogether in September, for they have written me that they are coming.'

It is a really exceptional case to find a landlord of a hotel who is a connoisseur in art and a lover of science, and who understands his business at the same time and is able to conduct a hotel. Paintings, old and new, adorn the walls; here is a Durand, there a Bouteille, besides many paintings by Hicks. They are on all the walls of the first story of the large house; while the collection referred to stands in the office, and is the admiration of all scientists and lovers of nature.—*Manufacturer and Builder.*

The Origin of Petroleum.

It is needless to say that the origin of petroleum has been the subject of much speculation, but from the scantiness of the facts hitherto collected nothing definite has been arrived at. The most generally received hypothesis is that it is formed, under conditions unknown to us, from vegetable matter; that it has, in fact, the same primary origin as coal. This theory is supported by the fact that we can, by chemical means, extract from coal and other vegetable matter bodies very similar in composition and properties to real petroleum.

But, at the best, this is merely a hypothesis with very few facts to support it; and Mendeleef, the well known Russian chemist, has recently proposed a new theory of the rmation of petroleum. From he fact that in Pennsylvania the petroleum occurs in the Silurian and Devonian formations, he considers it very probable that the hydrocarburets are the result of the decomposition of organic *débris*, because organic life at the period was very scanty. His theory, in conformity with the hypothesis of Laplace on the formation of the globe, supposes the existence of large masses of iron occurring with inorganic carbon in the heart of the earth. Water penetrating from the surface comes in contact with the iron in a state of fusion, and is decomposed, the oxygen combining with the iron, while the hydrogen, under the influence of the heat and pressure, combines with the carbon and produces the hydrocarbons of petroleum.

Every opinion of Mendeleef is worthy of the most respectful consideration ; but, at the same time, we have a right to treat it as we would that of any other man. As this is not a question of fact, but one of theory, we will proceed to examine it. Regarded simply from a chemical point of view, this theory is a possible one. But the author of it starts with the assertion that organic life was not plentiful in the Silurian and Devonian periods of geology, and therefore that there was not sufficient organized material to provide for the formation of the vast quantities of petroleum which have been yielded and are still contained in the American deposits. It is true that we find but few fossil organized remains in the deposits referred to: but any one conversant with modern scientific thought on this subject will know that this fact is not regarded as any proof of the actual amount of organic life then existing. It has been put almost beyond a doubt that only a very small portion of the living beings existing at any one period are preserved in a fossil state: and that by far the larger bulk undergo the ordinary process of decay, and entirely disappear. Professor Mendeleef, therefore, unjustifiably assumes the position from which he endeavors to overthrow the older theory.

In the explanation of his own theory he makes another assumption, which we hardly think will be borne out. That is to say, "His theory supposes the existence of large masses of iron occurring with inorganic carbon in the heart of the earth, and this supposition is said to be "in conformity with the hypothesis of Laplace on the formation of the earth." Laplace's nebular theory, here referred to, amounts to this. At some period in the infinitely remote past the globe had no existence as such. The matter composing it existed in space, but at such a high temperature that it was not merely liquid but a gas. Everything of which the earth is now composed—iron, gold, granite, as well as water and air—existed only in the form of incandescent vapor.

In the course of ages this mass of gaseous matter gradually cooled, and the globe assumed first the form of a ball of melted matter surrounded by dense clouds; then it became covered with a solid crust, the clouds gradually disappeared, and the earth assumed its present form. This theory, startling at first, becomes more plausible as our knowledge increases, and if not itself the final explanation of globe formation, is at least a long stride toward accurate knowledge. From the experience men have gained in the operations of smelting and other processes requiring intense heat, we are enabled to predict with great certainty what would be the state of things during the gradual condensation of the globe from a gas to a solid. And the knowledge thus gained leads us to the conclusion that it is extremely improbable that carbon could exist in the earth in a solid state. Every one knows what would be the effect of exposing white-hot carbon to the atmosphere. It would burn rapidly and disappear. Metallurgists will understand further that if a limited amount of air were supplied to a number of combustible bodies, the carbon would burn first. Sulphur, phosphorus, white-hot iron, zinc, and many other substances, all burn, that is, they all use up the oxygen of the atmosphere. But it is well known that charcoal is used to smelt iron, that is to say, when heated iron and heated charcoal are placed in contact with a limited amount of oxygen, such as is contained in hæmatite and other good ores, the iron gives up its oxygen to the carbon, and we get as results metallic iron and carbonic acid gas. Carbonic acid gas is always formed when carbon is burnt in the air. It is the same with most other materials. The carbon would extract from them all the oxygen they contained, and would be transformed into gas. It may be said that carbon in the center of the earth would be protected from the atmosphere and would have no chance of burning. Our contention is, that it would never get into the center of the earth. Remember that the whole material of the earth is in a state of vapor. As this gradually cooled, carbon and iron among other things would separate as solid or liquid masses at more than a white heat. And it is impossible to suppose that the carbon would not immediately seize upon all the oxygen surrounding it and be instantly converted into the permanent gas, carbonic acid.

Further, Mendeleef assumes that water could penetrate soil which was sufficiently hot to keep iron in a melted state. If the water could creep down a crevice to the melted iron, it is certain that steam could escape by the same passage, and the heat generated by the neighborhood of the masses of melted iron would certainly cause every particle of water to disappear long before it would come in contact with the iron itself.

If there was not sufficient organic life in the Silurian and Devonian periods to supply the materials for the formation of petroleum; if carbon and iron could exist in a melted state in the center of the earth and could reach that position before the carbon was completely oxidised and converted into gas; if water could penetrate the intensely heated soil without being transformed into vapor and restored to the atmosphere; if water could come in contact with heated iron or carbon, it is possible that petroleum might be formed through the combination of these materials. But it is evident that this involves too many suppositions to be worthy of great confidence, and until we have obtained more facts we must content ourselves either with the older theory or with the statement that we know nothing about the origin of this important commodity.—*The Ironmonger.*

Arrow Poison.

Lovers of the weird and ghastly will be gratified by the perusal of the account of the poisoned arrow manufacture as carried on by the Samoan islanders, and related to the Fellows of the Linnæan Society by the Rev. Thomas Powell. An old chief of Efat—one of the Sandwich Islands—thus reveals the mystery of the poison craft to his son Pomare. The initiated, distinguished by wearing the *os femoris* of a pig inserted between the arm and armlet, watch for the death of a sufferer laid low by any acute disease which may be accompanied by delirium. They note the place of his burial, and six months afterwards open his grave by stealth. From thence they carry the large bones of both extremities, and the parietal bones of the skull. Of these, by sundry sawing, polishing, and scraping, they make the points of spears and arrows. For a saw they use the spines of a large echinus, of which they need a goodly quantity, as the edge is soon worn out Three plants are pressed into service for the poison—the toto, the putu, and the fanuamamala. The most virulent is the toto, a large tree. When cut, a white milk exudes, which causes blindness; its sap introduced into the circulation causes death. A band of freebooters once landed on the western end of Efat. Proceeding eastward, they came to a place called Mole, where the inhabitants prepared for them an inhospitable reception. There was an enclosure of water on the beach, which, at low tide, served both for drinking and for bathing. The people dried some toto leaves and strewed them in the water. No sooner landed, the invaders rushed into the cooling lake. Immediately they were thrown into convulsive agonies. Those who only bathed in the impregnated water became blind, whilst those who drank, died. These three plants, the toto being chief, carefully picked and desiccated, were pounded in a mortar with a wooden pestle made of the ara. Next a species of holothuria was taken from the lagoon, put into a leaf of *colocasia Indica*, and placed in the shade till it became a putrid liquid, to which the powder was added in sufficient quantity to form a thin paste. One last ingredient was *na let*, or wasp food, and the villanous concoction was worked up with the expressed juice of an old cocoa-nut, stirred for a month at intervals till the mass became a dark cloudy oil, which, when bottled and preserved for twelve months, was fit for use. Great precautions were employed in applying the poison to the tips of spears and arrows. Every trace of moisture was got rid of by careful drying in the smoke. The poison, taken internally, was always fatal. When received into the system on the spear point, recovery might be effected by making instantaneous free incisions in different parts of the body, to allow the escape of the poisoned blood. Whenever fatal the same symptoms followed—convulsions, lock-jaw, death. Tetanus was one of the invariable results. Imagine the old Samoan noting the grave for which delirium had found an occupant, exhuming the fever corpse to barb his weapons with the poisoned bones; then, with a skill and patience which no modern pharmacist could surpass, mixing, evaporating, and perfecting his vile compound.—*Chemist and Druggist.*

How the French Workman Lives.

The French laborer probably gets more for his wages than any other. His food is cheaper and more nourishing. His bouillon is the liquid essence of beef at a penny per bowl. His bread at the restaurant is thrown in without any charge, and is the best bread in the world. His hot coffee and milk is peddled about the streets in the morning at a sou per cup. It is coffee, not slops. His half bottle of claret is thrown in at a meal costing twelve cents. For a few cents he may enjoy an evening's amusement at one of the many minor theaters, with his coffee free. Sixpence pays for a nicely cushioned seat at the theater. No gallery gods, no peanuts, pipe, smoke, drunkenness, yelling or howling. The Jardin des Plantes, the vast galleries and museums of the Louvre, Hotel Cluny, palace of the Luxembourg and Versailles, are free for him to enter. Art and science hold out to him their choicest treasures at small cost, or no cost at all. French economy and frugality do not mean that constant retrenchment and self-denial which would deprive life of everything which makes it worth living for. Economy in France, more than in any other country, means a utilization of what America throws away, but it does not mean a pinching process of reducing life to a barren existence of work and bread and water.

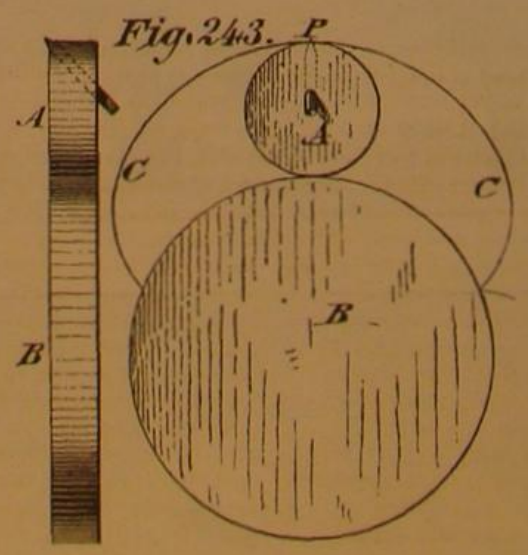
PRACTICAL MECHANISM.

BY JOSHUA ROSE, M.E.

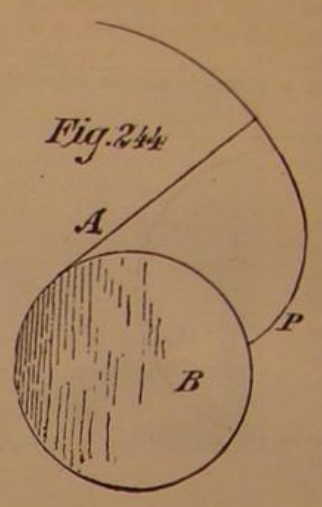
NEW SERIES—No. XXXV.

CURVES FOR GEAR WHEEL TEETH.

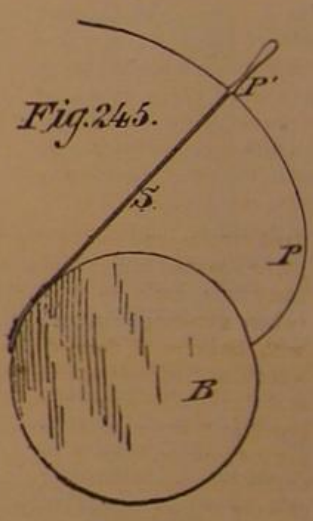
An epicycloid may be described or generated by a point in the circumference of a circle that rolls, without slip, upon the circumference of another circle. Hence to produce this curve, take two pieces of wood, having circular edges, A and B in Fig. 243, and bore a parallel hole obliquely in A to receive the tightly fitting and hard piece of pencil shown at P in the Fig. 243, which is to serve as a tracing point. It should be made to protrude well through the wood, be filed even with the circular edge of the same, and brought to a point by filing from the back and on the two sides. By adopting this plan of sharpening the pencil point we ensure



that it shall stand even with the circle of the wood, which is of great importance; and, furthermore, we can let the point protrude well, enabling us to see distinctly the operation of the point and place to any mark upon the base circle, B. Lay the radial face of the base circle, B, upon a sheet of drawing paper and, while holding it in a fixed position, take the piece, A, and placing its perimeter in contact with that of B, and pressing the two together to avoid slip, revolve A around B. The point, P, will then mark upon the paper the epicycloidal curve, C C. In this operation A (the moved circle) is called the generating circle and B (the stationary circle) the base circle. It will readily be perceived that the shape of the curve thus traced will vary with the size of the generating circle, but the properties of the curve will remain the same. If the diameter of the generating circle, A, be supposed to be infinite, than a portion of its circumference may be represented by a straight line, such as A in Fig. 244, and if this straight line be made to roll upon the circumference of a circle, as shown in Fig. 244, then the curve traced will be involute, P. In practice a piece of flat spring steel, such as a piece of clock spring, is used for tracing involutes. It may be of any length, but at one end it should be filed so as to leave a scribing point that will come close to the base circle or line, and have a short handle, as shown in Fig. 245, in which S represents the piece of spring, having the point, P′, and the handle, H. The operation is to bend the spring around the circle, B, holding the point, P′, in contact with the drawing paper, securing the other end of the piece of steel, so that it cannot slip upon B, and allowing the steel to unwind from the cylinder or circle, B. The point, P′, will mark the involute curve, P.



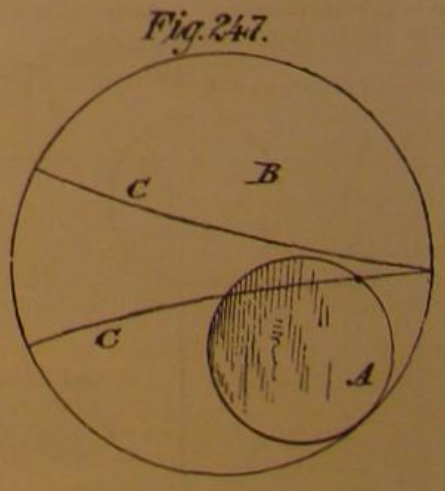
Another way to mark an involute is to use a piece of twine in place of the spring and a pencil instead of the tracing point; but this is not so accurate, unless, indeed, a piece of wood be laid on the drawing board and the pencil held firmly against it. In tracing any of these curves a hard pencil is necessary to obtain a fine line, and it is best to go over the operation twice, and if then the curve is a fine and not a double line, it is a proof of correctness.



Returning now to a generating circle of finite dimensions, we will suppose the radius of the base circle to be infinitely extended. A portion of its circumference may then be represented by a straight line, and the curve traced by a point in the circumference of the generating circle as it rolls upon the base line is termed a cycloid. Thus in Fig. 246, B is a portion of a base circle of infinite diameter, A is the generating circle, and C C is the cycloidal curve traced by the



point, D, when A is rolled along B. If now we suppose the line, B, to represent a rack, it will be obvious that the part of the cycloid which meets B at one end is suitable for the face on one side of the tooth, and the part at the end is suitable for the other side of the tooth.

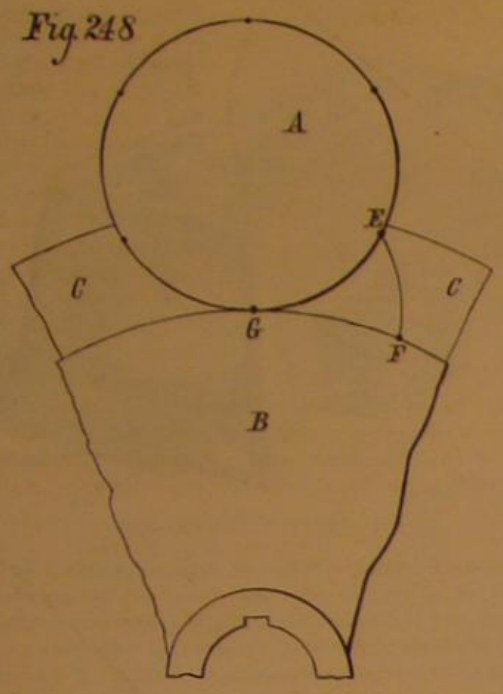


Let us now suppose that our base and generating circles have finite dimensions; the generating circle is rolled within instead of upon the circumference of the base circle, and

a point upon the periphery of the generating circle will then describe a curve called an hypocycloid. Thus, in Fig. 247, B represents a bore forming the base circle, and A a cylindrical piece of wood forming the generating circle. Then a point at the periphery of A would, upon rolling A within B, describe the hypocycloidal curve, C C. Now though in the four cases here given the curves produced by the prescribed mechanical means are called by different names, yet, as the conditions are the same, it is the same general curve throughout, and is known as the cycloid. If we consider the case of Fig. 243 as positive, then that of Fig. 244 is negative, that of Fig. 246 is neutral, and that of Fig. 247 infinite.

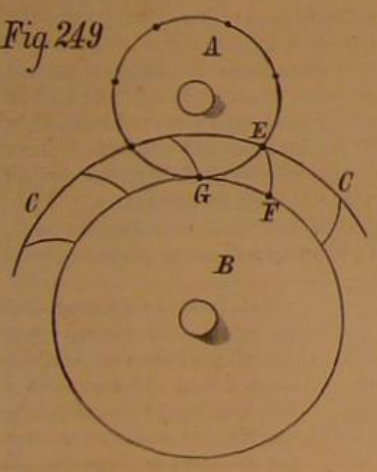
To demonstrate that, by the application of these curves, motion from one wheel to another may be communicated with as much uniformity as by frictional contact of the circumferential surfaces, let A B, in Fig 248, represent two plain disk wheels which are at liberty to revolve about their

Fig 248



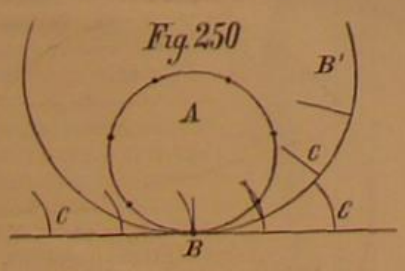
fixed centers, and let C C represent a margin of stiff white paper attached to B, so as to revolve with it. Now suppose that rotary motion to A and B commenced when the point, E (where a tracing point or pencil is attached), in conjunction with the point, F, formed the point of contact of the two wheels, and continued until the points, E and F, had arrived at their respective positions, as shown in the figure. The pencil at E will have described upon the margin of stiff paper the small portion of the epicycloid denoted by F E, and as this movement took place by the contact of the circumferences of the wheels it is evident that the arc, G F, must be equal to the arc, G E. The conclusion, therefore, is that the motion of the wheel, B, would be communicated uniformly to the wheel, A. Again, if we suppose a series of these small portions of epicycloids, as shown at E F in Fig. 249, to be arranged at equal distances around the wheel, B, and a series of points set up at equal and corresponding points around A, which we will call the pinion, then the wheel, B, in revolving in the direction from G to F, would impart a continuous and uniform motion to the pinion, A.

Fig 249



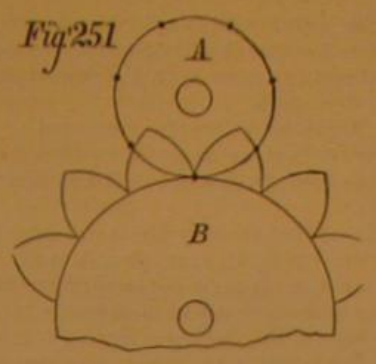
In Fig. 250 is shown a similar case applied to a rack and an internal wheel. The line, B, with the series of short curves, which are portions of cycloids struck with the gene-

Fig 250



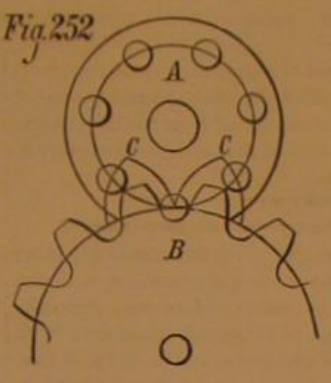
rating circle, A, representing the rack, B', with its small portions of hypocycloids representing an internal wheel, or more strictly the elements of one. In our figure the generating circle, A, is drawn half the diameter of the base circle, B, and consequently the hypocycloids are straight radial lines, which will not be the case where these two proportions are different, although the practical construction would remain the same. It will be seen that, by the arrangement of curves and points shown in our two figures, rotary motion may be either transmitted or converted into a plane motion, but it will be noted that this arrangement would transmit the motion in one direction only. To enable it to operate in both directions we have but to add another set of portions of cycloids, as shown in Fig. 251, and we shall have arrived at an elementary form of gearing, known as the wheel and lantern.

Fig 251



To render this device useful in practice all that remains is to increase the points to a suitable diameter, making them into rungs possessing the requisite strength. This will necessitate a diminishing of the teeth (to afford space for the rungs to fall into) by the same amount we have added to the points, or, strictly speaking, by rather more, since it is necessary to allow a little for irregularity in the workmanship and to permit of the free passage of the rungs. Fig. 252 represents this process carried out. A B represents the wheel, as before, C C the primitive teeth, as in Fig. 251; and by setting the points of a pair of compasses to a trifle more than the radius of the rung, and marking off a number of points of that distance from the curves, C C, we are enabled to trace out the same curves; that is to say, teeth adapted to work correctly with and allow space for those rungs.

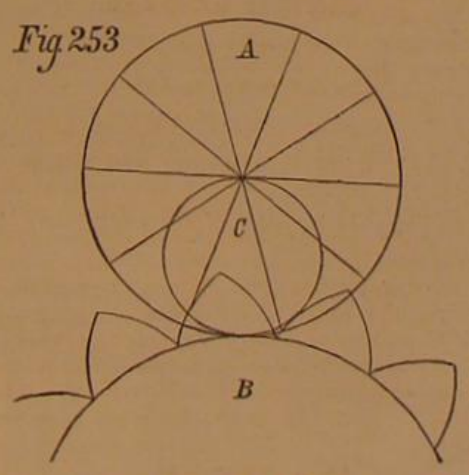
Fig 252



It is considered as established that the correct form to be given to the teeth of a wheel that is to drive or be driven by a lantern, trundle, or wallower (which are synonymous terms) must be epicycloidal with the curves generated by the rolling of a circle whose diameter is the same as that of the lantern, measured at the centers of the pins or rungs, which diameter represents, in this case, the pitch circle; the teeth being first drawn out as if the rungs were points, and then diminished by curves drawn parallel to the first, but set back, as it were, so as to make room for the full size of the rung and allowing a small portion for clearance. It is obvious, however, that such method of communicating rotary motion is unsuited to the transmission of much power, because the pins in the pinion, A, would be considerably weaker than the teeth in the wheel, B, and the pins would soon wear away from the small amount of wearing surface they possess.

Let us now suppose that instead of points we have radial

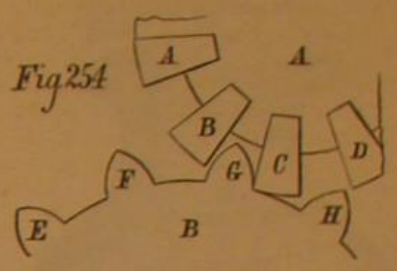
Fig 253



lines, representing the surfaces of projecting radial ribs, arranged at equal distances around the plane of the disk, A, as in Fig. 253. To determine the shape of the teeth of the wheel, B, to work with those lines, we take a circle, C, in the figure of half the diameter of A, and cause it to roll along in contact with the internal circumference of A, and a tracing point at its circumference will draw radial lines upon A, but the circumstances will not be altered if we suppose these three circles to be movable about their fixed centers and let the centers be in a straight line; and if under these latter circumstances we suppose motion to be imparted to these three circles, through frictional contact of their perimeters, a point on the circumference of C would trace epicycloids upon the revolving plane of B and hypocycloids upon that of A. The latter being a radial line, and therefore the proper curve for the teeth of these two primitive wheels, will be epicycloidal for B and hypocycloids, or radial lines, for A, as shown in the figure. Now let us render these teeth, which are adapted to work with radial lines, capable of practical use, by allowing for the thickness of the ribs, of which the radial lines represented the surface: or, in other words, let us proportion the strength, which we do by increasing the width of the radial lines on A, so as to represent the thickness of the ribs, and striking the epicycloidal curves with the same generating circle, but those formed with C rolling in one direction nearer to the roots of those struck when it rolled in the other, so as to reduce the thickness of the tooth to permit of the passage, between the teeth, of the radial arms, and we shall find that we have arrived at the form of teeth shown in Fig. 254.

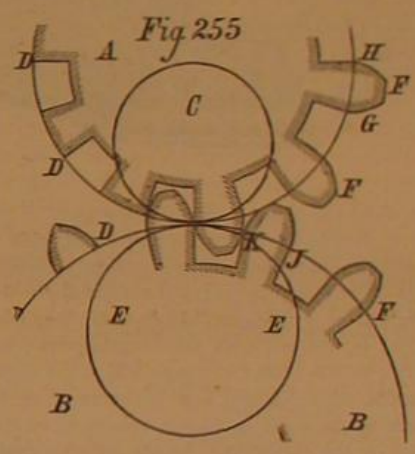
Now although the formation of teeth that shall enable any two wheels in a set to work practically correctly together is a subject not as yet under consideration, yet it is proper to here point out that a wheel having teeth of the form of those upon A, in Fig. 14, can only work in gear with one having the form of those upon B, and *vice versa*, and that, although these two forms of teeth were struck with the same generating circle, yet neither two of the wheels B and two of A will work together. We may, however, by means of the employment of another generating circle, carry the process a step further forward and form teeth that will do so. Then we

Fig 254



have in Fig. 255 the same two wheels shown in Fig. 254, with the shape of the teeth in that figure shown at D D and D D. We now introduce a second generating circle, shown in Fig. 255 at E E, and of half the diameter of B, and by rolling it outside of A a point on its circumference will mark or add to the teeth shown on A at D, the epicycloidal curves, G and H, G being marked with the circle, E, rolled in one direction, and H, with it rolling in the other direction, care being, of course, taken to let the tracing point start at each operation of tracing from the exact edge or corner line of the teeth or marks at D. So likewise, with the teeth upon

Fig 255



B, we place our generating circle in contact with the inside of the circle of B and bring the tracing point on its circumference exactly even with the face of the tooth at the pitch line, and then rolling the generating circle will trace a line representing the flank, as, for example, at J in the Fig. 255; then by going through the same operation, rolling the generating circle in the other direction, we mark lines on the other side of the tooth, as shown at K. Thus by the introduction of our last generating circle we have added epicycloidal faces to the teeth on A, shown at D, and hypocycloidal flanks to the teeth on B, shown at J K: giving us the form of tooth shown on the respective wheels at F, the circles forming A and B now representing the pitch lines of their respective wheels, the form of tooth thus arrived at being epicycloidal with hypocycloidal or radial flanks.

How Scorpions Sing.

At the September meeting of the London Entomological Society, Mr. J. Wood-Mason announced the discovery of singing organs in scorpions. He procured two large living scorpions; these, when fixed face to face and goaded into fury, at once commenced to beat the air with their palps and simultaneously to emit sounds which were most distinctly audible. It resembled the noise made by scraping a stiff tooth brush with one's fingernails. The singing apparatus is developed on each side of the body, the scraper upon the flat outer face of the basal joint of the palp-fingers, and the rasp on the equally flat and produced inner face of the corresponding joint of the first pair of legs. The former was thickly beset with stout, conical, sharp and curved spinules; the latter studded with minute tubercles shaped like the top of mushrooms. The sounds were produced by these parts being quickly rubbed together, friction in a dead specimen producing the same sound.

THE American export of petroleum has increased wonderfully within the last four years, until, to-day, there is scarcely a civilized spot on the face of the globe to which this cheapest of all illuminators is not shipped. The wells of Pennsylvania and West Virginia have yielded in all about 80,000,000 barrels, which has a value of nearly four hundred million dollars at the seaboard.—*British Trade Journal*

INSTEAD of the time-honored millstones, chilled iron rolls are beginning to be used in England for the purpose of reducing wheat and other kinds of grain.

SELF-WATERING FLOWER POTS.

We illustrate herewith a simple and novel device for moistening flowers and plants by means of the evaporation and condensation of water. Fig. 2 represents the parlor garden form. This is made of sheet metal, terra cotta, or other material, and can be made in any desired shape. The upper portion is pierced with openings after the manner of

Fig. 1.



a stove. In the bottom is a reservoir for water. The earthen flower pots seen in the figure are perforated with numerous holes, and are provided with projecting collars. They fit exactly into the openings of the cover, and the bottoms reach within one or two inches of the water beneath. The top of the pot is covered with segmental covers, provided with openings in the center, through which the stem of the plant protrudes. The natural heat of summer, or the artificial warmth of the room in winter, causes an evaporation of the water in the reservoir. As the exterior casings are water-tight, the water condenses on the sides of the flower pot. The earth contained therein absorbs through the holes the needed moisture, and the rest drips back into the reservoir. The segmental covers prevent the moisture evaporating from above, and in case of too much dampness, one or more of these covers can be raised. The water constantly passes back and forth from the reservoir to the earth, and is thus kept pure and sweet, and very seldom needs renewing. Fig. 1 represents a more ornamental design, constructed on the same principle. Flowers once placed in one of these gardens will, we are informed, remain fresh and green all winter with very little care. For further information address the inventor, C. H. Crater, Owego, N. Y.

IMPROVED CONSTRUCTION OF PORTABLE FRAME BUILDINGS.

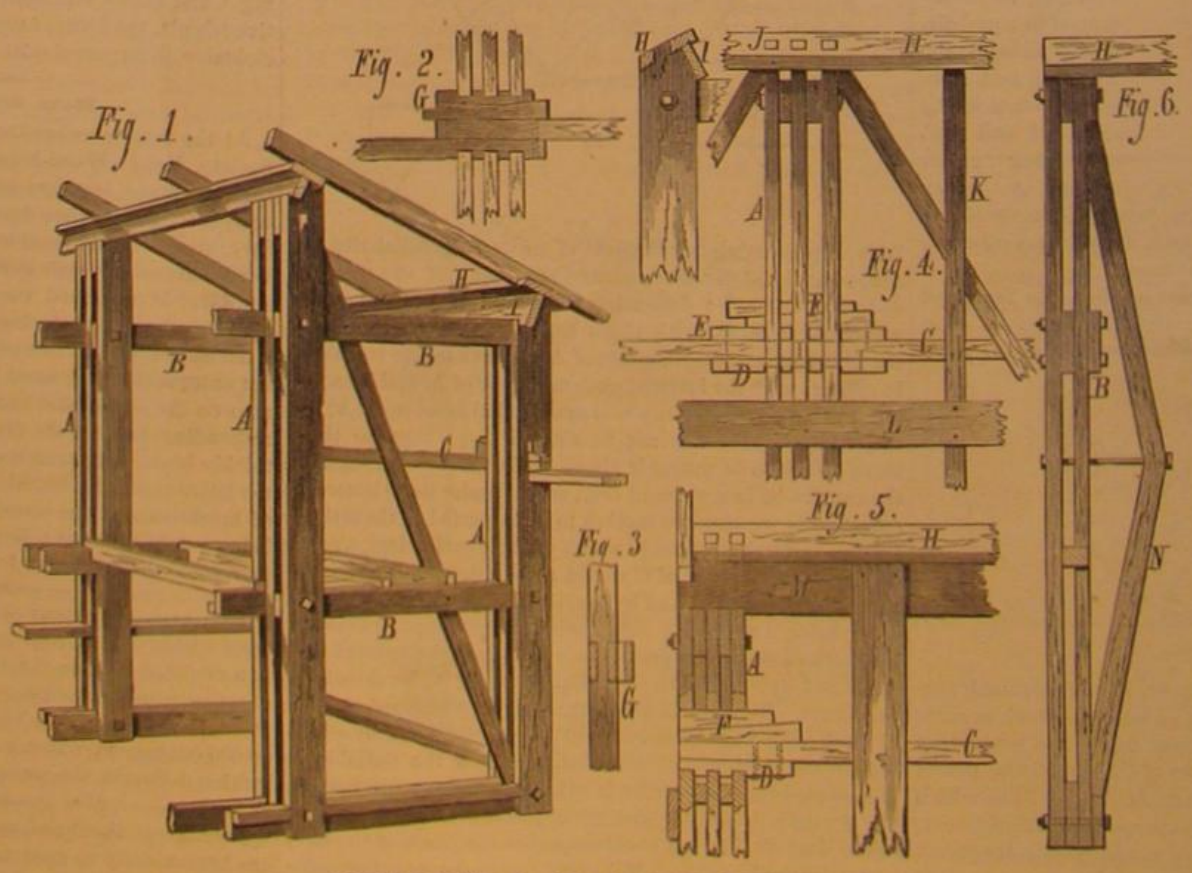
We illustrate herewith an improved method of erecting frame buildings by the use of planks of suitable length, and thickness, from which the posts, beams, joists, etc., are formed, so that the structure may be erected with much saving of timber and by unskilled persons. It also may be taken down and packed in small compass for shipment from place to place.

The supporting posts, A, are made of two or more planks according to the size of the edifice to be erected. The planks are placed at some distance from each other, and are firmly bolted to the beams, B, Fig. 1, which are made of several planks interposed between the post planks, the whole forming a strong and rigid construction. The lateral posts connecting girders, C, are passed through mortises of the plank posts, and are rigidly secured at their meeting ends by a recessed key, D, Figs. 4 and 5, which is first passed through the mortises of the post and then placed in position. The girder ends, after being inserted, are connected by a second recessed top key, E, of less width. Both keys are spiked to the girder ends in order to unite them. The keys and girder joint are finally locked to the mortises of the plank post by two wedge keys, F, introduced at relatively opposite directions.

The girders, C, are also connected to the posts by a similarly recessed key or girder, G, Figs. 2 and 3, that is inserted as above described, bolted, and finally locked by wedge keys.

The rafters are seated by their recessed ends on the rafter-bearing plates, H, Figs. 1 and 4, which are supported by pieces, I, set at right angles to the plates and fitted to the recessed ends of the posts to which they are spiked. The top ends of the posts have tenons, J, Fig. 4, that enter mortises in the rafter plates, H, so as to cause the rigid interlocking of said plates with the posts. Vertical siding strips, K, Fig. 4, are nailed to rafters, girders, etc., so as to receive the horizontal siding boards, L. A horizontal siding strip, M, runs below the rafter plate. In some cases posts are required that are not tied to the building by a girder or beam, in which case the post, constructed as already described, is strengthened by the brace, N, Fig. 6. This brace is made of one piece, and is attached to a central bolt and nut and seated against shoes.

This invention was patented through the Scientific American Patent Agency, December 25, 1876, and September 24, 1877. For further information address the inventors, Messrs. W. R. Morris and Joseph Slanser, LaRue, Marion county, Ohio.



CONSTRUCTION OF FRAME BUILDINGS.

Corrosion of Boilers by Smoke Deposits.

In the *Journal of the Franklin Institute*, Chief Engineer Isherwood, U.S.N., has a paper on the corrosion of steam boiler by the sulphuric acid in the soot deposited from the smoke upon the surfaces, the essay being translated from the French. The conclusions reached are that when smoke deposits on boiler surfaces distant from the furnace are rendered moist by any accidental cause, the sulphurous acid in the gases of combustion determines the attack upon metal by the formation of the sulphate of the oxide of iron.

The attack can take place, while the boiler is in use, on such of its metallic surfaces as may be wetted by leakage from the boiler itself, or by water infiltrated through the masonry, or derived from the condensation of the aqueous vapor in the gases of combustion by contact with surfaces relatively cold. It can also be produced while the boiler is out of use, by means of the humidity of the air in the flues.

These different origins of the corrosive action, point out the precautions to be taken for preventing its destructive effects. They are only those which should be adopted for the preservation of any apparatus, namely, careful construction, thorough cleaning, and maintenance in good repair.

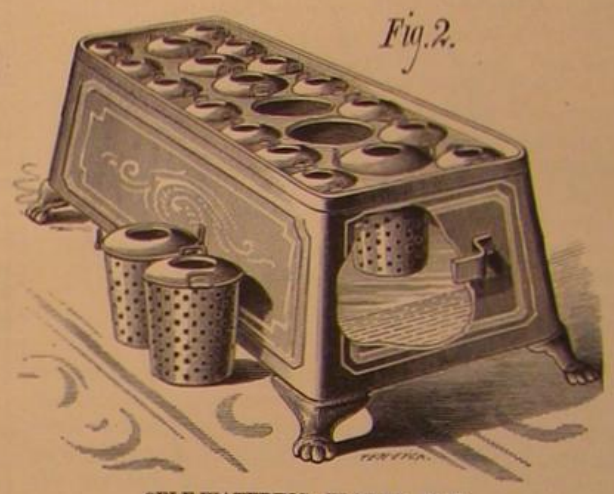
Egg Preservation.

We extract the following from the third report of the National Butter and Cheese Association, giving the method of preserving eggs which is practised by large dealers.

To make the pickle, use stone lime, fine salt and water in the following proportions: One bushel of lime, eight quarts of salt, twenty-five 10 quart pails of water. The lime must be lime that will slake white, fine, and clean. Have the salt clean and the water pure and sweet, free from all vegetable and decomposed matter.

Slake the lime with a portion of the water, then add the balance of the water and the salt. Stir well three or four times at intervals, and then let it stand until well settled and cold. Either dip or draw off the clear pickle into the cask or vat in which it is intended to preserve the eggs. When the cask or vat is filled to a depth of 15 inches or 18 inches begin to put in the eggs, and when they lie, say about 1 foot deep, spread around over them some pickle that is a little milky in appearance, made so by stirring up some of the very light lime particles that settle last, and continue doing this as each lot of eggs is added. The object of this is to have the fine lime particles drawn into the pores of the shells, as they will be by a kind of inductive process, and thereby completely seal the eggs. Care should be taken not to get too much of the lime in—that is, not enough to settle and stick to the shells of the eggs, and render them difficult to clean when taken out. The chief cause of thin, watery whites in limed eggs is that they are not properly sealed in the manner described. Another cause is the putting into the pickle old stale eggs that

Fig. 2.



SELF WATERING FLOWER POT.

have thin, weak whites. When the eggs are within 4 inches of the top of the cask or vat, cover them with factory cloth, and spread on 2 inches or 3 inches of the lime that settles in making the pickle, and it is of the greatest importance that the pickle be kept continually up over this lime. A tin basin (holding about six to eight dozen eggs), punched quite full of inch holes, edge muffled with leather, and a suitable handle about 3 feet long attached, will be found convenient for putting the eggs into the pickle. Fill the basin with eggs, put both under the pickle and turn the eggs out; they will go to the botom without breaking.

When the time comes to market the eggs they must be taken out of the pickle, cleaned, dried, and packed. To clean them, secure half of a molasses hogshead, or something like it, filling the same about half full of water. Have a sufficient number of crates of the right size (to hold 20 to 25 dozen eggs), made of laths or other slats, placed about three quarters of an inch apart. Sink one of these crates in the half hogshead, taking the basin used to put the eggs into the pickle, dip the eggs by raising it up and down in the water, and if necessary to properly clean them, set the crate up and douse water over the eggs; then, if any eggs are found when packing that the lime has not been fully removed from, they should be laid out and all the lime cleaned off before packing. When the eggs are carefully washed, they can be set up or out in a suitable place to dry, in the crates. They should dry quickly, and be packed as soon as dry. In packing the same rules should be observed as in packing fresh eggs.

Vats built in a cellar around the walls, with about half their depth below the surface, about 4 feet or 5 feet deep, 6 feet long, and 4 feet wide, are usually considered the best for preserving eggs in, although many use and prefer large tubs made of wood. The place in which the vats are built, or the tubs kept, should be clean and sweet, free from all bad odors, and where a steady, low temperature can be maintained—the lower the better—that is, down to any point above freezing.

CONDENSED forage is supplied to the Russian commissariat on the Danube by three Russian manufacturers, one of whom at St. Petersburgh turns out 30,000 lbs. per diem. The forage is composed of small biscuits of oatmeal, pea flour, rye meal, and ground linseed, and twenty-eight biscuits form a single ration for a horse, containing as much nutriment as 12 lbs. of oats, whilst only one fifth the bulk.

THE CAROLINA MANTIS

BY C. FEW SEISS.

One of the most peculiar of orthopterous insects found in the Southern and Western States is the mantis or "race horse" (*mantis Carolina*, Linnæus). It will easily be recognized among other insects by its large, spiny, raptorial fore legs or arms. With these it captures its prey, which consists entirely of insects. While devouring an insect it holds it firmly between the tibiæ and tarsi of its fore legs, which are strongly toothed or spined on their lower or posterior surfaces. When holding the insect to its mouth while eating, I have often thought it had a half human appearance, like a child devoid of table etiquette, with the end of a turkey's leg in each hand, tearing with its teeth the meat from the femur.

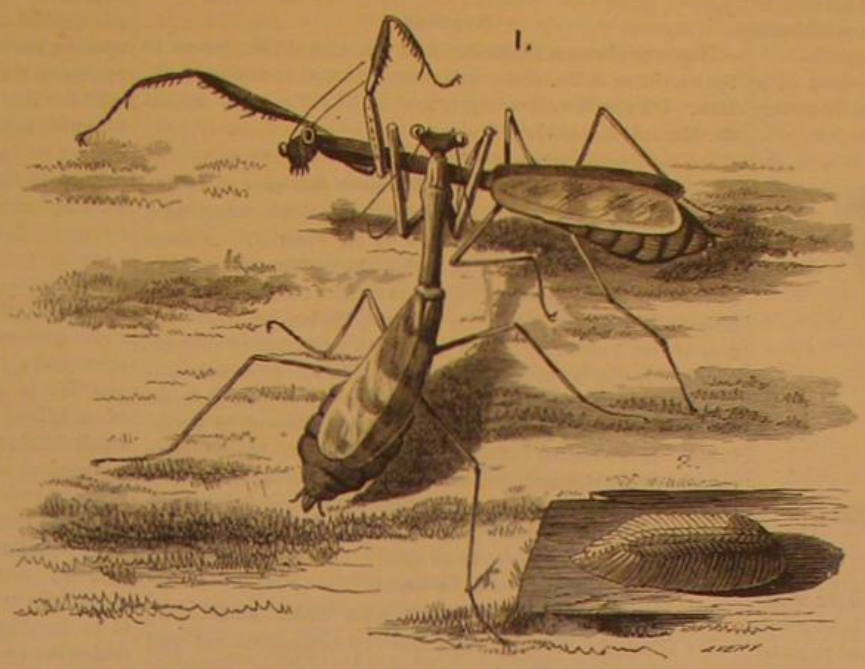
The mantis is savage in its habits, and they often have fierce combats among themselves. They rush to the attack with their raptorial legs elevated and wings expanded; but when the most expert of the two combatants has once firmly seized its adversary, they fold their wings and fight with tooth and claw. I have on two instances witnessed the victorious mantis partially devour the vanquished adversary.

The mantis does not merely "suck the blood" of its prey, as stated by a popular entomologist, but it generally devours blood, internal organs, and shell, especially if the object be a soft bodied insect. In the case of a caterpillar, if it should be a hairy species, the hair and skin are generally rejected.

In September the female attaches a cluster of eggs (Fig. 2) to the limb of a tree, or to the rail of a fence. Here they remain until the following summer, when the young mantes hatch out. I take the following from my journal: April 9, 1877.—The eggs of the *mantis Carolina*, sent me from Baltimore in November last, hatched to-day. The young mantes escape only from the upper, longitudinally, central portion of the convex sub-ovoid egg-cluster. They work themselves out by moving backward and forward and from side to side. Their legs are closely folded to the body when they emerge, giving them the appearance of a large gnat larva, and it requires several minutes before they fully extricate themselves, and are able to walk. In a short time they can run quite briskly, and will throw themselves in an attitude of defence when disturbed. When they quit the egg, they leave a small thin shell behind them, adhering to the egg case. The young mantes, when just hatched, are of a pale brown color; their legs and head pale green, the former with dull brown bands above the joints; their eyes are dark and prominent; their bodies linear; the abdomen but little wider than the thorax; no vestiges of wings visible. They became much darker in color after several hours' exposure to the sun. Each little mantis was about five sixteenths of an inch in length. They drank greedily from drops of water which were sprinkled about the board upon which they were sunning themselves, throwing back their antennæ to prevent them becoming wet.

From sixty to seventy individuals came from each egg-cluster. As the egg packets were kept in a warm room during the winter, their hatching was accelerated, and consequently the coming forth of the young mantes was premature. They lived only a few days, being killed by the coldness of the weather.

The specimens from which I made my drawing, and also the egg packet, were procured in Baltimore, Md., where it is common enough; but I have never met with it in the vicinity of Philadelphia.



THE CAROLINA MANTIS.

THE TRUNCATED PICHICIAGO.

The "truncated pichiciago" is one of the smallest of four-footed animals. It is not more than two inches in length. The shield which covers the entire upper portion of its body is composed of a single piece, and consists of regular, uniform, and smooth scales neatly arranged like mosaic. This coat of mail is truncated vertically at its rear portion. The animal has a curious cut-off appearance owing to the apparent absence of a tail, but in reality due to the position of that member, which is short and closely pressed against the body. All the lower portions, the neck, stomach, sides and legs are covered with long and fine hairs.

The pichiciago is found chiefly in the Cordilleras mountains, in Chili, where it feeds on earth worms, snails, and insects. It uses its long, large, and sharp nails to make burrows, which are often very deep. In these it remains concealed during the greater part of the day, and rarely ventures to wander to any great distance even by night. It can not jump or run swiftly; hence when attacked by an enemy it has no means of escape but by its subterranean gallery; hence, when hard pressed, it seeks safety in digging a new hole, and very often succeeds in thus escaping; but when this resource fails, the animal rolls its head and legs under its stomach, forming a ball like a hedgehog, and thus incased in armor defies the teeth or claws of its adversary. It is sometimes called the chlamyphore. As is the case with the mole and other subterranean animals, the eyes are of minute dimensions, and are hidden under the soft and profuse fur of the face.



THE TRUNCATED PICHICIAGO.

Tinted Paper.

Tinted paper may be prepared in any desirable shade as follows: 1 gm. of any aniline color is dissolved in 30 gms. of strong alcohol, 300 gms. of distilled water are added, and finally a solution of 1½ gms. of tannin in 15 gms. of alcohol. The tannin acts as a mordant. Moderately sized white paper is spread on a marble slab, or other smooth, hard surface, and the coloring liquid is applied in even horizontal lines by means of a small sponge. The paper is then hung up to dry, and may be covered after a few days with a concentrated solution of sodium silicate, to every 100 parts of which 10 parts of glycerin have been added, if it is desired to impart to it a gloss.

DRYER FOR OIL COLORS AND VARNISHES.—Water, 100 parts; gum lac, 12 parts; borax, 4 parts.

Botany of the Rocky Mountains.

Sir Joseph Hooker, a distinguished botanist of London, accompanied Dr. Hayden in the survey of Colorado and Utah. He has given in *Nature* some notes on the botany of the Rocky Mountains, which we copy. The section which he thus visited contained representatives of three very distinct American floras, each characteristic of immense areas of the continent. There are two temperate and two cold or mountain floras, namely, (1) a prairie flora derived from the eastward; (2) a so-called desert and saline flora derived from the west; (3) a sub-alpine, and (4) an alpine flora. Two of the principal American regions are in a broad sense humid; one, that of the Atlantic coast, and which extends west to the Mississippi river, the other, that of the Pacific side, from the Sierra Nevada to the Western Ocean, and two inland, that of the northern part of the continent, extending to the polar regions, and that of the southern part, extending through New Mexico to the Cordillera of Mexico proper. The vegetation of the middle latitudes of the continent resolves itself into three principal meridional floras, incomparably more diverse than those presented by any similar meridians in the Old World, being, in fact, as far as the trees, shrubs, and many genera of herbaceous plants are concerned, absolutely distinct. These are the two humid and the dry intermediate regions above indicated.

Each of these again is subdivisible into three, as follows: (1.) The Atlantic slope *plus* Mississippi region, subdivisible into an Atlantic, a Mississippi valley, and an interposed mountain region with a temperate and sub-alpine flora. (2.) The Pacific slope, subdivisible into a very humid cool forest-clad coast range; the great hot, drier Californian valley, formed by the San Juan river flowing to the north and the Sacramento river flowing south, both into the Bay of San Francisco; and the Sierra Nevada flora, temperate, sub-alpine, and alpine. (3.) The Rocky Mountain region, subdivisible into a prairie flora, a desert or saline flora, a Rocky Mountain proper flora, temperate, sub-alpine, and alpine.

The difference between the floras of the first and second of these regions is absolute; not a pine or oak, maple, elm, plane, or birch of Eastern America extends to Western, and the genera of thirty to fifty species are confined to each. The Rocky Mountain region, though abundantly distinct from both, has a few elements of the eastern region, and still more of the western.

Magnetic Nickel.

The magnetic properties of pure nickel have been lately investigated by M. Wild, of St. Petersburg, who procured a nickel magnet in the form of a flat pointed bar, made by Wharton, in Philadelphia. The results are as follows: 1. Pure nickel takes, as compared with the behavior of pure soft iron, a considerable quantity of permanent magnetism; but the maximum of this is only a half to a third of the permanent magnetism which may be acquired by hard steel. 2. The magnetism remaining in nickel after cessation of the magnetizing force is less permanent than in well hardened steel; the gradual loss of magnetism in course of time, both in warming and cooling, is in nickel greater than in hard steel, even when, by repeated heating and cooling it has, like steel, been brought to a certain state of permanence. 3. The temperature co-efficient of nickel magnets in the latter state is less than that of well hardened steel. 4. The temporary magnetism which pure nickel acquires is about double its permanent magnetic moment, half of the temporary magnetism which hard steel can acquire, and a fourth of that which soft iron can acquire. In its magnetic behavior, nickel is thus throughout subordinate to steel and iron.

Dangers of Galvanizers' Waste.

Pollution of streams by manufacturers' refuse has been assigned as the cause of more evils than can be fairly brought home to it. A new charge has been brought against it, not only of serious pecuniary waste, but also of great and increasing danger to life and property. It appears that the galvanizers of the Wolverhampton district, England, are in the habit of discharging their waste acid into the sewers. The damage caused by this practice is almost incredible; but it is clearly proved that the sewers themselves are being rapidly destroyed; the irrigation farms which dispose of the sewage are being rendered unproductive; and, most serious of all, the boilers of the surrounding factories, which are fed from the neighboring canals, are rapidly corroded.—*Ironmonger.*

NEW TRAPLESS WATERCLOSET.

Noxious gases issuing from defective closets and sewerage connections are an intolerable nuisance, productive of disease, and always injurious to health.

The watercloset illustrated in the accompanying engraving is designed so as to prevent efflux of these dangerous gases. Fig. 1 represents a sectional view of it, by which its peculiar construction will be easily understood. R is a detachable ring, which holds a porcelain non-corrosive valve seat; O, the overflow; T, overflow trap; W is a socket that can be closed with a cap or used as a connection with a washbasin waste; V is a socket for ventilator.

The feature of novelty in this closet is the absence of a trap between the basin and the soil pipe. It is, however,

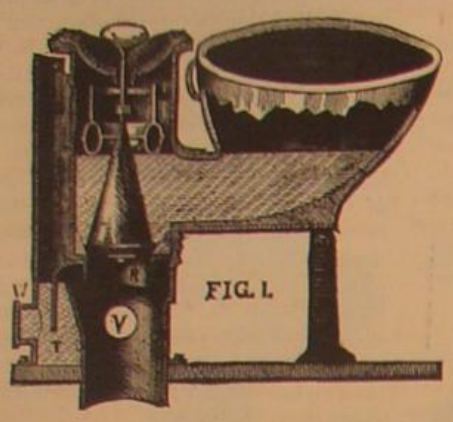


FIG. 1.

doubly protected by the tight seating ball valve and the water seal left in the basin after flushing. The overflow is trapped, as shown in the cut, with a sufficient depth of seal to resist any ordinary pressure, and much more than ever takes place in properly ventilated pipes. The valve of this "trapless" closet is regulated by a float, which makes it automatic and insures an abundant flush when the closet is in use. Cisterns and service boxes are unnecessary, but may be used as safeguards against the possible danger of fouling the service pipe when, from any cause, the head might fall below the closet level. The seat of the solid conical plunger is protected from corrosion by a porcelain non-corrosive coating, and the vent, V, relieves the soil pipe and overflow trap from any pressure of gas or foul air. This should always be provided in watercloset, in addition to the ventilation secured by the soil pipe. This is a feature that should enter into all good plumbing work. There is no complicated mechanism about this closet; it is strong, simple, and, we are informed, efficient and inexpensive. It is the invention of Mr. Jennings, the well known sanitary engineer, of England. Further information can be obtained at the Jennings' Sanitary Depot, conducted by Mr. A. G. Myers, 94 Beekman St., in this city.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations of the following notes, which are merely approximate, have been made by students in the Astronomical Department of Vassar College.

Position of Planets for December, 1877.

Mercury.

On December 1, Mercury rises at 8h. 9m. A.M., and sets at 4h. 53m. P.M. On December 31, Mercury rises at 8h. 37m. A. M., and sets at 6 P.M.

Mercury can probably be seen during the last week of December, after the sun has set, a few degrees north of the sunset point.

Venus.

On December 1, Venus rises at 10h. 45m. A.M., and sets at 7h. 43m. P.M. On December 31, Venus rises at 10 A.M., and sets at 8h. 23m. P.M.

Venus will be very brilliant all through the month; it will pass very near the moon, according to the *Nautical Almanac*, as seen at Washington a little south of the moon's limb on December 8.

Venus will be at its greatest eastern elongation on December 11, but will be higher in altitude later in the month.

Mars.

Mars is conspicuous all through the month, but is becoming smaller, and passes the meridian early in the evening.

On December 1, Mars rises at 1h. 10m. P.M., and sets at 0h. 53m. of the next morning. On December 31, Mars rises at 0h. 20m. P.M., and sets at 11h. 44m. P.M.

Jupiter.

Jupiter sets early and is so nearly in range with the sun that its satellites cannot be seen with ordinary glasses.

On December 1 Jupiter sets at 6h. 18m., and on the 31st at about 5 P.M.

Saturn.

Saturn, although it appears so pale and so small contrasted with the ruddiness of Mars and the brilliancy of Venus, is at present the planet of most interest to astronomers. The ring is so situated with regard to the sun and the earth that but little more than the edge is seen, but the numerous satellites which pass around Saturn, at different distances and at different inclinations, give great variety to the configurations. Some of these satellites pass along the edge of the ring, going around in a few days, and others are weeks in their circuit and depart long distances from the central body. Titan, the largest, can be well seen with an ordinary glass. It is now (November 16) on the right of the planet as seen in the telescope, and in seven days it will be on the left, and around again in fifteen days at the right.

On December 1, Saturn comes to meridian at 6h. 20m., and sets at 11h. 50m. P.M. On December 31, Saturn comes to the meridian at 4h. 28m. P.M., and sets at 10h. P.M.

Uranus.

On December 1, Uranus rises at 10h. 37m. P.M., and sets at 0h. 7m. P.M. of the next day. On December 31, Uranus rises at 8h. 37m. P.M., and sets at 10h. 8m. A.M., of the next day.

Neptune.

Neptune rises on December 1 at 2h. 48m. P.M., comes to the meridian at 9h. 30m., and sets the next morning at 4h. 12m. On the 31st, Neptune rises at 0h. 49m., and sets at 2h. 11m. A. M. of the next day.

New Use for Beet Molasses Refuse.

A promising new mode of producing cold has lately been described to the French Academy by M. Vincent. A short time ago he found that, by distilling the residue of molasses of beet, he could prepare large quantities of chlorhydrate, bromhydrate, and iodhydrate of trimethylamine. He has now shown how it is easy to pass from this body to chloride of methyl, and he insists on the applications of which this latter compound is capable: At 33° below zero (C.) it liquefies, and nothing is easier than to keep it liquid in sealed tubes. If it then be caused to evaporate—*e.g.*, by sending a current of air through the mass—a cooling is obtained which goes down to — 55°. Mercury immediately congeals in such a medium. This method of producing a very low temperature is, moreover, a very cheap one.

DORR'S ADJUSTABLE HAT AND COAT RACK.

We illustrate herewith an improved adjustable hat and coat rack, which may be constructed of either wood or metal and in a variety of styles. The hooks, it will be noted, slide upon parallel rods of polished metal, and can be placed either near together or far apart, as desired. The rods are secured in handsome brackets of either metal or wood. Fig. 1 represents the single rack; Fig. 2 is an ornamental form of metal rack; and Fig. 3 has a wooden bracket in the fashionable Eastlake style. Each rack may be easily taken to pieces for convenience in packing or shipping. The device is exceedingly strong and durable, and is a neat and handy substitute for the ordinary large and expensive stand.

Fig. 1.

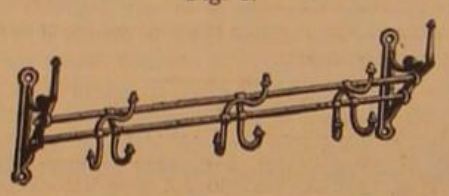


Fig. 2.

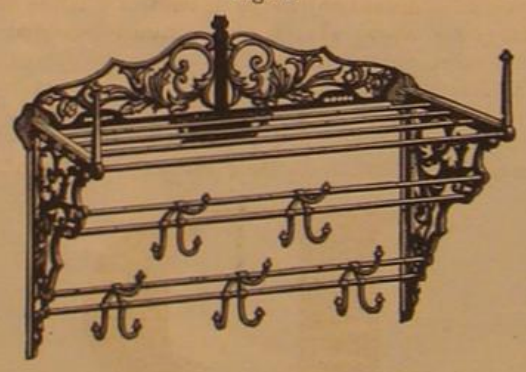
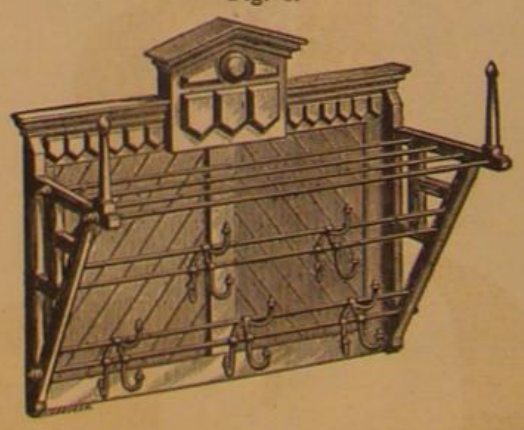


Fig. 3.



For further particulars relative to agencies, rights, etc., address the Dorr Hat and Coat Rack Company, 542 Broadway, Albany, N. Y.

The New Tea Region.

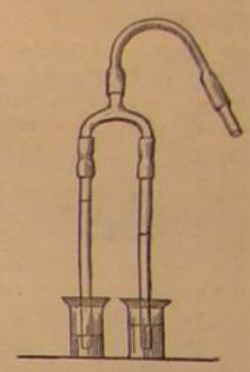
The tea trade is generally considered as being the exclusive business of China and Japan, and tea from other countries is apt to be looked upon with suspicion as a spurious article. Seventeen years ago the first tea plantations were established in Assam, and the growth of tea in India was regarded merely as an experiment. The trade steadily increased until, from 1,300,000 lbs. of tea in 1861, the export from Calcutta advanced to 25,000,000 lbs. in 1875. The cause of the poor quality of China teas of late years lies in hasty preparation, with a view of bringing the teas early to market. Small farmers grow from 50 to 500 lbs. of leaf, and carry it off to a market. If they fail to sell it here they take it to others, and in the meantime the unfired leaf is spoiling fast by exposure to the air. In India the planting, picking, and firing are done more systematically, and consequently a better quality of tea is produced.

A Special Specific Gravity Apparatus.

BY JAMES TAYLOR.

It is often desirable to ascertain approximately the specific gravity of a liquid in cases where the hydrometer and specific gravity bottle are not applicable, or would take up too much time. The following contrivance answers very well for this purpose, is very readily applied, even with tolerably small quantities of liquid, and easily gives results correct to the first decimal place.

Two straight pieces of glass tubing, 5 to 10 m.m. bore and 250 m.m. long, are joined by caoutchouc tubing to two ends of a T-joint which have been bent so as to be parallel. The third end of the T-joint has a piece of caoutchouc tubing of convenient length slipped on, and this is stoppered by means of a bit of glass rod. Two small beakers, a rule, and any convenient stand arranged so as to hold the long tubes vertically, complete the apparatus.



Its application is almost obvious. On pouring a little distilled water into one beaker, and the liquid whose specific gravity is to be determined into the other, bringing the beakers under the two vertical tubes so as to immerse the ends of the latter in the respective liquids, and partially exhausting above, the liquids will rise to heights depending on their relative densities. The plug is now inserted, the lengths of the liquid columns are measured, and the specific gravity required, is obtained by dividing the length of the water column by that of the other.—*Chemical News.*

NEW INVENTIONS.

A new Gasket, patented by Cyrus S. Stoy, of Butler, Ind., consists of two thin annular metallic plates, joined together at their inner edges, having a space between them for a coil of packing. In taking the joint apart, there being no part of the elastic packing in contact with the face of the joint, it may be readily removed without injury, and may be used many years without renewing.

A simple Wire Stretcher, the invention of D. A. Smith, of Marak, K., consists of a forked casting having a squared upper end for receiving a wrench, and perforated ears for receiving a nail that prevents the wire from unwinding after being tightened.

An ingenious Automatic Toy Figure of a Man, invented by John Schwippl, of Brooklyn, N. Y., performs somersaults in an amusing manner. A spring inside the body works a geared shaft, imparting a rotary motion to the arms, which causes the body to roll over and over.

An Iron Fence Post, patented by S. S. Crocker and Albert Wilcox, of Clarence, Iowa, has notches on the front edges of the upper part to receive the fence wires. In the bends and angles of the concave post are holes to receive the hook bolts by which the wires are locked together. By tightening the nut of the bolts the wires are drawn into the hollow of the posts, so that they cannot change their position. This invention will be of great service to farmers.

Cellar Bottoms are generally easily permeated by noxious gases exhaled from the earth, or crack from the pressure of gas beneath. To remedy this difficulty Tobias New, of New York city, has patented a vent for the gases. A narrow channel is constructed at the bottom of each cellar wall under the flooring, from which arises an escape pipe, and thence to the roof of the house. By means of this improvement cellars are freed from noxious gas and are rendered healthy.

A neat Basket, invented by J. J. Cole, of Hillsdale, N. J., consists of a single piece of veneer or similar material cut so that when folded together at the ends it may be fastened at a single point, where a handle is also affixed. It will prove very convenient for carrying berries or small groceries.

Abraham Morris, of New York city, has invented an improved Sofa Bedstead. A swinging seat section is hinged to the lounge frame and a head section is swiveled centrally to the swinging section, and connected at the upper rear corner by a strap with the head section of the lounge frame. The head section has a supporting front foot that fits into recesses of the lounge frame. It is a convenient article to have in the house.

A new Water, Grain, and Earth Elevator, patented by Levi Gallaher, of Businessburg, O., has an endless chain of lifting buckets, which are connected together by open links, a lower drum having scoops affixed to it, and which supply the buckets of the chain with the material to be raised. The upper drum has chutes so arranged as to register with the buckets of the chain and guide the water to the receiver. It promises to be an invention of much advantage.

A new Gas Burner Regulator, patented by Eugene Ginss, of New York city, consists of a hollow cylinder screwed on between the burner and gas fixture. Two conically bored nipples are screwed into the bottom of the cylinder and communicate with the interior of the socket. These nipples direct the head of gas against the side of the cylinder, thus

arresting the solid particles. The passage of gas through the nipples, and its expansion in the cylinder modify the pressure so that a uniform light is secured, blowing avoided, and gas economized.

In a new Process for Tanning and Dyeing Leather, invented by Gonzalio De Cordova and H. N. David, of Brooklyn, and Morris Wise, of New York city, an extract of the leaves of the pimento or allspice tree are used. The tanning is rapid and a rich brown color is produced.

Ira A. Paine, of New York city, the well known shooting expert, has patented a new glass ball for trap shooting. The ball is of the usual kind, but filled with feathers, so that when hit it will produce the same effect as when birds are struck by shot. It also enables a marksman to see the effect of his shot, the smoke having time to disappear before the feathers can possibly reach the ground.

The ordinary Billiard Bridge in common use is deficient in many respects. To obviate these difficulties F. E. Doughty, of New York city, has patented a bridge by which the cue may be supported in any desired position above the bridge by merely turning the handle of the bridge. The bridge has a central vertically sliding and guided cue rest, that is raised or lowered by a pinion connected to the end of the bridge handle, and intermeshing with an interior rack of the sliding rest.

Samuel H. Emanuel, of Gloucester, Mass., has invented an improvement on his Combined Overalls and Jumper. The material forming the front of the garment is entire and without transverse seams. The back is divided across the waist and a flap is formed in the overalls, which is supported by three elastic buttoned straps attached to the inner side of the jumper. A band sewed to the jumper over the waist gives it an appearance of a separate garment. This is a neat and desirable article of clothing for working men.

An improved Watch-case Spring has been invented by D. C. Voss, of New York city. It consists of an ordinary spring, but with the hook end turning on a fixed rivet or pivot of the spring, so that the hook end of the catch may be readily locked to or released from a recess of the watch case. The spring lasts longer and is more easily repaired than the old style.

A Coffee Roaster, the invention of A. R. J. Langer, of Mount Olivet, Ky., consists of a sheet iron cylinder with a shaft extending axially through it, upon which arms or rings are arranged radially at different points. These arms extend nearly to the inner surface of the cylinder, and serve to thoroughly stir the kernels of coffee as the cylinder is rotated, so that the whole mass is equally acted upon by the heat.

A Detachable Cuff, invented by E. K. Betts, of Lansingburg, N. Y., furnishes an ornamental and strong article of wear. It consists of a continuous back part, sectional intermediate layers, and front parts, and of a face strip that connects the intermediate and front sections, and is extended over the end of the cuff and down at the back to form stays for re-enforcing the button holes at the points of greatest strain.

Another Cuff, patented by the same inventor, is made with the back cut narrower than the other parts, so that the cuff may be sewed on both sides, and all the fullness will be taken up by the edges and a superior bead formed on both sides. The back extension is turned inward and thus strengthens the button holes.

A Fence Post, the invention of G. W. Chandler and S. H. Ceering, of Moingona, Iowa, fits into a bell-shaped base of hard clay and is bolted at the bottom. The base is filled with earth to make it secure. It is an inexpensive plan and makes a strong fence.

A Liquor Shaker and Strainer, invented by W. H. Trepus, of Chicago, Ill., will be a great convenience to bartenders. In the cover, with screws on the cup, is formed a strainer, covered with a close fitting cap. In the bottom of the cup are two small holes covered with a valve, the stem of which passes through a hole in the bottom, fitted with a spring and ends in a knob. When the ingredients are shaken up in the cup, the cap of the strainer is turned back, and by pressing the knob of the valve stem, air is admitted and the contents can be poured out.

A Nursing Apparatus, invented by G. F. White, of Middletown, is intended to prevent sore nipples. The mother's milk is drawn off by a simple device into a vacuum bulb, whence it is sucked by the infant while the milk is still warm.

A new Window Shutter has been invented by W. S. Everett, of Hyde Park, Mass., which provides for ventilation while a protection against the sun and storm. It can also be turned into an awning. It consists of an outer and inner shutter frame, the latter so hinged to the upper end of the former as to be thrown outward, while side wings close the the sides. The shutter slats have supplementary slats which are thrown up when the shutter is inclined, thus excluding the sun and admitting ventilation. It is a desirable improvement to a house.

A Broom Rack invented by S. W. Sheldon, of New York city, has three rod-connected disks, the upper having notches, the middle one holes, and the lowest disk a beveled edge. It is easy to use and answers the purpose well.

An Evaporator, patented by J. M. Randolph, of Somerset, O., consists of an evaporating pan, extending around the top, sides, and bottom of a sliding firebox, whose main smokepipe passes the cleansing tub to heat up the liquid therein, preparatory to its being let into the pan. The firebox is open at the front through the evaporator. A second smokepipe registers with the fire through the evaporator. It used up all the heat of the fuel and is thus economical.

In a new Hat Die, invented by R. L. Goddard, of Palmer, Mass., the shell is provided with holes in the top through which steam is admitted. A cross bar is secured detachably to its top by screws, the ends of which overlap. The die is kept from being drawn up too far by a flange formed around its lower edges and which fits into a rabbet in the lower side of the shell. It is a convenient device.

A new Grain Tally has been patented by Phillip Thomas, of North Huron, N. Y. To the forward end of the operating lever of the hopper is pivoted the upper end of a connecting rod, the lower end of which is pivoted to the forward part of the bottom. To the forward edge of the hinged bottom is pivoted the middle part of a bar which passes through the guide keeper, attached to the upper part of the hopper. The measure cannot be removed without operating the register. It is a simple and accurate device.

A Bung Extractor, the invention of W. A. Wiley, of Allegheny, Pa., consists of a spindle carrying at its lower end a a wood screw. To the stand which supports the spindle a forked lever is attached which draws the bung. It is easily and quickly operated.

An improved Spring Seat for wagons has been invented by L. J. Bazzoni, of Newburgh, N. Y. It consists in suspending the bottom of the wagon body from the reach bars of the seat, the bars being supported at their ends upon strings. The bottom and seat are thus elastically connected, and the driver is saved from shocks.

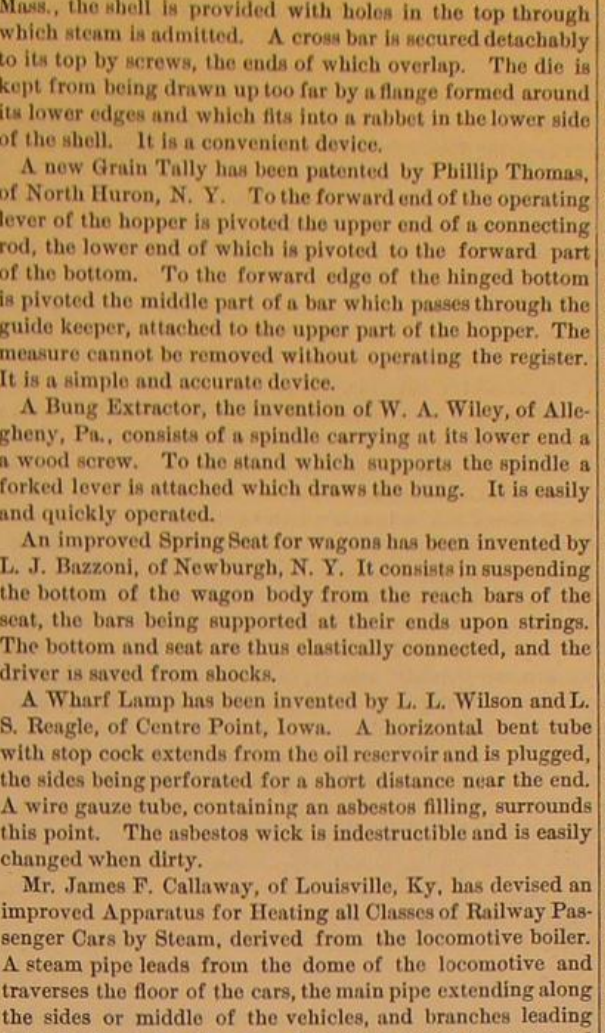
A Wharf Lamp has been invented by L. L. Wilson and L. S. Reagle, of Centre Point, Iowa. A horizontal bent tube with stop cock extends from the oil reservoir and is plugged, the sides being perforated for a short distance near the end. A wire gauze tube, containing an asbestos filling, surrounds this point. The asbestos wick is indestructible and is easily changed when dirty.

Mr. James F. Callaway, of Louisville, Ky, has devised an improved Apparatus for Heating all Classes of Railway Passenger Cars by Steam, derived from the locomotive boiler. A steam pipe leads from the dome of the locomotive and traverses the floor of the cars, the main pipe extending along the sides or middle of the vehicles, and branches leading laterally beneath each seat. Ingenious valves are arranged for allowing escape of water of condensation and controlling admission of the steam

Tests for Vision.

Dr. B. Joy Jeffries, 15 Chestnut street, Boston, Mass., is desirous of ascertaining what proportion of people with normal eyes, that is, who do not wear glasses for distant objects, and also of those who have their focus perfectly corrected for distant objects by glasses, are gifted with a visual power above what is now considered good average vision, called vision *one*.

The following letters are selected as nearest in size to the test letters used by oculists all over the world. The letters should be hung up in a good light; and those of our readers who are able to see them distinctly, further off than



the number of feet marked against each (which would be normal vision), are kindly requested by Dr. Jeffries to send him as above this information on a postal card, simply stating which letters were read and at what distance. From this he hopes to compile and publish some important data.

German Coal.

Hamburg has been the scene of a rather novel exhibition, that of German coal, which we are told, has excited much interest among German patriots and commercial men.

The idea that Germany should endeavor to emancipate herself from the English market and produce her own coal has, it appears, acquired a powerful hold upon the national imagination, and hence the promotion and development of the German coal trade has come to be looked upon as a matter of patriotism. It is also alleged that Westphalian coal is superior in heating power to English, and Senator Godeffroy, in his address on the occasion of the opening of the exhibition, even made it appear that Germany is in possession of coal fields incomparably larger than any that England can show. The Westphalian coal basin alone, said M. Godeffroy, is capable of producing for seven centuries to come the same quantity of best coal annually that all England now yields, and beyond this, the basin is not yet fully explored, and is probably capable of material extension. With all these supposed advantages Germany has not yet been able to beat England out of the field on her own ground. The city of Hamburg imported in 1876 about 1,500,000 tons of coal, of which about six sevenths were the produce of England, and only one seventh of home production.

Wooden Money.

Advocates of inconvertible paper currency may perhaps derive some satisfaction and encouragement from the fact that from the reign of Henry I. down to the period of the establishment of the Bank of England the legal tender money of England was fabricated out of wood. This instrument was called an exchange tally, and by virtue of it the holder was entitled to receive from the Crown the value inscribed thereon. It really consisted of one half of a four sided rod or staff, on which, when in its entire state, the sum it purported to represent was carved in transverse notches, varying in width for thousands, hundreds, scores, pounds, shillings, and pence. These signs were for the unlearned; for the advantage of those who could read, the sum was written in ink on two opposite sides of the staff, and, finally, with a knife and mallet the staff itself was split in two longitudinally. One half, called the tally or check, was given to the person for whose service it was intended; the other half, called the counter tally, was laid up in safe keeping until its corresponding tally should be brought in by the person who had last given value for it. Its intrinsic value was, of course, only that of the wood on which it was composed, but by representation it denoted large sums. It was a current token of real money, and served actually to distribute it from man to man by this exchange. From this primitive tally was derived the Exchequer Bill, first introduced in 1696 by Mr. Montague, the Chancellor of the Exchequer. The word "bill," too, was no doubt obtained from the Norman French word, *bille*, which means a staff. Bank post bills and bills of exchange in our own day came from the same wooden base, and soldiers are said at this hour to be "billeted," because formerly they tendered wooden "billes" or tallies to the victuallers upon whom they were quartered. In olden times officers of the army who were taken into the king's own pay were said to be put on the staff, that is, they were paid with exchequer tallies, or wooden money.

An Unknown Narcotic Plant.

I am tempted to notice a plant that grows here of such strong narcotic powers that, in the hands of a skillful practitioner, it will produce coma of any intensity or duration, or even death itself when so intended. The knowledge of this plant is confined to a few families, who transmit the secret as an heirloom from generation to generation, and the heritage is highly prized, confirming it is thought the power of miracle workers and priests. For the plant is in many ways used in aid of solemn imposture, superstition, and even crime. The power thus exercised is called "wanga," a word that inspires the African with awe and dread. The wanga priest can throw into a death-like coma, and knowing the moment of returning consciousness, he will make a show of recalling to life. If a burglary is to be committed, he can, by means of his art, cast a deep sleep on all indoors; and one may understand how he can attain other forbidden ends in the same way. An experienced botanist could not fail to discover this plant, which, as an anæsthetic, would no doubt prove a valuable acquisition to medical science.—*Major R. Stuart, Port au Prince.*

Bullet Making.

The manufacture of bullets is not so simple as it used to be. At Woolwich, England, the melted metal is poured into a receiver, and as soon as it solidifies, but before it is cold, it is forced by hydraulic pressure through cylindrical holes in the form of long strings. This process is to prevent the formation of air bubbles in the bullet, which would cause it, when fired, to swerve from its course. The leaden strings are thence carried to the bullet moulding department, where they are cut into lengths and roughed; then shaped in one machine, and finished in another. They have now to be plugged. These plugs were formerly made of wood, but are now prepared from a special powder, which solidifies after being pressed into form.—*Ironmonger.*

INK stains in cotton or linen can be removed by washing in salt and water. This should be done before the fabric is washed with soap.

New Agricultural Inventions.

A new Butter Mould has been devised by Mr. Augustus W. Faris, of Red Sulphur Springs, West Va., which presses out the milk and water from the butter and forms it into neat packages of uniform size, so that it can readily be stowed in boxes for transportation, and for the retailer.

Mr. Philip Leitz, of Baton Rouge, La., has patented a Machine for Cutting Sugar Cane, or Corn, Cotton Stalks, and Stubble. As the apparatus is drawn forward, upper knives first meet the cane and cut off the tops, and then a lower set of knives cut off the bottoms. These knives may be adjusted to work higher or lower, with reference to the ground. The new features consist mainly in the mechanical construction.

A novel Ditching Machine, devised by Mr. Peter N. Fowler, of Smith's Mills, Ky., embodies seven new devices. In rear of the machine is a large wheel having a wide smooth-faced rim. Around this passes an endless chain of buckets formed of sharp edged steel bars. As these begin to rise at the lower side of the wheel, the soil within them is separated from the ground by the edge of the plate, which retains the material in the buckets as they pass upward.

Mr. John J. Smith, of Unionville, Mo., has patented a new Sulky Harrow, which adapts itself to the surface of the ground, however uneven said surface may be. Its parts may be separately or simultaneously raised from the ground in passing from place to place or to clear obstructions.

A new Grain Separator for Thrashing Machines, invented by Mr. James M. H. F. Shepler, has an improved straw carrier by which all the grain that passes over or through the separator is saved and returned to the grain elevator of the thrasher. Another device prevents the choking of the riddle and keeps the same perfectly clean around and below the stacker.

Mr. John F. F. Porter, of Booneville, Miss., has patented a new Fastener for Colters and Plow Standards. It may be applied to any kind of a plow, is not liable to break or get out of order, and holds the colter or standard firmly in place. The colter may be raised or lowered as desired.

Mr. Royal W. Barnard, of Fayette, Iowa, has devised a new Butter Worker. It is made in the shape of a foot, one portion of which is made flat for packing, and the other portion has flanged edges to scrape down the butter from the sides of the tank, and also to prevent the grinding of the grain of the butter by not permitting washing or rubbing of the same.

New Mechanical Inventions.

Messrs. Nimrod Gooder and Bernard Lavin, of Kansasville, Wis., have devised an improved Machine for Punching and Shearing, which enables cold punching, shearing, and similar work to be conveniently and efficiently performed. The new feature resides in the combination of a vertically guided and interchangeable tool with a pivoted actuating cam lever, and interchangeable equalizing plate acting on the top of the tool and with a pivoted spring engaging the lower part of the tool. By retracting the spring the tool may be easily changed.

An Improved Rock Drill has been invented by Mr. W. W. Gaines, of AuSable Forks, N. Y. Ordinarily the serpentine groove which gives motion to the slide valve in these machines is formed of a single segment of a cylinder made of hardened steel. In the present instance it is made of two separate pieces of metal. This is claimed to obviate the danger of the segments cracking and admits of their easy removal from the piston head when they wear out.

A new Car Coupling, devised by Mr. Christmas P. Byrd, of North Cambridge, Mass., has a releasing lever which extends down to the drawhead and throws back, by the concussion of the latter, trigger mechanism so as to release a sliding pin and drop the coupling pin into the drawhead and link for coupling. The coupling link is held in the required position for entering the opposite drawhead by a crank screw and head adjusted from below the drawhead.

A curious and novel device is a new system of Buoyant Propeller Wheels for Vessels invented by Mr. Laurence Brown, of Chatham, New Brunswick. A number of airtight polygonal drums are arranged to turn in bearings on a supporting frame, upon which frame the saloons, etc., are erected. By suitable machinery these drums are revolved and cause the propulsion of the entire structure, on the principle of an airtight float or box which, when upset or turned, will change position and move over to the side towards which it falls.

Mr. Ezekiel Delano, of Greenwich, Conn., has devised a new Addressing Machine, wherein devices are embodied for addressing papers and packages rapidly without the sticking of the label strip so as to clog the machine, and also for removing the papers or wrappers. The construction is very ingenious and well calculated to save time and labor.

Mr. Henry D. Rodgers, of New York city, is the inventor of the latest machine for making car conductors honest. It is a Fare Register, shaped something like a large watch and containing a bell and a moving strip of paper, which last passes from one spool upon another. On the paper are marked numbers indicating the number of fares received, each number being greater than that preceding by the sum of one fare. When the conductor pushes down a follower, the bell is sounded and the paper moved to the second spool. At the same time one of the numbers marked on it is perforated by a needle. The last number found punctured represents the total of fares taken. The device is of exceptional ingenuity, and is well calculated to check the thieving proclivities of even the most conscienceless of conductors.

Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

A New Dyestuff from Anthracene.

A mixture of glycerin and concentrated sulphuric acid reacts upon the dyestuffs derived from anthracene and produces new compounds, which likewise possess coloring properties. As yet only alizarine and mono-nitro-alizarine have been tested in this respect. By heating a mixture of 1 part of alizarine paste, 2 parts of white glycerin, and 2 parts sulphuric acid of 66° B., the liquid becomes rapidly dark brown, and a large quantity of gas is evolved containing sulphurous acid and acroleine. The temperature is kept for some time at 200° C. (392° Fah.), in order to accomplish a perfect conversion of all the alizarine. It is then allowed to cool, the product poured in a large quantity of water and filtered. The dark yellow, insoluble residue is washed several times with hot water, then taken up cold by a mixture of equal parts alcohol and water, in which the new dyestuffs dissolve. The shades of red and pink which they yield in dyeing are more yellowish than those of alizarine, the violets are more bluish, and the browns more reddish, while the blacks are also finer than with alizarine. With ammonia and carbonate of soda it yields an orange-red solution, while alizarine with alkali dyes purple. If alcohol is added to these solutions they become dicroitic, namely, in transmitted light red and by reflected light green. It reacts toward alum the same as alizarine, and also resembles it in its other physical properties, such as its reaction toward soap, acid liquids, chlorine, etc. With like treatment the mono-nitro-alizarine produces peculiar results. On treating the washing water with caustic soda, a dark indigo blue precipitate is thrown down, which is reduced by tin salt and caustic soda solution to a pink liquid, which becomes covered with a greenish blue lustre. The precipitate collected upon the filter consists of two different substances, which may be easily separated by a cold mixture of alcohol and water. The substance, easily soluble in this, dyes violet with alum mordants, bluish-black with strong iron mordant and a mixture of iron and alumina, and bluish grey with weak iron mordant. The other and less soluble substance dyes quite a fine black, a grey violet, and instead of red a pink, and for brown a catechu brown without any red admixture. Both dyes resist soap well, chlorine not so well, and are destroyed by strong acids.

Dyestuffs of the anthracene series are known already which produce a violet with alum mordant. One of these is obtained by the action of ammonia upon anthrapurpurine in closed vessels, and has been found by Perkin in crude alizarine. It seems to be identical with the purpuramid of Stenhouse. The other was put into the market about a year ago by Gauhe & Co., of Barmen, under the name of "anthraviolet," but possesses no special interest from an industrial point of view. According to N. Potier's investigations (*Soc. Ind. de Rouen*, Sept. and Oct., 1876), this anthraviolet dyes uneven and with difficulty, and the colors produced do not withstand either soap or chlorine

A dyestuff which yields a series of colors similar to those given by Campeachy wood, and which can replace them, specially by the very fugitive steam dyes, would be of special interest. Both of the dyes obtained from nitro-alizarine by the author seem to satisfy these conditions. As regards the constitution of these substances, the author thinks that in their production the molecule of glycerin takes part in the reaction, and therefore they may perhaps be regarded as glycerides. He reserves to himself the right to subject the other dyestuffs of the anthracene series, such as purpurine, isopurpurine, etc., as well as the non-dyeing members of the series, anthrachinone and nitro-anthrachinone, to the same treatment.—*Bulletin Société Chimique.*

Poison in the Oven.

Sixty-six persons living in the neighborhood of the Parc Monceau, Paris, were almost simultaneously seized with symptoms of lead poisoning. The attention of a sanitary association was directed to the epidemic and a long investigation was then undertaken as to the cause of so many disasters. The water, wine, and groceries used by the sufferers were found to be unimpeachable. It was discovered however that, with two exceptions, all the patients had bought their bread from the same baker, and as to the two exceptions they had unwittingly consumed bread in an eating house which was supplied by this baker. The baker himself and his assistants were more severely poisoned than the majority of their customers. This led to an examination of the stove, and the places that would come in contact with the outside of the bread, and it was then finally revealed that the baker burnt wood brought from old houses recently destroyed. It had constituted the wainscoating of the house and was covered with several layers of paint, which the heat converted into pulverized oxide of lead, and which naturally adhered to the moist surface of the loaves. In consequence of this discovery a regulation has been issued by the Prefecture of Police forbidding bakers to heat their ovens with wood derived from old houses.

Roumanian Amber.

One of the natural products of the Danubian Principalities is amber, which, however, differs totally from the German product found on the shores of the Baltic Sea. Both are the fossil resins of antediluvian trees, and agree in chemical composition, but differ in color. German amber is found only of light colors—yellow, white, and pink—while Roumanian amber is red, pink, brown, blue, green, and black. These colors are frequently found mixed in a single piece, and we also have lumps with silver colored veins and gold specks. On account of this variety of colors, the Roumanian amber is highly esteemed, and darker and more beautiful pieces are more costly than yellow amber, especially as they are more rare.

The Flight of Partridges.

To the Editor of the Scientific American:

Why is it that a covey of partridges cannot fly across the Mississippi river? At this point the river, during low water, is 1,200 yards wide, and 50½ feet above tide water. I have seen whole coveys go down into the water at 600 yards; though in hunting I have seen single birds go nearly as far to windward, until they rose to the height of 40 feet, and then follow the wind to cover. A covey started from immediately below Natchez, Miss. (an altitude of 260 feet) to fly across the river (at that point the river is 1,000 yards wide). They came "like shot," almost describing a "bee line" from the altitude to the bed. They were unable to perch, and what were not killed by striking the houses, were picked up exhausted (October, 1871). They hatch here during May. Frequently the nests are broken up in April; they then continue to lay and hatch and bring their broods out during August. In the case cited at Natchez, Miss., they were old birds, or rather of the May brood. I have seen coveys, during the first quarter, fly from drift pile to drift pile, and accomplish their migrations in that manner. Drift does not generally run in the Mississippi river, only from November to June. Their migrations are always westward.

Bartlett's Bayou, La. C. F. S.

Testing Wool by Entomological Knowledge.

A practical example of the value of a knowledge of entomology in connection with commercial transactions is afforded by M. Viret's suggestion in the *Journal de l' Agriculture*, of a simple method of detecting the admixture of inferior foreign wools with fleeces purporting to be of superior quality. In certain cases the identification of wool is easy, Russian and Buenos Ayres wool, for example, being readily distinguished from all others by the presence in the fleece of wild oats in the one instance and a peculiar variety of small thistle in the other. But in German, Spanish, Australian, and Morocco wools no such test is applicable. To distinguish between these, M. Viret recommends us to have recourse to entomology. The fleeces from each of these countries will be found to contain coleopterous insects peculiar to it, and by an examination of these the real source of a wool in fleece may be indisputably determined by whatever name a dishonest stapler may have placed it on the market.

BLACK FINISH FOR BRASS.—Optical and philosophical instruments made in France often have all their brass surfaces of a fine dead black color, very permanent and difficult to imitate. The following, obtained from a foreign source, is the process used by the French artisans: Make a strong solution of nitrate of silver in one dish and of nitrate of copper in another. Mix the two together and plunge the brass into it. Remove and heat the brass evenly until the required degree of dead blackness is obtained.

"IS THIS a foreign country?" asks an American journal. "Russian leather is made in Connecticut, Bordeaux wine is manufactured in California, French lace is woven in New York, Italian marble is dug in Kentucky, Marseilles linen is produced in Massachusetts, English cassimere is made in New Hampshire, Parian art work comes from a shop in Boston, Spanish mackerel are caught on the New Jersey coast, and Havana cigars are rolled out by the million in Chicago."

A MODE of producing tissues printed in relief, imitating gold, silver, and silk embroidery, has been patented by M. Coffin, in France. The pattern is printed on satin by means of engraved plates and with gilders' fatty mordant, and, afterwards, the fine parts of the design are printed with the same vehicle with the addition of gold or silver in powder.

THE quantity of herrings caught this year on the Danish coasts is said to be enormous, and it is hoped that these fish, which suddenly deserted the Danish waters about three hundred years ago, after having for centuries represented the chief source of revenue to the country, may now again direct their migrations to the Danish coast.

THE *Atlantic Monthly* does honor to one of its old contributors by issuing a life-size likeness of the Quaker poet, John Greenleaf Whittier, in commemoration of the anniversary of the poet's seventieth birthday. The lithograph was executed by Mr. J. E. Baker and is in the highest style of the art. It can be obtained from the publishers, H. O. Houghton & Co., Boston, on remitting the price, $1.00.

THE depositors in the savings banks of New York city are mostly poor working people, who are allowed five per cent interest; but they are required to deliver up a little more than half of their interest money in the shape of personal taxes to the extravagant Tammany Ring who run the city government, and have run up the annual personal tax, on savings bank deposits, to 2.65 per cent.

Business and Personal.

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

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister Mf. Optician, 49 Nassau St., N.Y.

For Sale.—The Patent of a new Water Elevator. Address P.O.Box 470, N.Y.city.

Who sells Hardy's Reclining Chair? Address Drawer E., Johnstown, Pa.

A German gentleman, of large experience, speaking the modern languages fluently, wishes to represent one or two best American firms at the Paris Exhibition. Address L. B. 1,000, Youngstown, O.

"Our Pet" Scroll Saw, Lathe, Anvil, Vise, Drill, and Grinder, $10; with tools and extras, $12. W.X.Stevens, East Brookfield, Mass.

Lansdell & Leng's Lever and Cam Gate Valves. Cheapest and best. Leng & Ogden, 212 Pearl St., N.Y.

Applicable as are the Varnishes and Japans of Hyatt & Co& and successful as they are with the artisan and manufacturer in coach, car, carriage, furniture, sewing machines, organs, and general machinery, in wood, iron and tin, their use is recommended by them for their color, with purity and durability. Send for circular and price list. Office 246 Grand St., N. Y.

For Sale, Exchange, or To Let.—Large Factory, with engine complete. Address P.O.Box 470, N.Y.city.

Root Blowers, No. 1, 2, and 4; also a No. 5 Sturtevant Blower—all suitable for cupola or forges—and a No. 6 Hot Blast Heater, in perfect order, at very low prices. Address Hill, Clarke & Co., Boston, Mass.

Bishop Stave-Sawing Machine for light work. Novelty Iron Works, Dubuque, Iowa, sole manufacturers. It makes the best stave, uses less timber, cuts with the grain, and makes 6,000 to 9,000 per day. We also build Barrel Machinery for "Slack Work," Gauge Lathes, etc. Send us your address for circulars.

Manufacturers of Lock Nuts will please send price and description to Box 23, West Troy, N.Y.

Wanted.—Light Second-hand T iron to lay 1¼ miles track. Send prices to Potsdam (N.Y.) Lumber Co.

The $5 Rifle advertised in this issue by Messrs. Turner & Ross, well known and reliable dealers, is really a great bargain, and it is sold for a great deal less than its actual cost. They fill orders promptly.

Wanted—Blowing Engine, large air, small steam cylinder. Address Vacuum Oil Co., Rochester, N. Y.

Noise-Quieting Nozzles for Locomotives, Steamboats, etc. T.Shaw, 915 Ridge Ave., Philadelphia, Pa.

Organ Blowing Hydraulic Engines; best and cheapest. Roosevelt, 40 W. 18th St., N. Y.

For New Illustrated Catalogue of Foot Lathes, Scroll Saws, Small Steam Engines and Amateur's Tools, send stamp to Chase & Woodman, Newark, N. J.

Shaw's Mercury Gauges, U. S. Standard of Pressure. 915 Ridge Ave., Philadelphia, Pa.

Shop Stoves. Crawford & McCrimmon, Brazil, Ind.

Bolt Forging Mach. & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Town & Village use, Comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Best and Cheapest Wagon Tire Upsetter, only $12. Circular free. H. W. Seaman & Co., Millport, N. Y.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Boulter's Superior Muffles, Assayers and Cupellers Portable Furnaces, Slides, Tile, Fire Brick and Fire Clay for sale. 1,609 North St., Philadelphia, Pa.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U.S.A.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Felt of every description for Manufacturers' purposes, especially adapted for Polishing, can be furnished in any thickness, size, or shape. Tingue, House & Co., Manufacturers. Salesroom, 69 Duane St., N. Y. Factory at Glenville, Conn.

To Millwrights and Parties in want of Engines, Boilers Shafting, Gearing, Pulleys, etc., upon receipt of specifications we will give you promptly bottom prices for same. B. W. Payne & Sons, Corning, N. Y.

Extraordinary Offers in New and Second-hand Pipe Organs. Prices $100 to $1,500. Roosevelt, 40 W 18th St., N.Y.

Kreider, Campbell & Co., 1060 Germantown Avenue, Philadelphia, Pa., Machinists and Steam Engine Builders, Millstone Manufacturers, Contractors for Mills for all kinds of Grinding. Estimates furnished.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Fine Taps and Dies for Jeweler's, Dentist's, and Machinist's use, in cases. Pratt & Whitney, Hartford, Ct.

To Clean Boiler Tubes—Use National Steel Tube Cleaner; tempered and strong. Chalmers Spence Co., N.Y.

Blake's Belt Studs. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years constant use prove them stronger and more durable than wrought iron. See advertisement, page 366.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Safety Linen Hose for factories, hotels, and stores, at lowest rates. Greene, Tweed & Co., 18 Park Place, N.Y.

Notes & Queries

(1) J. H. asks: Can you give us a rule to measure the height of a tree or other standing object near enough for practical purposes? A. Place a small mirror in a level position on the ground, at a little distance from the tree, and then step backward until you see the top of the tree reflected in the center of the mirror. Height of tree =

$$\frac{\text{Your height} \times \text{distance of tree from mirror.}}{\text{Your distance from mirror.}}$$

(2) F. C. H. says: 1. I have a boiler that has 22 square feet of heating surface, contains 20 gallons water up to water gauge, will evaporate 20 gallons of water per hour, with ordinary firing. What horse power is it? A. As we have frequently explained, there is no standard for measuring the power of the boiler, that is generally accepted. 2. I have seen men working in a foundry pass their finger through the melted iron as it ran from the cupola without receiving any burn whatever. Can you explain the philosophy of this experiment? A. The moisture on the skin is converted into vapor, which forms a protective covering. 3. How can the ordinary bars of cast iron (pig iron) be broken so as to be melted in a crucible or small cupola? How are very heavy masses of cast iron broken, such as cannons, heavy machinery, etc., to be remelted? A. Cast iron can be broken with blows from a heavy hammer. Dynamite has sometimes been used for large masses.

(3) J. A. M. asks: What is the method of setting the valves of the Corliss engine, and regulating the cut-off? A. Advance the eccentric until the valve has the proper lead, and then adjust the tripping arrangement by trial.

(4) A. W. asks: What is the best thing for making a person grow? A. Good food and good habits.

(5) L. M. C. asks: 1. What is steam packing? How is it constructed and used in the pistons of steam engines? A. It ordinarily consists of metallic rings, which are set out by the pressure of steam. 2. What course would you advise a young man twenty years of age to pursue in order to learn to be a competent steam engineer? A. He should pursue a course of instruction such as is given in our best technical schools.

(6) J. W. S. asks: 1. How much advantage has the best automatic governor cut-off engines over the best throttling engines? A. You will find some notes on the subject on p. 321, vol. 30, of the SCIENTIFIC AMERICAN. 2. Is a valve which cuts off and admits the steam better than two valves for doing the same, one riding on the back of the other? A. Generally the clearance will be somewhat less in the case of the former arrangement, and there will be less mechanism and fewer wearing parts.

(7) P. G. asks: Is there any tool giving the exact length of a circle, in drawing that circle? Would such a tool be of any practical use? A. We do not know of any such instrument. It would be of some use if simple and cheap.

(8) T. J. R. asks: 1. Would it not be a better plan if, in reducing the area of grate bars in burning screenings with a blower, instead of bricking up the sides of the furnace to reduce the center over the grate bars? A. This idea is practically carried out in the dead plates or coking plates that are usually fitted. 2. What is the rule for finding the flow of steam through a pipe into the atmosphere? A. You will find rules in the SCIENTIFIC AMERICAN, p. 113, vol. 29.

(9) A. G. says: I have a 5 horse power engine and a horizontal boiler about 4½ feet long. The boiler does not make steam fast enough. I want to burn coal dust to save fuel. Please tell me what is best to increase the draught, a blower, or shall I turn the exhaust in the firebox above the flues? Also what is best to keep the boiler from rusting? A. T.y exhausting into the stack. Paint your boiler to prevent rusting. There is a black varnish made from mineral oil that is largely used.

(10) F. C. J. says: I have a boat 16 feet long and 4 feet beam with an engine which has a 4 inch stroke and 2 inch bore. What sized boiler will I require and how many tubes? What is the greatest rate of speed I can make? A. Boiler 2 feet in diameter, 3 feet high, with from 50 to 60 square feet of heating surface. Probable speed, 5 miles an hour in smooth water.

(11) R. C. says: I have a 5 foot wheel that runs on the end of a shaft that is 18 inches long and 1⅛ thick; it runs a belt over a 10 inch pulley. I run the large wheel by hand. Can I gain speed and save labor by putting a small cogwheel on the shaft with a larger one over it with a crank to run it? What will be the size of cogwheels that I will have to have? A. We think the present arrangement is likely to be more effective than the one proposed. If you wish to have greater speed change the pulleys.

(12) E. I. O. Co. says: We have a 11 inch high pressure engine with about 2 feet stroke. In winter time we have great trouble in separating the sand, being so mixed up with the frost. If we could get warm water in our hutches it would be a great benefit to us? Can we condense the steam of the engine in our hutches and will it interfere with the power of the engine, and to what extent? A. By carrying the exhaust pipe into the water, and letting the steam escape through numerous small perforations, you can heat the water without producing back pressure, that is, if there is constant circulation. You can put the pipe as far down as you please by arranging the discharge as indicated.

(13) R. R. R. asks: How is the Atlantic cable repaired when broken in mid ocean, and how do they find the place where the break occurs? A. The calculation is based on the principle that a current of electricity, having two or more courses open to it, will divide itself; and the current on each course will be in exact proportion to the resistance of that course as compared with the others. When the cable is laid, the resistance of the entire length is measured, and from this is calculated the average resistance per mile. Now if a break occurs, the current will escape through the water, and the resistance of the cable will be again measured and compared with its previous resistance; this gives the figures of a proportion from which the distance, in miles, is calculated; this calculation is made at Newfoundland, and at "Heart's Content," and a mean of the two results is taken. Two vessels furnished with grapples sail over the place indicated until the two ends are found, when they are drawn up and well spliced.

(14) S. H. K. says: I have found a vegetable color for the hair which makes a very natural brown or black. As I have it, it is not a fast color. When applied to the hair it can be washed off, but will not rub off. What can be combined with it to make it a fast color, or what could be applied to the hair, after the color is on, to set it? A. This can only be determined by experiment. You may try solution of chloride of tin, tannin, sumac decoction, acetate of iron, and alumina, cream of tartar, etc., applied before or after, or mixed with the dyestuff.

(15) W. J. C. says: I have a telegraph line ½ mile long, stovepipe wire, with ground plates 30x36 inches; one in a well and the other buried in moist earth with its upper edge flush with the surface. How many cells gravity, 4½ x 4½ inches, will give a fair sound, using two common office sounders? A. Your ground connection is not sufficient, and will require about ten cup cells, unless the magnet wire on your sounders is very fine. Connect your ground wire at each end with the gas or water pipes.

(16) L. H. McF. says: I have seen bottles of oil and phosphorus prepared in such a way that when the cork is removed, admitting air, the contents of the bottle become luminous. Please inform me what kind of oil and phosphorus, and how to incorporate them to use? A. Heat the oil (olive oil) to about the temperature of boiling water (212° Fah.) and drop in the phosphorus in small pellets. Ordinary stick phosphorus is used—it dissolves in the hot oil.

(17) M. R. asks: What fulminating material is used in small cartridges? A. The fulminate of mercury is generally used. To prepare it, 1 oz. of mercury is dissolved by a gentle heat in 8¼ measured ozs. of nitric acid (of specific gravity 1·4), and the solution is poured into 10 measured ozs. of alcohol (specific gravity ·830); action soon ensues with the evolution of copious white fumes, and the fulminate is deposited in white crystalline grains, which are washed with cold water, and dried at a gentle heat. It explodes at a temperature of 390° Fah. by friction, percussion, and by contact with strong acids. For percussion caps and cartridge a little chlorate of potash, or more commonly niter, is added to the fulminate.

(18) I. F. D. asks: What metal will heat and cool the quickest? A. Pure cobalt, nickel and iron have the lowest specific heats.

Will ammonia act corrosively on copper or iron? A. On copper, yes; on iron, no.

Will a fluid continue to increase in pressure if confined in a vessel and kept at a degree or two above the boiling point? A. The pressure will remain constant as long as a uniform temperature is maintained.

(19) J. R. S. says: In order to remove sulphurous acid from an aqueous solution of gum, I find nothing available but carb. baryta, which is expensive. What is the cheapest method of removing the sulphurous acid from the solution? A. Use marble dust, as free as possible from magnesia carbonate.

(20) F. C. says: I have a pump in my well with lead pipe 16 feet long. Sometimes the water has a sweet metallic taste. How can I test the water in the well as to whether the lead is poisoning it? Will cistern water drawn through lead pipe be affected by the pipe? A. The water is very probably contaminated. To test this pass sulphuretted hydrogen gas through a sample of the recently drawn water for some time, and observe if a black precipitate is formed; if so, lead is present, and the water should not be used for drinking or cooking purposes. To make the sulphuretted hydrogen, place in a large bottle a few small pieces of protosulphide of iron, and cover them with sulphuric acid previously diluted with two parts of water. Perforate the stopper with a bent glass tube to conduct the gas as it is formed. Lead pipe is not suitable for the conduits of well or cistern water—tubes of wood or enameled iron pipes may be used instead.

(21) W. B. S. asks how to clean iron rust off window glass? A. Mix muriatic acid with an equal quantity of water, and apply this with a small cloth cushion to the spots.

(22) C. F. P. asks how to make and apply a black japan to small iron castings that will dry soon and become very hard and durable at a small cost? A. Apply a ground of asphaltum, 3 ozs.; boiled oil, 4 quarts; burnt umber, 3 ozs. Mix by heat and when cooling thin with turpentine. Lay on three coats, and between each dry the article in an oven heated from 250° to 300°. Lay on several coats of varnish, drying in an oven between each, then polish with powdered pumice and rub with oil.

How many and what numbers of SCIENTIFIC AMERICAN SUPPLEMENT contain the lessons on mechanical drawing? A. Professor MacCord's lessons on mechanical drawing are now published in collected book form. Price $2.50 in paper covers. Sent postpaid by Munn & Co.

(23) H. K. O. asks: What is the varnish composed of which is used upon brasswork to prevent its tarnishing? A. Mix equal quantities of Canada balsam with very clear spirits of turpentine until the whole is of the consistence of ordinary varnish. Apply in the usual way.

(24) W. G. asks for (1) a recipe for gilding brass by dipping in acids? A. The gold bath is composed of distilled water, 17 pints; pyrophosphate of soda, 28 ozs.; hydrocyanic acid of ¼ prussic acid, ½ of an oz.; crystallized perchloride of gold, ½ oz. The pyrophosphate is dissolved in 16 pints of water, heated, filtered, and cooled. The filtered solution of the gold chloride is added, and then the hydrocyanic acid, when the whole is raised nearly to the boiling point for use. Before entering the bath the articles should be passed through a solution of water 2½ gallons; nitrate of binoxide of mercury, ½ oz.; sulphuric acid, ½ oz. 2. And for the best lye in which to soak brass articles before dipping? A. Caustic potash dissolved in 10 times its weight of water.

(25) M. V. asks for a process of nickel plating without a battery? A. Into the plating vessel place a concentrated solution of zinc chloride. Dilute it with from 1 to 2 volumes of water and heat to boiling. Redissolve any precipitate with a few drops of hydrochloric acid. As much powdered zinc as can be taken on the point of a knife is then thrown in. Add nickel salt (chloride or sulphate) until the liquid is distinctly green. Then put in the articles previously well cleaned with some zinc fragments. Boil for 15 minutes when the nickel coating is finished.

(26) J. B. U. asks for a rule for calculating the number of bricks that it will take to construct a wall? A. Allow 7½ bricks per square foot to every 4 inches of thickness of wall. Thus a 14 inch thick wall will require 26¼ bricks per square foot.

(27) P. S. asks for the proper composition of fusible plugs, attached to crown sheets of steam boilers. Working pressure 70 lbs. per square inch. A. Equal parts of antimony, tin, and bismuth, melted and well mixed, make a very good safety plug. The melting point of this proportion is about 300° Fah., and this is about the temperature of steam at 70 lbs. per square inch. If you wish to carry a higher pressure, increase the proportion of tin.

(28) J. T. asks for a durable black ink to be made with nutgalls and copperas? A. Bruise 12 lbs. Aleppo nutgalls, boil in 6 gallons of soft water for 1 hour, adding water to replace that evaporated. Strain and boil the galls again in 4 gallons of water for ½ hour; strain and boil with 2½ gallons more water. Strain and mix the liquors. Add 4½ lbs. coarsely powdered copperas and 4 lbs. gum arabic in small pieces. Agitate until dissolved and filter through hair sieve. This will give about 12 gallons of fine durable ink.

(29) J. R. M., Jr., asks how gold and silver bronze powders are made? A. Gold bronze powder is made by melting together in a crucible over a clear fire equal parts of sulphur and white oxide of tin. Stir until they become a yellow flaky powder. Silver bronze powder is made by melting together 2 lbs. each of tin and bismuth, and adding 1 lb. of quicksilver. Pound all together into a powder.

(30) C. W. P. asks how to granulate copper in fine grain? A. Ladle the refined copper from the furnace into cold water.

(31) M. G. L. asks: How can I harden a wooden pulley? A. Boil for about 8 minutes in olive oil and allow it to dry.

(32) E. G. asks (1) for a silver bronze powder? A. Melt together 1 oz. each of bismuth and tin, then add 1 oz. quicksilver, cool and powder. 2. How can I make blue bronze on copper? A. Clean the metal, polish, and cover the surface with a fluid obtained by dissolving vermilion in a warm solution of soda, to which some caustic potash has been added.

(33) F. T. C. asks: What is the so-called "flash" used for coloring spirits? A. It consists of burnt sugar caramel, to which is added enough capsicum extract or essence of cayenne to give the liquor a fiery taste. It is commonly used in flavoring vile whiskey.

(34) M. T. L. asks for a recipe for liquid glue? A. Dissolve (with heat) 2 lbs. of glue in 1 quart of water, add 7 ozs. of nitric acid, and when cold, bottle. This is an excellent preparation to sell.

(35) E. P. asks for a varnish to smooth moulding patterns? A. Alcohol, 1 gallon; shellac, 1 lb., lamp or ivory black sufficient to color it.

(36) F. G. inquires how to make japanner's gold size? A. Melt 1 lb. of gum ammoniac, add 8 ozs. of boiled oil, and then 12 ozs. spirits of turpentine.

(37) P. T. asks for a good sizing for linen? A. Crystallized carbonate of soda, 1 part; white wax, 4 to 6 parts; stearine, 4 to 6 parts; pure white soap, 4 to 6 parts; Paris white, 20 parts; potato starch, 40 parts; wheat starch, 160 parts. Boil with sufficient water to form 1,600 parts altogether, adding if desired some ultramarine to counteract the yellow tint of the linen.

(38) J. A. B. asks: 1. What kind of a preparation do watch repairers use to give that fine polished appearance to the brass movements of a watch? A. For brass, Spanish whiting is mixed with clear rain water in the proportion of 2 lbs. to the gallon. Stir and let stand for a few minutes to allow the gritty portion to settle; decant off the water into another vessel and again allow it to stand. The settlings in the second vessel are mixed with jeweller's rouge and used for polishing. 2. What kind to the steel portions? A. Take a flat burnishing file, warm it and coat it lightly with beeswax. When cold wipe off as much of the wax as can readily be removed, and with the file polish the metal. This is said to be equal to the finest buff polish.

(39) C. J. A. asks for a recipe for a lacquer for polished or burnished copper, that will prevent it from tarnishing when handled? A. 1 gallon methylated spirits of wine, 5 ozs. of shellac, 4 ozs. of gum sandarac, and 1 oz. of gum elemi. Mix in a tin flask and expose to a gentle heat for a day or two, then strain off

and add ½ gallon of the spirit to the sediment and treat as before.

(40) J. S. M. says: I wish to paint on porcelain or earthenware. Shall I use water colors or oil? Also by what method is the finish obtained that causes it to withstand washing, etc.? A. The colors used are enamels mixed with turpentine. The china is glazed first and the enamel is burnt in, in a muffle. Prepared colors for painting on china can be purchased of large paint dealers. The burning in must be done by an experienced potter.

(41) J. H. M. asks how to make a gold solution for battery gilding, such as is used by carriage platers? A. You had better gild in the hot bath. The composition is crystallized phosphate of soda, 21 ozs.; bisulphite of soda, 3½ ozs.; pure cyanide of potassium, ½ oz.; pure gold, transformed into chloride, ½ oz.; distilled water, 2½ gallons. This is good for silver, bronze, and copper alloys. For wrought iron and steel the bath consists of distilled water, 2½ gallons, phosphate of soda, 17½ ozs.; bisulphate of soda, 4½ ozs.; pure cyanide of potassium, ½ oz.; gold (chloride) ½ oz. It is not necessary to mind the weight of the chloride so long as the proper amount of gold is dissolved in aqua regia.

(42) S. B. H. asks: 1. Are north, south, east, and west relative or absolute terms? A. Relative. 2. State the greatest distance that could be traveled in any direction. A. You might go around the world an indefinite number of times, always traveling in the same direction according to the compass.

(43) J. E. S. asks how bright crimson writing fluid is made? A. Powdered cochineal, 1 oz.; hot water, ½ pint. Digest, and when quite cold add ammonia 1 oz., diluted with 3 or 4 ozs. of water. Macerate for a few days and decant when clear.

(44) G. M. W. asks how to make a good article of yellow soap? A. Tallow and sal soda of each 1½ lbs.; resin, 56 lbs.; stone lime, 28 lbs.; palm oil, 8 ozs.; soft water, 28 gallons. Put soda lime and water into a kettle and boil, stirring well; then let it settle and pour off the lye. In another kettle melt the tallow, rosin, and palm oil, having it hot, the lye being also boiling hot. Mix altogether, stirring well, and the work is done.

(45) K. H. R. asks what laundrymen use use besides starch to give a smooth glossy appearance to starched goods? A. One tablespoonful of strong gum arabic solution to each pint of starch.

(46) C. S. R. says: 1. If I bore a piece of 2 inch round bar iron 7 inches long, lengthways through the center, with ¾ inch drill, and previously plug the ends of bore, what internal pressure will the tube resist? A. About 30,000 lbs. per square inch. 2. If I fill the tube with water before closing the ends, to what degree of temperature can it safely be heated without exploding? A. A very slight rise of temperature only would be required. 3. How can the odor of petroleum and kerosene be destroyed? A. There are several patented processes, one of which consists in the use of superheated steam.

(47) C. B. L. says: I have two flywheels, each 1,000 lbs., running at the rate of 50 revolutions per minute; one is 10 feet in diameter and the other is 20 feet in diameter. Which would exert the most controlling influence on an engine, and why? A. The larger wheel would be the most effective, because its actual energy depends on the angular velocity and moment of inertia, both of which increase when the radius is increased, other things being equal.

(48) E. C. H. says: 1. Of two engines less than 2 horse power, running at 300 revolutions, and steam pressure 80 lbs., one engine having stroke the same as diameter of cylinder, and the other having a stroke twice the diameter of cylinder, which uses steam most economically, both engines cutting off at ¾ stroke? If there is a difference, please explain. A. The long stroke engine would ordinarily be the more economical of the two, on account of the higher piston speed and the less percentage of clearance in general. 2. What should be the size of engine ports of a 4 x 4 engine running 300 revolutions, steam pressure 80 lbs., cutting off at ⅛ stroke? A. Port area ½ square inch at least.

(49) J. D. W. asks: What is the heating surface of a boiler 28 feet long, 42 inches in diameter, with five 8 inch flues? A. If the tubes are the whole length of the boiler, the heating surface is about 297 square feet.

(50) I. L. L. asks: What sized boat would be required for an engine 2 inch bore, 6 inch stroke, with an upright boiler 4 feet high and 2 feet in diameter and what sized screw? A. Boat 18 to 20 feet long, 5 feet beam. Propeller, 18 to 20 inches diameter, 3 feet pitch.

(51) E. A. B. asks: 1. What are ocean steam boilers made of? A. Wrought iron. 2. Are they upright and tubular? A. Horizontal tubular. 3. Are the driving engines horizontal or upright? A. Vertical generally, in merchant steamers.

(52) F. H. R. asks: Is the pressure of a steam gauge diminished if it be located 20 feet from the boiler, the boiler being three horse capacity? A. Ordinarily, no, if properly located.

(53) F. H. says: 1. Can you give me a rule to find out how much packing is necessary to cover a pipe 105 feet long, diameter of pipe 3 inches, with a covering 3 inches thick; the material weighing 4 lbs. to the square foot? A. Let d = diameter of pipe, in feet. D = diameter of packing, outside, in feet. L = length of pipe in feet. W = weight of packing per square foot. Total weight required = $3{\cdot}1416 \times \frac{d+D}{2} \times L \times W$.

What is meant by cold short iron? A. Iron that is brittle when cold.

(54) H. A. P. asks: 1. How can I ascertain the horse power of a punching machine, to which steam cannot be applied for the purpose? A. Some form of transmitting dynamometer must be employed. 2. What is the relative toughness of cast steel and the best of "charcoal" iron castings? A. If you refer to tensile strength, the steel is to cast iron about as 5 to 1. 3. What kind of iron is the toughest for heavy machine castings? A. Cast iron toughened by the admixture of wrought iron scrap.

(55) J. C. wants to know how to drive several tilt hammers off the same driving shafts at varying speeds? Each hammer must be independent of the others, and the speed easily and immediately alterable to suit the heat being worked. Hammer heads are about 4½ cwt. weight, so any suitable arrangement must be of a substantial character. Also what are the best kinds of bits and anvils, the present ones of chilled metal get soft in a very short time? A. Friction wheels or clutches will enable you to vary the speed at pleasure. The same thing can be accomplished by using a pair of continuous cones connected by a belt. Steel facings may be used for your anvils.

(56) W. T. B. asks: Are there any schools teaching mechanical engineering, and if so, where is the best one, considering expenses? A. There are so many schools of this character that we do not feel inclined to make a comparison. We give a partial list: Lehigh University, University of Pennsylvania, Rensselaer Polytechnic Institute, Massachusetts Institute of Technology, Yale College, Harvard University, Worcester Institute, Stevens Institute of Technology, University of Illinois.

(57) N. W. H. asks: Which of the two engines below noted will develop the greatest power? One is 8 inch cylinder, 12 inch stroke, 100 revolutions with 30 lbs. boiler pressure. The other is 4 inch cylinder, 6 inch stroke, 175 revolutions, with 60 lbs. boiler pressure. Both are the common slide valve type, and both cut off at ¾ stroke. A. Probably the first would develop about twice as much power as the second.

(58) A. C. asks: What power can be got from a current wheel? The channel is 50 feet wide and 24 inches deep, with a fall of 24 inches in forty rods. I think of making a wheel 10 feet in diameter and 20 feet long, with 16 paddles. A. With a well designed wheel you may realize about 40 per cent of the effect of the water. This effect in foot lbs. per second = [lbs. of water passing the wheel per second × (velocity of water in feet per second)²] ÷ 64·4.

(59) W. F. S. asks if moonshine has the same effect on fish to spoil them as sunshine? A. The influence of the moon is restricted to lovers, dogs, and the tides.

In our last week's issue the answer to No. 22 of the inquiry column, 3,300 should be 33,000.

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

M. S.—It is zinc blende, and of good quality. Judging from the sample, this ore should yield 40 per cent of zinc. It contains cadmium.—E. A. S.—The substance cannot economically be purified as suggested. If finely ground and weathered for some time, it may answer some of the purposes of whiting. This could best be determined by comparative tests.—A. B. F.—No. 1 is principally carbonate of lead. No. 2 contains much more mineral impurities than No. 1; but both contain enough lead to poison the sugar if, as we understand you, they remain together. This should be known at once.

COMMUNICATIONS RECEIVED.

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

On the Tides. By U. H.
On Petroleum. By W. S. R.
On a New Galvanic Battery. By E. G. A.
On Matter. By W. B.
On Mica Bronze. By R. S. V.

HINTS TO CORRESPONDENTS.

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

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

Who makes Hyatt's patent sidewalk tiling?
Who sells grape sugar?
Who makes tile machinery?

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

October 30, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertising device, A. H. Dean 196,639
Animal trap, J. C. Ambrose 196,549
Annunciator, automatic time table, L. Dart 196,637
Arithmetic, teaching, R. W. Kavanaugh 196,583
Baby-walker, J. P. Wisk 196,560
Bale tie, J. W. Petty 196,699
Barrel hoop, L. Reed (r) 7,932
Bed bottom, Read & Howell 196,701
Bed bottom, spring, J. P. Allison 196,618
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Vehicle axle, A. K. Stone 196,719
Vehicle axles, splicing bar for, I. Arthur 196,620
Vehicle spring brace, M. Newton 196,536
Ventilating passage, regulator for, H. M. Lane 196,678
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Well boring apparatus, C. B. Hewitt 196,526
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Windmill, Gray & Knox 196,524
Window screen, J. S. Wilson 196,543

DESIGNS PATENTED.

10,286 and 10,287.—CASSIMERES.—A. Carmichel, Westerly R. I.
10,288.—ORNAMENTAL SCROLL WORK FOR JEWELRY.—L. Heckmann, Plainville, Mass.
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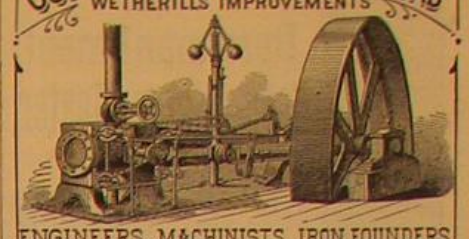
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V. MISCELLANEOUS.—A Bill to Amend the Statutes in Relation to Patents, and for other purposes. Brought before the United States Senate by Mr. Wadleigh, read twice, and referred to the Committee on Patents.

VI. CHESS RECORD.—Biographical Sketch of Miron J. Hazeltine, with Portrait.—The Clipper Problem Tourneys.—Prize Problem by J. M. BROWN.—Prize Problem by JAMES PATTERSON.—Initial Problem by DR. C. C. MOORE.—Game between LICHTENHEIN and MONTGOMERY.—Solutions to Problems.—Chess Problems.

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AMENDING (?) THE PATENT LAWS.

Senator Wadleigh's bill providing for amendments in the United States Patent Laws has been read twice and is now under the consideration of the Senate Committee on Patents. An abstract of the provisions is given elsewhere in this issue, and the bill in its entirety is published in the current number (No. 102) of the SCIENTIFIC AMERICAN SUPPLEMENT, in order that our readers may be enabled to give it thorough and critical examination. Its effect is upon future patentees, and not upon those already in possession of patents.

Our objections to this measure are founded, first, upon certain broad general principles which courts have held to be, and which plainly are, the true basis of our patent system; and second, upon certain specific reasons noted hereafter. The object of our patent laws is to benefit the community. They induce people to invent, so that the inventions produced may, by ultimately becoming public property, add to the knowledge, welfare, and comfort of the nation. The inducement offered is the securing to the inventor of an exclusive privilege in and to his production for seventeen years. While this privilege is a species of indefensible monopoly *per se*, it is nevertheless just and expedient in view of the ends accomplished, and this more especially as the period over which the inventor enjoys it is wholly inconsiderable in view of the advantages which it confers upon the public forever afterward. Now, if this privilege is to be reduced in value, through becoming hampered with unwise restrictions as to how the inventor shall enjoy it, then, the stimulus to invention being lessened, it follows that new and useful ideas will be more rarely produced, and thus the community will be the loser.

Our more specific objections to the bill are that is framed in the interest of a combination of railroad companies. About a hundred and thirty of these corporations some time ago organized an association for mutual protection and combined action in patent matters, and this is now devoting its energies to pushing through Congress the Wadleigh bill. As it is at present, the railway companies are ready enough to use good patented inventions, but about the only good reason which they recognize for paying an inventor royalty or damages is a certificate from their counsel to the effect that they cannot avoid doing so. It is almost needless to add that in the maintenance of protracted suits, etc., wealthy associations already have great advantages over the individual inventor; and if the latter is still further to be hampered, it may soon come to be said that his right is a deception and resides not in him, but virtually in any powerful combination which chooses to pirate it; and this is precisely the state of affairs which the railway companies are seeking to bring about.

The bill being before the Committee on Patents in the Senate, that body is hearing argument concerning it. Inventors should oppose it with all their influence, and we counsel them to go, or send representatives, or even lay protests or letters before the Committee, setting forth the disadvantages. Nor should the active opposition be restricted only to inventors. We have shown how the measure is likely to affect the whole country. It is therefore to the interest of every one who has the progress of the nation, in invention, discovery and science, at heart to lend his aid to prevent its becoming law.

CURIOSITIES OF SUICIDE.

The latest report of the Criminal Administration of France contains a very curious series of statistics relative to the suicides committed in that country in the year 1874. It appears that during that period 5,617 persons killed themselves, and that this total is greater than had ever before been reported. Of these unfortunates 79 per cent were men and 21 per cent women. Of 105 suicides the ages could not be determined, but of the remaining 5,512, 29 were under sixteen years of age, 193 between sixteen and twenty-one, 1,477 between twenty-one and forty, 2,214 between forty and sixty, and 1,590 over the last mentioned age. Leaving out those who committed the fatal act while laboring under mental disorders, in all 1,622, it is interesting to compare the condition of the suicides with the cause which impelled them to make away with themselves. How prolific a source of suicide unhappiness in the marriage relation is, is indicated by the fact that 48 per cent of the total were married people, and that out of 5,136 suicides, regarding which authentic particulars were obtained, 701 killed themselves because of family troubles. It will also be noted that the greater number of suicides were people past the prime of life, indicating that dissatisfaction with a wasted or unsuccessful existence determined their putting an end to it. This is further substantiated by the fact that out of the 5,136, 652 are known to have killed themselves because of reverses in fortune.

Seven hundred and ninety-eight people died to avoid physical suffering, and 489 because of various unclassified troubles. The fact that out of the 815 who were brought to self-destruction by dissipation, 572 owed their misery to drunkenness, is in itself a powerful temperance lecture. It is not easy to understand why spring and summer were the seasons in which most suicides occurred. The percentages are 23 for winter, 19 for autumn, 31 for spring, and 27 for summer. This would seem to negative the statement which has been made that most cases of self-murder occur during gloomy weather, which aids in depressing the spirits, for certainly there are more dark days in winter than in summer and fall. Again, it might be supposed that the privations incident to winter would lend an especial impulse toward the crime. As to the mode of death chosen, more than seven tenths perferred either strangulation (2,472) or drowning (1,514), showing that, while the suicides were willing to throw away their lives, they probably shrank from any mode of so doing which involved mutilation of their bodies.

A COMMON AILMENT.—MALARIAL POISONING.

We give in our this week's SUPPLEMENT—number 102—a full report of a very interesting clinical lecture, lately delivered by Professor Alfred L. Loomis, M.D., before the class of the University Medical College, this city, on Malarial Poisoning. According to Professor Loomis the effects of malarial poison are manifested in a surprising variety of forms and symptoms; so numerous and various, in fact, that they cannot be tabulated. They embrace enlargement of the spleen, neuralgias of different forms, that may or may not be periodical; dyspeptic troubles which cannot be relieved by dyspeptic remedies; headaches that are often treated as cerebral diseases; confusions of mind; staggering gaits; loss of power in portions of the body: impairment of mental faculties; inability to do work of any kind; not sick enough to go to bed, but too ill and habitually too tired to perform anything that requires the least exertion; shortness of breath; rapid, weak, irregular pulse; sleepless nights, etc. The first step toward cure is removal from the malarial locality; then only may the proper medicines be expected to prove beneficial. The infection appears to be far more widely spread than is commonly supposed; and all who have ailments that fall within the category here mentioned, will do well to read the excellent lecture.

NOTES OF PATENT DECISIONS OF THE COURTS.

Eppinger brought suit against Richey *et al.*, to restrain the infringement of his letters patent of June 17, 1873, for bunch or plug tobacco. The defendants answered, admitting the infringement but denying novelty and patentability of the claimed invention. In order that our readers may understand the case, it is necessary for them to bear in mind that licorice or some other moist and sweet substance is used in the manufacture of plug or bunch chewing tobacco, in order to impart moisture and sweetness to the manufactured article. The preservation of these two qualities is greatly desired by the consumer. When tobacco is thus prepared there is danger that the moist tobacco, if exposed to the air, will ferment, or will mould and "dry-rot." It is, therefore, important to make the plug or bunch as compact as possible, in order to preserve moisture and prevent mould. Before the date of Eppinger's invention, this kind of chewing tobacco was made by enclosing strands of sweetened "filler" tobacco in a binder. The wrapped tobacco was then spun upon a wheel, or twirled or rolled by hand into a roll, and, after being incased in a wrapper, was coiled and packed for market; or was subjected to extreme heat, and afterwards to pressure, before being put up in packages. Moisture was removed by this "hot-house" process, and thus danger of fermentation was obviated, but the quality of the tobacco was made inferior Another method of manufacture was by incasing the sweetened filler strands in an unsweetened binder, and also in a wrapper. The rope was then bent and braided, and the two ends of the braid were fastened by a cap of wrapper tobacco. The braids were subjected to sidewise pressure, but could not be subjected to pressure endwise, in consequence of their shape, and therefore were not compressed sufficiently to exclude the air, and the tobacco was liable to become mouldy. Each braid soon became quite dry in the pocket of the consumer, and lost its flavor.

Eppinger's method is to envelope the "filler" tobacco, treated in the usual way, in a "binder," which is a brighter and larger leaf, and around the binder he wraps what is called a "bright wrapper leaf," which is used in its natural condition without treatment. The rope thus formed is, in fact, a long flexible cigar, with a sweetened filler. This rope or strand is then coiled into a bunch around a central core, one end of the rope, either single or doubled, serving for the core. Several of these bunches are placed on their ends in a strong receptacle, of suitable shape, and a follower is then forced down with great pressure upon them. After about twenty minutes the follower is removed and the bunches are taken out and replaced in the same receptacle on their sides, and side by side, and pressed again in like manner. The claim of Eppinger's patent is for: "Plug or bunch tobacco made as herein described, the same consisting of a rope or strand composed of a sweetened or prepared filler inclosed in a binder, in turn enveloped in a wrapper, the said rope being coiled around a central core, forming a continuous part of the rope, and the bunch thus made being subjected to a pressure, as and for the purposes set forth."

The advantages of Eppinger's method are very marked. The moisture of the tobacco is preserved. Air and dampness are excluded by the compactness into which the tobacco is pressed. The tobacco, so put up, can be shipped to warm or damp climates without liability to detericrate by mould, and a single coil can be carried in the pocket of the consumer without becoming dry or friable.

The utility of the patented article was clearly proved. The evidence showed that it had had a very large sale, and had commanded a much higher price than the same quality of tobacco when put up in any other form.

The novelty of the invention was also clearly proved. The patented article manifestly differed from the ordinary spun or rolled plug tobacco, in this, that in such tobacco the filler and binder were rolled together, while in the patented article the binder simply encircled the filler. "Twist"

or "braid" tobacco was made in the same manner as the patented article was made—by encircling the sweetened filler with two separate wrappings of unsweetened tobacco—but the twist tobacco was simply braided and subjected to lateral pressure. Each plug was a flat braid, into the interstices of which air freely entered; and having a comparatively thin and flat surface, the plug could not be made compact by endwise pressure.

The important question in the case was as to the patentability of the invention. A rope of strands of sweetened filler, inclosed in a binder, which, in turn, was enveloped in a wrapper, antedated the patent. Plug tobacco had always been coiled and braided in various forms, and had been subjected to pressure. The peculiarity of the invention was, therefore, in the form and shape of the coil.

The argument on behalf of the defendants was that the combination filler, binder, and wrapper was old, which was true; that coiling or twisting a moist rope of tobacco had always been practised, which was true; and that subjecting a coiled rope of sweet tobacco to pressure was old, which was also true; and that the particular form of the coil was a matter of fancy, and that the form of the coil could not involve the exercise of the inventive faculty. This was the precise question at issue. Could any particular method of coiling be the subject of a valid patent?

The court, in sustaining Eppinger's patent, answers this question in the affirmative. It holds that the article of plug tobacco had been long in use, and in constant demand; that, as it had been prepared for market previous to Eppinger's invention, it had been liable to spoil in warm and damp weather, and to grow mouldy in any temperature; that no remedy was found for these evils until Eppinger's invention was made; and that it was manifest from the length of time during which the tobacco had been manufactured, from the constant demand for it, and from the well known evils to overcome, that the inventive faculty must have been brought into exercise, or else that mechanical skill would long since have avoided any danger of fermentation or mould; that, however simple Eppinger's change in the method of manufacture apparently may have been, yet it was a change which required invention for its accomplishment; and that the improvement resulting from the changed method of manufacture had been so great that the article which was produced was, in the meaning of the patent acts, a new and useful article of manufacture.

THE PROPOSED AMENDMENTS TO THE PATENT LAWS.

We give below an abstract of the new patent bill which has been introduced into the Senate by Mr. Wadleigh.

The first section enacts that from and after the passage of the act no profits or damages in any suit for infringement of a patent shall be recovered which shall have accrued more than four years next preceding the commencement of such suit, and that all rights of action at present existing must be sued for within four years thereafter. Under this section, if there are a hundred infringers of a patent, a hundred suits must be brought at once to fully protect it; or if an eastern man has a patent, and some one in the extreme west wishes to manufacture the patented article, he may do so for many years before his operations are discovered, and the owner of the infringed patent has no right to recover any damages accruing to him from the infringement that occurred more than four years before suit is brought.

Under the second section a license fee is to be the measure of damages which a patentee may recover from infringers, provided any such license fee has been established; but if not, where from the nature of the invention it *can be made to appear* to be for the interest of the patentee that other persons should use the same, the court or jury shall determine the damages from the evidence, and in such case no account of profit or savings is to be allowed. Where profits are to be taken into consideration, the defendant is not to be charged with any saving he may have made by infringing a patent, unless it can be shown that he has made money by his business. Where he acknowledges that profits have accrued from his infringement, the court is to determine what proportion of the profit is due to the said invention and what to the other elements from which such profit was derived, and the proportion due to the invention is to be the measure of profit recovered; but if said profits shall be found to be in *excess of the injury* done by the infringement, the court is to diminish the amount to such an extent as may be just and reasonable. This last clause appears to be open to the interpretation that, if the defendant can prove that from want of means or otherwise the patentee was in such a position as to be unable to use his invention, and was not therefore actually *injured* by the infringement, notwithstanding the infringer may have made an immense profit from the use of it, unless it can be shown that the inventor actually suffered great injury, he is to be cut down in the profits to the amount of injury he has suffered.

Section 6 has a clause to the effect that no machine or other article made prior to the surrender and reissue of a patent which did not infringe such surrendered patent, shall be held to be an infringement of the new claims of the reissued patent.

Section 9 allows infringers, where a patentee does not bring suit immediately he has knowledge of infringement, to bring a bill in equity to declare such infringed patent void for any of the causes which by law may render the same invalid. So that in case a patentee is too poor to immediately bring a suit against a wealthy infringer of his patent, said infringer may bring suit to declare it invalid; and in nine cases out of ten where the owners are too poor to employ good counsel to protect their rights, perfectly valid patents would be declared void under such circumstances.

Section 10 is to compel patentees to bring suits to enforce their rights, if an infringer demands that a suit be brought no matter whether the patentees have means to bring such suits or not, under the penalty of being enjoined from ever prosecuting such infringer at any time thereafter.

Section 11 is an imitation of the English law in the matter of fees, as it requires that a patentee shall pay fifty dollars on or before the first day of January after the expiration of four years from the date of the patent, and one hundred dollars on or before the first day of January next after the expiration of the ninth year of the patent. In default of either of these payments, the patent is to expire on the 1st day of April next thereafter, and during that month the Commissioner of Patents is to publish a list of the patents that have expired for the non-payment of these extortionate fees. In view of the fact that there is now in the Treasury of the United States over a million of dollars wrung from poor inventors in the shape of unnecessarily high patent fees, we think comment on this section entirely needless.

HOW TO TRUE UP A CRANK PIN.

A correspondent asks: "How can I true up my crank pin? I do not think it is true, because it appears to pound at two opposite parts of the stroke, and if I tighten up the brasses enough to take the pound out they get hot. I cannot find anything on the subject in the books."

One of the most prevalent faults of construction in stationary engines is a slight want of truth in the crank pin, and the result is just such as our correspondent has described. The cause may lie in either of three things, first, the two holes in the crank not being true, one with the other; second, leaving too much for the shrinkage of the large hole of the crank upon the shaft; and third, not properly fitting the key to its seating. If in boring the holes the same back of the crank, whether planed true or not, and although set as true as practicable the holes will be out of true, one with the other, to twice the amount that the chuck plate of the lathe may be out of true and twice the amount that the casting may alter in form from having its surface skin removed, the crank pin hole should be bored with the face which was turned up when the large hole was bored clamped to the face plate.

We may next consider the amount of shrinkage. If it is excessive, the metal must give way in the cooling process, and will yield the most where the metal is the weakest, throwing the crank pin end out of true. The proper amount to allow upon a crank of any size less than about 7 inches is just such as can plainly be perceived by setting the inside callipers, or a wire gauge, to touch very lightly the bore of the hole. The outside callipers or gauge having a barely perceptible contact, daylight should be just plainly visible between the gauge and the wire or inside callipers. Rules are given in books for the proper amount of allowance, but it is expressed in decimal parts of an inch, running to three places of decimals, and the machinist has neither inside nor outside callipers which will measure determinately such large sizes to such minute fractions. For steel tyres upon locomotives and other wheels, in which the amount allowed for contraction is very important, the heavy duty causing the tyres to break from the strain due to too much contractive tension, the following device has been employed: A piece of steel, say 8 inches long and an inch wide, is filed as thin at one end as the least amount of contraction and a little thicker at the other end than the greatest amount of contraction required upon such sizes of work as the gauge or wedge is intended to be used for. Upon the face of the wedge is marked a series of lines running across it at places where the thickness of the wedge represents the proper amount of contraction for the diameter which is marked upon each line. All, then, that the operator has to do is to find upon the gauge the line which is marked with the diameter of the wheel and to then set his wire gauge to fit the male gage or callipers with the wedge interposed at one end, the wedge having just contact with the two when inserted up to the line. This is a very accurate method, and is to be commended for the ease with which it can be applied. We now come to shrinking the crank on to the shaft. For this purpose care should be taken to heat the crank slightly more on the thick than on the thin side, and to make it to a very low red heat indeed—in fact, a just perceptible red heat is best. The crank should lie, while cooling, with the crank pin end vertically beneath the shaft, so that its weight may not tend to warp the crank in cooling, as it would do if lying horizontally.

In fitting the key it should not be driven in tight, because it is apt to spring and show unnatural bearing marks. Towards the finishing process it should be drawfiled, to ease the bearing marks, lengthwise, as that will make it drive easier and smoother. If the key is not fitted to bear exactly even all over the driving, it may spring the crank out of true.

If these instructions are carefully followed the job will be a true one, and there will be no possibility of the crank pin causing a pound in the engine. To remedy a pound in an engine we may proceed as follows: To test the truth of the crank pin we attach the crank pin end of the connecting rod in its place with the brasses and key properly adjusted. The other end of the connecting rod should have the brasses and key in place but should not be attached to the wrist pin, or gudgeon, as it is more properly termed. We now place the crank pin at one end of its throw and lower the connecting rod at the other end into the wrist pin bearing and note if the faces of the brasses fall, without the rod being sprung sideways, exactly true into the wrist pin flanges. We perform this testing operation with the crank pin at the four quarters of its revolution, moving the crosshead to the necessary position in each case. And it is obvious that if the crank pin is true the other end of the connecting rod will fall exactly true into the wrist pin bearing; but suppose that when the crank pin is on one dead center the connecting rod brass flanges fall outside, and when it is on the other dead center it falls inside of the wrist pin bearing, it proves that the crank pin does not stand true. If when the crank pin is on the dead center nearest to the cylinder the brass flange falls inside the wrist pin, the outer end of the crank pin inclines towards the cylinder, and *vice versa*, if the brass flange falls outside the wrist pin bearing, the outer end of the crank pin must incline away from the cylinder. Here it may be noted that if the main shaft is not at a right angle to the center line of the bore of the cylinder, the connecting rod applied as above will not fall into the wrist pin bearing; but in this case the deviation of the wrist pin brasses from the wrist pin journal will be all inside or outside of the wrist pin journal, hence the operation of testing the truth of the crank pin will at the same time test the lining of the main shaft.

To proceed, then, having gone through the above operation and thus discovered in what direction the crank pin is out of true, we note how much it was out of true, which may be ascertained as follows: When it is found that the flange of the connecting rod brass does not fall into the wrist pin bearing, we mark even with face of that flange a mark upon the crosshead, and moving the crank to the opposite point in its revolution we mark another similar line, and the sum of the two distances is the amount of the want of truth at that end of the rod. To find how much that is in the length of the crank pin, we divide the length of the crank pin journal into the length of the connecting rod, measured from center to center of the bore of the brasses; the sum thus obtained we divide into the amount first obtained, and the result will be the amount the crank pin is out of line. Now, suppose the amount thus obtained is the $\frac{1}{64}$ of an inch, and that the crank pin when on the dead center nearest to the cylinder stands so that the center line of its length points toward the center of the main shaft at the flywheel end. We take a pair of callipers, set them to a diameter $\frac{1}{64}$ inch less than that of the crank pin, and file upon the crank pin journal, at its outer end, a flat place of sufficient depth as to make the callipers just gauge correctly. This flat place must get shallower as it approaches the other end of the journal, until at the extreme of the other end it runs out, leaving the surface intact. We next file a similar flat place upon the inside end of the length of the crank pin journal, but on the opposite side of the diameter of the crank pin, that is at the end of the crank pin journal nearest to the crank and on that part of the perimeter nearest to the crank shaft center; this second flat place must be filed at that end enough to allow the callipers to gauge correctly at that end, and must disappear at the other end of the journal. Thus we have obtained two diametrically opposite flat places that are true with the center line of the length of the main shaft, and we may now file two more flat places on the crank pin journal, the faces of the four forming a square. The last two, however, must be filed to an equal amount from end to end of the journal, and equally deep on each side, until the callipers will gauge them correctly. This being done, we file up the protruding parts of the journal until one of the brasses rubbed upon the journal will mark evenly all round, and the flat places are just brought to a bearing, and the job will be complete. It is necessary to connect the rod again and go through the testing process the same as at first, to be sure that all is right.

J. R.

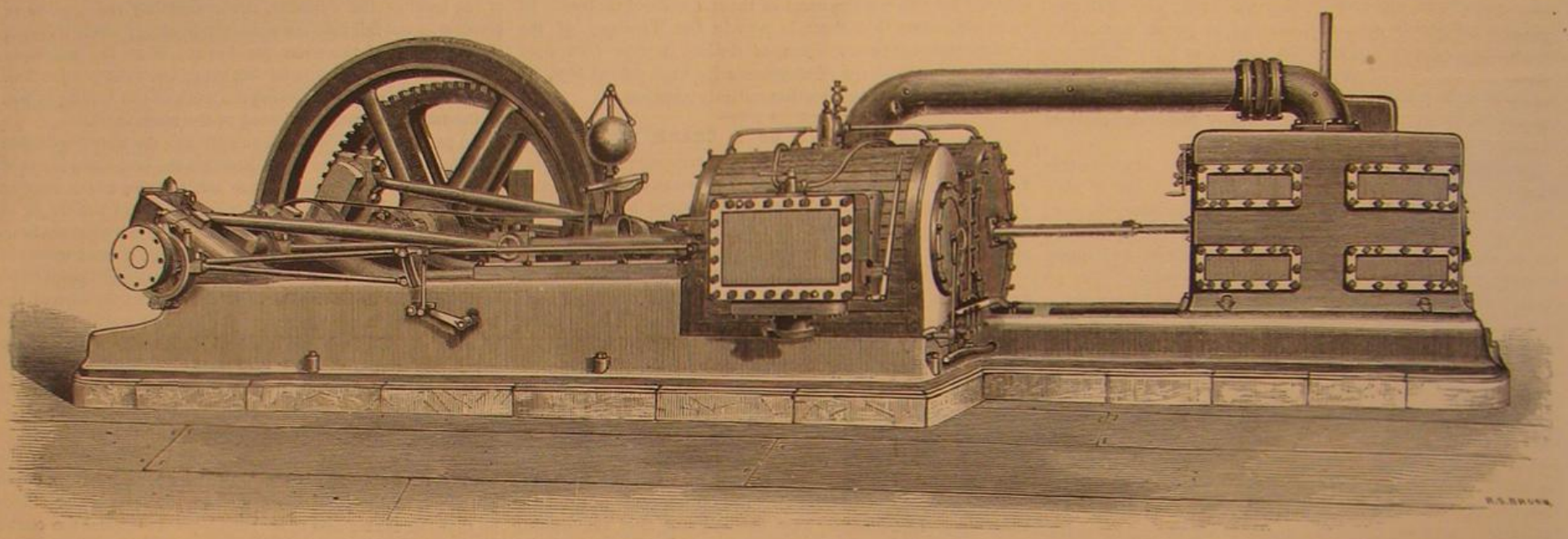
MORE NEWS FROM THE SUN.

We noted recently the fact of Dr. Janssen having obtained some exceedingly large and fine photographs of the sun, and that it was probable that by means of the facility which these afforded for observing the solar surface, new deductions concerning the nature of the latter would probably be reached. Dr. Janssen's photographs are some 15 inches in diameter, and show details of the mottling or willow leaf on the sun of less than 1 second of arc. By examining these points, Dr. Janssen has recently found that the surface of the photosphere has not a constitution uniform in all its parts, but that it is divided into a series of figures more or less distant from each other and presenting a peculiar constitution. They have contours more or less rounded, often very rectilinear, and resembling polygons. Their dimensions are variable, and they sometimes attain a minute or more in diameter. In describing the figures in *Nature*, Mr. J. Norman Lockyer says, that "while in the intervals between them the grains are clear, though of variable size, in the interior the grains are as if half effaced; for the most part indeed, they have disappeared to make way for trains of matter which have replaced the granulation. Everything indicates that in these spaces, as in the penumbræ of spots, the photospheric matter is submitted to violent movements, which have confused the granular elements.

Mr. Lockyer considers the discovery as confirmatory of his opinion that sun spots are an index and not a measure of solar activity; and that their absence indicates a reduction, not a cessation, of the sun's energy. Dr. Janssen also points out that this fact throws light upon the forms of solar activity, and shows that that activity, in the photosphere, is always very great, although no spot appears on its surface.

HORIZONTAL COMPOUND ENGINE.

We take from *The Engineer* the annexed engravings of a horizontal compound engine of excellent design, manufactured by the Avonside Engine Company, Bristol. The engine was one of the objects which secured the interested notice of many of those who visited the company's works during the recent meeting of the Institution of Mechanical Engineers in Bristol. It is provided with automatic expansion gear in the form of a link, operated by the governors, which are of Widmark's split ball type, and which are very sensitive in action. The crank shaft ends at a short distance from each bearing with a face coupling disk, the short piece carrying the fly wheel being fixed to a similar coupling disk to that seen in the upper view. It will be particularly noticed that the wall box supporting the fly wheel and main spur wheel bearing is of such form as to be capable of also embracing the pinion bearing. The two wheels are thus maintained with the proper distance between their centers, and the connection of the two bearings, thus in one wall box, makes a sound job not easily otherwise obtainable.



HORIZONTAL COMPOUND ENGINE.

The principal dimensions of the engine are as follows: Diameter of high pressure cylinder, 18 inches; diameter of low pressure cylinder, 34 inches; stroke of pistons, 3 feet; diameter of air pump, 9½ inches; stroke of air pump, 3 feet; diameter cold water pump, 6 inches; stroke cold water pump, 3 feet; double acting; working pressure intended, 60 lbs.; number of revolutions, 50 per minute.

Phosphate of Potash a Cure for Scurvy.

It is well known that an exclusive diet of salt provisions endangers scurvy, and that at sea or on expeditions where only such provisions can be carried over long periods of time, their injurious effects are prevented by drinking lime juice. Professor Robert Galloway has recently advanced the suggestion that phosphate of potash is a much better preventative of the malady, and at the same time that salt increases the nutritiveness of salted meat, so that he proposes in all cases where such meat is consumed that the phosphate be used as a condiment, the same as chloride of sodium is now employed. Professor Galloway points out that of the different substances which enter into the formation and constitution of the meat some are removed by the immersion of the same in brine, and the principal material thus extracted is phosphate of potash. It is evident, therefore, that if this salt was indispensable to the formation of fresh meat its absence in salt meat must be prejudicial.

The use of phosphate of potash as table salt is strictly analogous to the present employment of chloride of sodium, the latter being consumed and the taste requiring its consumption in order that it may be supplied as needed for the normal formation of the blood. Now, as salt meat lacks potash salts, and as the latter are useful in the formation of the fluids in the meat, it is as logical to use this substance as it is to use common salt. Furthermore, MM. Pasteur and Mayer have demonstrated the importance of phosphate of potash in nutrition, and have shown it to be indispensable to the development of the beer yeast cellule. Professor Galloway also considers that the beneficial effect of lime juice as a preventative of scurvy is due to the presence of potash and phosphates in it. If his views are correct, the discovery is of considerable importance, as phosphate of potash in the small amount needed can be transported with much greater facility and obtained more inexpensively than lime juice, while at the same time it increases the nutritive value of the cheap salt provisions now largely consumed by the poor.

Poisoning by Burning Gas.

The *Lancet* urges the inconvenience, and even danger, of the ordinary burning gas. It says:

"To have our rooms pleasantly illuminated with gas is to undergo a process of poisoning, the more disastrous because, instead of directly producing the characteristic symptoms of defective blood oxygenation, the gas-polluted atmosphere insidiously lowers the tone of vitality, and establishes a condition favorable to disease. It would be difficult to overrate the importance of this household peril. Pictures are spoiled by gas, gilt mouldings are tarnished, the colors of decorated walls and ceilings fade, and men and women of delicate organization are enfeebled and injured by the foul air in which gas is discharged and supposed to burn innocuously. The extent to which this evil works in the midst of domesticated families during the long evenings is not adequately appreciated After the first few unpleasant experiences are over, the physical insensibility becomes inured to the immediate results of breathing an atmosphere charged, more or less heavily, with the products of combustion and unconsumed coal gas. It is not creditable to the ingenuity of practical men that no method has yet been devised by which the advantages of gas as an illuminating agent may be secured without the drawback of slow poisoning, with the host of maladies a depressed vitality is sure to bring in its train."

Steel for Shipbuilding.

The British Admiralty tests at present for steel are as follows:

TENSILE AND EXTENSION TESTS.

1. Strips cut lengthwise or crosswise of the plate to have an ultimate tensile strength of not less than 26, and not exceeding 30 tons per square inch of section, with an elongation of 20 per cent in a length of 8 inches.

TEMPERING TEST.

2. Strips cut lengthwise of the plate 1½ inches wide, heated uniformly to a low cherry red, and cooled in water of 82° Fah., must stand bending in a press to a curve of which the inner radius is one and a half times the thickness of the plates tested.

3. The strips are to be cut in a planing machine, and are to have the sharp edges taken off.

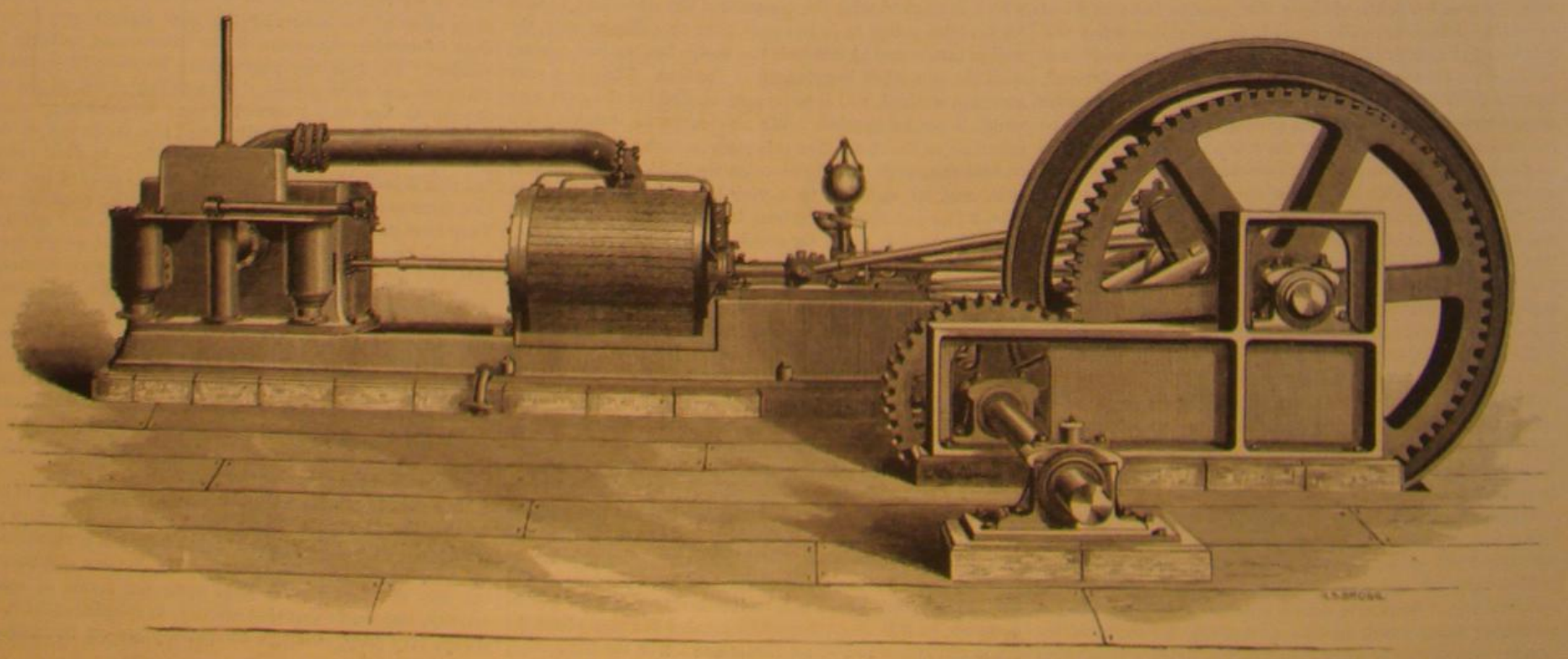
4. The ductility of every plate is to be ascertained by the application of one or both of these tests to the shearing, or by bending them cold by the hammer on the contractor's premises, and at his expense.

5. All plates to be free from lamination and injurious surface defects.

6. One plate to be taken for testing by tensile, extension, and tempering tests from every invoice, provided the number of plates does not exceed fifty. If above that number, one for every addition of fifty, or portion of fifty. Plates may be received or rejected without a trial of every thickness of the invoice.

7. The pieces of plate cut out for testings are to be of parallel width from end to end, or for at least 8 inches of length.

When the plates are ordered by thickness, their weight is to be estimated at the rate of 40 lbs. per square foot for plates of 1 inch thick, and in proportion for plates of all other



HORIZONTAL COMPOUND ENGINE.

thicknesses; the weight so produced is not to be exceeded, but a latitude of 5 per cent below this will be allowed for rolling in plates of half an inch in thickness and upwards, and 10 per cent in thinner plates.

These weights may be ascertained by weighing as much as 10 tons at a time.

TESTS FOR ANGLE, BULB, OR BAR STEEL.

The whole of the steel to stand a tensile strain of 26 tons to the square inch, and not to exceed 30 tons to the square inch. Also to stand the extension and tempering tests described for plate.

All the cross ends to be cut off. One bar is to be taken for testings from every invoice, providing the number of bars does not exceed fifty; if above that number, one for every additional fifty, or portion of fifty.

IMPROVED PROTECTED NON-RECOIL GUN.

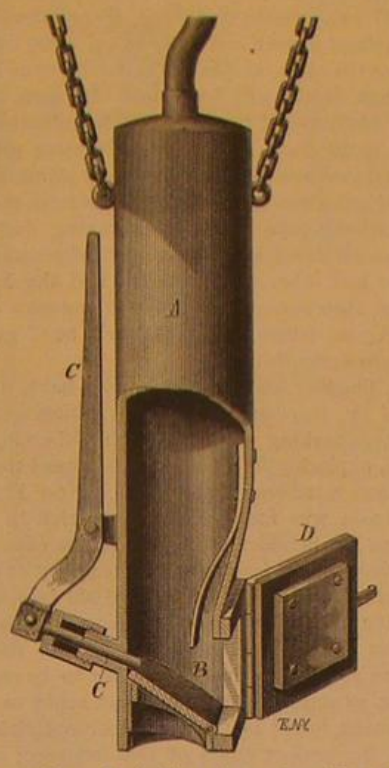
We are indebted to the *Engineer* for the annexed engraving and accompanying description of this invention. The object of the system is the complete protection of the gun detachment and of the gun itself, except at the muzzle. It is also supposed to insure accuracy of aim for a continuous series of rounds. The general idea is that the gun shall pivot at the muzzle in a ball and socket joint, fixed into the armour of a casemate, entirely closing the port and preventing recoil. Krupp claims that when once the gun is laid true on the object, it can be fired any number of times without recoiling, jumping, or otherwise changing its position or direction in the least; so that all error in shooting due to inaccuracy of laying is prevented when once the right direction is secured.

The drawing, Fig. 1, shows a section of a casemate for a 6 inch gun. The muzzle is enlarged to form a ball, A, which plays in a socket consisting of a steel port plug, B, into which is screwed a wrought iron cylinder, C, holding the ball of the muzzle firmly in the socket. On each side of the gun, trunnion, D, travels up and down a carrier, E, in which a slot is cut for the purpose. This carrier is fitted with a hollow soled truck, F, which permits the carrier to pivot on the racer, G, and so to accommodate the arc traveled through by the trunnion, when elevation is given, to the straight slot in the carrier. The truck also moves along the racer, G, when the gun is traversed. The casemate is composed of a thick wrought iron plate, H, in front, supported by strong box girders, K, and roofed with thin wrought iron plate, I. The lower portion is made of cast iron, J. It is protected from the enemy's fire by a glacis of concrete, L, in which is embedded a wrought iron glacis plate, M. A wrought iron shield, N, covers the muzzle of the gun when not firing. It rests on a trigger, O, so that when the gun is ready to be fired, the rope draws back the trigger and the shield falls. As soon as the gun is fired the shield is raised by the winch, P, acting in aid of the balance weight, Q, and the trigger is forced back to its place as a support by the spring, R. The sides of the casemate are built as of brick covered with wrought iron plates. They are all sloped as shown in Fig. 2 to cause shot to glance off.

IMPROVED PNEUMATIC DREDGING TUBE.

Our engraving represents a new pneumatic tube for dredging, mining, and wrecking purposes, which is worked by creating a vacuum and drawing the sand, earth, or other matter into the same. A represents the tube which is connected by a rubber pipe at the top, with an air pump on the vessel or float.

The lower end of the tube, A, is provided with a hinged inclined valve, B, that is fitted by rubber packing, hermetically, to a seat, and locked rigidly, when the tube has been lowered to the bottom, by a sliding bolt or key, C, which is guided in a stuffing box and operated by a lever.



A discharge door, D, is hinged to the side of tube near the bottom valve. A spring, at the inside of the tube, above the side door, serves to cushion the bottom valve when the same is opened for drawing in the sand or earth.

After the tube has been lowered and placed into position on the bottom of the river, the bottom valve being closed, and the air pumped out by the air pump until a vacuum is created, the key is withdrawn by the lever, and the sand or earth drawn into the tube until the same is nearly filled. The tube is then raised, and the contents discharged by opening the side door, the inclination of the bottom valve facilitating the discharge.

THE German government contemplate introducing the telephone into the telegraphic service, and are about to begin experiments upon it.

Progress of the New York Elevated Railroads.

When the elevated railroad on the west side of New York city is completed the termini will be South Ferry and Eighty-first Street. The total distance will be then six miles. Foundations for supporting columns are now being put down between Sixty-first and Eighty-first Streets, and the foundations necessary for making the track double between South Ferry and Sixty-first Street will be completed in a few days. Two fifths of the road are finished for a double track. The gauge is the standard one, 4 feet 8½ inches, and the rails are Bessemer steel, 50 pounds to the yard. Rolling plant consists, at present, of 21 dummies and 39 passenger cars. The average number of passengers daily is 11,000. In 21 days of last month (November) there were 207,926 passengers against 139,768 in the same time of the corresponding month in last year, an increase of 68,157.

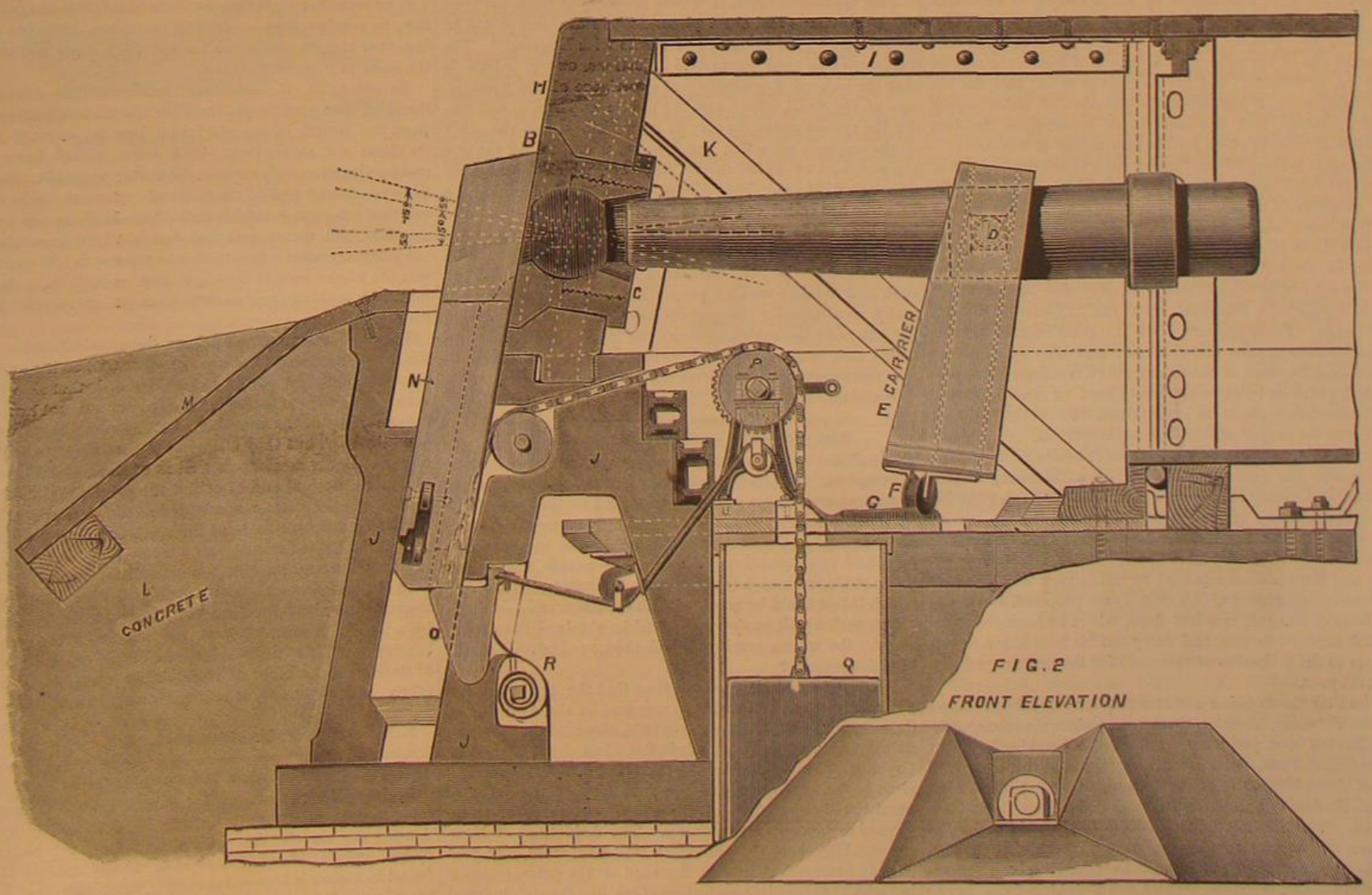
On the east side there will be a railroad from South Ferry to Sixty-first Street, having a double track all the distance. There will be branch roads: one to Fulton Ferry, another from Chatham Square to the City Hall and the end of the Brooklyn bridge, one to Thirty-fourth Street, and still another to the Grand Central Depot. The work on both sides of the city is progressing rapidly. An estimate of the cost by the chief engineer, for the double track on the east side of the city, from South Ferry to the Central Park at Sixty-first Street, 5 miles, with equipments, stations, and all the appointments necessary to its full operation, is $1,625,000, or $425,000 per mile. In this estimate is included sixty passenger cars, twenty-five dummies, eight stations to the mile, and engineering. The estimated numbers of passengers per annum is 14,700,000, and receipts, $1,250,000.

New Agricultural Inventions.

Ladore V. Sikes, of East Otto, N. Y., has invented an ingenious cider-mill. It has two curbs, which move on rails. While the ground fruit is being pressed in one curb, a grinding mill is filling the other. The cake in the first is then taken out and the full curb moved under the press. The curbs are thus alternately changed from the grinding mill to the press, and thereby the grinding and pressing of the fruit and the making of cider is accomplished quickly.

Joseph R. Palermo, of Gonzalez, Texas, has invented an improvement on Cotton Seed Planters by which the seed is more readily supplied to the endless belt of the hopper. By an ingenious device motion is communicated from the rear roller of a band to a crank to a rock post, and cross bar which works a curved wire inside the hopper thus keeping the seed well stirred up.

E. M. Wilcox, of Whitewater, Wis., has invented a check-row attachment for corn planters by which a field can be planted in accurate rows. At the end of a shaft which revolves in bearings attached to the hopper is fitted a chain wheel, the teeth of which mesh into the links of a chain extended across the field. By an ingenious combination of a cylinder, cam groove, shoe and bars, the wheel revolves and the chain marks out the check row. This is a very useful and convenient improvement.



IMPROVED PROTECTED NON-RECOIL GUN.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

In reply to a request from the Committee on Patents as to what legislation was necessary to preserve the models saved from the fire, the Commissioner of Patents has sent a letter to that body, stating that he estimated that about one third of the 90,000 patented models that were in the fire were of metal, and that probably one third of these metal models were so little damaged that by cleaning, polishing, etc., they could still be made available for exhibition and for a fuller understanding of the invention when the drawings and specifications fail, as they often do, to throw sufficient light on the inventions they are supposed to describe. The amount requisite to clean, identify, and re-arrange these damaged models, including the cases to contain them, the Commissioner estimates at $40,000. In addition to this he states that, besides the damage done by the fire, many thousand complicated models in the classes of sewing, spinning, and weaving, were drenched by water, and are rapidly corroding. Many of these will require taking to pieces, cleaning, and polishing, which the Commissioner thinks will cost about $5,000 more, and therefore asks for an appropriation of $45,000 for this purpose.

A bill has been introduced by Senator Windom to establish a Department of Commerce, essentially the same as that favored by the National Board of Trade, providing for the erection of a new department with secretary and assistant secretary, to be appointed and confirmed in the same manner as the other members of the cabinet, and to be charged with the supervision and care of the agricultural, commercial, manufacturing, and mining interest of the United States, so far as the national government is empowered by the Constitution. The new department is, if the bill becomes a law, to have charge of the execution of all laws relating to foreign and domestic commerce, customs, internal revenue, taxes, to navigation, lighthouses, rivers and harbors, and collect statistics relative to our agricultural, commercial, manufacturing, and mining interests and tabulate them.

Mr. Loring has introduced into the House a bill designed to aid in the establishment of additional telegraphic cables between this country and Europe, which proposes to give a liberal charter to a company said to be already organized, and ready to go to work as soon as they can obtain the charter. The company propose to run a line by way of the Azores, and offer to give the government the perpetual free use of the cable to an amount not exceeding the number of words which has been sent over the existing cables by the government in any one year. The bill provides, also, that in five years after the cables shall have been in working order, the rates shall be reduced to 20 cents per word, at the expiration of eight years to 17 cents, in twelve years to 13 cents, and after fifteen years to 10 cents. In return for these low rates, they ask for an exclusive right to land cables on our Atlantic coast.

A bill has been introduced by Mr. Paddock to authorize the appointment of a Committee on Foresting and Tree Planting, to examine and report upon the condition and management of the cultivated forests in Europe; the cost of growing, cultivating, and protecting the same; also the observed influence, if any, upon the climate and water supply of the country; and to examine and report upon the best varieties of trees to plant for the production of forests.

The manufacture of perfumery for exportation is becoming a large and growing interest, in which thousands of barrels of alcohol are used, but owing to a peculiarity of our revenue laws, nearly, if not quite all, of this is imported, because it can be withdrawn without the payment of duty. American alcohol cannot be used in this business without the payment of tax, and there is no provision of law which would authorize a drawback upon the exportation of such perfumery. There appears to be no good reason for this discrimination against our distillers; and the Commissioner of Internal Revenue, in his recent report, recommends appropriate legislation to allow alcohol to used by manufacturing perfumers in the goods for exportation, without the payment of tax, under proper restrictions against fraud.

Captain Tyson, in command of the Florence of the Arctic expedition, has forwarded a letter by a returning Scotch whaler, to Captain Howgate, under date of September 29, reporting his safe arrival, after a long and tedious voyage of forty days, at Niuntilick harbor, Cumberland Gulf. The crew were all in good health and spirits, and Messrs. Sherman and Kumlein are reported as doing very well in their respective departments. Captain Tyson proposed moving to the head of the gulf in a few days, where he intended to establish winter quarters, and carry out his instruction in reference to the collection of materials for the main expedition of next year.

The Fish Commission are at work upon the head waters of the Potomac, stocking them with California salmon, 30,000 having been just shipped from the hatching house at Druid Hill Park, Baltimore, being the first shipment of a lot of about 200,000 eggs received about the 1st of October from Professor Baird's camp on the McCloud river, California. The prospect of thus successfully stocking the Potomac and other rivers appears very favorable, as the success of their introduction into the Delaware has been demonstrated beyond a doubt, several fish weighing from five to ten pounds having been taken in it, as the result of stocking that stream a year previous to the commencement of the work on the Maryland rivers. About 200,000 more eggs are now on their way from the McCloud river, which will be hatched at Druid Hill Park, and distributed to the various rivers. The operations of the Commission in another direction during the summer have brought to light a fishing bank hitherto unknown, about fifteen miles from the mouth of Boston harbor, which is so rich in fish that upwards of 1,000 lbs were taken within half an hour by trolling, among which a splendid species of flounder, heretofore supposed to be peculiar to Greenland, was discovered. In the investigations in which this discovery was made, which are under the general direction of Professor Baird, assisted by Messrs. Verrill, Wilson, Goode, and Bean, observations are made as to the natural history and economical value of the marine animals of the coast, and as to the temperature of the water in different depths and localities. In some cases, at the depth of 100 hundred fathoms, the thermometer was found to stand at 30° Fah., or below the freezing point of fresh water, and yet these spots preëminently abounded in animal life, great quantities of fish being taken from them.

The Entomological Commission having, during the past season, accumulated a large mass of information regarding the locust and other similar insects, and the best means of preventing their ravages, will shortly present a report thereon to Congress, which, it is hoped, will be of great value to our western agriculturists.

Messrs. Scudder and Bowditch, who have, under the direction of Dr. Hayden, of the Geographical and Geological Survey, been making a tour through Colorado, Wyoming, and Utah, exploring for fossil insects, report that they have secured large numbers of specimens. Near Florisante, the tertiary basin was fonnd exceedingly rich in insects and plants, and Mr. Scudder estimates that the extent of insect-bearing shales are at least fifty times as great as the rich one in Southern Bavaria. Upwards of 6,000 insects and 3,000 plants have already been received from Florisante, and as many more are expected before the close of the year. Besides these specimens, many more are to be received from Wyoming, as arrangements have been made to receive all the specimens found in a newly discovered rich deposit of fossils in the tertiary strata of that territory; and it is believed that, within the next few months, the amount of material at hand for the study of this subject will be greater than ever before possessed by any single naturalist. Professor Leidy, who has also been operating under the direction of Dr. Hayden in the neighborhood of Fort Bridger Uintah Mountains, and the Salt Lake basin, has made a large collection, comprising the lowest and simplest forms of animal life, many of which require high microscopic power to distinguish their structure.

The House of Representatives having called upon the heads of departments to report what objections, if any, there were to making obligatory, in all government transactions, the use of the metric system of weights and measures, the Secretary of the Navy and the Postmaster General have sent replies, the first of which states that he sees no objection, except that in the matter of the soundings on the charts. "If it were applied to these, it would probably involve the total loss of all charts and chart plates now in use, and would be prejudicial to the exchange of charts with England." The Postmaster General states two objections, one of which is that the lack of knowledge and experience of the postmasters at the small offices and the public at large would render the system unsatisfactory in its workings, and the other is the expense attending the change, which would involve the purchase of 43,867 metric balances, which would probably cost $124,788. This alleged necessity of changing the balances has called out the suggestion that, as 15 grammes have been made the lawful equivalent of the ½ ounce for postal purposes, all that is necessary is to increase the movable weight on the present balance to the amount of $5\frac{5}{10}$ per cent, and to add a smaller proportionate weight to the pan, which would render the present balances capable of weighing letters on the metric system: the notches which now indicate one, two, or more half ounce rates, would then indicate corresponding 15 gramme rates.

Washington, D. C. OCCASIONAL.

The Standard of Metric Measurement.

To the Editor of the Scientific American:

Permit me through the columns of your valuable paper to correct an error quite prevalent in regard to the base of the "French Metric System." It is generally supposed that the meter is exactly the one ten millionth of the earth's quadrant, and consequently an absolute invariable unit, something in Nature which remains the same from age to age, and which if lost could be regained with exactness and certainty.

Can such a unit as above required be obtained for a reference by the means employed, and then re-obtained, should occasion require?

It was supposed in Newton's time that the earth was not a perfect sphere. Richer, who was sent by the Academy of Sciences, of Paris, to Cayenne in 1672, observed that the pendulum which vibrated seconds in Paris lost about 2½ daily at Cayenne. This fact, as Newton explained in his "Principia," must be the consequence of the reduction of the force of gravity, either by effect of the centrifugal force or an increased distance from the center. The deductions of Newton and Huyghens that the earth was a spheroid, like that already observed of Jupiter, flattened at the poles, conflicting with the opposite conclusions of the first Cassini, induced the Academy of Sciences to cause exact measurements of meridional arcs to be made both near the equator and the polar circle. The celebrated commission of the Academy of Sciences left Paris in 1735: Bouguer, La Condamine, and Godin to join in Peru the officers appointed by Spain, Antonio d' Ulloa and Jorge Juan; and Maupertuis, with four others, to proceed to the Gulf of Bothnia, where they were joined by the Swedish astronomer, Celsius. Ten years were spent by the party in Peru in the measurement of an arc of over three degrees in length, extending from latitude 2° 3' north to 3° 4' 32" south; and the length of a degree at the equator, reduced to the level of the sea, was calculated by Bouguer at 362,912 feet.

The northern party found a place for their operations between Tornea, in Lapland, and the mountain of Kittis. The difference of latitude being determined, they measured a base line upon the frozen rivers. The arc being then calculated, it was found to give about 367,500 feet as the length of one degree. The greater length of the degrees as they approached the poles was thus established, and consequently the greater equatorial than polar diameter of the earth.

In 1791 very extensive operations were commenced in France with the object of obtaining the exact length of the quadrant of the meridian, in order to make use of a definite part of this natural and permanent quantity as a standard unit. The measurements were carried out on the meridian of Paris under the distinguished astronomers, Delambre and Mechain. The line was extended across France from Dunkirk to Barcelona, making an arc of about 9°, and every precaution was taken to insure the greatest accuracy in the measurements. Though this arc thus determined was sufficient for the purpose required, the French astronomers in 1805, after an interval of three years, began to carry the measurement still further south, Biot and Arago directing the work after the death of Mechain. It was continued until Formentary was reached, distant about 12° 22' south from Dunkirk.

A similar anomaly was noticed upon some portions of this arc, and the same was observed in the English surveys, that where these portions were considered separately, the length of the degree appears to increase toward the equator. The effect is to produce an uncertainty in the exactness of the result obtained, showing that there must have been some error in the measurements of the meridian, as the true curvature of the earth has been established beyond a doubt, that it is an oblate spheroid, and that the length of a degree increases as we approach the poles.

In the deliberations of the members of the Academy of Arts and Sciences, at Paris, the length of the pendulum at first appeared proper for a basis for a system of weights and measures, being easy to determine, and consequently to verify, if it should be necessary, by any accidents happening to the standards; but it was thought that to take, as was proposed, for the unit of measure the length of the simple pendulum vibrating seconds, was to employ, in order to determine a measure of length, not only a heterogeneous element, namely, time, but also an arbitrary division of time, namely, the second. A measure of length was, therefore, preferred that did not depend on any other quantity; but it will be seen that observations of the pendulum can, nevertheless, be employed as a means of verifying, and even of finding, that unit of measure, although they have not served as the basis of its determination.

In short, as it has been found that the one ten-millionth of the earth's quadrant (or the meter) differed only from the length of the pendulum beating seconds at Paris about six millimeters, both units would have led to results almost exactly similar. But after years of troublesome experiment and trial of the metrical system, the only advantage that has been gained is that of establishing one common standard, the meter, and that has just now been shown is not correctly what it is intended to represent. If uniformity was the object sought it might just as well have been obtained by making their ancient toise (so universally known) the standard.

The chief reccommendation of the metrical system, or of the meter, as stated in their decree, as well as the authors of the system, Brillat, Brisson, and Tarbe, is that should it be ever lost or altered it may be easily restored, not by a second measurement of the meridian, but by comparison with the pendulum. Thus they allowed the pendulum to be the regulator of linear measure as well as of time, and in short, the ultimate criterion, and of course the principal standard.

If before the meter was adopted as the standard, other meridians on different parts of the earth had been measured, as one in the United States, and a mean taken of the several, the results would have been more satisfactory.

In the astronomical calculations of the length of an arc of the meridian, base lines are used which must be measured by arbitrary means, whereas the length of the pendulum beating seconds at a given latitude of the sea level is a unit of itself, and the labor of re-obtaining it when lost, with certainty and exactness, is reduced comparatively to a minimum. C. F. LEWIS.

Knowlesville, N. Y.

Iron and Its Companions.

In the ordinary metallurgic products of iron a number of other metals may almost always be detected by analysis. Among the metals that accompany iron are manganese, nickel, cobalt, chromium—which metals are all likewise found in meteoric iron—also copper, vanadium, titanium, and tungsten. It is a curious fact that the spectrum of the sun indicates the presence of iron, together with all of the metals above named except tungsten and vanadium.

THE CURIOUS LIFE-HISTORY OF OUR BLISTER BEETLES.

Number II.

BY PROFESSOR C. V. RILEY.

It is generally stated by writers on the hive bee, that the oil beetle (*Meloe*) is one of its parasites. The possibility that our more common blister beetles were similarly parasitic on bees, taken in connection with the frequent complaints from apiarians of the wholesale death of bees from causes little understood, led me, some years since, to pay attention to the biological characteristics of the blister beetles, in the hope of ascertaining whether or not they really bear any connection with bee mortality. From these investigations, I am satisfied that *meloe* is only parasitic on the perfect hive bee, as it is on so many other winged insects that frequent flowers, and that it cannot well, in the nature of the case, breed in the cells of any social bee whose young are fed by nurses in open cells. The triungulins of our blister beetles refuse to climb on to plants furnished to them, or to fasten to bees or other hairy insects. Nor will they nourish upon honey, bee bread, or bee larvæ.

They show a proclivity for burrowing in the ground, and act quite differently from those of *meloe* or *sitaris*, which not only attach to bees in confinement, but which, in the case of *meloe*, I have known to so crowd upon mature hive bees as to worry them to death and cause extended loss in the apiary.

While analogy and the law of unity of habit in species of the same family pointed, therefore, to a parasitic life, I began to conclude, from the facts just stated, that the parasitism was of another kind, having satisfied myself by various experiments that the triungulins did not feed on roots.

Few discoveries are stumbled upon. We find, as a rule, that only which we anticipate or look for. Late last Fall, in digging up the eggs of the Rocky Mountain locust (*caloptenus spretus*) at Manhattan, Kansas, blister beetle pseudo-pupæ were not unfrequently met with. The suspicion thus raised that these insects preyed, in the preparatory states, upon locust eggs, was confirmed last Spring by finding the larvæ of different ages within the egg pods, and devouring the eggs of the locust just mentioned. From such larvæ preying on the eggs of *spretus* I have reared the unicolorous form of *epicauta cinerea*, Forster, or the marginal blister beetle; the *epicauta Pennsylvanica*, De Geer, or the black blister beetle; the *macrobasis unicolor*, Kirby, or ash-gray blister beetle; and the form of it described as *murina*, by Le Conte, or the black rat blister beetle.

Since then I have had no difficulty in tracing the larval habits and development of the two more common species around St. Louis, namely, the striped blister beetle (*epicauta vittata*, Fabr.), and the marginal blister beetle just alluded to. Careful examination of locust eggs, in the vicinity of potato fields frequented by the parents, show a varying proportion of the egg pods affected, and in some locations nearly every pod of the differential locust (*caloptenus differentialis*) will contain the *epicauta* larva. The eggs of the locust are laid in large masses of 75 to 100. The pod is but slightly bent, rather compact outside, while the eggs are



Fig. 1.—Caloptenus differentialis.

irregularly arranged and capped with but a shallow covering of mucous matter. It is the egg pod of this species which the larvæ of the two blister beetles in question prefer. The larval habits of the genus, as well as of *macrobasis* and *henous*, which I have studied, may be illustrated by reciting those of either of these species.

From July to the middle of October the eggs are being laid in the ground in loose, irregular masses of about 130 on an average. The female lays at several different intervals, producing in the aggregate probably from four to five hundred ova. She prefers for purposes of oviposition the very same warm, sunny locations chosen by the locusts, and doubtless instinctively places her eggs near those of these last, as I have on several occasions found them in close proximity.



Fig. 2.—Epicauta vittata.

In the course of about ten days—more or less, according to the temperature of the ground—the first larva or triungulin hatches. These little triungulins (Fig. 4, *c*), at first feeble and perfectly white, soon assume their natural light brown color and commence to move about. At night, or during cold or wet weather, all those of a batch huddle together with little motion, but when warmed by the sun they become very active, running with their long legs over the ground, and prying with their large heads and strong jaws into every crease and crevice in the soil, into which, in due time, they burrow and hide. Under the microscope they are seen to fairly bristle with spines and spinous hairs, which all aid in burrowing. As becomes a creature of prey that must be industriously sought, they display great power of endurance, and will survive for a fortnight without food in a moderate temperature. Yet in the search for locust eggs many are, without doubt, doomed to perish, and only the more fortunate succeed in finding appropriate diet. Reaching a locust egg pod, our triungulin, by chance or instinct, or both combined, commences to burrow through the mucous neck, and makes its first repast thereon. If it has been long in search, and its jaws are well hardened, it makes quick work through this porous and cellular matter, and at once gnaws away at an egg, first devouring a portion of the shell and then sucking up the contents. Should two or more triungulins enter the same egg pod a deadly conflict sooner or later ensues, until one alone remains the victorious possessor. A second egg is attacked, and more or less completely exhausted of its contents, when a period of rest ensues, the triungulin skin splits along the back, and there emanates the second larva (Fig. 4, *d*), white, soft, with reduced legs, and quite different in general appearance from the first. This molt is is experienced about the eighth day from the first taking of nourishment. The animal now naturally lies in a curved position. After feeding for about another week a second molt takes place, the skin, as before, splitting along the back and the new larva hunching out of it until the extremities are brought together and released almots simultaneously.

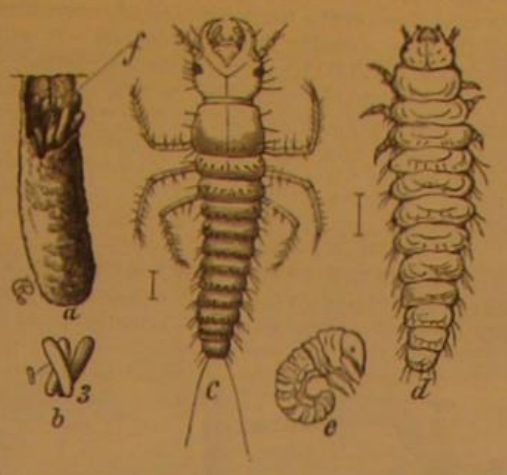


Fig. 4.—EPICAUTA.—*a*, locust egg pod, with triungulin just entering (*f*); *b*, eggs; *c*, triungulin; *d*, second larva; *e*, natural position of same.

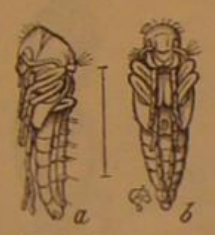


Fig. 6.—EPICAUTA.—*a*, pupa, side view; *b*, same, ventral view.

This kind of molting is exceptional among insects, the skin being ordinarily worked backward from the head. The modification at this molt is slight. A third molt ensues with but little change in the form and character of the animal. In this, the ultimate stage of the second larva (Fig. 5, *a*), the creature grows apace, its head being constantly bathed in the rich juices of the locust eggs, which it now rapidly sucks, or more or less completely devours. The color is somewhat more yellowish than it was before. In another week it forsakes the remnants of the pabular mass and burrows a short distance in the clear soil, where it forms a smooth cavity within which it lies, stretched on one side. In three days the skin splits again, but is only partially shed. The mouth parts and legs are now quite rudimentary and tuberculous, the soft skin rapidly becomes rigid and of a deeper yellow color, and we have what has been called the pseudo-pupa or coarctate larva (Fig. 5, *c*, *d*). The insect has the power of remaining in this coarctate larval condition for a long period, and generally thus hibernates.

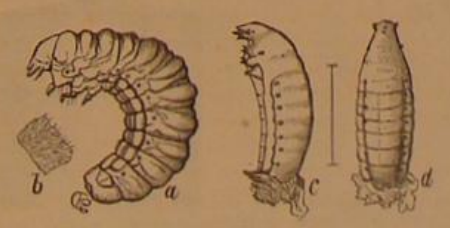


Fig. 5.—EPICAUTA.—*a*, full grown larva; *b*, setaceous points that cover the back; *c*, coarctate larva, side view; *d* same, back view.

In spring the coarctate larval skin is in its turn rent on the top of the head and thorax, and there crawls out of it the third larva, which differs in no respect from the ultimate stage of the second larva already mentioned, except in the somewhat reduced size and greater whiteness. This third larva is rather active, and burrows about in the ground; but while there seems to be no reason why it should not feed, nourishment is not at all essential, and all my specimens have, in the course of a few days, transformed to the true pupa (Fig. 6) without feeding. The pupa state lasts but five or six days.

Our blister-beetle larvæ are, therefore, partial parasites. An animal that feeds on eggs is not necessarily parasite, but the term is justly applied to such as feed within, and are confined to, the egg pod, in contradistinction to predaceous species which move from one egg pod to another. Like all parasitic insects that nourish on a limited amount of food, and possess no power to secure more, the blister beetles vary greatly in individual size in the same species, and the larvæ have the power of accommodating their life to circumstances, and of assuming the coarctate larval form earlier or later according to the size of the egg mass which they infest. In an average sized egg pod of the differential locust, however, there are more than enough eggs to nourish the largest specimens of *E. vittata*, and a few are usually left untouched. The period of growth from the first feeding to the coarctate larva averages about a month.

That the eggs may exceptionally hibernate is possible, but from their delicate nature improbable. That the triungulins frequently do so there can be no doubt, especially in specimens like the black blister beetle, which is found on the flowers of solidago, eupatorium, etc., till the end of October and continues laying till frost.

CONCLUSION.

From the foregoing history of our common blister beetles it is clear that, while they pass through the curious hypermetamorphoses so characteristic of the family, and have many other features in common, yet *epicauta* and *macrobasis* differ in many important respects from *meloe* and *sitaris*, the only genera hitherto known biologically.

To resume what is known of the larval habits of the family, we have: First, the small, smooth, unarmed, tapering triungulin of the prolific *sitaris*, with the thoracic joints subequal, with strong articulating tarsal claws on the stout-thighed but spineless legs, and, in addition, a caudal spinning apparatus. The mandibles scarcely extended beyond the labrum: the creature seeks the light, and is admirably adapted to adhering to bees but not to burrowing in the ground. The second larva is mellivorous, and the transformations from the coarctate larval stage all take place within the unrent larval skin. We have: Second, the more spinous and larger triungulin of the still more prolific *meloe*, with long caudal setæ, but otherwise closely resembling that of *sitaris* in the femoral, tarsal, and trophial characters, in the sub-equal thoracic joints, unarmed tibiæ, and in the instinctive love of light and fondness for fastening to bees. The second larva is also mellivorous, but the later transformations take place in the rent and partly shed skins of the second and coarctate larvæ. We have: Third, the larger and much more spinous triungulin of the less prolific *epicauta macrobasis* and *henous*, with unequal thoracic joints, powerful mandibles and maxillæ, shortened labrum, slender femora, well armed tibiæ, slender, spinous, less perfect tarsal claws, combined with an instinctive love of darkness and tendency to burrow and hide in the ground. The second larva takes the same food as the first, its skin is almost entirely cast from the coarctate larva, while subsequent changes are independent and entirely free of the shell of this last.

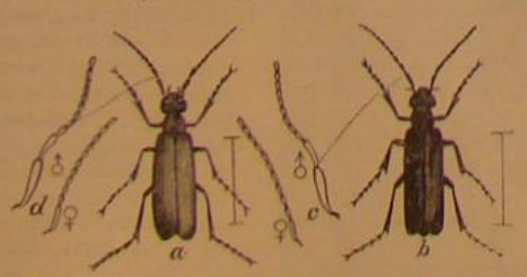


Fig. 3.—MACROBASIS UNICOLOR.—*a*, normal gray form; *b*, black (*murina*) form; *c*, *d*, male and female antennæ.

Recent Tests of the Telephone.

Some interesting trials of the articulating telephone were lately made in England through Dr. Muirhead's artificial cable. This artificial line, says the *Telegraphic Journal*, offers the closest approximation to the electrical conditions of an actual cable that has been hitherto attained. The experiments were made through a length of artificial cable of the type of the Direct United States Cable, and it was so constructed that artificial line capacity could be added to the circuit or taken away from it at will. When the capacity is taken off, the circuit is of course a mere resistance circuit; but when the capacity is put on, the circuit was equivalent to a length of submarine cable. In speaking by telephone through a hundred miles of this cable the words were comparatively loud and distinct, but the instant the capacity was put on, the voice lost both power and distinctness in a remarkable degree. It appeared only half as loud as before, and dull and smothered in tone. With a hundred and fifty miles of artificial cable, while the voice was apparently as strong as ever through the resistance circuit alone, it was completely silenced by putting on the capacity. Even with a superior telephone, the extreme limit of articulation would thus be less than two hundred miles. Theory points out, and experiment verifies the fact, that if the voice is allowed to dwell on a note for a sufficient time to establish, despite induction, a regular succession of electric waves in the cable, a faint sound will be audible. Thus, singing can be heard through a greater length of cable than talking. In articulation the changes of the voice are so hurried that time is not given the cable to establish the regular series of waves necessary to reproduce sound, so nothing is heard at all.

Novel Method of Preparing Oxygen.

The author finds that oxygen may be very readily obtained even at common temperatures by the mutual reaction of two oxygenated compounds formed of several atoms of oxygen, such as hypochlorate of lime and peroxide of barium. These facts prove, he considers, that the oxygen is produced by the neutralization of the opposite electric polarities of the oxygen in one of the compounds and that in the other.—*Sylvester Zinno, in Les Mondes.*

La Nature says that when the whale in the Westminster Aquarium, London, died, all the living eels, which had been put in the tank as food for the monster, at once attacked the body and attempted to devour it.

The Telephone in Collieries.

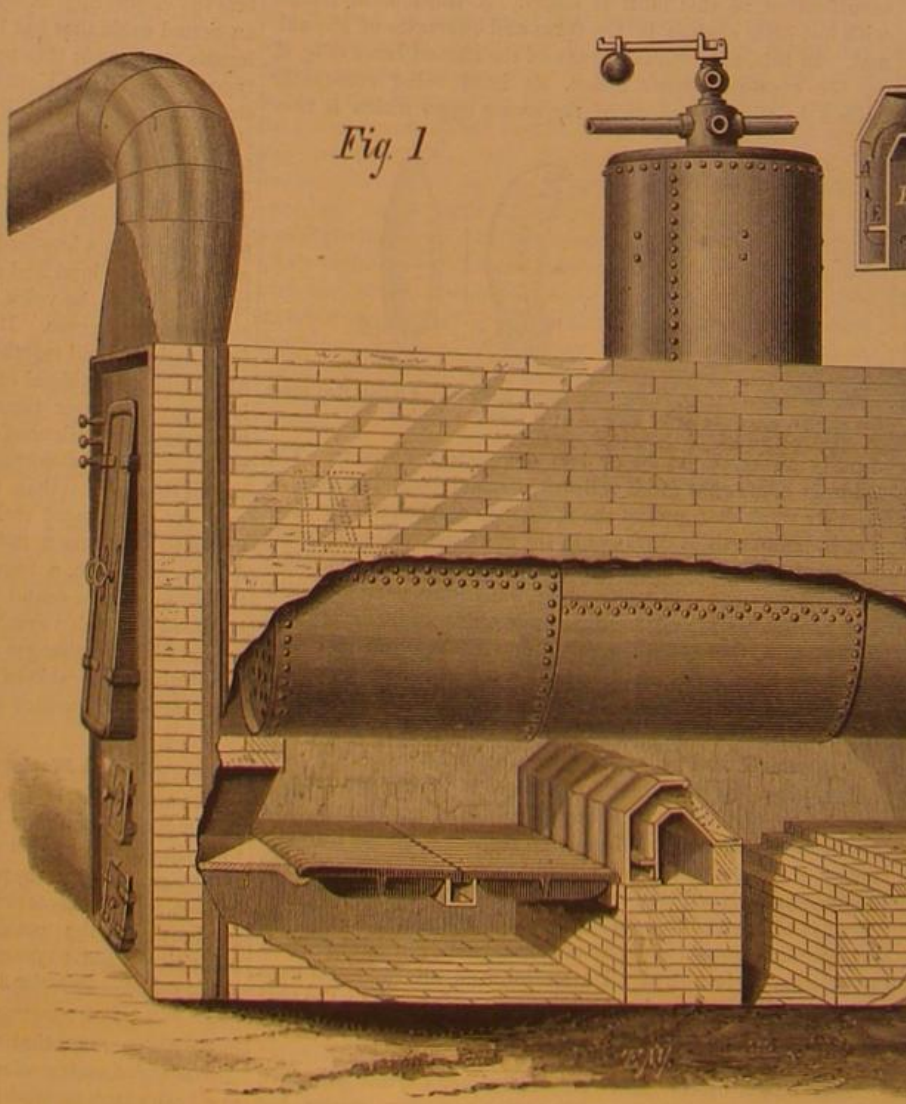
A number of gentlemen connected with the principal collieries in West Lancashire, Eng., lately assembled at Prescot Colliery, belonging to the Wigan and Whiston Coal Company, for the purpose of witnessing experiments with Professor Graham Bell's Telephone, but especially with reference to its use in the working of collieries. By an adaptation of Mr. Hall, Government Inspector of the mines of the district, one of Mr. Biram's anemometers used in collieries for testing the velocity of air passing through the workings had attached to it, instead of the regulator, a telephone, and it was to test whether the state of the ventilation could be ascertained at the surface that the experiments were made. Instead of the ordinary diaphragm, a small thin iron bar was substituted in the telephone attached to the anemometer, every tenth revolution of which caused this bar to vibrate. An anemometer thus provided was connected with the telephone placed in the colliery offices, and then taken down the shaft and fixed in the main intake—an ordinary coated electric wire, some 600 yards long, joining the two instruments. Mr. Hall and a party of underground managers had charge below ground. The vibration of the anemometer was distinctly heard by the instrument in the office, and it was found to give 28 beats to the minute, or 280 revolutions, which, multiplied by area of airway, showed the quantity of air passing. The result was considered eminently satisfactory, and was communicated to Mr. Hall. Experiments in speaking to those in the mine were then made, and Mr. Hall recognized the voices of several friends. At times word was sent from below that they could hear noises going on in the room, conversation between several of the gentlemen taking place, and this interfered with the distinctness of the messages. On the conclusion of the experiments, Sir W. Thomson, using the telephone, addressed a few words to those present, and to Mr. Hall. He expressed himself as both delighted and astonished with the result of the experiments. Never before had he heard the voice more distinct, and the experiments were very satisfactory. He explained the difference between previous telephones and Professor Bell's, and said that although he had often tested the telephone he had never before seen it made of practical use as in the present case.

THE CORRUGATED IRON AIR BRIDGE AND FUEL ECONOMIZER.

Mr. Robert K. McMurray, Chief Inspector of the Hartford Steam Boiler Inspection Company, is the inventor of the new steam boiler attachment herewith illustrated. which, it is claimed, provides an efficient means for economizing fuel, reducing the time and expense usually required for the renewal and repair of bridge walls and preventing smoke by the admission of a proper supply of heated air to the gases evolved by combustion. The principal feature of the device is that last mentioned, the inventor claiming positive advantages through the mingling of heated air instead of cold air with the gases. The bridge is also constructed so as to offer increased resistance against blows shocks, and the effects of expansion and contraction, while it may be easily removed for renewal or repairing.

The arrangement of the bridge in the furnace is shown in Fig. 1, and the device detached with portions broken away to exhibit its interior arrangement in Fig. 2. It consists of a fire plate, A, a back or base plate, B, and a dispersing plate, C. The plate, A, is corrugated in order to give it increased strength and is provided with a light bottom flange which rests upon the bridge wall and thence rises vertically for about two thirds of its height, at which point it is inclined at an angle of 45 degrees. The bottom plate, B, conforms in the relative position of three of its sides, to the plate, A, and terminates below in a horizontal foot. Both plates, A and B, are connected by bolts passing through thimbles, so as to form a hollow case. The perforated diffusing plate, C, is inserted in groves formed in the other plates. A series of air supply openings, D, are formed in the plate, B, near the base. Above them extends a deflecting flange, E. The device is so set that the lower edge of the fire plate, A, is slightly below the level of the grate bars, and its ends are closed by the side walls of the setting or by metal plates fitted therein, the latter arrangement allowing of the bridge being removed as desired by drawing it out longitudinally through the opening in the side wall.

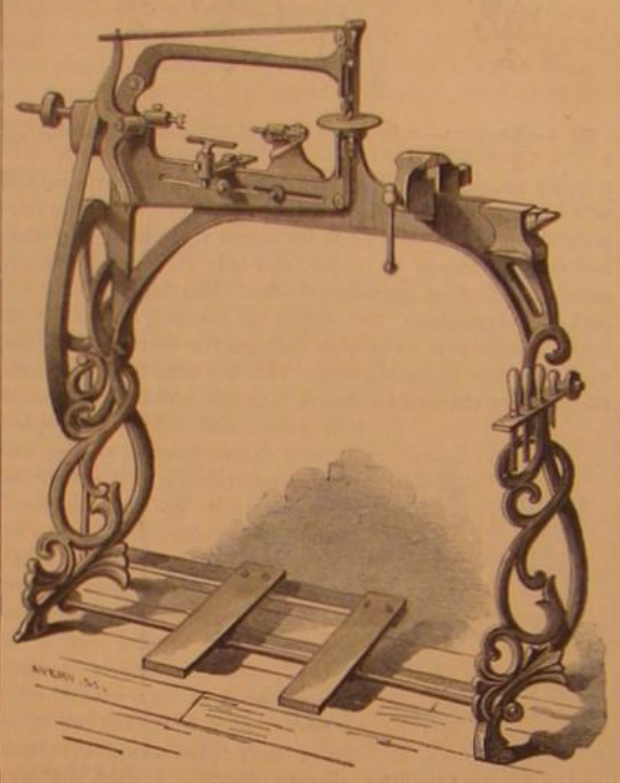
The fresh air enters the space between the back plate and fire plate through the supply openings, D, and is deflected by the flange against the heated surface of the fire plate and thence passes upward as indicated by the arrows, Fig. 2, along the space between the two plates. The air thus becomes introduced in a minutely divided condition into the combustion chamber at a temperature closely approximating that of the gases escaping from the furnace. It mingles with said gases, and is claimed to oxidize the carbonic oxide and to effect complete combustion, with a corresponding economy of fuel and prevention of smoke. The inventor informs us that the device has been well tested with uniformly successful results. Patented September 4, 1877. For further particulars, address Robert K. McMurray & Co., 285 Broadway, New York city.



THE CORRUGATED IRON AIR BRIDGE AND FUEL ECONOMIZER.

COMBINATION LATHE, SCROLL SAW, ETC.

The machine illustrated herewith is a combined foot power drill and turning lathe, scroll saw, grinding wheel, vise,



and anvil, in the construction of which many novel features are embodied. The body and legs are cast iron, the treadles wood, the belts leather, the wrench iron, the fixed screws polished iron, the set screws casehardened, the finish black japan with ornamental paintings. The lathe will turn work four inches by nine long. It is suitable to hand turning, has a press lever for drilling, and is furnished with steel spur and pointed centers. The rest has all the adjustments common to large turning lathes. The scroll saw plays vertically through the center of an iron table, which may be tipped on an angle for inlaid work. The saw is held by means of iron clamps and thumbscrews, said clamps being attached, each to the end of a leather band, which bands pass over friction pulleys and are hung to pins on the ends of the vibrating lever, which is driven by an eccentric on the lathe spindle. There are several pin holes in the upper band to adjust the strain to saws of varying lengths. An arm projecting over the table serves as a presser foot to hold the work down while sawing, and adjusts itself to varying thickness in boards. When the saw is disconnected to enter holes, said arm may be raised to admit the board, or it may be swung over to leave all clear above the lathe if desired. This machine swings fifteen inches under the arm, and the motion of the saw is in a straight line.

In carrying out this principle of operating the jig saw on a large machine, the saw is hung in sliding guides as usual, but the bands for reaching any distance on the work and the vibrating lever are the same as here shown.

It is claimed that no perceptible jar is felt in running a sixteen inch saw that will reach the center of work up to ten feet radius. This steadiness is caused by the vibrating lever being very short and well balanced, and by the cushioning effect of the inertia of the bands. The lever need not be over six inches radius to give the saw four inches stroke.

The vise and anvil are permanent attachments to the machine. The emery wheel on the spindle is heavy, and serves as a fly wheel to the lathe and saw. In the outer end of the spindle is a drill for bracket work. When desired, the manufacturer furnishes tools and extra parts with the machine, such as face plates for chucking, a drill plate, a circular saw, and table, turning gouges, chisels, etc.

Patent pending. For further particulars see Business and Personal column, or address W. X. Stevens, East Brookfield, Mass.

The Delicacy of the Telephone Circuit.

In a recent lecture before the Society of Telegraph Engineers in England, Professor Bell called attention to the remarkably slight earth connection which is needed to establish a circuit for the telephone. In describing an experiment showing this, he stated that while an assistant made connection at his end of the line by standing on a grass plot, he himself stood upon a wooden board. On trying the telephone Professor Bell was very much surprised to hear a continuous musical note uttered by his coadjutor, and on looking for the cause he found that a single blade of grass was bent over the edge of the board and that his feet touched it. The removal of the grass was followed by a cessation of sound from the telephone, but the sound became again audible whenever the Professor touched even the petal of a daisy with his foot.

Ferroux's Rock Drill at the St. Gothard Tunnel.

M. Ferroux's rock drill, which has been in operation since 1873 at the works of the St. Gothard tunnel, has recently been much simplified in the mechanism for the feed and the percussion. The piston of the percussion cylinder is formed conically at each face for the purpose of reversing it at the end of each stroke. When it arrives at the end of the stroke it strikes a small plug, which slides in a cylindrical opening and presses it inwards. This movement is simultaneously communicated by a lever to the small supply piston at the upper end of the cylinder by which the compressed air is shut off, and the exhaust opened. The percussion piston is then promptly returned to the upper end of the cylinder, where it strikes the small supply piston, and opens it for a fresh supply of compressed air, when the percussion piston makes the next down stroke. This rotation of the percussion piston and rod is effected by means of an inclined groove cut in the rod, in which a pawl is engaged. The pawl is one piece with a ratchet wheel, which turns freely with the pawl as it is swayed by the groove in the descending piston rod, but is prevented by a ratchet from returning. The ball being thus held stationary, the piston rod necessarily sways to the pawl in its turn, and makes a portion of a revolution, shifting the position of the jumper for each stroke. The weight of the new Ferroux drill is about 440 lbs. The calculated volume of air expended per stroke of the piston is 85 cubic inches.

THE DUCK-BILLED PLATYPUS.

The *ornithorhynchus* or platypus is a singular animal, which seems to form a connecting link between the mammals and birds, and in some respects having affinities even with reptiles. It is from 18 to 22 inches long, and has a stubby tail 5 inches long. The color is brown above and whitish below. The jaws are inclosed in a a horny sheath, very sensitive, like the bill of a duck, and have two horny teeth on each side; the snout is flat and broad, the lower jaw shorter and narrower, the eyes small and brilliant; ears not apparent externally, with an aperture that can be opened or shut at will; and the fur is soft and thick, like that of the otter. The legs are short, and the feet five toed, and webbed. It secretes milk for the nourishment of its young, which are born blind and naked. It burrows in the banks of streams, where it passes the day in sleep, rolled up like a ball, coming out at dusk and during the night in search of food. It is an excellent swimmer and diver, and feeds upon worms, insects, and small aquatic animals, in the manner of a duck. It walks very well, and climbs trees with facility. It can remain under water for eight minutes at a time; it is cleanly in habit, and fond of warmth and dryness. The young die very soon in confinement.



THE DUCK-BILLED PLATYPUS.

Poisoning by Earrings.

Two young girls in Paris suffered from blepharitis, and one of them also from an inflammation of the lower part of the left auricle. All the usual remedies proved inefficacious, but both patients quickly recovered after their copper earrings were discarded.

PROPOSED BALLOON VOYAGE TO THE NORTH POLE.

We find in the London *Graphic* the annexed engraving of an arrangement of balloons proposed by Mr. Henry Coxwell of England as a means of crossing the Palæocrystic Sea and so reaching the north pole. Our contemporary attributes to Commander Cheyne, R.N., the origination of the idea of using balloons for this purpose. It is believed that the three balloons connected in the manner shown in our engraving would carry six men, besides three tons weight of gear, boat cars, stores, provisions, tents, sledges, dogs, compressed gas, and ballast. The triangular framework connecting the balloons would be fitted with foot ropes, so that the occupants could go from one balloon to another in the same manner as sailors lie out upon the yards of a ship, and the balloons would be equipoised by means of bags of ballast suspended from this framework, and hauled to the required position by ropes. Trail ropes would be attached to the balloons, so as to prevent their ascent above a certain height (about 500 feet), at which elevation they would be balanced in the air, the spare ends of the ropes trailing over the ice. The boat cars would be housed in for warmth, and telegraphic communication kept up with the ships by means of a wire uncoiled from a large wheel (see sketch) as the balloons moved onward. This wire, being marked at every five miles, would also serve to keep a record of the distance traversed. Commander Cheyne proposes that the balloons should start about the end of May, on the curve of a wind circle, of known diameter, ascertained approximately by meteorological observations conducted on board the vessel, and at two observatories some thirty miles distant in opposite directions. It is estimated that, with a knowledge of the diameter of the wind circle, and the known distance from the Pole, the balloons could be landed within at least twenty miles of the long wished-for goal. There the balloons would be securely moored; and when the necessary observations at the Pole had been carried out, a return wind would be secured for their return, the requisite full inflation having been made by means of the surplus gas taken out in a compressed condition. The returning voyagers would arrest their course to the southward on the parallel of latitude on which they left their ship, and the remainder of their journey, east or west, would be performed by means of the dogs and sledges conveyed in the balloons.

Recent Archæological Discoveries.

In a volume on "Notes on the Barrows and Bone Caves of Derbyshire," Mr. Rooke Pennington, the author, gives some interesting facts in regard to explorations made near Castleton. The surrounding country is dotted with tumuli, usually rough, round heaps of stone and turf and some of a peculiar oblong shape. The large mounds are about fifty feet in diameter and five feet high in the center. Their contents are all the evidence in existence as to the beliefs, practices and social life of men who tenanted the British Islands in the neolithic or polished stone and bronze periods of culture. In one barrow was found a stone cist made of six rough slabs, four for the sides and two for top and bottom. Fragments of pottery with rude scratches for ornamentation laid scattered around the bones of an old man. Near by and in the very center was found in a shallow grave the skeleton of a young man, buried in a crouching position. Large pieces of limestone were piled around and there were many bones of the short-horned ox, the boar and the horse. It was evident the young man was one of high rank, both from the high mound and the bones of the animals, which were, Mr. Pennington thinks, the remains of a funeral feast. An awl made of stag horn and a jet ornament were the only personal articles found.

In a recent number of the *Athenaion* is a short summary of the discoveries which have been recently made in tombs at Spata in Attica, Greece. To the south of the village a square chamber cut in the rock was found accidentally at a depth of about 17 feet from the surface. On the eastern and northern sides of this chamber were smaller ones. The door leading into the great chamber was walled up with small stones and earth, a small aperture being left at the top; the entrance to the two smaller chambers was free. In clearing out the passage were found many objects in glass or ivory and a few in silver, gold, bronze and terra-cotta; also a few ashes and bones. These objects were found scattered about in the earth, as if the tomb had been anciently sacked and some of its contents dropped by the plunderers in their way out. In the northwest corner a layer of ashes and burnt bones was found intact.

A Patent Law for Switzerland.

Switzerland and Holland are the only two European nations that at the present time refuse to inventors the protection of patents. Holland, it seems, is soon to be left alone in that glory. A bill is now under discussion, prepared by Federal Councillor Droz, which if passed will give to the republic of Switzerland a patent law system very much like that of the United States. The fees for patents are to be small, and the mode of securing inventions simple. We shall give our readers due notice of the passage of the Swiss patent law.

CHARCOAL FOR OFFENSIVE BREATH.—A correspondent of the *Dental Cosmos* says that the best treatment in regard to offensive breath is the use of pulverized charcoal, two or three tablespoonfuls per week, taken in a glass of water before retiring for the night.



PROPOSED BALLOON VOYAGE TO THE NORTH POLE.

MACHINES THAT HEAR AND WRITE.

The propagation of sound in air is excellently illustrated in the ingenious apparatus devised by Professor Tyndall and represented in Fig. 1. A is a stem passing through the upright, B, to which a shock can be sent from a ball, C, through a spring to another ball, thence through another spring to another ball, and so on until at last the shock reaches the last ball, which is projected against the india rubber pad at the end, D, placed there to represent in a rude mechanical way the drum of the ear. When the stem, A, is pressed, the ball, C, only moves to and fro, yet it sends a kind of pulse, *f*, *e*, *e*, *f*, which travels along the line and ultimately causes the last ball to give a smart stroke on the pad, D. That this represents what takes place in air, when sound is propagated through that medium, is shown by the apparatus represented in Fig. 2. A tube 11 feet long and 4 inches wide has its ends closed with thin india rubber. Against the rubber at one end there presses a cork, *a*, with which is connected a hammer, *b*, which is in contact with the bell, *c*. If now a pulse be sent from the other end of the tube, the india rubber will drive away the cork and will cause the hammer to strike the bell. It will thus be evident that, when vibrations are caused in the air of a tube closed by a membrane, that those vibrations will be transmitted to the membrane. In the ear, as we have stated, the auditory nerves take the vibrations from the membrane to

FIG. 1.

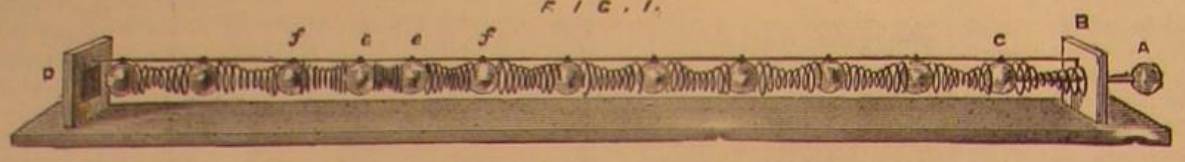
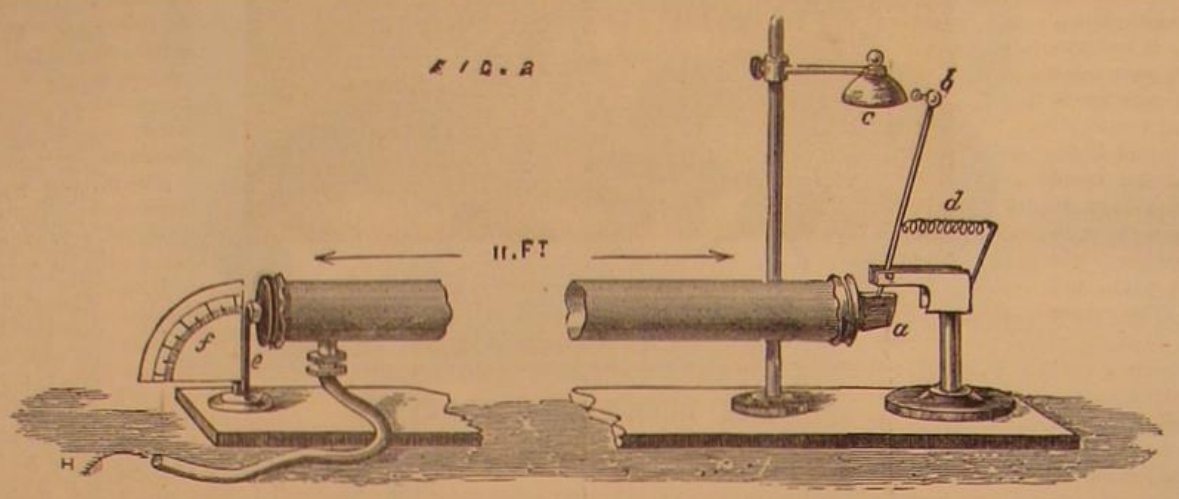


FIG. 2.



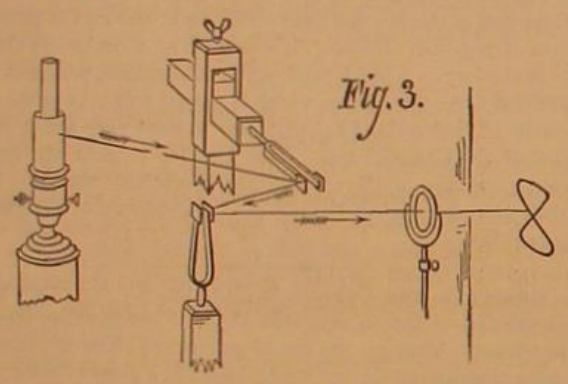
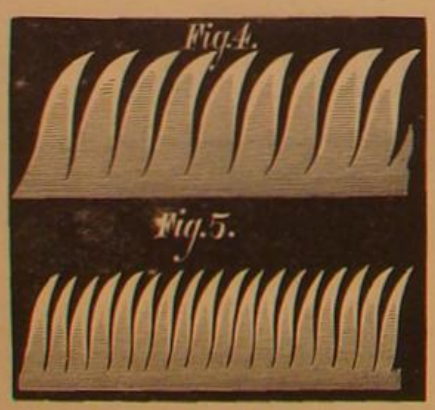
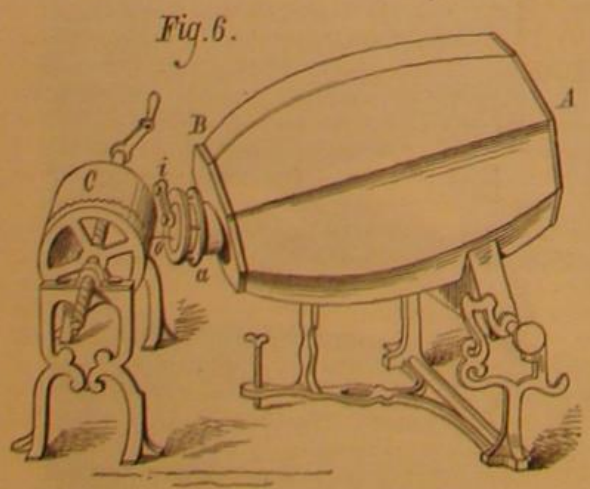


Fig. 3.

the brain, and the latter influences other nerves and muscles which cause us to write down what we hear. The problem to be solved in the phonograph is to find a mechanical substitute for auditory nerves, brain, and muscles, or, in other words, to connect some device with the body thrown into vibration by the sound, which shall register the movements

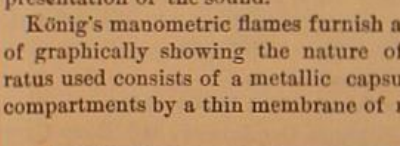


of that body. The simplest and most direct method of recording vibratory movements is by Lissajou's apparatus, by which the vibratory motions of two sounding bodies may be compared without the aid of the ear. This method,

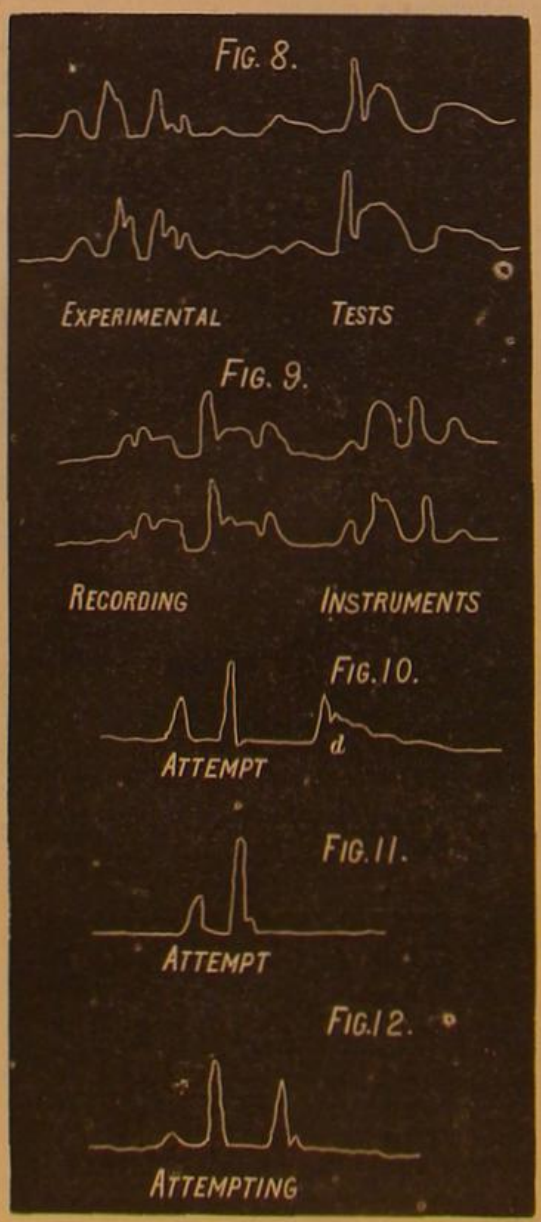


which depends on the persistence of visual sensations on the retina of the eye, consists in fixing a small mirror on the vibrating body, so as to vibrate with it, and to impart to a luminous ray a vibratory motion similar to its own. The bodies used are tuning forks, and in Fig. 3 is represented the optical combination of two rectangular vibratory motions, the figure being projected on a screen. A large number of curves are produced, which are more complex when the ratios or the numbers of vibrations of the bodies are less simple; and as each curve or variation corresponds to a definite condition of the forks (pitch, etc.) it is evident that, while it is a graphic representation of the vibrations which take place in the bodies, it also represents the sound resulting from such vibrations. If the beam of light producing the curves were projected upon a sensitized surface, then the curve would be photographed, and consequently we should have a graphic representation of the sound.

Fig. 7.

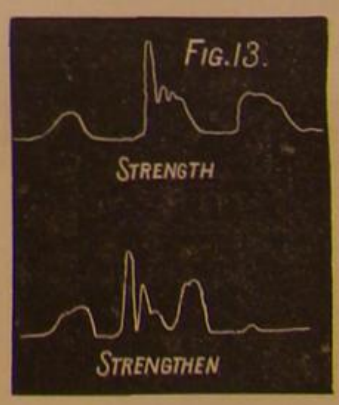


König's manometric flames furnish a very delicate mode of graphically showing the nature of sounds. The apparatus used consists of a metallic capsule divided into two compartments by a thin membrane of rubber. The tube on one side of the capsule connects with a mouthpiece; the space on the other side is connected with a gas burner, the supply pipe of which also enters said space, so that on one side of the membrane is air and on the other gas. When the sound waves enter the capsule by the mouthpiece and tube, the membrane yielding to the condensation and rarefaction of the air waves, the gas in the compartment on the opposite side of the membrane is alternately contracted and expanded, and hence are produced alternations in the length of the flame, which are, however, scarcely perceptible when the flame is observed directly. But to render them distinct they are received on a mirror with four faces, which is rotated on a vertical axis. As long as the flame burns steadily there appears in the mirror, when turned, a continuous band of light. But if the capsule is connected with a sounding tube for example, yielding the fundamental note, the image of the flame takes the form represented in Fig. 4, and that of Fig. 5 if the sound yields the octave. For different sounds produced before the capsule the flame assumes widely differing appearances. It would not be impossible to photograph the representation of the flame in the mirror, and thus permanent graphic records of sounds might be obtained.



We now come to purely mechanical means of registering sound, to which class belong the Edison and other phonographs. In Fig. 6 is represented Leon Scott's phonautograph, which consists of an ellipsoidal cask, A, of plaster of Paris, and about 1½ feet long. The end, A, is open; that at B is closed by a solid bottom having an orifice, in which is a bent brass tube, *a*, which carries a ring on which is affixed a thin membrane. Near the center of the latter is a very light style; and in order that this style may not be at a node, the membrane stretching ring carries a movable piece, *i*, which is termed a subdivide, and which, being made to touch the membrane first at one point and then at another, enables the experimenter to alter the arrangements of the nodal lines at will. It follows that, when a sound is produced near the apparatus, the air in the ellipsoid, the membrane and the style will vibrate in unison with it, and it only remains to trace on a sensitive surface the vibrations of the style and to fix them. For this purpose a rotating copper cylinder, *c* is covered with lampblacked paper and the style is brought in contact with the latter, so that, when the cylinder is rotating and the style vibrating, a sinuous line is produced, the nature of which depends upon the sound. Thus in Fig. 7 is represented the trace of the sound produced jointly by two pipes, whose notes differ by an octave. This arrangement of rotating cylinder is also employed in connection with tuning forks, a style being arranged on one arm of the fork. On a note being sounded in unison with which the fork is tuned, the fork vibrates and consequently a sinuous line showing the nature and velocity of the vibrations is made upon the paper of the cylinder.

In April, 1873, Mr. W. H. Barlow read before the Royal Society a paper on the "Logograph," an invention of his own for recording sound, which consists of a small speaking trumpet about 4 inches long, having an ordinary mouthpiece connected to one end of a tube of ¼ an inch in diameter, whose other end is broadened out so as to form an aperture of 2½ inches diameter, which aperture is stopped by a membrane of goldbeater's skin or thin gutta percha. Against this membrane a spring presses lightly and has connected to it a light arm of aluminum, which carries a marker consisting of a very fine sable hair pencil, projecting from the lower end of a glass tube containing coloring material, the tube and pencil together forming a kind of fountain marker, as the coloring material gradually oozes out and keeps the pencil continually moist and supplied with color. Under this marker a continuous strip of paper is made to pass, in in the same manner as the strip of paper in the register of the Morse telegraph, and the whole is so arranged that when the membrane occupies its normal position the marker makes a simple, straight line, as the strip of paper passes beneath it, but any force acting on the membrane will cause the marker to move, and a crooked line will be the result, the deviation from a straight line depending on the amount of force exerted on the membrane.



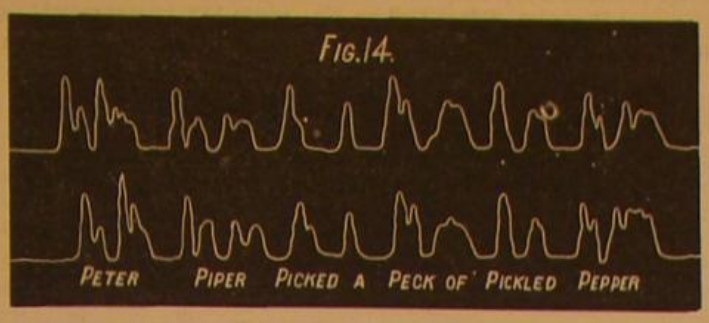
To provide for the escape of the air passing through the trumpet a small orifice is made in the side of the tube, so that the pressure exerted upon the membrane and its spring is that due to the difference arising from the quantity of air forced into the trumpet and that which can escape through the orifice in a given time. The pressure of the spring and the size of the orifice have to be so proportioned to each other as to admit of the movement of the marker with the slightest pressure of the breath, and yet it must not move so easily as to pass over the edge of the paper under the greatest pressure which the breath is capable of producing. By

this apparatus, when properly adjusted, the various sounds produced by speaking will act on the membrane, causing it to move the marker correspondingly to the force exerted by the differing tones of the voice, and thus a series of irregular lines will be produced, exhibiting remarkable uniformity when the same phrases are repeated, as is shown by the diagrams in Figs. 8 and 9, made by the instrument when the words under them were pronounced by the same speaker successively.

One of the first peculiarities manifested in using the instrument was the action produced by the silent discharge of air from the mouth after a word was pronounced. This silent discharge appeared to depend on the force required in the last syllable, and was most developed in those syllables terminating with the consonents termed "explodents," whether with or without the silent vowel E after them. This effect is shown in Fig. 10, in which the part marked *d* is the silent discharge, and its appearance in the diagram is under the control of the will, for by holding the breath immediately after pronouncing the word, this part of the diagram can be altered as shown in Fig. 11. If, instead of terminating with an explodent, another syllable be added to the word, making it terminate with a consonant of softer sound, the air which would have been silently discharged is used to form the syllable added, and the subsequent silent discharge is very much diminished, as at Fig. 12.

Some words appeared shorter when a syllable was added, as, for instance, the word "strength" and "strengthen," the mark made by sounding the latter being considerably shorter than when the former was spoken, as may be seen by comparing the diagram of the two words in Fig. 13.

To test the rapidity of the action of the instrument, the old nursery line "Peter Piper picked a peck of pickled pepper" was repeated at the rate of six syllables per second, and the diagram shown in Fig. 14 was the result.



In Fig. 15 may be seen the diagrams made when the word "Incomprehensibility" was spoken in different tones, showing that, although a certain amount of variation due to the energy occurs, yet each sound preserves the same specific character.

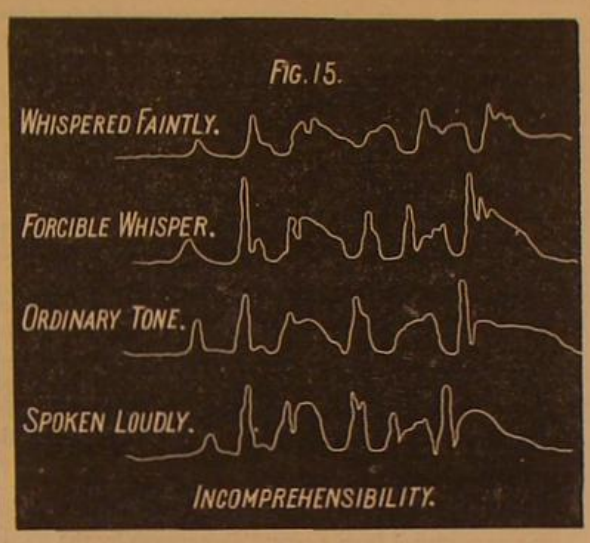
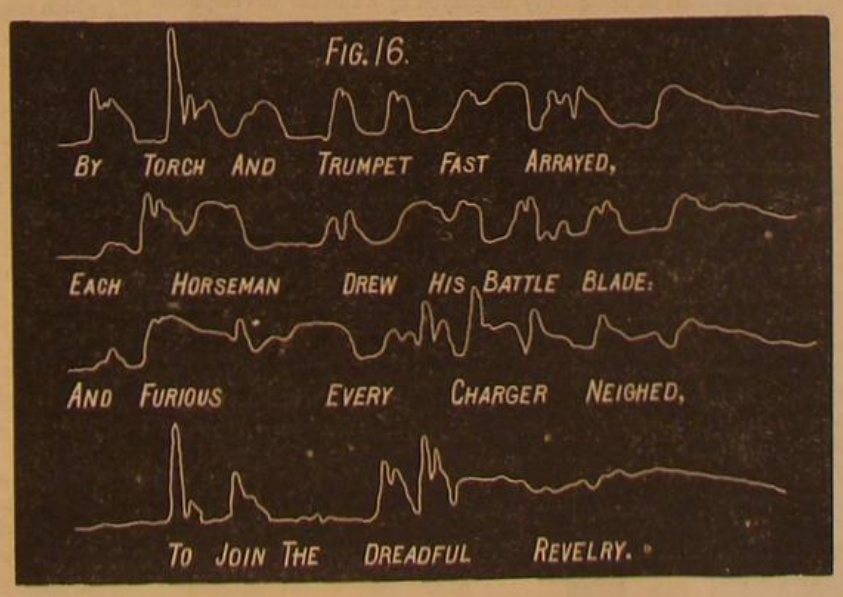


Fig. 16 shows the diagrams made by repeating the well-known stanza from "Hohenlinden."

From the above it would appear that sooner or later we may expect to see the desks of our popular preachers provided with reporting instruments something on the same principle as Mr. Barlow's logograph, only much more delicate, so that each discourse may be taken verbatim, as it would seem that it would be comparatively easy to learn to translate the logographic diagrams (or logograms, if we may be allowed to coin a word) into plain English writing. It may be more difficult, however, to report the speakers at a public meeting in this manner, as, so far, we know of no means of separating from the discourse the various noises that indicate the applause or dissatisfaction of the audience, and which would, when operating in conjunction with it, produce a strange jumble of marks that would puzzle not only a Philadelphia lawyer, but a dozen of them, to decipher. If to the various noises produced by the vocal organs of the audience is added the occasional peculiar "swish" of a mal-odorous egg, deftly thrown by one used to the business, we are inclined to think that the deciphering of the extraordinary logogams thus made would require something more than human judgment, and it may therefore sometimes be necessary to press into the service as a translator the spirit of some defunct reporter or compositor, who, when in the flesh, made his living by rendering the late Horace Greeley's hieroglyphics into decent Roman type.



Washing with Silver.

Copper articles can be covered with an almost imponderable layer of silver. Some idea of the thinness of this layer can be imagined when we think that, inclusive of material, labor, capital, etc., the cost of silvering 1 lb. of corset eyelets is only 6¼ cents, while 1 lb. of buttons, suspender buckles, pins, etc., cost from 2 to 3 cents, while a grain of pure silver is worth 5 cents.

The method of washing these articles with pure silver is thus described by Roseleur in the *Metallarbeiter*, p. 316: Any desired amount of granulated silver is dissolved in twice its weight of nitric acid. The solution of nitrate of silver is then diluted with distilled water, and precipitated by a solution of table salt or hydrochloric acid, when a white cheesy precipitate is produced, which soon settles (especially if stirred). It is easy to ascertain whether all the nitrate of silver has been decomposed, which is the case when a drop of the salt solution or acid does not produce turbidity in the clear, supernatant liquid over the precipitate. The liquid is poured off and the precipitate washed by decantation repeatedly with distilled water to remove all free acid. If it is necessary to preserve the chloride of silver some time before using, it must be carefully protected from the light, because under the influence of light it changes rapidly and acquires a bluish color.

The chloride of silver is then intimately mixed with a little water and at least 80 per cent of tartar (bitartrate of potash), and the whole preserved in a stone pot. The composition of the mass is found to be extremely varied, for to the tartar is added a quantity of other substances like sulphate of soda, common salt, quicklime, magnesia, corrosive sublimate, etc., most of which, if not exactly injurious, are at least perfectly useless. We give here a formula somewhat cheaper than when tartar alone is used, which gives very good results: Chloride of silver from 30 grammes silver; pulverized tartar, 2½ kilos.; table salt, 2½ kilos. Some persons employ the salt alone without any tartar, but the silvering is then rather bluish.

When the paste is ready, some water is heated to boiling in a vessel of red copper, and one or two spoonsful of the paste thrown in it, which dissolves more or less. In a bath prepared in this way, the articles to be silvered must either be suspended from hooks or contained in a colander; usually a second vessel, less deep than the first and full of holes, is set against it, resting upon edge of the first, so that the articles in it are covered to a certain depth with the bath. When the silvering is ended it can be removed without wasting any of the solution. The articles are stirred around with a wooden spatula.

In each operation a quantity of paste, proportional to the surface of the articles to be washed, is added.

This silver bath improves by use, and finally acquires a dark green color from the dissolved copper, which takes the place in solution of the precipitated silver.

The silvering is not so perfect as the gilding in gold washes. They generally make use of the useless acids as in coppering. They are polished by means of sawdust, scarcely ever by means of a brush.

The smallest quantity of iron, zinc or tin, in the bath, spoils it, for all brass and copper articles then turn red.

The iron is first removed by means of a magnet. Little splinters of zinc are removed by treating the article with very dilute hydrochloric or sulphuric acids, which do not attack copper when cold. Tin or lead, which, however, are seldom present, must be removed by hand.

If, for any reason, the silvering did not succeed, the articles are subsequently dipped for a few seconds in boiling solution of nitrate of silver, 100 parts; cyanide of potassium, 600 parts: water, 1,000 parts.

This bath, which does not keep long, increases the lustre and the whiteness of the article considerably.

Another mixed process, which stands intermediate between dry and wet silvering, is the "paste process," and is also called thumb silvering, stuffed, or pencil silvering (*Daumen, stopfen*, and *Pinsel*, in German). These methods, whose results possess no considerable permanence, but still are much better than the washing process, frequently serve to repair the small breaks in better silvering, and also to produce on thinly gilded articles a mixture of gold and silver, or gold with so-called oxidized silver. The portions which are to be left unsilvered are simply varnished.

The paste for this process is made by grinding in a mortar, or with a muller upon a plate, excluding the light as far as possible, an intimate mixture of the following substances: Fused nitrate of silver, or, better, chloride of silver, 100 parts; binoxalate of potash, 300 parts; tartar, 300 parts; table salt, 420 parts; sal-ammoniac, 80 parts; water, 100 to 150 parts: or, take chloride of silver, 60 parts; tartar, 200 parts; table salt, 300 parts.

The mixture is ground as fine as possible in the mortar, then ground with a muller upon a thick piece of ground plate glass, until no grains are felt when pressing it between the fingers. This paste is kept in a black bottle, or a jar of opaque material, to protect it from the light, which rapidly decomposes it.

When about to use it, a small quantity is triturated with some water in a glass or porcelain dish, and the mass applied with brush or pencil to an article completely covered with gold, either by dipping or electro-plating, where the gold is so thin that the paste can be decomposed through it by the copper. It is then allowed to dry, and warmed. The dry paste exhibits a pink or perfectly green color, according to the thickness of the gold plate and the consequent strength of the chemical reaction. The latter color indicates that a considerable quantity of the copper is dissolved, and in consequence a corresponding amount of silver has been reduced.

The salt that sticks to the article is removed by washing with cold water. The silvering is then pretty but dull, and its lustre and whiteness is increased by dipping for a few seconds in very dilute sulphuric acid, or, better, a solution of cyanide of potassium.

This silvering will bear brushing and polishing, and can also be oxidized, hence it is easy to see that it is preferable to the washing or boiling with silver first described.

In case the first deposit has not been thick enough to make it sufficiently durable, it can be repeated, after polishing, a second or third time.

By the use of this mixture upon non-gilded copper, the silvering is less white and not so durable as upon the gilded articles.

The different powders and liquids which are met with in commerce under the names of silver water, plate conservator, California liquid, etc., and which are used in restaurants and cafés to repair their worn-off silver plate, are nothing more than some of this paste suspended in pure water or salt water.

In America, silvering solutions are usually some poisonous mercurial compound which forms with the brass or copper a brighter and silver-like amalgam, which lasts just long enough for the guilty pedler to effect a safe retreat before its brightness disappears.

These liquids must not be confounded with others sold under the pompous names of "aurophile" and "argentophile," which latter are intended to freshen up old gilded and silvered articles by dissolving the layer of oxide formed on the surface. These fluids are simply solutions of cyanide of potassium, which was formerly recommended for this purpose. They are most violent poisons, and ought under no circumstances to be tolerated in the kitchen.

American Railway Builders in Brazil.

Mr. Gowen, of Philadelphia, has just received a cable telegram from London announcing the execution of the contract there between the Madeira and Mamoré Railroad Company (Limited), the National Bolivian Navigation Company, and Messrs. P. & T. Collins, contractors, of Philadelphia, by which the latter agree to complete the grading, masonry, and superstructure, and furnish the equipment of the railroad of the first named company. This road is projected from the present head of navigation on the Madeira River, a branch of the Amazon, in Brazil, to Bananeria Falls, on the Mamoré River, on the borders of Bolivia, and is about 180 miles long, embracing the falls and rapids, which now render navigation impracticable. It is designed as a narrow gauge road, with iron rails of 45 pounds per yard, and will be used to transport the products of the Atlantic slopes of the Andes to the navigable waters of the Madeira River and thence down the Amazon. The Philadelphia and Reading Coal and Iron Company will supply all the rails and other ironwork and materials that will be required to construct and equip the road. This is a first and most important opening of trade between this port and Brazil. The equipment will include locomotives, cars, rails, spikes, bolts, chairs, turn-tables, etc., and the total cost of the road is said to be

$5,000,000. The payment to the contractors will be about three quarters in cash, for which the money is now in hand, and the remainder in the debentures of the railway company, guaranteed by the Brazilian Government. The Philadelphia and Reading Coal and Iron Company will receive immediate cash payments on shipment of the materials from the port of Philadelphia.—*Engineering News.*

New Inventions.

A novel Horse Detacher has been patented by Mr. John L. Kellum, of Salem (Maxwell Station P. O.), Tenn., the arrangement of which is such that the animal may be quickly let go should he become frightened or unmanageable. The device also enables the traces to be conveniently fastened to or loosened from the whiffletree when attaching or detaching the horses.

A new Sun Dial, patented by Mr. Axel W. Anderson, of Bedford, Pa., consists of a ring having circumferential slots, surrounded by a perforated adjustable band, and containing an adjustable dial or scale, formed in an epicycloidal curve. A pencil of light falls upon hour marks engraved on the device, through an aperture in the band. This invention is both curious and ingenious, and as the inventor states it may be made small enough to serve as a charm for a watch chain, it doubtless would be a profitable article to manufacture.

Mrs. Julia Wuerfel, of Sheboygan, Wis., has devised a new Dress Pattern Chart, which is quite simple, and which furnishes a guide for any size or style of cutting. Its use is quickly learned.

A new Photographic Camera, invented by Mr. John C. Moss, of New York city, is adapted for drawings photographs, etc. It consists mainly in a device for suspending the instrument so that it will not be affected by the jarring or vibration of the building in which it is placed, and also in novel mechanism for focusing and adjusting the camera.

Mr. Joseph G. Densmore, of West Dresden, Me., has invented a Ferry Boat, which is impelled across rivers, etc., by the action of the current. The boat is adjusted at an angle with respect to the crossing rope, so that the current will strike directors at an angle which may be increased or diminished at will.

A novel Thill Coupling has been devised by Mr. David R. Silver, of Sidney, Ohio, which is so constructed as to have little wear, to allow of wear being taken up, and which admits of the thills being readily and quickly attached, or they may be detached by removing one bolt from each coupling.

A Surgical Apparatus, patented by Frank Green, of Columbia, S. C., for preparing bandages, spreads the plaster of Paris simultaneously with the winding of the bandage, so as to save time and material. It consists of a box with guide, tension, and winding devices, used in connection with a hopper for the plaster of Paris, having slides to regulate wide and thickness of plaster to be spread, and to cut off the supply when the bandage is nearly covered. The box has also a tank to apply soluble glass to a bandage. It is valuable to surgeons.

A new method of Attaching Shanks to Door Knobs, patented by A. E. Young, of Boston, Mass., consists in pouring into the hollow knob a quantity of melted cement, sufficient to partly fill it, inserting the shank or socket, and inverting it to permit the cement to settle around it.

In a Rein Holder patented by Gregory Jennings, of West Cairo, O., a slotted tube is provided with a hook and spiral spring. The rod is fitted with a screw and crosshead, which fits between the arms of the hook. It holds the reins firmly and prevents their falling to the ground.

In a Bicycle, patented by John Smith and E. T. Thurston, of Rockville Center, N. Y., the driving wheel is provided at the axle with end pinions, which are operated by internally geared wheels loosely pivoted on each side and provided with treadles. It has the merit of simplicity.

G. Keilicks, of Chapin, Ill., has invented a Door Securer. At one end of a slotted bar is a chisel-shaped point at right angles, which fits into the jamb of the door. A thumb screw is fitted to the other end, which works through brackets. It is of use to travelers.

An improved Brush has been patented by B. R. Hill, of Pompton, N. J. After boring the usual holes in the wood, a suitable tool is introduced into them, and interior tapering holes are made larger than the outer hole. The brush is driven in with a small wedge, which expands in the large hole within and firmly holds the bristles.

In a Smoke Ventilator, invented by C. K. Edwards, of Boston, Mass., the strips and openings being all constructed by sixes, three openings will receive the wind, leaving three for the smoke and foul air to escape through. By an ingenious device the strips and openings are so arranged that the wind cannot blow into the main pipe, but must pass out through the openings on the opposite side, carrying the smoke with it and increasing the upward draft of the flue.

A Tucker, patented by Eliza Ann Vance, of Gallipolis, O., consists of two movable parts, both of which are clamped to the cloth plate of the sewing machine. The upper part is movably attached to the lower by flanges, to regulate the distance apart of the tucks, and edges of arms are turned over each other. It is a useful addition to the sewing machine.

An Oil Well Torpedo has been patented by C. A. McCoy, of Edenburg, Pa. It consists of a cylindro-conical vessel adapted to contain nitro-glycerin, and which is provided externally with annular elastic cushions to prevent premature explosions. Percussion cap plungers are secured to a weight and suitably guided and arranged to strike upon anvils fixed inside of the vessel. It is an effective instrument.

JOHN WILLIAM DRAPER.

John William Draper was born at St. Helen's, near Liverpool in 1811. From an early age his attention was devoted to chemistry, natural philosophy, and the higher mathematics. After prosecuting his chemical studies for some time at the University of London, he emigrated to the United States and entered the University of Pennsylvania. He took the degree of M.D. there in 1836, with the rare distinction that his thesis was selected for publication by the medical faculty. For a time he was Professor of the Natural Sciences at Hampden, Sidney College, Va., and in 1839 he was called to the chair of chemistry in the University in the City of New York. Among the first studies to which Dr. Draper directed his attention was the chemical action of light. In 1842 he discovered that not only might the Fraunhofer fixed lines in the spectrum be photographed, but that there exists a vast number of others beyond the violet, which up to that time had been unknown. Of these new lines, which more than doubled in number those already known, he published engravings. He also invented the instrument for measuring the chemical force of light, the chlor-hydrogen photometer. His memoir "On the Production of Light by Heat," published in 1847, was an important contribution to spectrum analysis. It gave the means for determining the solid or gaseous condition of the sun, stars, and nebula. He established experimentally that all solid substances, and probably liquids, become incandescent at the same temperature; that the thermometric point at which such substances are red hot is about 977° Fah; and that the spectrum of an incandescent solid is continuous—it contains neither bright nor dark fixed lines.

Dr. Draper was the first person who succeeded in taking portraits of the human face by photography, and was also the first to take photographs of the moon. His memoir on the Distribution of Heat in the Spectrum showed that the predominance of heat in the less refrangible regions is due to the action of the prism, and would not be observed in a normal spectrum, such as is formed by a grating; and that all the rays of light have intrinsically heating power.

He discovered more than forty years ago the facts in regard to capillary attraction, claimed by Mr. Lippman and which lately excited so much attention in Europe.

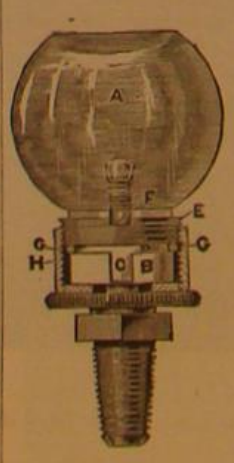
Dr. Draper has published many works on scientific and other subjects, and has made many other important discoveries, too numerous for us to mention here. He stands in the front rank of living scientists. His two sons, Professor J. C. Draper and Professor Henry Draper have also written much and made many important researches, the latter having lately discovered the presence of oxygen in the sun.

The large and elegant likeness we present on our front page was engraved from a recent photograph by the Photo-Engraving Company of 67 Park Place. It shows to what perfection the art of photo-engraving has been brought, and the fineness of the work which it performs. There is no hand work whatever on the block, and yet the lines are deep sharp, and even, and fairly rival the best work of skilled wood engravers. It seems eminently proper that the portrait of one of the first discoverers of photography should thus be beautifully displayed by a further development of his own discovery.

AUTOMATIC SHAFT OILER.

The annexed cut represents a new and simple shaft oiler, by means of which it is claimed that the difficulty experienced in making an air-tight joint between the glass globe and its brass socket, and in regulating the flow of oil, is avoided.

A is a glass globe with grooved neck, B, the end of which is ground smooth to form a tight joint against a cork washer.



A threaded brass ring with a projection, C, to prevent turning, slips over the neck, and is retained by a soft brass ring to the groove above B. The feed is regulated by a hole in slotted screw, D, with air-tight packing, E. The slot in screw is parallel with the hole, and will show the amount of fuel like a cock. A new glass is easily replaced by removing the soft brass ring from the groove, and the feed regulated without removing the cup.

By the use of these cups, waste in oiling machinery is claimed to be avoided, as it is stated that a cupful of oil will keep machinery well lubricated for many months.

For further particulars address F. Lunkenheimer, Cincinnati Brass Works, Cincinnati, Ohio, sole owner and manufacturer.

New Regulation about Boilers.

Supervising and local inspectors of steam vessels are now notified by the Treasury Department Supervising Inspector-General, that some manufacturers of boiler iron are stamping iron of their manufacture at much higher tensile strain than such iron will bear when tested by the Riehle testing machine. In consequence of this practice, injury has resulted to boiler manufacturers, who innocently purchased such iron, and failed to apply the test until after the completion of the boilers, as recently occurred in two cases in the local districts of New York and Philadelphia.

To prevent a practice so unjust and manifestly dangerous, Inspectors are directed to obtain samples from the plates of all boilers about to be constructed in their districts, and subject them to an actual test *before* the boilers are begun, and to represent to boiler manufacturers the importance to themselves of this precaution. Whenever the results of such tests fall below the tensile strength stamped on the iron, Inspectors must report such results to the Supervising Inspector-General.

Inspectors are also directed to carefully ascertain that all samples of boiler plates tested by them have the homogeneousness and toughness required by Revised Statutes, and to be especially careful in that respect where the plates are stamped above 50,000 lbs. tensile strength.

New Mechanical Inventions.

An improved system of Friction Gearing has been patented by Mr. Daniel H. Merritt, of Marquette, Mich., which consists in making a V-shaped groove between the bases of the ribs or teeth, the angle being more acute than that of the latter. As the teeth travel faster at this periphery than at their bases, they are consequently liable to greater wear at the former portion, but by this construction as they are abraded they maintain their original form.

Mr. Greene Chote, of East Saginaw, Mich., has devised a new Pipe Elbow Seaming Machine. The parts of the elbow are passed through collars, so that the seam is closed directly over the edge of a plate. The rear collar is then drawn down, forming one bend of the seam and holding the inner section. The drawing down of the forward collar closes the seam.

A new Breech-Loading Firearm, patented by Mr. Victor Bory, of New York city, is an improvement on the arm patented by same inventor June 5, 1877. The construction is materially simplified, and new devices for hinging the barrel to the breech-piece, working the extractor, etc., are added.

A new Rock Drill has been patented by Mr. Uriah Cummings, of Buffalo, N. Y. The novelty consists in constructing the clutch head with ratchet teeth on its upper end, in combination with a pawl, which is so arranged on the frame of the machine that the drill rod will receive intermittent rotary movement during its ascending strokes.

Mr. Albert S. Todd, of Pultneyville, N. Y., has invented a very ingenious Mechanical Movement, which may be driven either by hand or foot, and by one or more persons, for actuating machines, propelling boats, and carriages. Several correspondents have asked us for a machine of this kind, and their attention is accordingly directed to Mr. Todd's device.

J. R. Vellacott, of Buffalo, N. Y., has patented a Tension Attachment for Scroll Saws. It consists in the combination, with a suitable frame, of two curved levers, connected by a link of flexible material, and drawn upward by spiral springs attached to stirrups, in which are journaled rollers, that travel on the under surface of the curved levers and equalize the strain upon the saw. It is a good device.

A Hinge patented by Benjamin Fahnestock and H. F. Peckham, of Watsonville, Cal., consists in a reversible or right and left butt hinge, which is constructed with a removble solid eye, having secured to it a washer and also pintles, which are designed to enter double barrel eyes formed on one of the leaves. It is a good hinge.

H. Niles Harrington and Mitchel Stoddard, of Stockbridge, N. Y., have invented an improved Washing Machine It consists of a permanent suds box with side uprights or standards. Oscillating upon a cross rod at the top is a slightly convex rub board grooved diagonally on its lower face. A curved lever, suitably attached, serves to press the rubber upon the clothes, which are placed on a series of rollers which are themselves supported on springs, which yield to the varying thickness of material. It will prove a very useful article in the laundry.

George W. Higgins, of Shelbyville, Ind., has invented an improved Saw Frame for Sawing Machines. It is independent of and detachably fastened to the vehicle frame, and can be slid upon the latter, so as to allow the vehicle to turn conveniently among the trees. It can be operated easily by one attendant.

In a Water Meter invented by D. P. Weir, of Salem, Mass., a toggle-jointed spring lever works the valve by the recoil of the spring, which is compressed by the piston of the engine in the forepart of its movement, and escapes after passing the center, and then acts on the valve. It is geared to the valve by a simple and effective device, thus furnishing a reliable meter.

A Cut-off Valve has been patented by Thomas Whittaker, of Passaic, N. J. The top plate of the cylinder has steam ports and induction and eduction channels, and is combined with a balanced side valve with correspondingly tapering cavities, to which longitudinal and transverse motion is imparted for regulating the speed of the engine, so as to secure uniformity of speed. The valve is guided by a transversely reciprocating slide frame connected to the governor. A steam chest is thus dispensed with and a simple slide valve obtained.

An improved Circular Saw patented by C.Y. Wilson, of Macon, Ga., has three teeth in each set, the front one being a base recessed clearer in line with the saw plate, and the other two being cutters vertical on one edge, inclined on the other, and sharpened as well as rounded on the points. It cuts smoothly and quickly.

Business and Personal.

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

For Sale Cheap—A 4 inch Refr. Telescope with accessories. Address H. Harrison, P.O. Box 179, Jersey City, N. J.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister Mf. Optician, 49 Nassau St., N.Y.

Lansdell's Steam Siphon pumps sandy and gritty water as easily as clean. Leng & Ogden, 212 Pearl St., N.Y.

Lipsey "Reliable" Wrench; strong, convenient. Best. Roper Caloric Engine Manuf. Co., 91 Washington St., N.Y.

We intend building a Foundry. Parties having Cupolas, Blowers, etc. for sale, address Victor Machine Co., Niverville, N. Y.

Ice Machines. Clayton & Cook, Daretown, N. J.

Corliss Engine Builders, with Wetherill's improvements, Engineers, Machinists, Iron Founders, and Boiler Makers. Robt. Wetherill & Co., Chester, Pa.

The Niles Tool Works, Hamilton, O., have second-hand Machine Tools in first class order for sale.

Auction Sale of 17 Screw Cutting Engine Lathes, 5 Planers, Engine, Boilers, etc., at 301 Cherry St., Phila., Pa., 11 A.M., Dec. 3d. Send for Catalogue to M. Thomas & Sons, Auctioneers, S. 4th St., Phila., Pa.

Electrical Goods of every description. Annunciators, Bells, Magnets, Batteries, Wire, etc. Finger, Risteen & Co., Melrose, Mass.

For Steam Engines with Corliss Valve, all sizes, apply to Watts, Campbell & Co., Newark, N.J.

Wanted to Manufacture small Articles or light Machinery (Wood or Iron) on royalty or otherwise. Address Box 401, Westerly, R.I.

Don't Infringe. See notice of Patents on Wood Driers of G. W. Read & Co., on page 380.

Bound Volumes of the Scientific American.—I have on hand about 100 bound volumes of the Scientific American, which I will sell at $1 each, to be sent by express. John Edwards, P.O. Box 773, N.Y.

Wanted.—A New or Second-hand Brown & Sharp No. 1 Universal Milling Machine. Address, giving full particulars and price, Lidgerwood Manufacturing Co., P.O. Box 3,132, N. Y.

Wanted.—A Partner with $4,000, to buy a half interest and take the management of a Manufacturing business in St. Louis, established several years. A young man with a knowledge of Mechanics and Engineering preferred. Address James V. Chalmers, Morgan Iron Works, N. Y.

The Best Mill in the World, for White Lead, Dry, Paste, or Mixed Paint, Printing Ink, Chocolate, Paris White, Shoe Blacking, etc., Flour, Meal, Feed, Drugs, Cork, etc. Charles Ross, Jr., Williamsburgh, N. J.

Boilers set with the Jarvis Furnace will burn screenings and little soft coal without blower.

If you have a good thing you wish introduced into Canada, address W.H. Sheppard, General Manufacturer's Agent, 183 Queen St., Toronto, Canada.

A good Machinist or Pattern Maker having $2,000 may secure ⅓ interest in an old, valuable, and pleasant business. For particulars, address T. B. Jeffery, Canal St., Chicago, Ill.

The experiments in testing the efficiency of different Coverings for Steam Pipes at Trinity College Buildings, Hartford, Conn., which resulted in favor of the Chalmers Spence "Air-space" Covering, were conducted under the supervision of F. H. Kimball, the architect of the buildings.

For Sale.—The Patent of a new Water Elevator. Address P.O. Box 470, N.Y. city.

A German gentleman, of large experience, speaking the modern languages fluently, wishes to represent one or two best American firms at the Paris Exhibition. Address L. B. 1,000, Youngstown, O.

For Sale, Exchange, or To Let.—Large Factory, with engine complete. Address P.O. Box 470, N.Y. city.

Root Blowers, No. 1, 2, and 4; also a No. 5 Sturtevant Blower—all suitable for cupola or forges—and a No. 6 Hot Blast Heater, in perfect order, at very low prices. Address Hill, Clarke & Co., Boston, Mass.

Bishop Stave-Sawing Machine for light work. Novelty Iron Works, Dubuque, Iowa, sole manufacturers. It makes the best stave, uses less timber, cuts with the grain, and makes 6,000 to 9,000 per day. We also build Barrel Machinery for "Slack Work," Gauge Lathes, etc. Send us your address for circulars.

Noise-Quieting Nozzles for Locomotives, Steamboats, etc. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For New Illustrated Catalogue of Foot Lathes, Scroll Saws, Small Steam Engines and Amateur's Tools, send stamp to Chase & Woodman, Newark, N. J.

Shaw's Mercury Gauges, U. S. Standard of Pressure. 915 Ridge Ave., Philadelphia, Pa.

Bolt Forging Mach. & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Town & Village use, Comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Best and Cheapest Wagon Tire Upsetter, only $12. Circular free. H. W. Seaman & Co., Millport, N. Y.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

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Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R.I.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Boulter's Superior Muffles, Assayers and Cupellers Portable Furnaces, Slides, Tile, Fire Brick and Fire Clay for sale. 1,939 North St., Philadelphia, Pa.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U.S.A.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Felt of every description for Manufacturers' purposes, especially adapted for Polishing, can be furnished in any thickness, size, or shape. Tingue, House & Co., Manufacturers. Salesroom, 69 Duane St., N. Y. Factory at Glenville, Conn.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Best Pulleys and Couplings made; secured to shafts without keys, set-screws, bolts, or pins. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

Articles in Light Metal Work, Fine Castings in Brass Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles' Specialty Works, Chicago, Ill.

Gun and Sewing Machine Tools. Pratt & Whitney, Hartford, Conn.

The Varnishes and Japans of Hyatt & Co., established 1872 ("The London Manuf. Co."), made from scientific formula by a practical maker of materials, free of deleterious substances, are, in the success met with, noted for color, purity, and durability, with cheapness, giving them meritorious pre-eminence. Try them. Send for circulars and price list to Company's office, 346 Grand street, N. Y.

C. C. Phillips, 4,048 Girard Ave., West Phila., manufactures Vertical and other Burr Mills adapted to all kinds of grinding: also Portable Flouring Mills.

Wind Engines, for general use, where economy and regular power is required. Estimates given and printed instructions furnished. Territory granted. Apply to S. W. Kennedy, 516 Fairmount Ave., Philadelphia, Pa.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 382.

Notes & Queries

(1) H. S. asks: What is the cause of a person sweating after death? There was a case of that kind in our settlement and it was thought very strange. A. Probably it was caused by the condensation of vapor on the cold surface of the body, similar to the action in the case of a pitcher filled with ice water.

(2) R. C. A. asks why the drive wheels of a locomotive grip the rails when the cranks are down, and slip when up? A. It is due to the action of the counterbalance.

(3) W. W. W. asks for a recipe for cleaning kid gloves? A. Wash them in benzine.

(4) B. T. M. says: I had a large brick house on my hands, although not an old one. The foundation having given out, I determined to take it down and build a smaller one, using the same bricks. The brick work is now done, but the old mortar shows very much on the brick, more especially on the headers. Is there any way of cleaning off the old mortar with acid, and what acid, what proportion, and how done? A. It would be very difficult to clean the old lime off so as to look well. It would be better to clean the house a light cream color. However, if you can touch the red spots with a little red paint of the color of the brick, you could then give the house a coat of linseed oil.

(5) W. G. R. says: In painting on china with oil colors I find that the paint will not stick, or rubs off. Can you give a recipe to prepare the object so as to make the painting adhere without burning? A. You might scratch the glaze with fine emery paper and use thick colors; but there is no way of permanently applying colors to china except by burning them in.

(6) W. R. K. says: I am desirous of becoming a surveyor, can you tell me where I can learn? A. It is a very common plan for one who desires to obtain practice in surveying to join a surveying party in some humble capacity, and work his way up. There are also technical schools in which surveying is taught. The profession, like most others, has some vacant seats in the front row.

(7) I. G. R. says: I have a mill and well which stand 160 yards from the bed of the creek; from the bed of the creek to the top of the well is 30 feet. The well is 38 feet deep, 8 feet below the bed of the creek. Can I draw the water from the creek into the well by a siphon? A. Yes.

(8) S. A. H. can free his pot plants from lice by enclosing them in a tight chamber and fumigating them with tobacco smoke.

(9) E. R., in answer to R. P. N., says that the Indian summer is caused by the heat which is absorbed by the Lakes, which is given off during the fall as the atmosphere grows colder.

In answer to W. A. P., who inquires what angle the under side of the teeth of an upright saw should make with a horizontal line, E. R. suggests to make the angle 2°, and to hang the saw forward for cutting soft wood.

(10) I. J. I. asks: What are the different kinds of trout and do they belong to the same species? What is the difference between the salmon and the salmon trout? A. All trout are but a species of the salmon family, inhabiting principally fresh water. The salmon trout belong to the genus *fario*, having one row of teeth on the vomer, true salmons having a smooth palate. It is very much larger than the true trout, of a different color, and is found in larger lakes and rivers. Its habits resemble those of the salmon. There are several species of salmon trout in the lakes of Maine. The brook trout is the *salmo fontinalis*, and inhabits streams. To the genus salmo also belong the char of the British and Swiss lakes, the gray trout or togue, and the siskiwit of our own great lakes.

(11) T. G. B. asks: Is there such an instrument as an oblong square? A. No.

Does not the wheat crop of California exceed that of Michigan? A. Yes.

Which are the most valuable, the copper mines of Michigan or the gold mines of California? A. The gold mines.

(12) H. W. W. asks how to prepare electro-plates from engravings on lead? Have obtained an impression with plaster of Paris, but cannot copper plate it. A. Take your impression in beeswax and dust it lightly over with finely powdered plumbago. There should then be no difficulty in obtaining a copper deposit in a suitable bath.

(13) E. T. H. asks for a recipe for polishing show cases of German silver? A. A good polishing powder consists of rock alum, burned and finely powdered, 5 parts; levigated chalk, 1 part. Mix. Apply with a dry brush.

(14) H. F. B. asks: How to mix paints? A. Buy your paints ready mixed in sealed cans in colors to suit your taste.

What is the best and shortest way of building a continued stairway? A. To learn how to build a stairway with continuous rail, you require a treatise on stairbuilding. If, however, you send the dimensions set apart for your stairs to a stairbuilder in this city, he can furnish the stairs for you, and send a man to put them up. Consult a New York business directory if you do not find what you want in our advertising columns.

(15) R. W. asks for a method of rendering canvas or cotton goods impervious to water, yet pliable? A. Plunge the fabric in a solution containing 20 per cent soap, and afterward into another solution containing the same percentage of sulphate of copper. Wash afterwards.

(16) H. R. H. asks: What is the correct answer to the following example? 714—·714+(·34—·034×·25 of 6.) The above said example was given at an examination at the Oshkosh State Normal School, and a dispute arose as to how it should be solved. The following are the solutions of the disputants;

First. 714—·714=713·286
·34—·034=·306
·25 of 6=1·5
·306×1·5=·459
713·286+·459=1554; answer.

Second. ·25 of 6=1·5
·034×1·5=0·51
·34—·051=·289
·714+·289=2·47058+
714—2·47058+=711·52942+ answer.

Should the signs of multiplication and division have preference to those of addition and subtraction? A. The second solution is the correct one. For the first solution the example should be given thus: (714—0·714)÷[(0·34—0·034)×0·25 of 6.]

(17) H. S. asks how to make a powder or solution whereby he can silver plate without a battery? A. Mix 1 part of chloride of silver with 3 parts of pearlash, 1½ parts common salt, and 1 part whiting. Rub the mixture on the metal, previously well cleaned by means of a piece of soft leather. When properly silvered the metal should be washed in hot water slightly alkaline.

(18) C. S. F. says: The indicator on my steam gauge before using was down to the pin (zero). After a few days' use it rests at 10 with the boiler empty. Can I safely consider it as indicating 10 lbs. too much under all pressures? It is in working order. A. You cannot, in the absence of a test.

(19) A. A. W. asks whether any better results would be obtained in setting the valves of a locomotive for fast passenger trains, by giving the backing eccentric more lead than the go-ahead one? A. Other things being equal, we think not.

(20) A. A. asks: What is the strength of a band of wrought iron 2 inches in width and ¼ about (or No. 10, I think) in thickness? A. It should be able to bear a strain of from 10,000 to 12,000 lbs., if the ends are properly welded; a little more than ⅓ as much if they are secured by rivets.

(21) J. W. P. asks: Does not the compression of exhaust steam in the cylinder retard the motion of the engine, and is it a disadvantage only in taking up the lost motion? I find my engine runs smoother with compression, but I do not know about its economy of fuel. A. It is economical to cushion to a certain extent. Compression beyond the economic point is frequently required, in order to make the engine work well.

(22) I. T. S. asks whether a reciprocating engine can be so balanced at a given speed as to stand steady? A. A horizontal engine can be so balanced that there is no tendency to move in a horizontal direction, and if it is sufficiently heavy, it will also be steady in a vertical direction.

(23) S. B. asks: 1. Has an artificial rainbow ever been produced? A. Yes; by projecting a beam of white light through water in the form of very fine spray. 2. Can it be produced, and how? A. See the Scientific American Supplement No. 52, and Science Record for 1874 and 1875.

1. How can I construct the simplest machine (to work by water power) to produce the electric light? A. Sixty to one hundred carbon or Grove cells are connected in series—the zinc of the first and the carbon of the next, and so on. A wire from either end of the series to the lamp completes the circuit.

(24) W. M. says: I have got Bessemer steel shoes ready made for my horse, but the blacksmith cannot weld on cauiks of common steel of the Bessemer shoes. A. There should be no difficulty in the welding if the parts are cleaned on leaving the fire with a steel wire brush; try borax as a flux.

(25) G. C. says: 1. Please inform me if I will get more pressure of water by having my tank bottom made like a funnel, and have a pipe from bottom to my feed pump, than to have it flat? A. No. 2. Also do I want more space for exhaust to escape from heater with two engines than from one, using same steam on both, as one? A. No. 3. Also if one engine has more stroke than the other, will it work all right, both on same shaft, crank on each end, one 8 x 17 and one 10 x 15? A. It can be made to do so. 4. Can I run two engines with as much economy, providing one would do the work? A. Generally, no. 5. I have two rigged up, one 8 x 17 and one 10 x 15; which should I run if only one? I use two boilers, locomotive built. A. It makes very little difference, if they are equally well designed and built. 6. Please say how fast I should run both, and how fast one if used alone? A. You can run them at a piston speed of between 400 and 500 feet per minute, if they are properly constructed.

(26) T. E. M. says: A friend has a horse-chestnut tree in front of his house, a limb of which points toward the west. In the winter, when the weather gets down to zero, the limb turns about 7 inches toward the south: when it becomes warm again it resumes its former position. Will you please give me some explanation? A. The phenomenon may be due to unequal contraction in the trunk of the tree or ground.

(27) E. F. says: I have a small seed microscope with 2 lenses, 1⅛ inch in diameter and 2½ inch focus. Can I make a camera obscura with them? A. No.

How thick is a bound volume of the Scientific American? A. 1¼ inches including covers.

(28) D. F. asks: How is gaseous ammonia made? A. Place a quantity of ammonia water in a retort and apply heat. The gas will immediately begin to come over; it is nearly all expelled from the water by boiling for a few minutes. Ammonia is also obtained by heating ammonium carbonate or chloride (sal ammoniac) with a solution of caustic potash. 2. How can I make gaseous chloride? A. If you mean chlorine, heat an ounce of peroxide of manganese with an equal weight of hydrochloric acid. Chlorine is very poisonous when inhaled. 3. How can I distil chloroform? A. Place the chloroform in a glass retort gently heated. The vapor must be passed through a glass worm surrounded by water, which condenses it.

(29) E. S. asks how to tin cast iron pipe? A. File bright the piece of iron required to be tinned, and mix up the following solution: In a small quantity of spirits of salt, put a piece of zinc the size of a quarter dollar; the spirits of salt will eat it away; wet the places required to be tinned with the solution, then while wet use a copper bit with fine solder, and it will immediately tin.

(30) N. B. asks for a good freezing mixture? A. Pounded ice, salt, and a little sal ammoniac, or ice and hydrochloric acid.

(31) A. J. wishes to polish mother of pearl? A. Go over it with pumicestone finely powdered, and make it very smooth; then apply putty powder and water by a rubber, which will produce a fine gloss and good color.

(32) B. F. asks for a cheap invisible black ink? A. Dissolve 1 fluid oz. of common oil of vitriol in a pint of soft water. Stir well and allow to cool. Write with a clean pen. When dry it will be invisible; held to the fire it turns an indelible black.

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

L. H.—It is quartz—of little value.—J. H. M.—A is a sandstone containing scales of mica. B is a limestone with small particles of marcasite. An analysis would be necessary to determine the exact composition of the samples.—C. M. H.—It is an alloy of tin and lead; the amounts of each can only be determined by a chemical analysis.—E. B.—No. 1 is hornblende. No. 2 is hausmanite—an ore of manganese.—J. S. H.—The rock contains much graphite, and can probably be economically worked.—E. J. F.—It is a ferruginous sand. It does not contain precious metals.—H. F. L.—It is partially altered fibrous talc—a hydrous silicate of magnesia. The mineral is extensively used in the manufacture of writing paper and fireproof roofing paper and paints. It is the chief constituent of many anti-friction powders. See p. 309, current volume of the Scientific American.

COMMUNICATIONS RECEIVED.

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

On a Method of Ventilating Rooms. By H. E. V.

HINTS TO CORRESPONDENTS.

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

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elici-

ted from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

Who makes "Colard Slides" for magic lanterns?

Where can Stephen's writing fluid be bought at wholesale?

Who makes small steam propellers?

What is the address of D. S. H., who inquires about gas purifiers in our issue of December 1?

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

November 6, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Adze eye tools, die for forging, D. Maydole	196,917
Album, B. J. Beck	196,776
Ammonia, producing acid, etc., of, J. D. Siebel	196,771
Apple quartering and coring machine, S. Cooper	196,743
Axle box, self-oiling, J. Dawber	196,789
Barrel machine, J. Naylor, Jr.	196,927
Bath, hot air and vapor, G. Gordon	196,890
Beer cooler, H. Voigt	196,956
Belting machine, C. Kohsel	196,911
Boot, E. F. Bickford	196,778
Boot jack, J. H. Aufderheide	196,857
Bottles, etc., stoppering, J. L. Besnard	196,867
Bottles, etc., stoppering, T. Rule	196,936
Brick machine, R. W. Brownhill	196,782
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Butter worker, R. W. Barnard	196,859
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Carbureter, J. Stratton	196,946
Cartridge, blasting, A. C. Rand	196,767
Chair seat and back, P. Rath	196,824
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Cider mill, portable, L. V. Sikes	195,837
Cigar box, H Meyers	196,920
Clothes wringer, D. G. Beers	196,777
Coffee and peanut roaster, C. L. Hall	196,964
Corkscrew and extractor, combined, N. Oak	196,761
Corset clasp, O. K. Scofield	196,940
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Cultivator, wheel, W. Mettler	196,818
Curtain fixture, J. Reichert	196,768
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Ditching machine, G. W. Nevill	196,922
Door securer, G. E. Kerlicks	196,810
Drawers, men's, H. Borkhim	196,780
Elastic fabrics, manufacture of, M. E. Bowra	196,871
Electric engineering, W. E. Sawyer	196,834
Electroplating, Weston & Quimby	196,846
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Feed water regulator, Gorriti & Unanue	196,797
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Fire pot and water heater, E. P. Doyen	196,884
Fireman's helmet and dress, J. Bechtold	196,892
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Fluting iron, J. H. Cleveland	196,878
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Pen, stencil, T. A. Edison	196,747
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Spoke socket, G. F. Graves	196,891
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Stilts, adjustable, C. S. Shute	196,941
Stirrup, H. M. Hollingsworth	196,900
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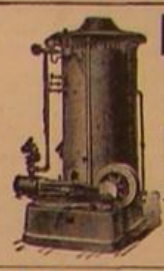
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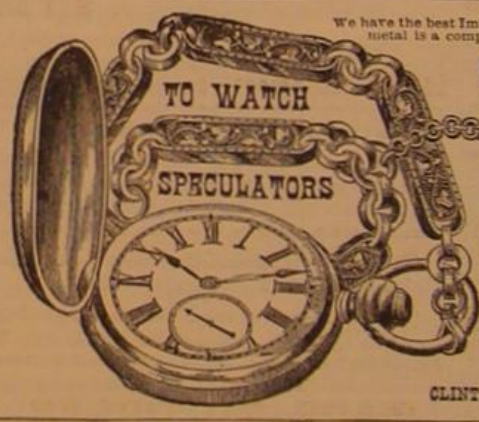
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TESTIMONIALS.

PESHTIGO, Wis., Oct. 23, 1876.

Messrs. CURTIS & Co.:

GENTS—You are at liberty to use our name in reference to the Slotted Saw, as we will endorse anything you say about it, as they have given the fullest satisfaction. Very truly yours, THE PESHTIGO CO.,
Per W. A. Ellis.

VICKSBURG, Miss., Oct. 19, 1876.

Messrs. CURTIS & Co., St. Louis, Mo.:

GENTS—Yours of the 14th inst. received and contents noted. In reply we say you are at perfect liberty to refer to us in any way as regards the Slotted Saw, as we consider it the best saw we have ever seen in every respect. Yours very truly, H. FRENCH & CO.

TOLEDO, ALEXANDER Co., Ill., Oct. 25, 1876.

CURTIS & Co., St. Louis, Mo.:

GENTS—As to the Slotted Saw, you may use my name in any way you wish. I have been foreman in a mill for sixteen years, and have never found any saw to equal it for running light and straight and with the least set. I do say that it is the best saw now in use for hard or soft timber. Yours truly, B. F. DUNCAN.

NECEDAH, Wis., Nov. 2, 1876.

Messrs. CURTIS & Co., St. Louis, Mo.:

GENTS—After having used four of Lockwood's Patent Slotted Circular Saws purchased from you the whole of the past season, we take pleasure in recommending to all who are interested in getting good saws as the best and most perfect working saws we have ever used. If you can do yourselves any further good by referring to us you may do so at any time.
Yours respectfully, T. WESTON & CO.

MILLVIEW, Fla., Oct. 20, 1876.

Messrs. CURTIS & Co., St. Louis, Mo.:

GENTLEMEN—Your favor of the 14th inst. at hand and contents noted; also your inquiry in regard to the merits of your Patent Slotted Saw. I take pleasure in saying that I regard them as being the very best circular saw made, and shall at any and at all times take pleasure in so recommending them.
Respectfully yours, GEO. W. ROBINSON.

NORFOLK, Va., Nov. 2, 1876.

Messrs. CURTIS & Co., St. Louis, Mo.:

GENTS—In reply to your letter of inquiry regarding the 60-inch, nine gauge, Slotted Saw of the Lockwood Patent, which we purchased of you during the early part of the present year, we are happy to state that it does its work well, giving us entire satisfaction. We are running it 700 revolutions and carrying 2-inch feed, in Virginia green pine, which during the largest part of the year comes to the log-yard with more or less mud and grit. Yours truly, BATCHELDER & COLLINS.

MILL SPRINGS, Mo., March 27, 1876.

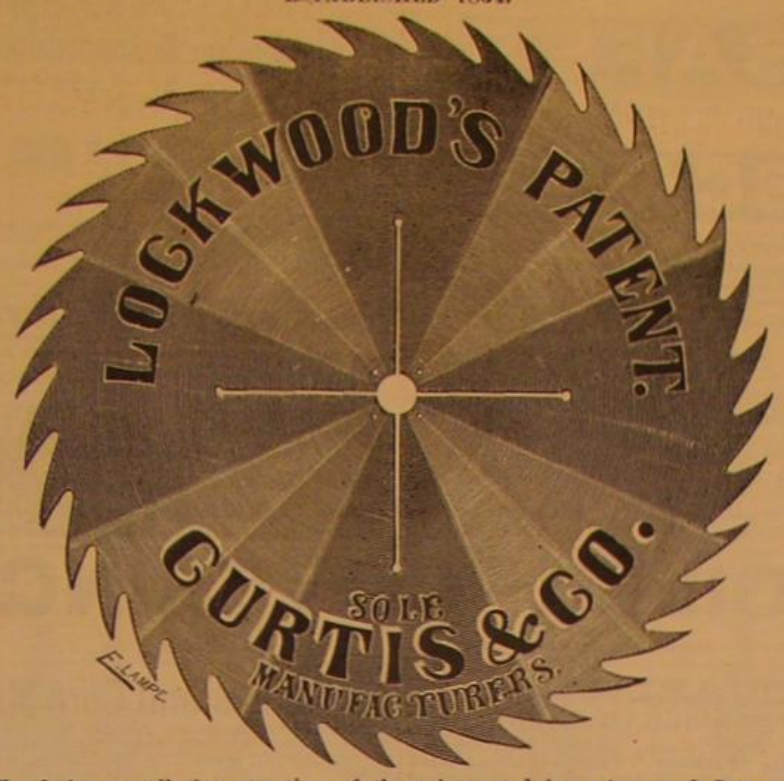
Messrs. CURTIS & Co.:

GENTLEMEN—Your favor at hand. In reply, allow me to congratulate you upon the success of your Lockwood Patent Slotted Saw. I have been using the saw for six months, and I can frankly say in my entire sawmill experience of fifteen years I have seen no improvement of any nature in a sawmill that combines so many good qualities—no waver, no beating, etc.; and I am able to run it with such little set that I make no more sawdust than I can conveniently burn, while before I was compelled to employ an extra man to wheel away the surplus dust. I have known my sawyer, Samuel Benfield, after hammer swedging the teeth, to run from 6 A. M. to 12 noon, without pointing up.
Yours respectfully, R. CUTLER.

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It has stood the test, both in the different kinds of pine and hard wood lumber with best possible results, demonstrating that a slotted saw can be run with at least one gauge less set. Will make much truer and smoother lumber, and, being unaffected by heating, retains its stiffness and will never require re-hammering, as the case with solid saws.

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TESTIMONIALS.

LUDINGTON, Mich., March 6, 1876.

Messrs. C. & Co.:

GENTS.—In reply to your inquiry as to the working of the Lockwood Slotted Saw, we are happy to state that it has given us the most perfect satisfaction. We used the saw alternately with a solid saw, and we found from actual test that during every tour of the Slotted Saw (and it run equal time with the solid) we cut from 3 M to 5 M feet more lumber than we did with the solid saw. The lumber was smoother and better, and during the whole season the Slotted required no hammering and never dodged from a perfect line. We filed the Slotted to run into the log and forced the saw with the guide to its true position; but it made as good lumber as before, and no heating affected its work. We can do with a Slotted everything that we can do with a solid saw, and we can make good lumber with a Slotted Saw, when, under like conditions, a solid saw could not make a cut. We have given this saw a thorough practical test, and are fully satisfied that it is the most successful working saw ever made. We care to use no other in our mills, and shall take pleasure in showing its work to all who are interested in getting good saws.

Very truly yours, DELOS L. FILER,
Pres't Pere Marquette Lumber Co.

MR. H. B. HOFFMAN:

DEAR SIR—I am very glad to tell you that the 60-inch Lockwood Patent Slotted Saw I ordered from you, manufactured by Curtis & Co., St. Louis, has been put to the severest test, and we are perfectly satisfied that the Slotting is a great improvement over the ordinary saw, and it gives us perfect satisfaction. I have just received a second saw and so far find it to fill the bill perfectly. A. MARTIN.

New Orleans, March 13, 1876.

Messrs. CURTIS & Co., ST. LOUIS, Mo.:

GENTS—Yours of the 14th inst., asking our opinion of the Lockwood Patent Slotted Circular Saw, is received. We hasten to say that we have run it the past season, sawing old, dry, condemned hewn timber into sawn timber, the most severe test we think that could be made, and one which no other saw which we have used has withstood and have not cut a crooked line. We shall want another just as soon as this business starts. No runner for other make of saws stops to bother us after seeing our saw and its work. *It is a complete success.* Yours very truly,

THOMAS F. BURGESS, Manager.

Island Mills, Pensacola, Fla., Oct. 21, 1876.

CURTIS & Co.:

GENTS—Yours of the 14th inst., to hand, and in reply will say I have been in the saw-mill business twenty years and have never run a line with any other but a circular saw, and have run the following brands: Hoe; Diston; Welch & Griffith; Branc., Crookes & Co.; Turner & Son; Spear & Jackson; Curtis & Co.; but I think the Slotted Saw I got from you last spring is the simplest cutting saw of any I ever controlled. I run on a 2¾ inch feed through any common timber, with 80 lbs. steam and a 10 x 20 Blandy Portable.

Yours respectfully, W. J. JACKSON,
of the firm of Manny & Jackson.

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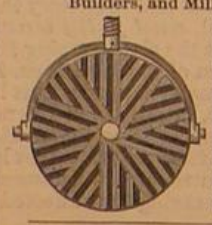
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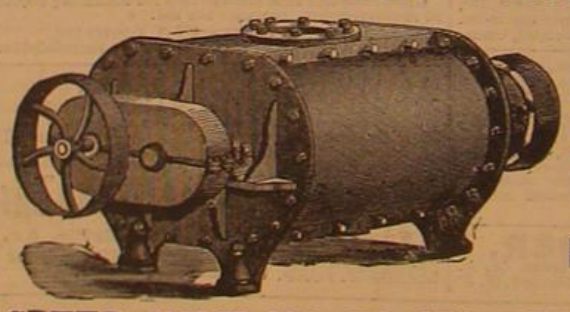
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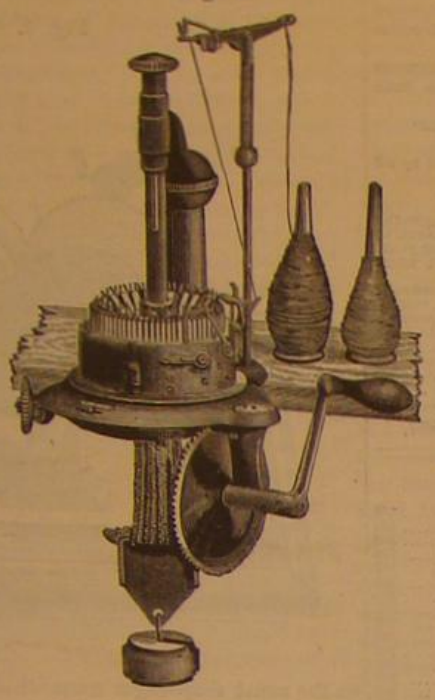
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Fig. 1.



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Fig. 3.

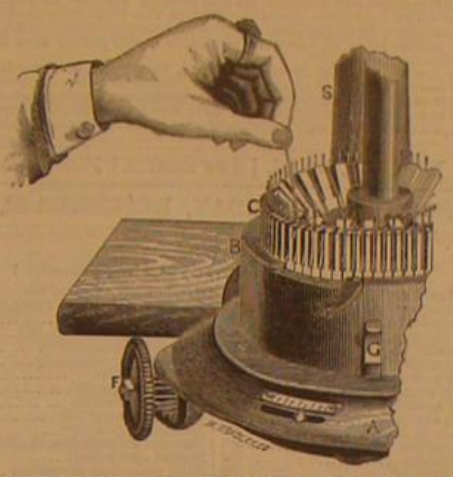
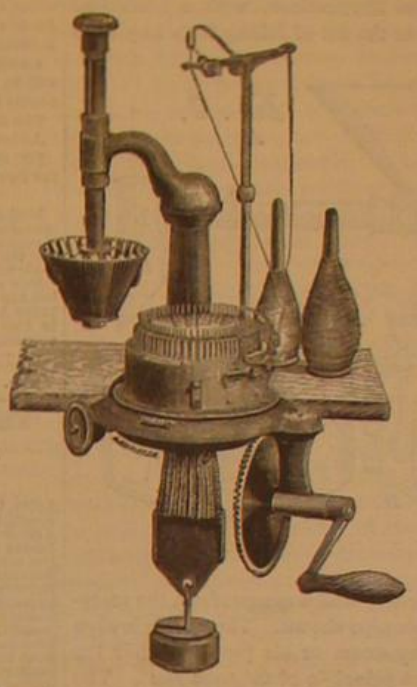


Fig. 2.



THE TUTTLE FAMILY KNITTER.

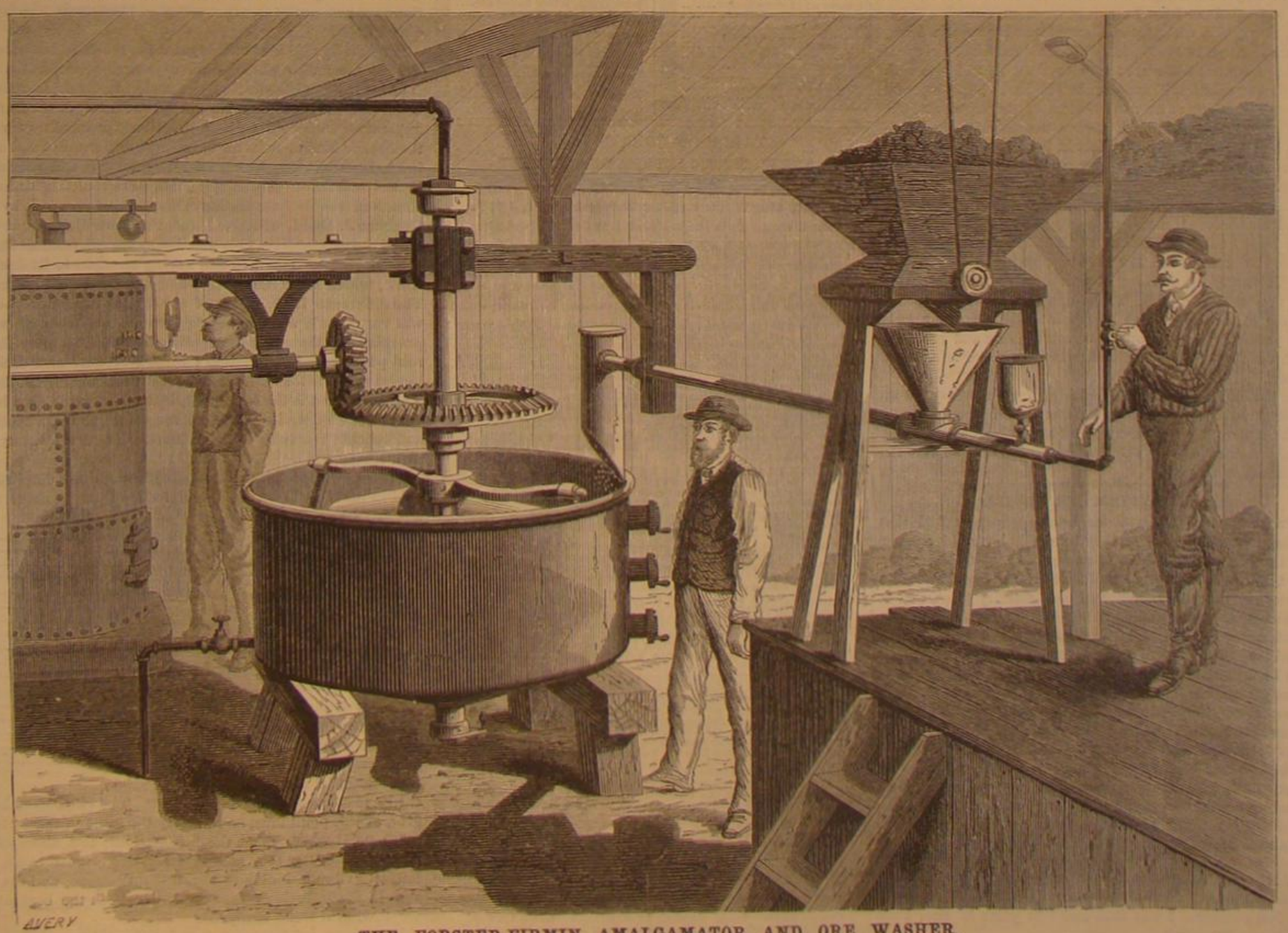
This machine has a compound motion and can be run either way, backwards orforwards. Thus the work may stand still while the cylinders revolve, or the work revolve while the cylinders stand still. Each machine is provided with a register which accurately counts every full revolution of the machine whether turned either way.

Fig. 1 shows the conical cylinder or ribber at work, Fig. 2 the ribber when thrown out of work, and Fig. 3 exhibits the operation of transferring a needle from one cylinder to another. The machine is adapted to the manufacture of all kinds of hosiery and for family use.

Patented April 14, 1874. For further information address the Lamb Knitting Machine Company, Chicopee Falls, Mass.

THE FORSTER-FIRMIN AMALGAMATOR AND ORE WASHER.

The magnitude of the mining interests in this country and the difficulties of treating ores containing the precious metals have resulted in many attempts to produce a machine or



THE FORSTER-FIRMIN AMALGAMATOR AND ORE WASHER.

system that will shorten the process of extracting the metals and reduce the cost, so as to enable poor ores, which are so abundant, to be worked at a profit. Millions of tons of the material are technically known as "tailings" (that is, ores from which has been taken all the gold and silver that, by present processes, can be profitably extracted, but which still contain an appreciable quantity of the precious metals) exist in all the auriferous districts. For the treatment of these ores various methods have been suggested. The principal difficulty that has been encountered is that of bringing mercury into contact with the gold where the latter exists in only small quantities, or from the flouring of the mercury when vapors of mercury are employed, entailing loss of amalgam and mercury in the subsequent treatment.

Messrs. Forster and Firmin, of Norristown, Pennsylvania, have recently devised a novel method of treating ores with mercury, for which letters patent have been granted them in the United States, Canada, Australia, and other countries. The pulverized ore containing tree gold or silver is fed from the hopper, shown in the illustrations, with a horizontal tube, A, Fig. 2. While in the act of falling it is impinged

Fig. 2.

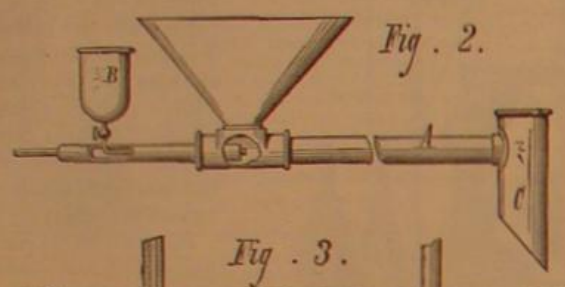
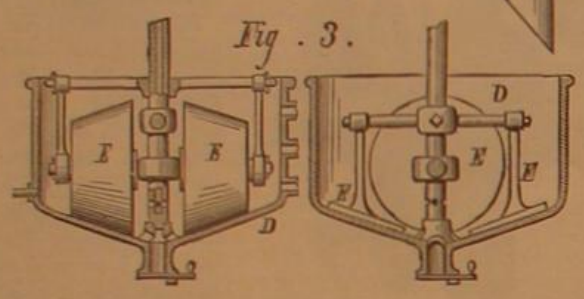


Fig. 3.



upon by a stream of mercury, which escapes from the receptacle, B, through the inner pipe shown. The flow is broken up and carried forward by steam or air pressure, after the manner of the well known principle of the sand blast. The horizontal tube connects with a vertical tube, C, upon which the ore and the atomized mercury are together forcibly projected, grain by grain, in a continuous stream, and fall, by their own gravity, into the washer or receiver, D. It is claimed that an almost unlimited quantity of ore may be treated by this process, as the attendants have only to feed the hoppers and remove the deposit. The inventors state that "with only a three inch tube from three to five tons of ore can be treated per hour."

In connection with this amalgamator an improved washer, shown in detail in Fig. 3, is used. This consists of a vessel, having a conical bottom, in which rollers, E, and also with scrapers or mullers, F, are placed. The feed water is injected through the shaft or near the bottom of the vessel, and the upward current carries off the waste ore, while the amalgam and surplus mercury collect in the dead water space in the conical bottom, whence they are drawn off through the discharge cock.

The advantages claimed for this invention are: 1st. The rapid continuous process of amalgamating, thus treating very large quantities of ore. 2d. The thorough impregnation of the metals with the mercury, giving larger results. 3d. The profitable working of poor ores or tailings, which are now valueless. 4th. The simplicity of the apparatus, having no parts to get out of repair. 5th. The cheapness and portability of the apparatus, and the ease and economy with which it can be operated wherever there is a steam boiler.

In the improved washer the amalgam and mercury are recovered rapidly with a comparatively small flow of water, without the danger of carrying off a portion of either the amalgam or mercury. For further information, address the inventors as above.

CONSTRUCTING ICE HOUSES.

People who do not own ice houses generally find that before the summer is over, they have paid a very high figure for their ice and that the sum so expended would have gone far toward the construction of a suitable storage building. Ice can be gathered near almost any country place, and it can easily be moulded into blocks even if obtained only in the form of a thin layer. The question is how to build a good ice house that will preserve it, and on this point there has been much discussion. Mr. R. G. Hatfield, one of the most prominent architects of this city, points out the best, cheapest and simplest way in SCIENTIFIC AMERICAN SUPPLEMENTS Nos. 55 and 59. There he gives working drawings of an admirable ice house which he has constructed and which has been found to answer its purpose in every particular. If the reader retained an architect to prepare a similar plan the cost would probably be at least fifty dollars; in the SUPPLEMENT, plans, specifications, and descriptions of all the details are given for but twenty cents.

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NEW YORK, SATURDAY, DECEMBER 22, 1877.

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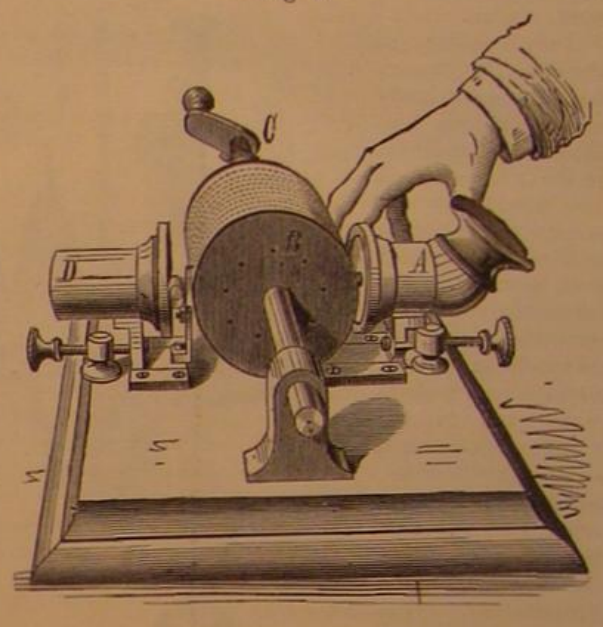
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THE TALKING PHONOGRAPH.

Mr. Thomas A. Edison recently came into this office, placed a little machine on our desk, turned a crank, and the machine inquired as to our health, asked how we liked the phonograph, informed us that *it* was very well, and bid us a cordial good night. These remarks were not only perfectly audible to ourselves, but to a dozen or more persons gathered around, and they were produced by the aid of no other mechanism than the simple little contrivance explained and illustrated below.

The principle on which the machine operates we recently explained quite fully in announcing the discovery. There is, first, a mouth piece, A, Fig. 1, across the inner orifice of which is a metal diaphragm, and to the center of this diaphragm is attached a point, also of metal. B is a brass cylinder supported on a shaft which is screw-threaded and turns in a nut for a bearing, so that when the cylinder is caused to revolve by the crank, C, it also has a horizontal travel in front of the mouthpiece, A. It will be clear that the point

Fig. 1.



on the metal diaphragm must, therefore, describe a spiral trace over the surface of the cylinder. On the latter is cut a spiral groove of like pitch to that on the shaft, and around the cylinder is attached a strip of tinfoil. When sounds are uttered in the mouthpiece, A, the diaphragm is caused to vibrate and the point thereon is caused to make contacts with the tinfoil at the portion where the latter crosses the spiral groove. Hence, the foil, not being there backed by the solid metal of the cylinder, becomes indented, and these indentations are necessarily an exact record of the sounds which produced them.

It might be said that at this point the machine has already become a complete phonograph or sound writer, but it yet remains to translate the remarks made. It should be remembered that the Marey and Rosapelly, the Scott, or the Barlow apparatus, which we recently described, proceed no further than this. Each has its own system of caligraphy, and after it has inscribed its peculiar sinuous lines it is still necessary to decipher them. Perhaps the best device of this kind ever contrived was the preparation of the human ear made by Dr. Clarence J. Blake, of Boston, for Professor Bell, the inventor of the telephone. This was simply the ear from an actual subject, suitably mounted and having attached to its drum a straw, which made traces on a blackened rotating cylinder. The difference in the traces of the sounds uttered in the ear was very clearly shown. Now there is no doubt that by practice, and the aid of a magnifier, it would be possible to read phonetically Mr. Edison's record of dots and dashes, but he saves us that trouble by literally making it read itself. The distinction is the same as if, instead of perusing a book ourselves, we drop it into a machine, set the latter in motion, and behold! the voice of the author is heard repeating his own composition.

The reading mechanism is nothing but another diaphragm held in the tube, D, on the opposite side of the machine, and a point of metal which is held against the tinfoil on the cylinder by a delicate spring. It makes no difference as to the vibrations produced, whether a nail moves over a file or a file moves over a nail, and in the present instance it is the file or indented foil strip which moves, and the metal point is caused to vibrate as it is affected by the passage of the indentations. The vibrations, however, of this point must be precisely the same as those of the other point which made the indentations, and these vibrations, transmitted to a second membrane, must cause the latter to vibrate similar to the first membrane, and the result is a synthesis of the sounds which, in the beginning, we saw, as it were, analyzed.

Fig. 2



In order to exhibit to the reader the writing of the ma

chine which is thus automatically read, we have had a cast of a portion of the indented foil made, and from this the dots and lines in Fig. 2 are printed in of course absolute facsimile, excepting that they are level instead of being raised above or sunk beneath the surface. This is a part of the sentences, "How do you do?" and "How do you like the phonograph?" It is a little curious that the machine pronounces its own name with especial clearness. The crank handle shown in our perspective illustration of the device does not rightly belong to it, and was attached by Mr. Edison in order to facilitate its exhibition to us.

In order that the machine may be able exactly to reproduce given sounds, it is necessary, first, that these sounds should be analyzed into vibrations, and these registered accurately in the manner described; and second, that their reproduction should be accomplished in the same period of time in which they were made, for evidently this element of time is an important factor in the quality and nature of the tones. A sound which is composed of a certain number of vibrations per second is an octave above a sound which registers only half that number of vibrations in the same period. Consequently if the cylinder be rotated at a given speed while registering certain tones, it is necessary that it should be turned at precisely that same speed while reproducing them, else the tones will be expressed in entirely different notes of the scale, higher or lower than the normal note as the cylinder is turned faster or slower. To attain this result there must be a way of driving the cylinder, while delivering the sound or speaking, at exactly the same rate as it ran while the sounds were being recorded, and this is perhaps best done by well regulated clockwork. It should be understood that the machine illustrated is but an experimental form, and combines in itself two separate devices—the phonograph or recording apparatus, which produces the indented slip, and the receiving or talking contrivance which reads it. Thus in use the first machine would produce a slip, and this would for example be sent by mail elsewhere, together in all cases with information of the velocity of rotation of the cylinder. The recipient would then set the cylinder of his reading apparatus to rotate at precisely the same speed, and in this way he would hear the tones as they were uttered. Differences in velocity of rotation within moderate limits would by no means render the machine's talking indistinguishable, but it would have the curious effect of possibly converting the high voice of a child into the deep bass of a man, or *vice versa*.

No matter how familiar a person may be with modern machinery and its wonderful performances, or how clear in his mind the principle underlying this strange device may be, it is impossible to listen to the mechanical speech without his experiencing the idea that his senses are deceiving him. We have heard other talking machines. The Faber apparatus for example is a large affair as big as a parlor organ. It has a key board, rubber larynx and lips, and an immense amount of ingenious mechanism which combines to produce something like articulation in a single monotonous organ note. But here is a little affair of a few pieces of metal, set up roughly on an iron stand about a foot square, that talks in such a way, that, even if in its present imperfect form many words are not clearly distinguishable, there can be no doubt but that the inflections are those of nothing else than the human voice.

We have already pointed out the startling possibility of the voices of the dead being reheard through this device, and there is no doubt but that its capabilities are fully equal to other results just as astonishing. When it becomes possible as it doubtless will, to magnify the sound, the voices of such singers as Parepa and Titiens will not die with them, but will remain as long as the metal in which they may be embodied will last. The witness in court will find his own testimony repeated by machine confronting him on cross-examination—the testator will repeat his last will and testament into the machine so that it will be reproduced in a way that will leave no question as to his devising capacity or sanity. It is already possible by ingenious optical contrivances to throw stereoscopic photographs of people on screens in full view of an audience. Add the talking phonograph to counterfeit their voices, and it would be difficult to carry the illusion of real presence much further.

THE END OF VOLUME XXXVII.

With our next issue the thirty-seventh volume of the SCIENTIFIC AMERICAN closes. At the same time several thousand subscriptions terminate; and as it is our invariable rule never to send the paper after the period subscribed for has elapsed, those of our readers who desire no break in the regular reception of their numbers will favor us by a prompt renewal of their subscriptions. The volumes of the SCIENTIFIC AMERICAN for the coming year will, we believe, excel any of their predecessors. No pains will be spared to render their contents the most complete exhibit of everything that transpires in the world of science, mechanics, or arts, and it will be our endeavor to place this information before our readers at so early a date, and so simplified and digested, as to render it a constant fund of suggestion for those who are ready to exercise their inventive powers to devise new and useful modifications, improvements, or original conceptions. In order to invent it is necessary to know, first, what has been done, second, what is in progress, and third, the general drift of present advancement. The SCIENTIFIC AMERICAN presents the first through carefully prepared articles on prominent industries and lucid illustrated descriptions of the most recent and improved mechanical devices; the second through its correspondence from various parts of the world, its selections from the immense range of current foreign technical periodicals, and from the immediate contact of its managers with the best inventive minds of the country; and lastly, the third is pointed out in elaborate editorial reviews and comments on new ideas as the same are brought out. It may be safely said that more people have obtained from the SCIENTIFIC AMERICAN valuable suggestions which have returned them direct profit than through any other medium extant.

Besides pointing out the road to invention, the SCIENTIFIC AMERICAN during the coming year will give particular attention to the presentation of papers of practical instruction to mechanics of every class. Thoroughly competent mechanical experts will explain the best methods of workshop manipulation, and, both in answer to the questions of correspondents and elsewhere, an immense number of reliable trade recipes, besides valuable advice in special cases which may be submitted to us, will be given. In the department of natural history much that is rare and curious in the animal and vegetable worlds will be illustrated and described, and no engineering structure of importance will be undertaken but that it will be fully elucidated in our pages. The Great French Exposition of 1878 will also be completely described, and whatever is there exhibited of novelty or interest will be found illustrated in these columns.

All this valuable and varied information appears in no other journal, for none other enjoys the facilities for obtaining the same, now possessed by the SCIENTIFIC AMERICAN. The subscription price will remain, as heretofore, $3.20 per year, postage paid.

WINTER SHOP WORK.—BUILDING BOATS.

Many of our readers, especially those who are mechanical amateurs, are just now considering what work they shall undertake in their spare hours during the coming winter. We know several members of professions and other callings who make it a rule to work in their nicely fitted-up shops a few hours daily, and thus they gain health, strength, and relief from brain work, while the result of their labor often proves of value and profit. There are also many regular mechanics who are anxious to find some good paying job to labor at, over hours, so that they can lay up a little extra fund above their wages. Among the suggestions we make to these workmen, amateur and regular, is to build boats. Boats are very expensive to buy. The smallest kind of a 10 foot yawl costs about 50 dollars when purchased from a regular builder, and for a good sail boat from 200 to 600 dollars is charged. Boats can be built indoors. They require nice work, and the amateur mechanic can lavish on them just as much fine manipulation as he chooses as all such shows and enhances the beauty and value of the craft. A boat besides is always useful and frequently necessary to any one who lives near the water.

Most people, whose boat building has not extended beyond the construction of a flat bottomed scow, think that to build a yawl or a yacht is a difficult and expensive undertaking, while it is just the reverse. Any one who can put up a workmanlike chicken house can build an excellent sail boat. All he has to do is to follow instructions, and those he will find in the SCIENTIFIC AMERICAN SUPPLEMENT. In that journal we have published, with elaborate working drawings and directions, full particulars how to construct a scow for three dollars (SUPPLEMENT No. 25), a rowing skiff for five dollars (SUPPLEMENT No. 26), a fine sailing skiff for fourteen dollars (SUPPLEMENT No. 29), a neat ribbed row boat for twelve dollars (SUPPLEMENTS 30 and 32), a large row boat for sixteen dollars (SUPPLEMENT No. 36), a Whitehall boat of fine model, such as is used in New York harbor, for fifteen dollars (SUPPLEMENT No. 37). A sailing and rowing canoe of the type of the famous Rob Roy for fifteen dollars (SUPPLEMENT No. 39), a fast sailing yacht for thirty dollars (SUPPLEMENT No. 42), and finally a large fast and serviceable yacht for three hundred dollars (SUPPLEMENT No. 67). These estimates cover the materials, not the labor, of the amateur builder. The entire series, which embraces about 100 illustrations, mainly accurate drawings to scale, besides full details as to how to rig and manage the vessels, may be obtained for one dollar.

Last summer a great deal of attention was given to catamarans or double boats. Not even professional boat builders as a rule understand the construction of these exceedingly fast craft. In SUPPLEMENTS Nos. 105 and 106 will be found full directions of how to build three different sizes of these remarkable vessels at costs ranging from $50 to $500. Not only can the vessels above referred to be constructed for pleasure purposes, but we have no doubt any mechanic could find in their construction and sale a very profitable source of revenue.

BUILDING ICE BOATS.

In a few weeks the rivers and streams of the Northern States will be frozen over, and therefore the present is the time for those who propose to pursue the exhilarating and health-giving sport of ice yachting to get their vessels in readiness. There is no known mode of locomotion which outrivals the ice yacht in speed. It travels at a mile a minute with ease, outstrips fast railway trains, and, when contrasted with the ordinary sailing vessel, is handled with ease and safety.

Ice yachting has been practiced on the Hudson river for a number of years past. The owners of the boats have exercised great skill and ingenuity in devising improved models, until at present by far the most elegant and swift ice vessel are to be found during the winter on the above stream. The ice yacht Whiff, which, it will be remembered, was exhibited at the Centennial Exposition, proved a revelation to thousands who had practiced ice yachting in comparatively slow and clumsy contrivances. Especially was this true of the people of Northern Europe, whose ice boats were little more than heavy sledges with sails. The result has been a demand for knowledge regarding the best form of ice yachts, a demand not confined to this country, but which comes from every quarter of the world where rivers and lakes freeze over, and where ice yachts can be used either for pleasure or as a source of profit.

Any mechanic of average ability, or any young man of fair mechanical acquirements, who knows how to handle carpenter's tools, can construct an ice boat from the minute directions, accompanied with elaborate working drawings, made to scale, which are to be found in the SCIENTIFIC AMERICAN SUPPLEMENT No. 63. If these are followed, a duplicate vessel in every particular to the famous Whiff is produced. Such information has never before been published and is not attainable elsewhere, and it is now being sent in response to calls to all parts of the world. In SUPPLEMENT No. 1 is given other engravings, showing how to construct ice vessels of different builds, besides full particulars as to management, organization of clubs, etc. For twenty cents, therefore, the mechanic can obtain information whereby he can construct the best class of ice yachts, which he can sell at large profit; or the amateur the directions which will enable him to produce a fine fast vessel at minimum expense and at little labor.

RECEIVING YOUR PAPER.

We shall consider it a favor if subscribers, editors of exchanges, and all others who are entitled to receive the SCIENTIFIC AMERICAN or SUPPLEMENT regularly, and whose numbers fail to reach them in proper season, or who miss numbers, or whose addresses are not printed exactly right on the slip pasted on the wrapper, will notify us promptly of the fact. A line in pencil to this effect is easily written on a postal card, and it may save considerable annoyance during the year. The internal affairs of this establishment, and especially those of the mailing department, are carefully systematized: our subscribers addresses are printed and affixed to the wrappers by machinery; and it is obvious that if anything goes wrong, there is error or neglect somewhere, which is easily traced and remedied. Our readers need have no fear with regard to giving us any trouble in this matter. We ask the information for the mutual advantage of both our readers and ourselves.

BUILD A STEAMBOAT.

Not a big one, but a small craft large enough to run around the river on the pond near your place. To construct the hull will be an excellent winter's work, and the engine can be obtained at a moderate price. There is no better practice for a boy of mechanical tastes than for him to learn to run a small steam vessel. It would be a good idea to buy the engine first, set it up in the shop and make it drive the saw and other tools which can be used in constructing the hull. This will familiarize you with the machine, which may afterwards be put in its place in the boat.

In building a craft of this description, there is every chance for fine work and for some really valuable invention. Shipbuilders everywhere are seeking to discover the best lines for small vessels, through which the highest speed may be obtained, for it is well known that the model of a boat has a great deal to do with her speed. On such a vessel the builder could easily try ideas in this direction of his own, and thus perhaps reach some valuable results. A steam launch is besides a much greater source of pleasure to her owner than any sailing yacht, as she is independent of wind and tide and admirably suited for long trips or even a summer's cruising.

To learn how to build the fastest kind of steam yacht send for SUPPLEMENTS No. 14, 69, 75 and 81, price ten cents each. These explain (with working drawings) how to construct a 15 foot launch like the Black Hawk, a very celebrated boat in this vicinity; how to build a fine 30 foot launch with machinery and everything complete for only $380. How to build a 40 foot steam launch with a three cylinder engine, and finally how to construct a 21 foot launch that will steam 10 knots per hour. An ingenious builder will take all these plans, pick out the best features of each, and produce a boat which probably will excel all.

Wire for the East River Bridge.

Proposals were recently called for the supply of the steel wire for the suspending ropes of the East River Bridge. The specifications require 325,000 pounds of wire rope, making, 70,000 lineal feet in all. There are two sizes required, one measuring 1⅝ inches in diameter, weighing 4½ pounds to the lineal foot, and having a breaking strength of not less than 180,000 pounds; the other measuring 1¾ inches in diameter-weighing 5 pounds to the lineal foot, and having a breaking strength of 200,000 pounds. The attention of the members of the board was called to a gnarled, broken, and twisted suspender rope. This specimen was made at the factory of Roebling's Sons & Co., by the direction of Chief Engineer Roebling. It was 1⅝ inches in diameter, and had been tested by the Keystone Bridge Company, of Pittsburg. It was broken under a strain of 197,500 pounds, the required strength being 180,000 pounds. It was resolved award the contract to J. A. Roebling's Sons & Co., at seven cents a pound, for Bessemer steel wire.

THE PHOTO-ENGRAVING COMPANY OF NEW YORK.

The earliest attempts to produce engraved plates by the aid of light appear to have been made in France about the year 1813, by Nicéphore Niépce. He was prosecuting experiments in lithography, then in its infancy, when he conceived the idea of transferring his drawings on to the lithographic stone by the aid of light. While thus engaged it occurred to him that he might produce engraved plates by the same means, and even render permanent the image shown in the camera obscura. After continuing his experiments for more than fifteen years, he associated himself with Mons. Daguerre, who had also spent several years in similar investigations. In 1833 Niépce died, and a year or two later Daguerre invented his method of developing the latent image impressed by light on an iodized silver plate, by means of the vapor of quicksilver.

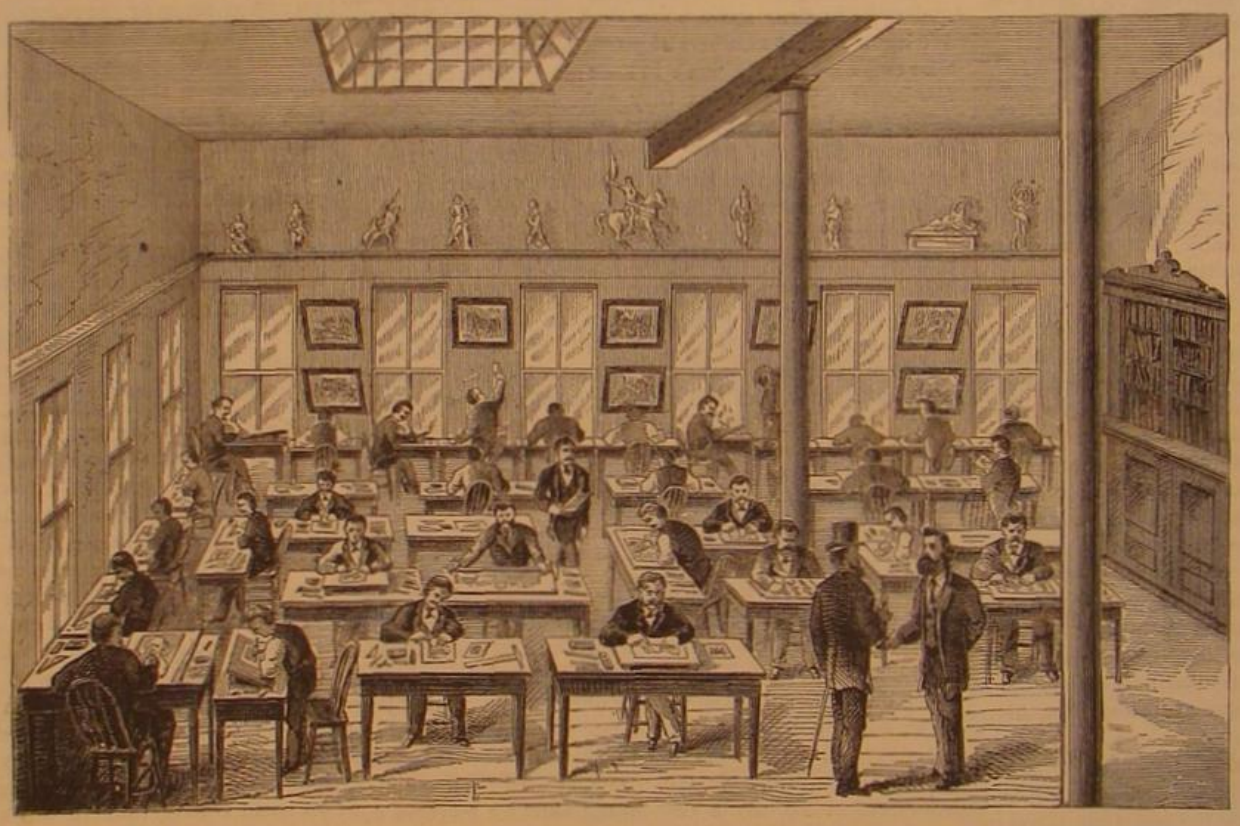
Niépce's method of heliography, as he called it, consisted in coating a metallic plate with a film of asphaltum dissolved in oil of lavender. Over this plate he laid a print or drawing, which had been rendered transparent by the application of oil, and then exposed it to the sun. The dark lines of the drawing protected portions of the asphaltum from the light, while the unprotected parts were acted upon and became insoluble. The plate was then washed with turpentine, which removed the asphaltum where the light had not acted, but left the remainder undisturbed. The bare metal, thus exposed, was then etched with an acid, and an engraving produced. But the results thus obtained were very imperfect and practically useless.

There are quite a number of different processes which may be classed under the general heading of photo mechanical printing, which it is not deemed necessary to review in detail here, as the degree of success attained has been frequently small, especially when the particular system was subjected to the rapid and comparatively careless manipulation incident to the use of the fast newspaper press. It may be stated, however, that nearly all of these processes depend upon the use of bichromate of potash with which is associated gelatin or similar organic matter. Mungo Ponton, in 1839, first discovered the sensitiveness to light of a sheet of paper treated with bichromate; in the following year Becquerel found that the sizing of the paper played an important part in the change, and in 1853 Mr. Fox Talbot discovered and utilized the insolubility of gelatin exposed to light in the presence of bichromate. In 1854 Paul Pretsch discovered and utilized the quality which such exposed gelatin possesses of not swelling in water. On Pretsch's discovery are based the gelatin processes that have attained most notoriety, and that have excited among experimenters the largest expectations of success, as follows: A glass or metallic plate is coated with a mixture of gelatin and bichromate of potash, which is allowed to dry and afterwards is exposed to the sun through a photographic negative. It is then immersed in cold water, when the parts protected from the light by the negative rapidly swell, while the parts not so protected are hardened and do not swell to the same extent. This gelatin surface then becomes the matrix from which, through intermediate steps, the final plate for printing is formed. The main difficulty encountered is that the surface of the matrix is made up of unequally swelled lines, and these, as reproduced, come out without sharpness—uneven and clumsy. Hence when placed upon the press, the plates are found incapable of yielding a clean and bright impression. The other process differs from the foregoing in that instead of swelling the soft parts they are wholly washed out. The difficulty here is that the water affects the insoluble portions, so that the lines are rendered rounded. Broad lines are also likely to become concave and to require subsequent pumicing to level them, a proceeding which is fatal to their delicacy and fineness of definition.

These processes, as already stated, constitute the foundation, but the results they yield are materially affected by the different minor modifications which individual experimenters have introduced and which, as a rule, are kept secret and not patented. The Moss process arose from an effort to avoid the difficulties above referred to. It is a combination of certain elements of other processes, for the purpose of securing completeness and delicacy of detail, in connection with all desirable depth and smoothness of lines. Of the two prominent photo-engravng concerns in this city, one prepares its plates of zinc, and turns them out ready for the press without the further necessity of any hand routing or other tool work; the other produces fine plates in type metal, and finishes by hand. In both cases, however, hand work is involved, as in that first mentioned the necessary sharpening of the lines is done on the negative.



OFFICE OF THE PHOTO-ENGRAVING COMPANY, NEW YORK.—Fig. 1.



ARTISTS' STUDIO OF THE PHOTO-ENGRAVING COMPANY.—Fig. 2.



PHOTOGRAPHIC DEPARTMENT OF THE PHOTO-ENGRAVING COMPANY.—Fig. 3.

The annexed illustrations, representing the various steps in the photo-engraving process, were prepared by the Photo-Engraving Company, of this city, and are excellent examples of the fineness and delicacy of the work done by means of the Moss process. These plates are made of type metal by stereotyping, and are hand finished. The first operation is to prepare the drawing which is to be reproduced. To do this successfully it is necessary that the picture should be formed of clean, sharp, and very black lines. Flat tints and washes, or blurred shadows, cannot be photo-engraved unless they are first translated into lines. Where an engraving is to represent a piece of machinery, for example, a photograph of the object is taken, but is not fixed in the gold bath. From this print the artist obtains his outline in black ink, and this done he obliterates the photograph by corrosive sublimate. He has then an accurate outline, which he proceeds to fill in with a shading, etc., of pen lines. It is usual to make the drawing somewhat larger than the engraving is to be, in order that by the reduction the lines of the latter may be rendered finer.

The interior of the artists' room of the Photo-Engraving Company is shown in Fig. 2. Next ensues the photographing, and the apartment in which this is conducted is represented in Fig. 3. Here a negative of the drawing is prepared, from which, by several intermediate steps, a mold is made. The picture during this process is reduced or enlarged as desired, the reduction being only limited by the capability of the resulting block to yield a clear impression under the conditions of printing to which it is to be subjected. Thus a finely reduced engraving would soon fill with ink and produce a disagreeable and blurred impression on a rapid press, while, on a slow book press and on fine smooth paper, the same engraving would give excellent prints.

The reader will notice from this illustration that the cameras used are exceedingly large, thus giving clear and very well defined pictures, while the entire apparatus of both camera and retaining device for the picture to be photographed is suspended from the ceiling of the room by a single rope. The advantage of this last arrangement is that it prevents independent accidental movements of camera and object. Should one or the other move even the merest fraction of an inch—and this might easily be caused by the jarring of the building through the passage of heavy vehicles in the street—it is evident that the accuracy

of the photograph would be impaired, but, so long as both camera and object must move together if at all, their relative positions always remain unaltered. It is by such nice relative refinements as this that the clear sharp work, of which the annexed engravings are excellent specimens, is produced by the Photo-Engraving Company.

After the photo-plate is finished, and this is a work requiring skill and scrupulous care, it is copied in metal, and this copy forms the engraving or block that is used on the printing press. The room in which these metallic plates are made is shown in Fig. 4, and here appear the various devices for melting the metal, running it upon the molds, etc. The next process is the trimming of the plates, and this is done by skilled engravers, who, with the burin, render the lines sharp and clear, and cut away metal in the high lights to intensify the same. This work is of course entirely auxiliary to the photo-engraving process, but it has the advantage of rendering the engravings produced by the Photo-Engraving Company from drawings or other engravings almost as perfect as the originals. Very often it is found necessary to reproduce a picture which is poor, but the only one attainable giving the desired representation. In such case the photo-engraving is an accurate reproduction, faults and all, but the latter are speedily modified by the skill of the finishing engraver.

The plate of metal is now mounted on a block, type high, and no further treatment is necessary to adapt it for the printing press. Sometimes where a large number of impressions are to be taken, the surface is coated with a thin film of copper by electro-metallurgy, or an electrotype is taken from the plate the same as from a wood cut.



STEREOTYPING DEPARTMENT OF THE PHOTO-ENGRAVING COMPANY.—Fig. 4.

Fig. 1 represents the interior of the office of the Photo-Engraving Company, at Nos. 67 and 69 Park Place, this city. Here may be seen a large collection of engravings reproduced by the process we have described. Fine line steel engravings are duplicated with wonderful accuracy, so that instead of paying ten or fifteen dollars for a choice picture, the lover of art may now obtain the same at a tenth the price. The capabilities of the photo-engraving art were never better illustrated than by the splendid portrait of Professor John W. Draper, which occupied our initial page last week. For color, delicacy of line, and general artistic effect, this work of art is universally admitted to equal the best efforts of the wood engraver. The process used by the Photo-Engraving Company is due to the ingenuity of Mr. John C. Moss, who has labored constantly in inventing and improving the same for nearly twenty years. The exact means whereby the excellent results we have noted are obtained are kept secret, but this is of no importance to the public, so long as such high grade work can be uniformly produced at a cost less than that of wood engraving. Several thousand illustrations prepared by the Photo-Engraving Company have appeared in the SCIENTIFIC AMERICAN and SUPPLEMENT during the last few years, side by side with the best productions of hand wood engraving; and in this fact will perhaps be recognized one of the best recommendations as to their excellence, which photo-engraved illustrative plates have received.



PROVING AND FINISHING DEPARTMENT OF THE PHOTO-ENGRAVING COMPANY.—Fig. 5.

Electric Fire Balls.

M. Planté seeks in the foregoing experiments of his an explanation of the *foudre globulaire* or "fire ball." They show that with a sufficient quantity and tension of electricity we can obtain the electric light in a globular form. He therefore thinks that this manifestation of the lightning discharge is due to an abundant flow of electricity in the dynamic state in which great quantity and potential are united. Those particular cases wherein the fire ball is seen to move and to stop are explained by the motion or rest of a column of humid air, strongly electrified and invisible, which serves for an electrode. In order to imitate this effect it suffices to oscillate the platinum electrode in the above experiments, pendulum fashion, over the water, or a metallic surface, when a little fire ball is seen to move over the surface opposed. This explanation of the fire ball has been advanced before by Mr. Cromwell F. Varley.

Prismatic House Signs.

A new contrivance for rendering the numbers of houses visible by night is becoming general in Paris. It consists of a hollow triangular prism about nine inches long, two of whose sides are formed of panes of blue glass,,on which the number of the house is picked out in white. This prism-shaped lamp-glass rests against the front of the house, so that the two sides with the numbers on them can be plainly seen by the passers-by. In the interior of the prism is a gas jet, fed by a pipe from the house. Householders on the Avenue de l'Opera have been obliged to supply this mode of numbering at their own expense on the houses they are building; and the municipal authorities have introduced it on some 450 of the municipal establishments, schools, police offices, fire brigade offices, etc.

Proposed Diversions of the Nile.

It is well known that the main stream of the Nile is supplied by the great equatorial lakes of Africa, and that the annual inundations are caused by the inrush of torrent water laden with soil from the fertile slopes of the Abyssinian plateau in July, August, and September. This silt is now for the most part being deposited in the bed of the Mediterranean, where it is gradually forming a new delta similar to the delta already formed at the river's mouth. Sir Samuel Baker has written to the *Times* suggesting a plan by which not only the water of the Nile but the mud, which it now deposits wastefully in the sea, may be turned to good account as a fertilizer of the deserts of Nubia, Libya, and the Soudan. He proposes by suitable engineering works to divert a portion of the Nile flood water into these deserts, where it can deposit its rich sediment on the sands, and also irrigate them so as to transform them from a desert into "cotton fields that would render England independent of America." This could be effected by having suitable dams and sluices at different points of the Nile, say at the Cataracts. These dams and sluices, by enabling craft to pass the Cataracts, would also render the Nile navigable from the Mediterranean to Gondokoro, a space of 29° of latitude.

New Oil Wells—Pennsylvania.

A correspondent of the *Petroleum Reporter* says the Clarion oil region is just now experiencing livelier times in the way of operations and new developments than it has ever done heretofore. The number of wells going down is simply enormous, and the statistics total for November will far exceed that of any previous month. The principal field of production, and that wherein lies the most excitement at present, is the Eastern belt, or what is known by that title in the district. A large number of "wild-cats," or test wells, have gone down off the eastern edge of the defined line, but with very few exceptions they have proved dusters. The venturesome operators have succeeded in widening the belt but little, although a great deal of money has been spent for that purpose the present summer. The most prolific territory appears to be in the vicinity of Slam Bang City, a new town on the Twenty-two degree line, and situated between the Stone Church and Shippenville. The Davis well, struck at this place, about three months ago, started off at 400 barrels a day, and has averaged about 125 barrels ever since the "head" was pumped off. Several other wells have been struck in the same vicinity, the largest being that of Cram & Co., on the Wood farm. This one made 750 barrels the first twenty-four hours, and is yet doing over 100 barrels a day.

A good deal of operating has also been done on what is known as the Middle belt, but the territory is all old and developed, and no big strikes have been effected. The Western belt came into existence in May last. Three wells which had been sunk previous to that time proved dusters, and the first oil was found in that month. The next well down on this belt was the great Howe gusher, which did 400 barrels the first day. After that strike operators went crazy, and scores of holes have been put down since. About one half of them are dry, while the others are gradually and fast decreasing in production. The sand is very tight and thin, and the pumping wells decrease after the style of the Bullion gushers.

Some New Lecture Experiments.

H. Kämmerer proposes to show the combustibility of nitrogen, in other words, that nitrogen will unite with oxygen at a sufficiently high temperature to form nitric tetra-oxide, NO_2, a reddish colored gas. He takes a half gallon glass cylinder full of air, and burns in it some 12 or 15 inches of magnesium ribbon. The heat produced is sufficient to produce some of the red gas, which can be easily recognized by its color and intense odor. To prove its presence to an audience, he puts in the jar an acetic acid solution of iodide of potassium and a little starch solution, which is blued by the iodine which has been liberated by the nitric tetra oxide.

Gramp exhibits the green flame of burning zinc, and the cloud of white oxide (philosophers' wool) formed, by making a little brush of zinc turnings 1½ inches long and ¾ inch thick, and fastening it to the end of an iron rod, which he holds in the flame obliquely over an iron plate. To show the combustion of cadmium and the cloud of brown oxide he heats the metal in a small porcelain crucible over the blast lamp. Cadmium can be obtained in beautiful brilliant crystals by distillation in hydrogen gas current.—*B. d. D. Ch. Ges.*

MAGNETIC PROPERTIES OF NICKEL AND COBALT.—M. Hankel finds that with feeble currents the magnetic power of nickel is equal to that of soft iron, but with strong currents it is comparatively feeble. The magnetic power of cobalt with both strong and feeble currents is much less than that of nickel and soft iron.

AQUA FORTIS, applied to steel, produces a black spot.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Besides the bills for amending the patent laws, referred to in my previous letters, many others are being introduced into Congress for the

EXTENSION OF PATENTS,

and for the reviving of old rejected cases. Among these, I notice that the application of Aikin and Felthousen, for an extension of their patent on sewing machines, has again made its appearance, as it has done every session for many years past. This patent, if extended, would lay the whole sewing machine interest under tribute, as no sewing machine can be made that people would now buy without infringing it. There does not, however, seem any probability of the success of this case, as neither Senators or Representatives are willing to grant any more extensions of sewing machine patents.

Rollin White is also on hand again with an application for an extension of his patent on repeating fire-arms, dated April 3, 1855, which, if granted, would give him the monopoly of the manufacture of all revolvers using metallic cartridges. A bill for its extension was once passed by Congress, but it was vetoed by President Grant, acting, it is said, under the advice of General Dyer.

Roxana Rice, as the widow of B. T. Rice, makes application for an act to authorize the Commissioner of Patents to extend the patent of said B. T. Rice for a paper bag machine, dated April 28, 1857, already once extended by the Patent Office.

Another bill authorizes the Commissioner to extend, for the benefit of Olivia C. Reed, also the widow of an inventor, the patent granted to her late husband for handcuffs, dated June 14, 1862.

The heirs of C. H. Davidson, the inventor of an enema syringe, have had a bill brought in authorizing the extension of his patent of March 31, 1857, which was once extended by the Commissioner of Patents.

C. Shunk has also applied for an extension of his patent on manufacturing iron and steel, which, I believe, covers the Bessemer process.

The heirs of the late W. A. Graham, who filed an application in 1837—*only* forty years ago—for a patent on a fire extinguisher, are again before Congress with a bill authorizing the Commissioner to grant a patent for his apparatus. This, if allowed, would cover every chemical fire extinguisher manufactured.

Another bill, similar to this, authorizes the granting of patents to W. W. Hubbell, for a "self-loading and self-firing gun," "a gun to load with great rapidity and effect," and "ammunition for the same," for which Mr. Hubbell alleges that he filed applications in 1853 and 1865.

A third similar bill has been introduced in favor of Stephen V. Benet, authorizing the issue of a patent to him for an improvement in cartridges, for which he made application April 14, 1866.

Another bill introduced into the House continues in force, for the full term of seventeen years, the patent of T. A. Weston, granted in 1867, for the well known differential pulley, as otherwise it expires with his English patent granted several years earlier.

THE AGRICULTURAL DEPARTMENT.

General Le Duc some time since opened a correspondence with many of the leading agriculturists in all parts of the land, and their ideas thus obtained are now being classified and digested, and the results will from time to time be published for the benefit of farmers generally. The Commissioner believes, from what he has seen in several trips made to different parts of the South, that the people of that region are fairly started on the road to prosperity, that public opinion is adapting itself to the new order of things, and that hands formerly soft and delicate showed, by their hardened condition, a familiarity with the handles of the plow and other similar implements that gave good evidence that the old ideas as to labor had undergone a great change.

The Commissioner has also devoted considerable attention to what he thinks may be a new industry in this country—the cultivation of the tea plant. He has been collecting data respecting it from various sources and finds that, so far as climatic conditions are concerned, a strip of country lying in the latitude of the northern part of South Carolina, and running from the Atlantic coast to the Mississippi, seems very favorable for the purpose, and the results of some few attempts in the cultivation of the tea plant that have been made in that neighborhood have been so encouraging, he thinks, as to remove all doubt as to the success of future efforts to produce it here. The Commissioner will, however, most probably find that the successful cultivation of the plant is not all that is necessary to the production of tea, but that the picking, curing, and preparing of the leaves for market is one of the essential points. I am under the impression that one of the most promising attempts to introduce the cultivation of tea, made some years since in California, failed from this reason. But it is possible, and indeed very probable, that our inventors may be able to overcome this difficulty by devising machines for picking, rolling, and curing the leaves, thus removing one of the main difficulties in the way to the practical cultivation of tea in this country; but if we have to perform these operations by hand, it is useless for us to try to compete with the cheap labor of China, even if we import Chinese laborers used to the business.

The commission sent by this Department to Southern New Jersey, to examine into the possibilities of beet culture in that section for the manufacture of sugar, have returned, and report that, while the experiments made last year were not pecuniarily successful, yet it is decided that the climate is favorable, and that the soil can be made so. At present, a large amount of the sugar used in this country is imported in the crude state, and therefore considerable interest should be taken in this matter, so as to avoid the loss of the large amounts of money annually sent out of the country to pay for the imported article. Under the efforts of the first Napoleon the manufacture of beet sugar became thoroughly established in France, and there seems no reason why it should not be as successful in this country.

THE GEOLOGICAL AND GEOGRAPHICAL SURVEY.

Dr. Hayden, the director of the above important work, has prepared his annual report to the Secretary of the Interior, of his operations during the past year. The most important of those in the field have been referred to from time to time in my previous letters. Of the office work, not so much has been said, although equally important, as but for it the world at large would remain ignorant of the results of the investigations carried on in the field. The publications of the survey during the past year have been quite numerous, consisting of more than 10,000 pages quarto, profusely illustrated. The reports, which are in an advanced stage of preparation, are two quarto volumes on the vertebrate fossils of the West, one on the fossil insects, and another on the rhizopods. The atlas of Colorado will be completed about February, 1878. The tenth and eleventh annual reports of the survey are well advanced, and will be printed and ready for distribution before the close of the regular session of Congress. The work of publication has been much delayed by the cutting off for the last two years of the amount heretofore appropriated for engraving.

THE SIGNAL SERVICE.

From General Myer's report, it appears that 159 stations have been maintained during the year to fill the system of stations of observation from which reports are deemed necessary to enable proper warning to be given of the approach and force of storms, and other meteoric changes, for the benefit of the agricultural and commercial interests. From the data thus obtained, 1,095 tri-daily reports, known as the "Synopsis and Indication," have been furnished for publication. These are based on the observations telegraphed in cypher from the different stations to the headquarters, where they are spread upon seven charts for study, from the result of which the "Synopsis and Indications" are sent out. The average time, elapsing between the moment at which the instruments are read at the outlying stations to that at which the reports are telegraphed to the press, has been one hour and forty minutes. Notwithstanding the little time thus consumed, but a small portion of which is given to considering the reports and making ready the "Indications," their truth has been verified to be on an average at the rate of 86·19 per cent, and it is hoped to bring the average as high as 90 per cent. Cautionary signals are now displayed at 47 different ports and cities, and of these, 78·91 per cent have been reported as justified. In addition to these reports and cautionary signals, by an arrangement with the Post Office Department 6,264 "Farmers' Bulletins" are distributed and displayed daily in as many different post offices, for the benefit of our agricultural population. The service has now in its care, and operated by its force, no less than 3,200 miles of telegraph lines.

From these figures some idea of the amount of work that has to be done by the signal service may be had. The importance and usefulness of it is now well known by every one, and it is hoped that our rulers, with their economical notions, will not decrease the facilities now possessed by it, but rather increase them, as General Myer requests. The late fearful calamity of the loss of the Huron might have been avoided had proper attention been given to the cautionary signals; and there is no knowing how many lives nor how much money has been saved by those who have heeded their warnings, nor what losses may be caused by limiting the operations and usefulness of the service.

THE LIFE-SAVING STATION.

The disadvantages of too close economy may also be seen in this service. From a desire to save money, the stations on the coast where the Huron was wrecked are not manned until the 1st of December, and the stations are not about half the number actually required. It is believed by the head of this service that if the stations had been manned, although it is probable no boat could have reached the vessel, that by the aid of the shot line, which would reach double the distance the vessel lies from the shore, many, if not all, of the lives of the crew could have been saved. If the stations had been manned, as they would have been but for the false economic ideas now prevailing, the discovery of the wreck would have been made shortly after the vessel struck, as a constant patrol is kept up along the beach every night, and immediate attempts to help the crew could have been made. Instead of this immediate discovery and relief, seven and a half hours elapsed between the striking of the vessel and the discovery of the wreck, during which time there is no doubt but that a resolute crew trained to the service could have rendered such efficient help as would probably have saved a majority, if not all, the lives lost on the ill-fated vessel.

MORTALITY OF THE NEGRO.

A recent report of the Board of Health of this city calls attention to the alarming death rate of the negro population. From the statistics, which are kept with great care, it appears that, while the death rate of the white population is only 18·27 per cent, that of the colored is as high as 44·50. Of 119 still birth investigations by the sanitary inspector, 107 were colored, while, reckoning according to population, the still births would be as 23·77 of the black to 31·04 of the white. This heavy death rate is not confined to this city, but is equally well known in other parts of the country to those who take an interest in the welfare of the colored people. Mr. Redfield, the well known correspondent of the Cincinnati *Commercial*, contends that the race is doomed to extinction, and, to sustain his view, states that from 1850 to 1860 the rate of increase of our colored population was 25 per cent, but that in the succeeding ten years the rate fell to 10 per cent; and as many reports concur in showing that there are more deaths than births among these people, it seems probable that our next census will show an actual decrease in this class of our population. This excessive mortality among them in this city is, no doubt, owing mainly to their great ignorance of sanitary laws; the overcrowding of their houses, ten or a dozen frequently occupying one small room; their living, as a majority of them do, in filthy back alleys, and in huts utterly unfit for human habitation: their irregular mode of living, half starving frequently, and then, as soon as a little money is procured, as the result of some chance job, spending every cent in a feast for the day, without a thought of the morrow; and, lastly, to their radically weak constitution, which causes them, as soon as any serious sickness touches them, to give right up and die off like rotten sheep. Outside of the cities they do not probably suffer so much from overcrowding as they do in them, but other causes step in and overbalance the point.

Washington, D. C. OCCASIONAL.

Locomotive Economy.

To the Editor of the Scientific American:

The query is often made as to what can be done to render the locomotive more efficient. Letters are frequently received asking for an opinion upon some detail pertaining to the improvement of this machine.

As to its general arrangement, with its horizontal cylinders and outside connections, the modern locomotive cannot be much improved probably. But while it requires some 120 lbs. pressure to the square inch in the boiler to realize an average maximum of 70 or 80 lbs. to the square inch against the pistons, it is quite clear that there is a chance for some improvement in its supply apparatus between the steam chamber of the boiler and the pistons. It is of course well known that the nearer the initial or maximum pressure in the cylinders can be made to approach the boiler pressure the greater the economy and efficiency of an engine. As the supply apparatus is now proportioned and arranged, there is a steam pipe some ten feet long and five inches in diameter (more or less according to the size of the engine) between the throttle valve and the cylinders, which must be filled with steam every time the throttle valve is opened before the steam can act upon the pistons; all of this steam (some two or more cubic feet) must of course be discharged at the exhaust nozzle with that in the cylinders as often as the throttle valve is closed.

The amount of steam directly lost here, in addition to the loss from low effective pressure, must depend upon the frequency of starts and stops and upon the degree of expansion the steam has attained when discharged; but the chief loss is in the low percentage of the boiler pressure utilized. If an auxiliary throttle valve for common use were placed near the cylinders, and the steam pipe enlarged and kept fully open to the steam chamber of the boiler during working hours, as high as 90 per cent of the boiler pressure could doubtless be made effective, instead of 60 per cent as now. In other words, from 20 to 30 per cent less boiler pressure would suffice for doing the work of the engine. The saving of fuel would, of course, be in like proportion.

F. G. WOODWARD.

The Keely Motor Deception.

To the Editor of the Scientific American:

I notice in some of my exchanges that "even the SCIENTIFIC AMERICAN was deceived by the Keely Motor." Now as I have never seen where you have even ventured a suggestion of the possibility of the success of a machine so wholly at variance with the known laws of natural philosophy, I would be pleased to see your position from first to last clearly proclaimed. S. H. H.

Our correspondent cannot be a very attentive reader of the SCIENTIFIC AMERICAN if he supposes that we have endorsed or supported so gross and palpable a deception as the Keely Motor. He will find our views sufficiently expressed if he glances over some of our back numbers.

Effect of Glycerin upon Fermentation.

Munk has observed that if cheese be added to a solution of milk sugar, and enough carbonate of soda added to give a distinctly alkaline reaction, and then mixed with an equal volume of pure glycerin, neither lactic nor butyric fermentation results for three weeks, even at a temperature of 104° C., whereas without the glycerin the formation of lactic acid can be recognized in 11 or 12 hours. Small quantities of glycerin merely postpone fermentation.

The spontaneous fermentation of milk is very energetically

checked by glycerin. The addition of ½ glycerin at a temperature of 60° to 68° prevented the milk from souring for 8 or 10 days; even 2 to 2½ per cent retarded it essentially at 60° to 70°. A larger addition of glycerin, ¼ or ½, had retarded it 6 or 7 weeks. The higher the temperature the more glycerin is required for the same effects.

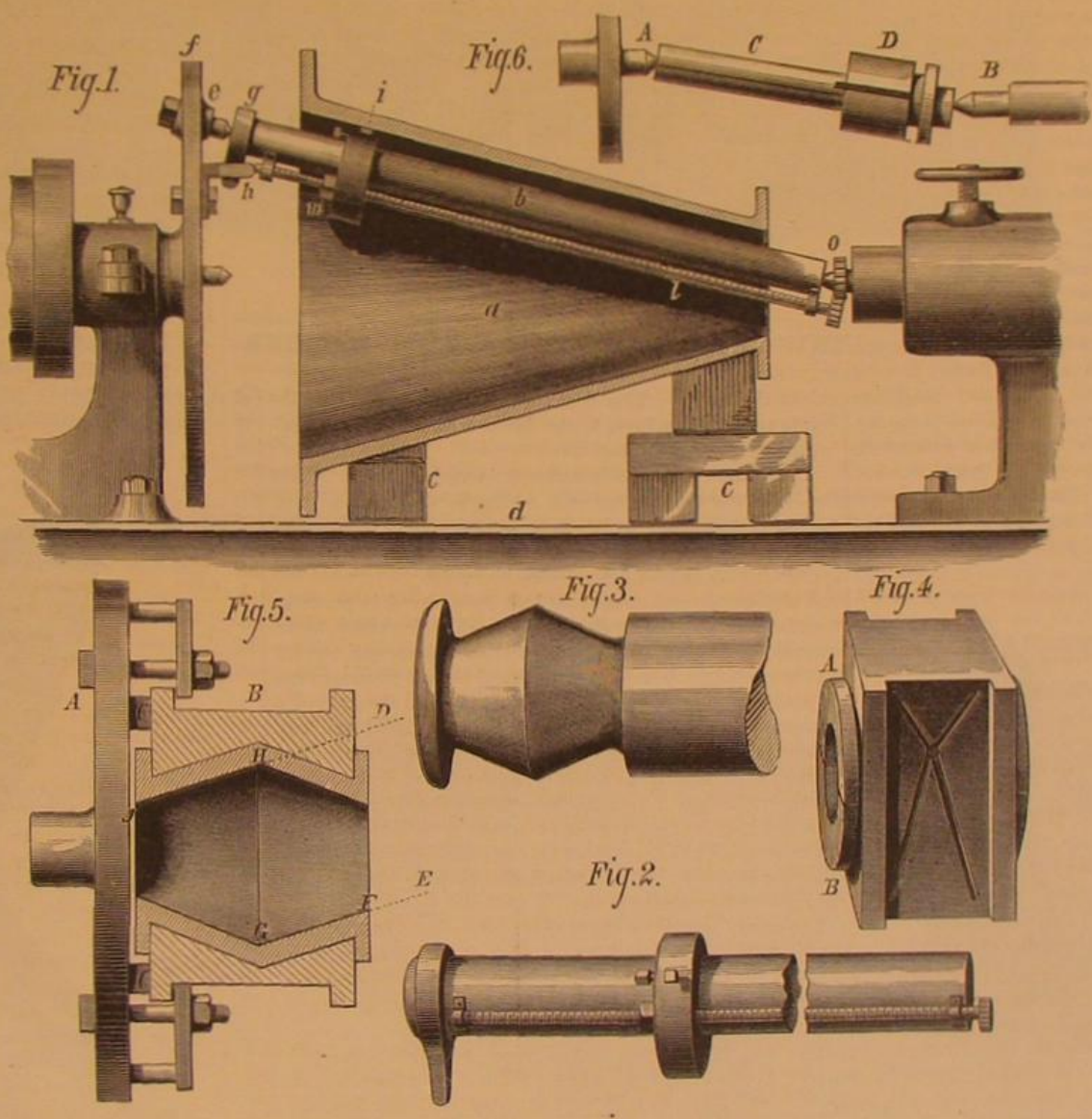
The alcoholic fermentation of the carbo-hydrate is also retarded by glycerin. A sugar solution containing fresh beer yeast and an equal quantity of glycerin had not given off any carbonic acid at the end of 48 hours.

Munk has also studied the effect of glycerin upon the decomposition of amygdalin by emulsion. This action being much more energetic requires more glycerin to stop it. By adding 2 volumes of glycerin to a mixture of emulsion and amygdalin, in which prussic acid would otherwise form in a few minutes, its formation was delayed 7 hours, and was slower afterwards than otherwise.

Finally, it was established that the diastatic action of pancreatic juice upon starch paste was retorted by glycerin.—*Industrie Blätter.*

SOME CURIOUS METHODS OF BORING TAPERS.

With the old-time method of setting a lathe to bore a taper by setting the upper slide of the slide rest out of parallel with the bed of the lathe, every machinist is of course familiar. That method has been superseded in lathes where many tapers require to be bored or turned by fixing the head and tail stocks upon a bed, which in turn swings by means of a vertical pin pivoted in a closely fitting hole provided in the lathe bed proper, so that from that center the bed or plate upon which the head and tail stock stand will swing out of parallel with the lower bed upon which the carriage slides. The advantage of this device, which is coming largely into use in the Eastern States, is that the center line of the lathe centers stands parallel with the work instead of at an angle to the same, as is the case when the upper part of the tail stock sets over, as is so common in ordinary lathes. The advantage of the new plan is that the centers do not wear large or get out of true, and therefore the truth of the taper with the parallel parts of a piece of work may be depended upon, no matter which part of the work was finished first or last. It sometimes happens, however, that a job will present itself which is not provided for in the construction of any ordinary lathe or machine; and here it is that the inventiveness of the workman is called upon to devise some means of doing the job without an undue expenditure for machines, tools, or appliances; and two noteworthy instances of such examples are presented in our engravings.



That shown in Fig. 1 is a case in which it was required to bore a taper casting for a cylinder for grinding pulp. It was about 8 feet long, the bore being 40 inches diameter at one end and 12 inches at the other. The small end necessitated the use of comparatively a very small boring bar and head, while the length demanded a strong stiff bar so as to bore the cone true and smooth throughout. The workman took a 6 inch iron shaft, see *b*, Fig. 1, its length being 9 feet 6 inches, turned it true and parallel, and cut in it a keyway from end to end for the feather preventing the head from revolving upon the bar from the pressure of the cut and relieving the feed screw of pressure. For a boring bar head an old eccentric was employed, a gib key being used so that it could not slide out from the eccentric while sliding freely in the keyway of the bar. The feed screw was made of a piece of 1⅛ round iron, the thread being cut by a common die of a bolt machine, and the screw was straightened after being cut. A common square nut was attached to the side of eccentric head (see Figs. 1 and 2) by a small machine screw, the nut being placed so as to push and not pull the eccentric when at work. A hole about 1¼ inch diameter was drilled through the eccentric for the feed screw to pass freely through, so that the irregularities of the feed screw were not felt on the bar, the nut being left able to slide a little freely in any direction to also accommodate defects in the feed screw, the machine screw before mentioned merely serving to prevent the nut from turning around upon the eccentric head, or the head from moving forward in case the tool lost the cut in any part of the bore of the cone; and in this way was a suitable boring bar improvised. The conical cylinder, *a*, in Fig. 1, to be bored throughout its whole length, was then laid upon the suitable wooden blocks *c*, *c*, and secured with bolts and nuts to the lathe bed, *d*, the center of its bore being set parallel with the lathe bed by placing a piece of iron in the lathe centers and setting the bore of the casting true with it by means of a piece of iron wire used as a gauge. Then a lathe center, *e*, was fastened in one of the radial slots of the lathe face plate, the center line of this lathe center being made to stand parallel with the surface line of the bore of the casting or cylinder The bar, *b*, was secured, the center was screwed by a nut on its end firmly to the lathe face plate, and the boring bar was secured firmly by a lathe dog, G, to the driver in the latter, also being bolted firm to the lathe face plate so as to prevent the bar, *b*, from turning upon its own centers. A feed motion or gearing was provided to the bar as follows: The feed screw, *l*, was provided with bearings affixed to the boring bar at each end, and on the dead center end which protruded through its bearing a small gear wheel was keyed. Another and suitably sized gear wheel was fastened on the dead center of the lathe so that the revolutions of the bar caused the feed screw to revolve in the usual manner, thus feeding the tool as the lathe revolved. The result was that a cone of unusual proportions was bored true and smooth at a slight expense, and throughout the whole operation no special care was needed, except to have the lathe center fastened to the face plate of the lathe pointing dead true to the center in the lathe tail stock, because any deviation from the center of motion in the dead center, O, would cause the boring bar to be too tight in one and too loose (between the lathe centers) in another portion of each revolution.

The second instance referred to was as follows: In cases where it is of great importance to prevent the end play of journals in bearings, it is not unusual to have the journals either ball-shaped or else V-crowned. In the instance under consideration the journal was of this latter form, as shown in Fig. 3, and the journal box was of the form shown in Fig. 4, in which it will be noted that the brasses, A and B, have flanges fitting outside the bore as shown. Now the ordinary method of doing such a job would be to chuck the box on the face plate of the lathe, setting it true by the circle (marked for the purpose of setting) upon the face of the brasses and by placing a scribing point tool in the lathe tool post and, revolving the box, making the circle run true to the point which would set the box one way, and then setting the flanges of the box parallel with the face plate of the lathe to set the box true the other way: to then bore the box half way through from one side and then turn it round upon the face plate, reset it and bore the other half; thus the taper of the slide rest would not require altering. This plan however is a tedious and troublesome one because, as the flanges protrude, parallel pieces have to be placed between them and the lathe face plate to keep them from touching; and as the surfaces of the casting parallel with the face plate were not trued up, packing pieces of paper or tin as the case might require had to be placed between the box and the parallel strips in the necessary places; and under these circumstances, ordinary ones as they are, to set the box and to unset it after boring one side and reset it quite true to bore the other side becomes a tedious and difficult job. While several of the men were studying how to obviate the difficulty, one of the workmen offered to take the job contract for a price that was thought ridiculously low; but when he had the front end of the first box bored, the secret was found to be that he had discovered a way to avoid the second chucking, which was as shown in Fig. 5, in which A represents the lathe chuck and B is a sectional view of the bearing chucked thereon, *e*, *e* being the parallel pieces. Now it will be observed that the plane of the cone on the front end and on one side stands parallel with the plane of the cone on the back end at an exactly opposite diameter, as shown by the dotted lines, D and E. If then the top slide of the lathe rest be set parallel with those lines, we may bore the front end by feeding the tool from the front of the bore to the middle as marked from F to G, and then, by turning the turning tool upside down, we may traverse or feed it along the line from H to *g*, and bore out the back half of the double cone without either shifting the set of the lathe rest or chucking the box after it was once set; and this was the workman's secret and very successful it proved to be. Another workman in a different shop adopted for a similar job the plan of boring the front end as usual, and then, crossing the lathe belt, he ran the lathe backwards, used a tool with the face up as usual, to bore the back half of the box. This plan had the advantage that he could see the tool cut and perhaps work to a little better advantage in that respect; but this was more than counterbalanced by the trouble entailed in lacing and unlacing the belt to cross it (for the lathe had no reverse motion), and the liability of the chuck to unscrew, unless indeed it be provisionally fastened.

In lathes not having a compound slide rest, the device shown in Fig. 6 is almost invaluable for boring small conical holes or indeed for parallel ones if no reamer or standard bit is at hand. A is the running lathe center, and B the dead center. C is a mandrel placed between the two centers and having a keyway running along it as shown, the end at A is made square to prevent it from revolving with the lathe head and to hold it against the pressure of the cut by applying a wrench there. D is a sleeve, a neat working fit upon the mandrel, *c*, and is provided with a feather, a good sliding fit in the keyway of *c*, the duty of the feather being to prevent the sleeve, D, from revolving from the pressure due to the cut. Along D is cut upon its circumference a slot to receive a boring tool; to feed the sleeve, D, a piece of steel is fastened in the tool post and the end of it projects in the annular groove shown at one end of D. The amount of taper is of course regulated by the set over of the lathe tail stock. This device is so much stiffer than a boring tool that it produces a much better job and will take a heavier cut, nor is it so liable to spring away from the cut.

Population of the World.

According to recent careful computations, the population of the world is 1,423,917,000, or 28 persons for every square mile. The following table shows the populations of the great divisions of the earth:

Europe	309,178,300	Australia	4,748,600
Asia	824,548,500	America	85,519,800
Africa	199,921,600		

The combined populations of 1876 exceed those of 1875 about 27,000,000. The inhabitants of different States of Europe are divided as follows:

Germany	42,723,000	France	36,102,921
Austro-Hungary	37,700,000	Great Britain	35,450,000
Switzerland	2,699,147	Spain	16,551,647
Holland	3,809,527	Portugal	4,298,881
Belgium	5,336,634	Italy	27,482,174
Luxemburg	205,153	Turkey in Europe	8,500,000
Russia	71,730,980	Roumania	5,073,000
Sweden	4,383,291	Servia	1,377,078
Norway	1,802,882	Montenegro	190,000
Denmark	1,903,000	Greece	1,457,894

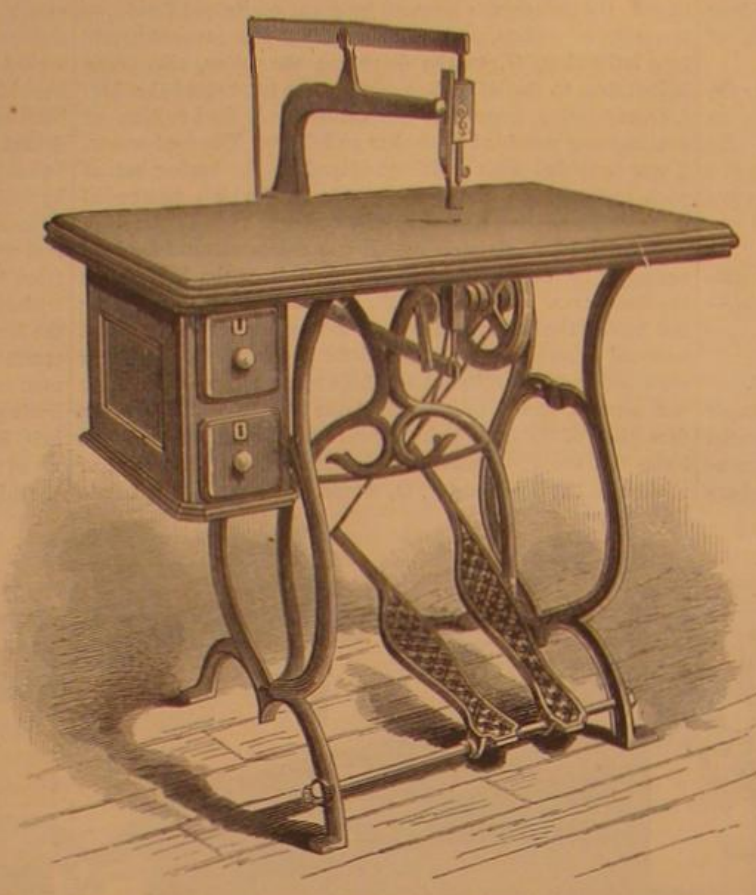
The population of Turkey in Europe, Asia, and Africa reaches 47,600,000 souls, of whom 20,500,000 are divided between Egypt, Tripoli, and Tunis, Asia having 13,000. The population of the Russian Empire is estimated at 85,586,000, or 900,000 over the population of 1875. The population of the British Indies numbers 289,000,000, that of China 405,000,000, and that of Japan 33,299,015. London has 3,489,428 souls, Paris 1,851,792, New York and Brooklyn 1,535,622, and Berlin 1,045,000.

IMPROVED SCROLL SAWING MACHINE.

The annexed engraving represents an accurate and durable scroll sawing machine, highly finished in all its parts. The table is black walnut, 2½ feet long, 1½ feet wide, and 1 inch thick. It is ornamented with a heavy moulding, and a case is provided holding two drawers with locks and key.

The machine will saw material up to two inches thick; it saws under the arm seventeen inches. The legs, treadles, and arm are cast iron, and the spindles and shaft are of steel. The spindles are bored so that long saws can be used without bushing them off. The machine operates with a fast, steady, even stroke, and straight up and down. The saw blades are strained equally at all parts of the stroke. The machine occupies no more room than a sewing machine, and is very light running. It is well adapted for the uses of carpenters, joiners, cabinet and pattern makers, and amateurs.

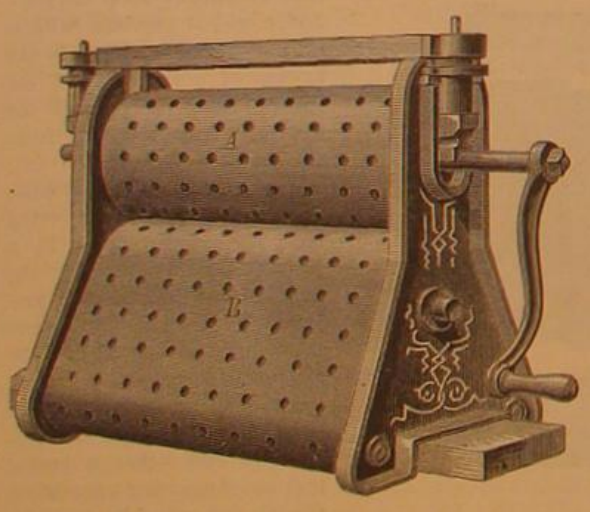
For further particulars address W. E. Lewis, Cleveland, Ohio.



LEWIS' IMPROVED SCROLL SAWING MACHINE.

THE DENNEY WASHING MACHINE.

The accompanying engraving illustrates a washing machine which is claimed to be well suited for use upon the finest articles of wearing apparel, or other domestic goods. The two washing rollers are about four inches in diameter, and are corrugated; the rounded ridges formed upon the top roll fit into corresponding grooves in the under roll; a sleeve, A, of pure vulcanized India rubber fits tight upon the top roller. To prevent its getting loose by stretching under the severe pressure, there is applied to the top roll a narrow strip of cloth which is inserted in the rubber near to each end of the sleeve; lines of perforations extend lengthwise of the sleeve, directly over the groove formed between the rounded surfaces. An endless band, B, rests upon the upper surface of the under roll, and passes down at quite an angle around small carrying rollers at the lower corners of the frame, and crosses underneath the machine; this band is made, like the roll cover, with narrow strips of cloth near the edges, and is perforated also. The roll cover and band are made of pure rubber. The pressure is applied to the top roller by a rubber spring, which is encased in a chamber, and acts upon a suitable bearing protruding from the same which rests upon the roller shaft. The amount of pressure applied to these machines ranges from 60 to 75 lbs; and yet



from the peculiar adaptability of the rubber, it is stated that the machine operates easily, runs smoothly,, and makes little or no noise in running.

The clothing passes between the two elastic surfaces, and the action of the rolls is such that the water and air which enters the channels in the under roller is forced in jets through the body of the goods. The articles can be passed entirely through, past the rolls, and are carried back by the band, thus washing each piece out to the end without continually dropping down into the tub.

For further information address the manufacturer, Mr. S. L. Denney, Gap, Lancaster county, Pa.

IMPROVED OSCILLATING GRATE BAR.

The new grate bar illustrated herewith is claimed to be adapted for burning any kind of fuel with but little loss, to be durable, easily managed, and easily cleaned. Each bar consists of an axis, A, Fig. 1, from which wings or lugs radiate. In the wings are slots or holes, as shown in the illustration, which are so arranged that the apertures do not come opposite each other, so that the fuel that falls from the wings of one bar is caught by the wings of the adjoining bar, without stopping up the passages.

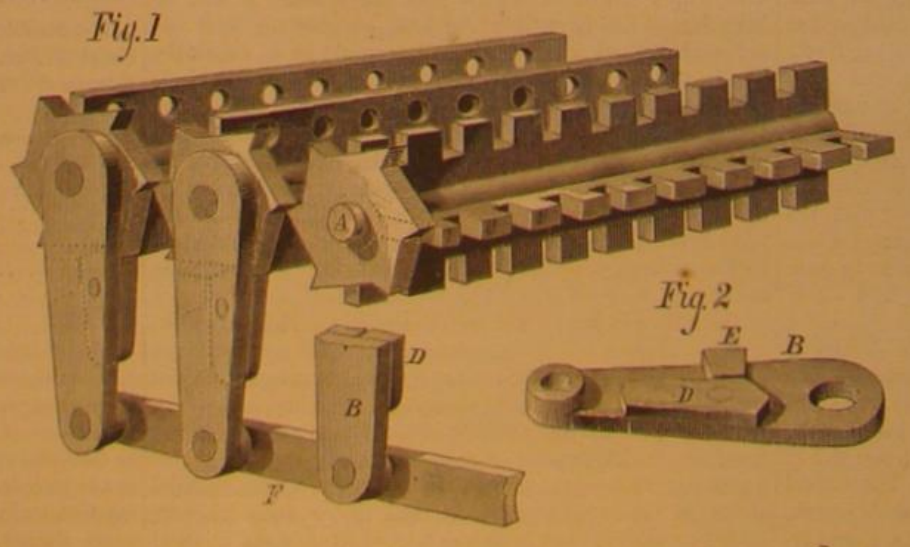
The shafts of the bars project, and upon said shafts the bars work freely. The levers, B, Fig. 2, fit over the ends of the shafts; and attached to the bars, and just inside the levers, are ratchet wheels, C, having six teeth. A pawl, D, on each lever, engages with these teeth and gives the bar an intermittent rotary motion when the lever is oscillated back and forth. The lug, E, on the lever acts as a support to the pawl and receives the thrust. The connecting bar, F, unites all the levers and extends back to the boiler room where it is attached to an upright hand lever.

These bars are placed in furnaces in various ways. When the furnace is constructed with a view to their use, a long, narrow opening may be left in front underneath the furnace doors, and at the back end of the furnace a support is placed, provided with holes a proper distance apart to receive one end of each bar. After the bars have been placed in position, a similar support can be slipped on over the front ends of the bars, thus securing them firmly in their places, and closing up the opening. The bars thus placed cannot be moved out of position, and can be readily inspected. In the case of a locomotive or portable engine furnace, the supports may rest on projections on the inside of the firebox, or be bolted on the lower edge of the same. When used on locomotives a lever extending up into the cab enables the fireman to operate the bars to clear the fire of refuse or to dump the entire contents of the furnace. This bar is also specially adapted to use in stoves, as it enables fuel to be used which would drop through ordinary grates.

The rotary motion of the bars is claimed to break up and discharge all clinkers and dross by crushing them between the lugs or wings. By continuing the rotary motion the grate becomes, in effect, a dumping grate, and the whole contents of the furnace can be discharged.

The bars being set so that the wings or lugs overlap to a greater or less extent, as may be desired, they form a continuous fuel table, so that finely divided coal, sawdust, tanbark, etc., can be burnt, as it is almost impossible for it to pass through without being caught by the lugs or wings on the adjoining bars.

For further information, address Messrs. Denny & Ruth, patentees, Circleville, O.



DENNY & RUTH'S IMPROVED GRATE BAR.

A GOOD bell metal consists of copper 100, tin 20 parts.

Origin of the Carbon in Plants.

It has long been known that the green parts of plants are able in sunlight to decompose carbonic acid and absorb the carbon. To decide the question whether plants can take up carbon in any other way than through their leaves, J. W. Moll undertook a series of experiment, which led to he following results: Leaves and parts of leaves kept continually in a place free from carbonic acid never form any perceptible quantity of starch, even if in immediate contact, by over or underground parts of the plant, with an atmosphere much richer in carbonic acid than the air. Hence the excess of carbonic acid that is at the disposal of any portion you choose of a plant, never causes the production of a perceptible quantity of starch in a leaf or part of leaf united to it, if the leaf is kept in a space free from carbonic acid. The formation of starch in a leaf in open air is not perceptibly hastened when any other part of the same plant is in a place containing more carbonic acid than the atmospheric air. The carbonic acid at the disposal of the roots of a plant, in the soil, neither causes the formation of starch in a leaf excluded from carbonic acid nor perceptibly hastens it in those in the open air.

REVOLVING BOOT AND SHOE HEEL PROTECTOR.

The annexed illustration represents an ingenious device which serves the double purpose of protecting the heel of the boot or shoe, so that it cannot be worn away unequally, and also of preventing the wearer slipping upon ice. It also, by affording an elastic cushion to the foot, renders walking easier and less fatiguing.

It consists of a circular metal or rubber plate having a dovetail flange. Inside the latter a rubber disk is inserted, and through the center of the disk is an aperture with a metal conical lining. Through this opening the fastening screw which enters the heel of the boot passes. The screw is forced in just tight enough to enable the plate to be revolved by hand, so that when the wearer walks it will be caused to rotate of itself, and in this way the wear on the India rubber pad will be equalized. When the head of the screw is forced into the conical aperture, the effect is to expand the rubber pad under the flange, thus causing



the former to be tightly secured in place. When the rubber is worn out another disk may be inserted at small expense, and without renewing either plate or screw.

Among the advantages specially claimed for the device not mentioned above are that it tends to support the ankle and to keep the foot erect; it will not mark or soil floors, oilcloths, or carpets; it gives a neat finish to the shoe, and is furnished at less expense than that ordinarily involved in re-heeling the shoe. Twelve sizes of the protector are manufactured, and it is sold with the necessary implements for applying it. Patented through the Scientific American Patent Agency. For further particulars, see our advertising columns and address the Massey Revolving Shoe Heel Co., 824 Broadway, New York.

THE new pipe line between Great Belt and Pittsburg was lately finished. It is thirty-six miles long, and will supply twenty-eight refineries in Pittsburg, all owned by the Standard Oil Company.

THE "hygroscopic flowers," as indicators of damp or dry weather, do not appear to be very modern. They were used as early as 1792.

THE BANDED CHERSYDRUS.

The achrocorde or banded chersydrus is a curious aquatic serpent found in the bottoms of marine creeks and mouths of rivers on the borders of the sea, in the vicinity of Malacca, the bay of Manilla, Coromandel, Java, Sumatra, New Guinea, and generally along the coast of southern Asia. The fishermen frequently catch them on their lines, not willingly, as the fangs of the reptile are provided with a deadly poison. It is distinguished from other serpents by being almost entirely free of scales. The body is covered with grain-like particles inserted in the thin and wrinkled skin. Those on the back project slightly in the center, and those on the stomach are pointed. The median line is marked out by two or three ranges of scales placed at angles. The nostrils can be closed with a membraneous fold. The tail is flat and compressed, resembling an oar blade. The body is generally banded with black and white oval rings, the tail is spotted with white, and the small head is brownish. Some specimens have yellow or brown bands. They are classed by some among the sea serpents, and by other among boas.



THE BANDED CHERSYDRUS.

Preservation of the Dead.

The corpse of the great Italian republican, Mazzini, was petrified by the method invented by Señor Gorini, of Lodi. Recent travelers say that it proves entirely successful, the features of the eminent agitator presenting no visible alteration, and the expression well preserved, as he reposes in his tomb, which is open to the inspection of visitors. Señor Gorini has not revealed the secret of his method, but has taken measures to give it to the public at his death.

STORKS EATING YOUNG RABBITS.

Our engraving represents a hungry stork making his breakfast off of an unfortunate young rabbit. It is not often that the bird captures such large prey, but probably, while searching the thick grass with its bill partly open, as is its curious habit, it encountered the rabbit and pounced upon without stopping to consider the difference between young rabbits and field mice. The latter, together with snakes, toads, frogs, and large insects, constitute the stork's ordinary food. The unhappy victim is not gorged instantly, but is carried off to the margin of some pond where its captor shakes it and beats it with its bill until it is reduced to a proper condition for easy swallowing. Then the meal is dispatched in a gulp or two, and the bird, which possesses an enormous appetite, resumes its hunting. The stork's favorite food is eels, which it captures with great dexterity. No spear in common use for taking that fish can more effectually secure it between its barbs than can the stork's mandibles. A small eel, despite its lightning movements, has no chance of escaping when once aroused from its lurking place by a stork.



STORKS EATING YOUNG RABBITS.

In Europe the stork attaches itself to man and his habitations, building huge nests on tops of houses, and tamely walking round the streets. It especially parades about fish markets, where it finds no lack of subsistence in the offal.

EDUCATION, as defined by Aristotle, means an agency for the implanting of sound and virtuous habits. Nothing else would satisfy him for a moment.

Testing Lubricating Oils for Acids.

That a small quantity of fatty acid in oil renders it unfit for lubricating purposes is too well known to need repeating, but how to ascertain its presence before irreparable injury has been done is a more difficult problem. Dr. Wiederhold proposes the following simple method of testing for acids, namely, its action upon sub-oxide of copper, or red oxide. If the red oxide is not at hand, the copper scale or ash of the coppersmith may be employed, as it contains this sub-oxide. Either of these substances is placed in a white glass vessel, and covered with the oil to be treated. If the latter contains a trace of acid, or any resinous acid from rosin oil, with which it may have been adulterated, the oil soon turns green, and that too nearest the copper scales. A gentle heat hastens the reaction, which, in the cold, requires from 15 to 30 minutes. The test is extremely delicate, and cannot result in any doubt or error to those who use it for the first time. The author states that it is superior in accuracy, reliability, and simplicity, to any method previously known, so that an oil which is not turned green by the copper scale can unhesitatingly be pronounced absolutely free from acid. If there be but little acid present the green color is fainter, by more acid, intenser, and if rosin has been added it is bluish. The chemical reaction is this: The free vegetable and fatty acids separated the sub-oxide into oxide and metallic copper; the former then combines with the acids to form greenish blue salts, that dissolve more or less in the oil and impart their color to it. The oxide of copper does not answer as well as the sub-oxide.

BRASS castings shrink $\frac{1}{8}$th inch to the foot, in cooling.

Peace and Prosperity in Holland.

The Department of State has received a report on the social and political condition of the Dutch from the Minister of the United States to the Hague. As an illustration of the carefulness and steadiness of the Dutch, the Minister says that there has not been a bank failure in Holland during the last forty years, and that the paper money of the banks during that time has been equal to gold. In regard to fire insurance companies, there is no such thing as a failure on record, and, while the rate of insurance does not average more than half of one per cent, the companies are in the most flourishing condition, realizing twelve to sixteen per cent per annum. First class railroad travel is only one cent per mile, and yet the roads pay good dividends. Pilfering officials are scarcely ever heard of, and when they shock the nation by turning up, they are severely punished and forever disgraced. No free passes are granted, and managers and directors have no power to pass anybody over the roads free. All must pay the public rates. Dishonesty of any kind, or failure in business, means public dishonor, and utterly bars the dishonest from any future public consideration. Four millions of people live within an area of 20,000 square miles, a fact unprecedented in any other country; and all appear to be happy, prosperous, and contented. The secret of this prosperity lies in the fact that all live within their income, and that industry and honesty are principles so firmly established that their violation is looked upon as an outrage on the national characteristics.

Cape of Good Hope International Exhibition.

It has been officially announced from the Cape that a second International Exhibition is to be opened in Cape Town in April, 1878. It appears that the success of the first exhibition was sufficient to cause a demand for a repetition on a larger scale, especially as regards machinery, implements, and other matters employed in agriculture. This subject was, therefore, laid before the Assembly, a committee was appointed to examine the petition and statements presented, and in reporting thereon it recommended the Government to subscribe a sum not exceeding a thousand pounds, in aid of the coming exhibition: "It being of opinion that the enterprise and energy which has accomplished so much for the colony should be encouraged and assisted," ending with the recommendation above quoted as "in return for the advantages already derived."

During the last few years there has been a marked increase in the commerce of the Cape, for it appears that the imports of the colony increased in value from less than two millions sterling in 1866, and little more than two and a half millions in 1871, to £5,731,319 in 1875, while the exports had grown in the same time from two and a half to nearly four and a quarter millions; and as there are no manufactures of any importance carried on in the colony, the exports consisting of raw material, horses, cattle, and sheep, copper, ore, tallow and skins, and from Natal, sugar, arrowroot, pineapples, indigo, coffee, etc., there seems no probability of this rapid growth of the trade with our South African colonies being arrested.

The figures referring to reports given above do not include diamonds, which are principally sent in letters or parcels, and of which there are no custom house returns; the

amount to the present time is estimated at about twelve millions.

The exhibition of the coming year is introduced under the special patronage of Sir Bartle Frere, Governor of the colony. Its programme includes almost every article of export: Class 1. Preserved meats, fruits, vegetables, etc., condiments, preserves, wines, beer and spirits, corn, flour, etc. Class 2. Chemicals, perfumery, medicines, surgical appliances; oils, soaps and candles, paints, colors, inks, varnishes, glue, starch, blue, black lead, etc.; surgical and dental instruments and appliances; tanning matters, disinfectants, insect destroyers, etc. Class 3. Furniture and upholstery of all kinds; glass, porcelain, earthenware, household utensils, and small wares of all kinds; sewing, washing, and other domestic machines; toys and games; writing-desks, work-boxes, etc.; shop fittings, show cases, etc. Class 4 includes all kinds of clothing and fabrics, watches, plate, and jewelry. Class 5. Vehicles, tents, and anything connected with traveling, emigration, and camp life. Class 6. Tools, cutlery, and needle goods. Class 7. All the machinery and materials of construction. Class 8. Agricultural implements and materials of all kinds. Class 9 is devoted to science and education, and includes books, maps, printing machinery, etc., instruments, apparatus, and materials. Class 10 em braces tobacco, cigars, etc.; aërated water apparatus, beer engines, etc.; ropes, cordage, boats, etc.; fire extinguishers, and papier maché ornaments.

The Wreck of the U. S. Steamer Huron.

The United States steamer Huron, an iron gunboat of 1,020 tons measurement, recently, during a heavy storm, ran ashore at Kitty Hawk, on the coast of North Carolina, some 35 miles south of Norfolk, and was totally wrecked. Out of 138 persons on board, but 34 are known to have been saved. The disaster occurred during the night, and only about twelve hours after the ship had sailed from Norfolk. The cause seems to have been the entanglement of the vessel in a shorewise setting current which carried her nearer land than her navigator supposed her to be. The heavy sea prevented accurate sounding, and the dense fog rendered the shore invisible, so that the first intelligence received of the ship's peril was her contact with the bottom, which was followed soon after by her bilging.

The large proportion of lives lost will give rise to the question of what means of safety the vessel was provided with, and why the same were not of more avail. It seems that there were a few cork jacket life-preservers—articles of great rarity on board of a man-of-war—but beyond these there were a small balsa life-raft, which proved of little utility, and the boats, which were of none, as they were unable to live in the surf. Although the wreck was quickly known to people on shore, and a large crowd gathered on the beach, no method of communicating with the wreck was at hand; while the crew of the stranded vessel, although abundant time seems to have been afforded, were unable to get a line ashore. Although numerous devices have been suggested for sending ropes to land from wrecks, notably by kites, it would seem that still simple means of communication are necessary. A new adaptation of men-of-war's cutters as unsinkable and uncapsizable life-boats would be of utility. The arrangement must be such that the space in the boat necessary for transportation of men, provisions, etc., is not cumbered with large air cylinders or similar devices, nor must the arrangement be such as will interfere with the ordinary every-day use of the boat. A life-preserving jacket, which might also serve as a waterproof dress in bad weather, might also be a useful device, and if such were invented, of sightly appearance and capable of easy storage, the Navy Department could be asked to consider the propriety of its being made a part of the regulation uniform outfit of naval seamen.

AN EASY METHOD OF PRODUCING BAS RELIEFS.

The production of patterns from which to cast ornamental articles is confined to a class of artizans who, by long experience in carving and modeling, have attained great excellence in workmanship. An amateur, while he may not hope to attain to such excellence, and cannot expect to produce, by the usual processes and with limited practice, such exquisite articles as may be seen in many of the city shop-windows, may, if he possesses even a modicum of artistic taste and skill, do something in that direction for both pleasure and profit, by observing the following directions:

The articles required to carry out the process are some thin sheets of semi-transparent wax,* a knife having a narrow, dull blade, and the printed or drawn design of the form to be produced. The backing, or surface on which the relief is made, may be of any of the materials of which patterns are commonly made.

Having given the backing the required form and located thereon the position of the relief, a sheet of wax is laid over the design and the extreme outline of the figure is traced on the surface of the wax with a dull point. The wax is now laid upon a smooth board and cut upon the line just made with the knife, the blade being slightly warm. The wax thus cut is now placed on the foundation or backing, and fastened by heating the knife blade quite hot and touching the wax at several points, so as to cause it to melt and adhere to the backing. Supposing this piece of wax to have the thickness required in the thinnest portion of the relief, another sheet is laid upon the design and traced within, and a small distance from, the outline of the design. It is cut and laid upon the first piece and made to adhere by pressing it down slightly.

Fig. 1.



Fig. 2.



Another sheet of wax is traced within the outline of the second, and cut and placed upon the two already secured to the backing, and so on until the design is produced in what might be termed the *rough*. This stage is illustrated in Figs. 1 and 2, which are respectively front and edge views, which give the idea of the arrangement of the several sheets.

Fig. 3.



After the sheets are placed upon one another in the manner first observed, the edges may be burnished down by the rounded back of the knife, or by any smooth rounded implement, which must be slightly warmed.

Superfluous wax may be removed by scraping when cold, and indentations and interstices may be filled by adding a little wax. A scroll design is shown in Fig. 3.

When the model is to be reproduced in metal cast in sand moulds, the wax should be slightly varnished with pattern varnish; but when the design is to be produced in plaster, a mould of plaster may be taken from the model after it has been oiled.

Fig. 4.

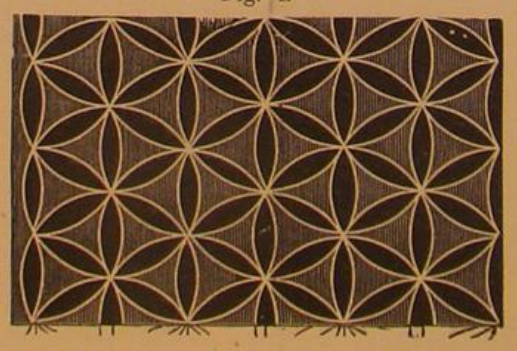


Fig. 5.

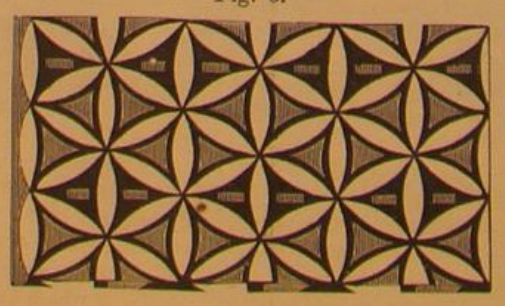
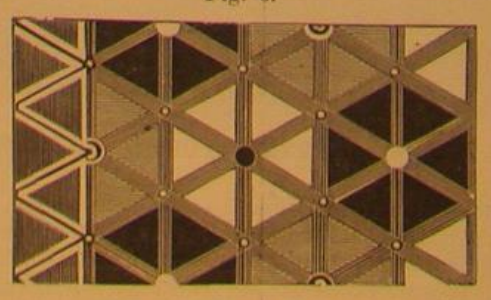


Fig. 6.



A bas relief may be made in this way from a profile photograph or from an engraving.

The process may be employed to advantage in ornamenting patterns for the coarser and heavier kinds of work.

Figs. 4, 5, and 6 represent surfaces ornamented in this manner.

The process is applicable to bas relief ornamentation only, but it is capable of considerable development. G.M.H.

The Sense of Beauty.

There is nothing which more distinctively marks true progress in education than the increasing breadth of view which is taken of the whole subject. Gradually we are discovering that man needs not merely the knowledge contained in text books, and laid down in the various courses of study, but much that must be gleaned from other sources; that he has not only one set of faculties to be developed, but many; and that true culture includes the careful nurture of every part.

Among the hitherto neglected powers of our nature is the sense or perception of beauty. We all have this in its germ, but few of us ever think it worth our while to cherish and improve it. Yet there is scarcely one of our faculties that is so amply provided for in the external world as this. Beauty pervades the entire universe. Mountains and valleys, forests and meadows, skies and oceans are full of it. The more we explore Nature the more do we discover of her loveliness. Science is every day revealing new beauty by her discoveries, and every accession of knowledge opens up charms of which we had never dreamed. Only a small portion of creation can minister to the necessities of the body, and that portion can only be made available by toilsome labor; but the sense of beauty has but to awaken to its own need to find the whole universe waiting to pour upon it the richest supplies. In most cases our desires far outrun their possible fulfilment, but in this it is just the reverse. Here it is the inner sense that needs developing to respond to the wealth of beauty that awaits its recognition. It is as if, in an exquisite palace, filled with choicest pictures and statuary, and adorned with everything that taste could suggest to make it attractive, the inhabitants were partially blind, and could barely distinguish one article from another, much less comprehend the loveliness by which they were surrounded. The world is full of beauty that we barely see, or seeing yet fail to understand or to enjoy.

It may, however, be questioned whether, after all, it is so important that this sense should be quickened and sharpened into keen appreciation. It does not help a man to earn his living, or to grow rich; it does not give him standing in society or political power; it does not add to his stock of knowledge, or enable him to fight the battles of life with any more success. It is true that it does not directly promote these results, though through its culture some of them may be indirectly aided. Yet these are not the only things in life worth pursuing, though in our materialistic age we are apt to think so. The joy that beauty confers is of itself no mean or trifling thing. Pure and innocent pleasures are the best safeguards against unwholesome excitements. He who early learns and retains the habit of enjoying external beauty, and letting its influence sink deeply into his nature, will not be greatly exposed to temptations of a gross or sensual nature. Beauty is eminently refining, purifying, ennobling. As the eye which perceives it is the most delicate and sensitive of all the bodily organs, so the inner sense which responds to it is the most tender and refined of all the faculties. To cultivate and develop this sense is then to exalt the pleasures, to purify the desires, to refine the feelings, to ennoble the aims. No one can expand and intensify his sense of beauty without being a better man, and breathing out a sweeter influence than before. It may be, as Socrates declares, that outward beauty is but the emblem of expression of what is lovely, grand, or noble in the unseen or spiritual world. Certain it is that they are closely akin, and they act and react upon each other with the most perfect harmony.

Whoever is imbued with the sense of beauty will involuntarily create it around him. It will give a grace to his demeanor, a fitness to his words, a harmonious proportion to his conduct. Good taste and consistency will shine in his domestic arrangements and in his business affairs. Unconsciously, by his intercourse, he will develop the same power in others. Partaking of his pleasure and enthusiasm, they also will respond to the beauty around them with fresh joy and fervor. Let us, then, no longer neglect the culture of this important part of our nature. Let us open our eyes and our hearts to receive all the beauty that they are capable of taking in; let us welcome its pure delights, and hasten to shed them on others: let us give it a place in our daily life and thoughts, and let its presence ever dwell in our homes, to bless and purify them.—*Phila. Ledger.*

A Mammoth Barrel Factory.

The Standard Oil Company is constructing at Pittsburg a factory for the manufacture of barrels for its own use. The building will be 300 feet square, and supplied with the latest improved machinery for making barrels, with a capacity of turning out 5,000 to 7,000 barrels a day. The establishment, it is c lculated, will cost about $50,000. In connection with this immense cooperage there is being erected a huge agitator, to be used in completing the process of refining oil, and to which the oil will be conducted by means of pipe lines, and barrelled. These establishments will have the effect of making the locality an extensive shipping point.

* For complete directions for making sheet wax, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 17, "Casting, etc."

Manufacture and Uses of Bird Lime in Japan.

The following extract, which is taken from the Hiogo *News*, is inserted by Consul Annesley, in his report upon the trade of Hiogo and Hsoka. Although bird lime may be obtained in small quantities in other countries, still Japan may perhaps be considered the only country in the world in which it is regularly manufactured on a large scale, and as an article of some commercial importance, the production of which gives employment to some thousands of people.

The Chinese characters used to express the word "mochi," sometimes called "tori-mochi," to distinguish it from "mochi" (rice cake), give an excellent idea of the nature of the article, and may be freely translated "bird-catching, sticky substance." It was first manufactured at a place called Yoshino, in the province of Yamato, and the manufacture has spread thence over the whole of Southern Japan, being limited in the locality by the habitat of the trees from which the article is made. The date of its discovery it is certainly difficult, and perhaps altogether impossible, to obtain, some placing it 500 years back, and some only 300. It is, however, certain that, within the last twenty years, the quantity that has been brought into the market has been perceptibly affected through the destruction of the trees, by denuding them of their bark for its manufacture. The Japanese have made some attempt to arrest this destruction by leaving, in a particular manner, a certain amount of the bark on the trees, with the hope that they might serve a second time; but it is found that the article made from this second bark is of very inferior quality.

Osaka is the great center of the mochi trade; large stocks of it may be found, anomalously enough, in the hands of the Kane-Cutsaya (dried fruit merchants), who have their headquarters in and about Tema. Its present value is about 13 yen to 16 yen per picul (133⅓ lbs). The best kinds, which are distinguished by being free from bark, of a dull whitish color, extremely viscid, and having a very gummy consistency, come from the provinces of Yamato, Kischin, Tosa, Aiva, and Igo, an inferior quality being made in Satsuma, Chosin, Bungo, Isé, and Mino, the two latter places being the northern limit of its manufacture. All found north of these provinces is imported from Osaka and places south of that port. The best kinds are said to keep good for any length of time. The principal tree from which this bird lime is made is a dark evergreen, having its habitat in the southern half of Japan; it grows high up the shady side of deep mountain glens, and is frequently used by the Japanese as an ornamental shrub; in fact, it may be seen in the ornamental grounds of the Osaka Railway Station. Its bark is of a grayish-brown color, and roughish texture; the leaves are opposite, smooth, dark green, rather more pulpy than the English holly leaf, ovate-acuminate in form, have an unbroken linear edge, a very short petiole, and almost imperceptible stipules. Its efflorescence is a panicle, centripetal in its development, having small, white, wax-like diandrous and monopetalous florets, which are also slightly cruciform.

The manufacture of bird lime extends over a period of several months, commencing about June, when the bark of the mochi trees is stripped off and macerated in water for about forty days, after which it is collected and beaten in a mortar, exactly in the same manner in which rice is cleaned. The pestle, however, is of a different make, being shod with iron, the flat under surface of which is armed with spikes projecting downwards. When the pulpy mass under the pestle becomes glutinous, it is taken out and washed in water. This is done to remove as much as possible of the rough outer bark, and the pulp is then again pounded and treated in a cauldron with hot water, on the surface of which it floats. During this treatment it undergoes continual manipulation at the hands of the workman, for the purpose of disengaging the remaining particles of bark, which sink to the bottom of the boiler. This is the most difficult part of process, as considerable skill and experience are required in the workman to keep the stuff from adhering to his hands. After this it is again washed in cold water, and the pounding, boiling, and washing are again repeated until the material becomes sufficiently clean and pure. During the above process about nine tenths of the weight of the raw material is lost, 250 catties of the latter not turning out more than 25 of good bird lime.

The uses to which this article is put by the Japanese are more extensive and diverse than one would suspect, its principal one being, of course, for the snaring of birds and animals. By its means animals as large as monkeys are caught. When they once get the stuff upon their paws they soon cover themselves with it, and so exhaust themselves in trying to get rid of it that they fall an easy prey. Birds also as large as ducks are taken, and by a very ingenious process. The young shoots of the fugi (*Wisteria*), which attain considerable length, and are strong, light, and flexible, are gathered, dried, and knotted together in one continuous length. This is smeared with bird lime, and floated out to sea, when very often in the morning, as the writer has witnessed on the eastern coast of Choshin, the hunter is rewarded with several birds. It is a very inexpensive method of bagging wild fowl, as the tackle will serve any number of times till the bird lime dries, when it is easily replaced. Small birds are caught in various ways, some by means of a decoy bird concealed near a patch of tempting feed, which is plentifully planted with little splinters of bamboo, like large needles, the upper half of which is covered with lime. Others are caught while on trees by means of a long, slender bamboo, the top of which is anointed with the lime, and then stealthily thrust against their feathers. Rats are easily caught by spreading a small quantity on a piece of board or paper, and placing it near their holes. It is spread upon a bamboo leaf, and universally used throughout Japan during summer, for catching flies or other insects. The writer has even seen a flea trap made of it, and used by the Japanese in bed. This trap looked more like an English toast-rack without a handle than anything else, simply a piece of board with the lime spread over its upper surface, while over this semicircles of bamboo were fixed at some distance apart, to prevent the bedding, etc., from getting smeared with lime. Should the vivacious insects happen to get on to this during their noctural frolics, their fate is as surely sealed as that of a little fish in the embrace of an octopod.

Another use of bird lime is for medicinal purposes. In certain diseases of the eye it is taken in small pills or dissolved in hot water. It is also used for those complaints of the pelvis which the Japanese call "senke;" it is considered one of the best cures for flesh wounds, cuts, etc., and is almost universally used in the manufacture of plasters. Both water and oil are used in its manipulation, to prevent it sticking to the fingers, but it is generally handled with a stick. It can be purchased at any greengrocer's ("yawoya") store throughout Japan. It might be as well to mention that a very inferior quality of bird lime is made out of wheat by most of the "fuga" (makers of wheaten food); it soon loses its properties and becomes useless.

THE LIMITS OF NATURAL KNOWLEDGE.

In an address delivered at the Munich meeting of the German Association, by Professor C. von Nägeli, on "The Limits of Natural Knowledge," the lecturer maintained that the solution of the question: In what way and how far may I know and understand Nature? is evidently determined by the answers to three questions: (1). The condition and capacity of the intellect; (2). The condition and accessibility of Nature; and (3). The demands which we make of knowledge. In regard to the capacity of the intellect, were it not for our five senses we would not know at all that there is anything besides, nor indeed that we are in bodily existence ourselves. With regard to the completeness of sensual perceptions there is another boundary which is not generally thought of. Scientific analysis shows that each particle of matter influences and is influenced by every other particle, according to distances. The theoretical possibility, therefore, exists that the human organism may obtain bodily perceptions of all phenomena in Nature. In reality among the beings known to us certain parts have developed themselves into organs of sensation, which are extremely sensitive for certain natural phenomena. As Darwin says, in organic Nature only such arrangements attained full development which were useful to the individual bearer. We are endowed, for instance, with great sensitiveness for temperature; it is necessary for our existence, otherwise we might perish through cold or heat without knowing it. We are very sensitive towards light; it acquaints us in the best and quickest manner with all objects which surround us and which may be useful or dangerous to us. On the other hand, we are not organized to perceive the electricity which surrounds us; and were it not for accidental experiences, which revealed it to us, we should have no idea of that force which undoubtedly plays the greatest part in organic and inorganic Nature. Our senses are indeed only organized for the requirements of our bodily existence, but not to satisfy our intellectual cravings. We cannot rely upon our sensual perceptions acquainting us with all the phenomena of Nature.

There are, therefore, two important limits to our perceptions of Nature. On the one hand we are probably deficient of the power of sensation for whole domains of natural life; and on the other, as far as we really have this power, it is confined in time and space to an insignificantly small part of the whole. By conclusions from facts which were recognized by the senses, we arrive at facts equally certain which can no longer be perceived by the senses. The hope of conquering the entire domain of Nature by the reason can, however, never be realized. As the effect of a natural force decreases with the distance, the possibility of knowledge also decreases as the distance of space and time increases. The confined capacity of the intellect, therefore, allows us only an extremely fragmentary knowledge of the universe.

In passing to the second question, we find that the difficulty which Nature opposes to human knowledge is her endlessness of time and space, and of everything which depends on this as a necessary consequence. We cannot conceive her as a whole, because a process of conceiving which has neither beginning nor end does not lead to conception. On all sides uninvestigable eternity bids the investigation categorically to stop. As soon as man wishes to overstep this domain, and wants to form some conception of the whole, he falls into absurdities. Whenever our finite reason wishes to raise itself to conceptions of the eternal in however logical a manner, its wings become paralyzed, and, like a second Icarus, before the sunny heights are reached it falls back into the depths of finite and obscure ideas.

The third question regards "the demands which we make of knowledge." As all conceptions which we form of Nature are exclusively the results of sensual perception, our knowledge cannot go further than to compare the phenomena we have observed, and judge them with reference to one another. We understand something perfectly if we create it ourselves because in this case we see its cause. The only thing in the domain of knowledge which, based upon our sensual perceptions, we can accomplish, is mathematics. We can also understand real things with certainty, as far as we find mathematical ideas realized in them. Our knowledge of Nature is therefore always a mathematical one, and consists either in simple measurement, as in the morphological and descriptive natural sciences, or in casual measurement, as in the physical and physiological sciences. To understand a natural event means nothing else, as it were, than to repeat it in thought, to reproduce it in our mind.

We can thus only know what our senses acquaint us with, and this is limited in time and space to an infinitesmal domain. Of all that is endless or eternal, of all that is stable or constant, of all absolute difference, we have no conception. Of that with which we are acquainted at all we can only know what is relative and differs by degrees, because we can only apply mathematical ideas to natural things. Professor Von Nägeli sums up in the words: "We can only know the finite, but we can know all the finite which comes within reach of our sensual perception."

New Inventions.

An automatic fan and fly brush has been patented by J. B. Boone, of Galveston, Texas. It consists of a fly brush attached to a shaft with rotary-reciprocating motion communicated to it by a clockwork device. The spring has strips of paper attached to it and fans are affixed to the revolving shaft which works in a supporting plate attached to the ceiling.

John W. Drake, of Toronto, Ill., has invented an improved lamp shade and reflector. The shade has a conical top section and a lower supporting section of inverted conical shape. The lower section has at one side a large opening for the exit of the light, which opening may be enlarged or diminished by ring-shaped sections. At the opposite side of the of the lower section is arranged an adjustable and detachable reflector, for throwing the light through the opening of the shade. A strong light can thus be thrown to any point.

An insole patented by J. K. Gittens, of Brooklyn, N. Y., consists of sheepskin with wool for the inner layer, heavy paper for the intermediate layer, and heavy japanned drilling for the outer layer, gummed together, and bound with a worsted or silk binding. It does not wrinkle.

Mr. Frederick Becker, of Hokah, Minn., has devised a new window shade in which thin strips of wood are connected together, tilted to shut out or admit more or less light and raised by cords passing over pulleys or rollers near the top of the window.

An instrument for cleaning telegraph wires, patented by Joseph Walsh, of New York city, consists of a long tube fitted with knives and springs. When it is placed around the wire and moved along, the device cuts away all obstacles such as kite strings, and clears the wire.

A Tap Attachment to Beer Barrels has been patented by J. H. Bruns and Henry von Dehsen of New York city. It consists in an externally threaded cup which screws into the barrel head. The cup has an apertured bottom, into which is screwed a faucet, which is threaded at its outer end, to receive the coupling by which it is connected with the counter beer faucet. The plug of the faucet is placed midway in the cup and is moved by a pin. The cup has a screw cover, which when removed and the plug turned permits the beer to pass.

Owen W. Taft, Brooklyn, N. Y., has patented a Bird Cage. It consists in a bird cage body made in detachable parts and arranged to be held in its complete integral form by a tension exerted either individually or collectively upon the several wires constituting the same. In practising the invention, numerous modifications of the same may be made all tending to the same result, but the preferred form is that in which each wire has formed in the same a spiral coil which gives an individual tension for each wire to hold the which gives an individual tension for each wire to hold the detachable cap piece, standards, and base ring together, to form a complete bird cage body.

Sylvester Root, of Kentland, Ind., has invented a Fire Escape, which consists in an apparatus so constructed that persons may be lowered from a building to the ground by means of a chain or rope, and the latter will then be automatically drawn up again to facilitate the descent of other persons. The means employed consist of the chain with waist belt attached, a drum for winding and unwinding the chain, and spring power and brake apparatus for regulating the action of the drum.

A Chair Seat and Back has been patented by Paul Rath, of Jersey City, N. J. It consists of a molded pasteboard seat or back, having a central hole, stuffing, and covering, in connection with a separate pasteboard section bolted thereto, and carrying auxiliary springs, to increase the elasticity of the stuffing. It furnishes a light and useful seat.

A Bougie invented by Stephen St. John, of Port Jervis, N. Y., consists in a compound of gelatin or isinglass and glycerin, thoroughly mixed together in proportions varied accordingly to the quantity of the ingredients and the requirements of the species and intensity of the disease. The compound thus made is then formed into cylinders, and medicated to suit different purposes.

A Dress Elevator has been patented by Emil C. Calm, of New York city, by which the dress may be supported at any elevation, and adjusted with great facility. It consists of the connection of the hook by which the dress elevator is attached to the belt, and of the chain to which the dress-holding clamp is applied, of a pulley or other guide device connected to hook, and of a suitable chain-retaining device.

Imitation of Wood Mosaics.

Hugo Riha describes the following neat method of imitating mosaics in wood: The smooth pine board is painted with three or four coats of dull white for a ground. When dry it is ground with *ossa sepiæ*, well dried with a piece of buckskin and left a day standing. A thin liquid paint is made by grinding the finest ivory black with turpentine on a glass plate, very fine, and mixing thoroughly with a mixture consisting of three parts of ordinary copal varnish and one part turpentine. This is applied evenly, with not too stiff a brush, upon the white tablet, and graded down very fine and delicately with a badger's hair grader. After two hours the paint dries so solid that work may be begun on it. The tablet is placed on an inclined position and the drawing of the design, the outlines of which have been pricked through the paper with a needle, is laid upon it, and reproduced on the black surface by striking it gently with a bag filled with finely ground chalk, and after removing the paper the outlines will be found in white upon the black background. The design is next painted over with a solution of calcined soda. In two or three minutes afterwards the painted part is washed with a piece of sponge dipped in water, with a circulatory motion of the hand and arm. With a little rubbing the black paint is removed from the portions where the soda was applied. The washing with clean water and sponge is repeated until the design appears in white. This, of course, is the white ground that was under the black. This surface is then dried with a piece of buckskin. By this process the white portion is depressed while the black portion which did not come in contact with the soda remains raised. The colors are now applied to the white portion to imitate the different kinds of wood; and where two kinds of wood are to be matched together, a strip of adhesive paper is pasted along the line where they are to meet, and one kind of paint applied up to the paper. When dry the paper is removed and placed over the painted part and the other color applied. When the design is completed it may be varnished and polished. As the paint applied does not form a thicker coat than the black which surrounds it, the work has the appearance of natural wood mosaic inlaid in a black groundwork, instead of being raised from it as in the usual method.

Making Wrought Iron and Steel.

In a paper on the direct process of making wrought iron and steel read before the Franklin Institute, Mr. Charles M. Dupuy recently gave many interesting facts, from which we make selections.

Forged iron is made by the "direct" and "indirect" methods. By the primitive direct method 400 or 500 lbs. of ore, mingled with charcoal, are subjected to the action of blast for 3 or 4 hours, when it becomes imperfectly matted together, and is transferred to the hammer, where its earthy impurities, being melted, are removed by pressure. This process secures a high grade of iron, at a cost of about 300 bushels of charcoal and great waste of ore to the ton of iron. The "indirect" method treats large masses of ore, carbon and fluxes in the blast furnace. The earthy impurities are mainly tapped off, but still the pig iron may be said to be a compound of iron, carbon, silica, and other substances which require a second melting, and laborious manipulation to purify the metal for forging or rolling.

The devices for improving and cheapening iron by the direct method have been numerous, for the superiority of the metal thus treated had been observed. In 1791 Samuel Lucas patented a process for reducing ores with carbon in airtight pots, and in 1794 Mushet forged iron which he had reduced in a crucible. The simplest method, by reduction of ores in crude clay pots, seems to have been known from the earliest times. A fresh pot for every operation was, of course, too expensive, and devices have been invented by which ore could be deoxidized and the vessel used over and over again.

In a long series of experiments on iron reduced in close pots, Mr. Du Puy found that ore and carbon are such perfect non-conductors that the highest heat penetrates from the outside very slowly through a thickness of about 3 inches of this substance, and that to add 2 or 3 inches thickness of crucible, or containing vessel, practically defeats complete reduction in a sufficiently speedy time to be successful. He also found that a white welding heat was necessary to thoroughly reduce the ore. Crucibles of any refractory material sufficient to withstand this heat are costly at first, and in frequent renewals; besides the material would soften, and incorporating with the metal, deteriorate it. To secure the advantages of the "close pot" it became evident that some substance should compose it that should withstand the high welding heat, and be homogeneous with the metal, and finally, when its work was done, and the ore changed to metal, would weld up with it.

As it is estimated that every pound of silica ordinarily carries with it about three pounds of iron, it occurred to Mr. Dupuy to create for the silica a greater affinity than it has for the metal, by mingling alkalies, and to so proportion them, that the glass thereby produced by not combining with it, should not only save the iron, but that it should be further utilized by forming particles of glazing or varnishing material, covering the little particles of metal as formed, and thus protect them from furnace reoxidization. This step proved effective. Now the alkalies in quantity, and kind, having been determined by an analysis of the ore, they are mingled with it along with the carbon, and are all pulverized together, by being thrown, in the proper proportion, into an ordinary Chilian mill, such as is used in Western rolling mills for grinding the "*fix*," and from thence shoveled at once into the canisters, and charged into the furnace.

It will be observed that a triple chemical operation begins to take place at once, from the moment the canisters are charged into the furnace.

First. The oxygen of the ore combines with the carbon, passing off as carbonic oxide.

Second. The silica and alumina combine with alkalies introduced, and form the glazing material which cover the particles of newly made metal, effectually sealing these particles from reoxidation from the furnace gases.

Third. The phosphorus melts into this glass, and passes off with it as a slag, not contaminating the iron.

If it is desired to make steel, the canisters, filled as described, are charged on end into the furnace on a layer of coke, a few inches in thickness, so as to allow the heat to penetrate from the bottom, as well as sides and top. They are usually placed 7 or 8 inches apart to secure a radiation of heat between them.

In the course of from five to seven hours, according to the strength of the heat, the ore will be reduced from its oxide and settle down into almost a solid metallic mass, so firm as to be separated and broken with great difficulty, even in its highly heated state in the furnace. In this solidified condition it is removed and hammered, or thrown into the squeezer and rolled to muck bar, at this one first heat. It is then cut up, reheated and piled, with the usual loss of 8 to 10 per cent of ordinary piled iron. This stock is then fitted for the steel pot, producing all grades of steel, up to the highest, without mixing with other stock, but by simply varying the carbon.

If iron is required, as soon as the metal has separated from its impurities, precipitated to the bottom, and covered with slag, the operator at once rolls it up in balls and subjects it to the hammer or squeezer. No excessive labor is required in stirring the metal, as is required to decarbonize pig iron, for this metal has been deoxidized without labor, simply by the chemical action of heat on the material; and there is no excess of carbon to eliminate. It has also separated itself, in the liquid state, by specific gravity, from its metalloids altogether, without the aid of physical labor. Finally, as it lies at the bottom of the furnace, it is incorporated with just sufficient carbon as is needed by the operator to produce the grade of metal required.

The ore, carbon, and fluxes, as has been proved by working, may all be ground together and charged into the canisters at an outside cost of 40 cents per ton of ore; when systematized, 30 cents per ton will be sufficient.

It will be found that muck-bar may be produced a few dollars per ton above the cost of pig iron; that it will rank with the highest grades of wrought iron for special purposes; and that the plant is so simple and inexpensive, as to make a large reduction in the interest account of all ironworks. Besides this, it will be found that the process is so greatly under the control of the operator, as to enable him to make such mixtures as to produce the exact quality of iron or steel desired, not being subject to the irregularity of the blast furnace. This direct process, in a word, reduces the exact results of the laboratory to a large and intelligent practical working basis for the manufacture of iron and steel.

Astronomical Notes.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., December 22, 1877.

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

PLANETS.

Mercury sets	5 56	evening
Venus "	8 18	"
Mars in meridian	6 18	"
" sets	0 30	morning
Jupiter "	5 21	evening
Saturn in meridian	5 1	"
" sets	10 33	"
Uranus rises	9 15	"
Neptune in meridian	8 6	"
" sets	2 50	morning

FIRST MAGNITUDE STARS.

Sirius rises	7 32	evening
Procyon "	7 7	"
Betelgeuse "	5 16	"
Regulus "	9 11	"
Aldebaran in meridian	10 22	"
Vega sets	9 21	"
Altair "	8 8	"
Fomalhaut sets	8 45	"
Capella in meridian	11 0	"
7 stars (cluster) "	9 33	"

REMARKS.

The sun entered the constellation *Sagittarius* and attained his greatest southern declination (23° 7′ 26″) December 21. Twilight begins in the morning at 5 h., 42 m., and ends in the evening at 6 h., 14 m., having lasted in both instances 1 h. 39m.

All the planets are advancing or moving eastward among the stars, except Uranus and Neptune, which are retrograding. Mercury is now brightest, and can be seen in the west in early evening. He sets 1h. 25m. after the sun, and almost at the same point in the horizon (½° south). He is between Venus and Jupiter, having almost the same declination as the latter and setting 35 m. later. His color will serve to distinguish him from Jupiter and stars. Only 0·226 of Venus' illuminated disk is visible, yet on a clear moonless night she will now cast a well defined shadow.

White and Colored Troops.

The recent annual report of the Surgeon General gives somes figures in regard to the health of the army during the fiscal year ending June 30, 1877, which are interesting. The average mean strength of the army was 23,284 white men and 2,075 colored men. Among the white troops the total number of cases of all kinds reported as taken on the sick list was 40,171, or, taking the average, each man was sick less than twice a year. The average number constantly on sick report was 1,026, or about one twenty-second part were sick all the time. The total number of deaths was 260, making the proportion of deaths from all causes one in one hundred and fifty-five. Among the colored troops the total number of cases was 4,348, or each colored man was sick on the average more than twice a year. The average number constantly sick was 99, or about one twentieth. The number of deaths was 32, or one in one hundred and thirty-six. Comparing the ravages of disease among the two races, we find that 1,482 per 1,000 strength of white men suffered, against 1,821 per 1,000 strength of colored men, the proportion being about 20 per cent against the latter. In deaths, however, we find the proportion reversed, for only 7 per thousand of colored men died of disease, as against 8 per thousand of white men. In cases caused by wounds, accidents, or injuries 8 per thousand negroes died, against 3 per thousand of white men. It thus appears that the negroes become diseased more easily than white men, and also recover more easily; but when actual bodily injury occurs they die more than twice as fast as white men.

It is easy to follow out this line of thought in case of actual warfare. The negro troops would be more subject to sickness and when wounded would die quickly. The white troops would be less liable to succumb to disease, though when afflicted the percentage of recovery would be against them. But on the other hand they would recover more easily from their wounds, which are after all the most serious troubles to be met with in war. Disease can be guarded against, but wounds can not. The superiority of the white to the colored soldier would thus seem to be in measure a proved on the score of health alone.

Heat Waves.

Professor Piazzi Smyth, of the Royal Observatory, Scotland, says that the coming winter is to be exceedingly cold. From the observations of earth thermometers over a period of 39 years, he finds that between 1837 and 1876 three great heat waves from without struck Great Britain, namely: The first in 1846·5; the second in 1858—0, and the third in 1868·7. The next one will probably come in 1879—5, within limits of half a year each way. The periods of minimum temperature, or greatest cold, are not in the middle time between the crests of these three heat waves, but are comparatively close up to them, on each side, at a distance of about a year and a half. Hence the next cold wave is due at the end of the present year, and very frigid weather may be looked for.

NEW BOOKS AND PUBLICATIONS.

WHITWELL'S IRON SMELTER'S POCKET ANALYSES BOOK. By Thomas Whitwell. John Wiley & Sons, Publishers, New York. Price $2.

The want of a pocket analysis book, properly prepared for the various materials used in an iron or steel works, or by the metallurgical engineer will be fully supplied by this choice little work. It contains tables of specific gravities, proportion of weights, melting, boiling, circumference, English and French weights, and other tables of use to the furnace owner or engineer. It is designed for the pocket, and contains room for 400 analyses; its value will increase with the use made of it.

THE CHEMISTS AND DRUGGISTS DIARY. Publishers: 44 Cannon street, E. C., London, England.

This is a volume of great value to chemist and druggists. It contains a dictionary of chemical synonyms, a list of poisons and antidotes, mineral waters, books interesting to pharmacists, a directory of London hospitals, addresses of London doctors, and a dictionary of minerals. Also acts of parliament affecting druggists, botanical calendar and a large diary with ample space for every day in the year. A similar work for the profession in this country would undoubtedly be appreciated.

THE WATER SUPPLY OF SOUTH AFRICA. Compiled by John Croumbie Brown, LL.D. Oliver & Boyd, Publishers, Tweeddale Court, Edinburgh, Scotland.

Mr. Brown has already published valuable works with the philanthropic object of exhibiting the bad results arising from forest destruction and the positive advantages to be gained by tree culture. He has entered with much detail into the effects of forests upon rainfall, and in another work he has exhibited the benefits of the plan pursued in replanting the Alps and other mountains of Europe with trees and bushes, the object being to arrest and prevent the destructive consequences of torrents. In the present volume he has gathered a large amount of material showing the why and wherefore of the desiccation of South Africa, and pointing out the appropriate means for reclaiming the country. These means it is considered are irrigation, arboriculture and an improved forest economy, or the erection of dams to prevent the escape of a portion of the rainfall to the sea, besides other means of minor importance. A very large number of authorities are cited and the subject is treated with great minuteness.

THE LAW OF PATENTS, TRADE MARKS AND COPYRIGHTS. By Orlando L. Bump. Baker, Voorhis & Co., Publishers, 66 Nassau street, New York. Price $6.00.

This is a very complete compendium of the law as contained in the Revised Statutes of the United States. Notes are given under each section referring to decisions of the courts and the Commissioner of Patents. A valuable table is added, showing the time of the repeal of each act, and other information, so that a lawyer may readily ascertain whether a provision in a statute cited in a decision is still in force, or whether a statute has been so modified as to affect the application of a decision. The rules of practice of the Patent Office and a large collection of forms are appended. Nearly 2,500 cases are referred to and digested, and it is believed that, what with the information contained in the book itself, besides that attainable through its very copious references to original sources, the reader will be furnished with all likely to be required in the investigation of any subject under the laws.

A MANUAL OF VEGETABLE PLANTS. By Isaac J. Tillinghast. Tillinghast Brothers, Publishers, Factoryville, Pa.

This is a neat volume of 100 pages containing the experiences of the author in starting all those kinds of vegetables which are most difficult for a novice to produce from seeds, with the best methods for combating and repelling noxious insects and preventing the diseases to which garden vegetables are subject. It is a handbook of much value to gardeners and embraces a variety of useful information.

Business and Personal.

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

Weldless Cold-drawn Steel Boiler and Hydraulic Tubes. Leng & Ogden, 212 Pearl St., N. Y.

A young German Chemist, Phil Dr., arrived from Germany a few weeks ago, desires a situation. Good references. Address Harbordt, 1,317 Hoehn St., St. Louis, Mo.

For Fly Wheels and Pulleys, all kinds and sizes, apply to Watts, Campbell & Co., Newark, N. J.

Manufacturers of Fruit Preserving Machinery please address E. T. Martin, Box 204, New Brunswick, N. J.

Lipsey "Reliable" Wrench; strong, convenient. Best. Roper Caloric Engine Manuf. Co., 91 Washington St., N. Y.

Ice Machines. Clayton & Cook, Daretown, N. J.

Corliss Engine Builders, with Wetherill's improvements, Engineers, Machinists, Iron Founders, and Boiler Makers. Robt. Wetherill & Co., Chester, Pa.

Hearing Restored.—Great invention by one who was deaf for 20 years. Send stamp for particulars. Jno. Garmore, Lock Box 905, Covington, Ky.

"Our Pet" Scroll Saw, Lathe, Anvil, Vise, Drill, and Grinder, $10; with tools and extras, $12. W. X. Stevens East Brookfield, Mass. See illustration, page 374.

The Niles Tool Works, Hamilton, O., have second-hand Machine Tools in first class order for sale.

Electrical Goods of every description. Annunciators, Bells, Magnets, Batteries, Wire, etc. Finger, Risteen & Co., Melrose, Mass.

Bound Volumes of the Scientific American.—I have on hand about 100 bound volumes of the Scientific American, which I will sell at $1 each, to be sent by express. John Edwards, P. O. Box 773, N. Y.

The Best Mill in the World, for White Lead, Dry, Paste, or Mixed Paint, Printing Ink, Chocolate, Paris White, Shoe Blacking, etc., Flour, Meal, Feed, Drugs, Cork, etc. Charles Ross, Jr., Williamsburgh, N. Y.

Boilers set with the Jarvis Furnace will burn screenings and little soft coal without blower.

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For New Illustrated Catalogue of Foot Lathes, Scroll Saws, Small Steam Engines and Amateur's Tools, send stamp to Chase & Woodman, Newark, N. J.

Shaw's Mercury Gauges, U. S. Standard of Pressure. 915 Ridge Ave., Philadelphia, Pa.

Bolt Forging Mach. & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Town & Village use, Comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Boulter's Superior Muffles, Assayers and Cupellers Portable Furnaces, Slides, Tile, Fire Brick and Fire Clay for sale. 1,009 North St., Philadelphia, Pa.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearms Co., Lawrence, Mass., U. S. A.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Felt of every description for Manufacturers' purposes, especially adapted for Polishing, can be furnished in any thickness, size, or shape. Tingue, House & Co., Manufacturers. Salesroom, 69 Duane St., N. Y. Factory at Glenville, Conn.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

C. C. Phillips, 4,048 Girard Ave., West Phila., manufactures Vertical and other Burr Mills adapted to all kinds of grinding; also Portable Flouring Mills.

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The Varnishes and Japans of Hyatt & Co., merit their success from the satisfaction they give in purity, color, and durability, with cheapness. Try them. Send for circular and price list. Office 246 Grand St., New York.

To Clean Boiler Tubes—Use National Steel Tube Cleaner; tempered and strong. Chalmers Spence Co., N. Y.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years constant use prove them stronger and more durable than wrought iron. See advertisement, page 366.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Notes & Queries

(1) E. N. asks: 1. Can old work be re-kalsomined? A. Yes, unless too much smoked: in which case it will be necessary to wash the wall first. 2. How can a new patch of plastering in old work be kalsomined so the old and new wall will look uniform? A. Make the kalsomine somewhat thicker than usual, and if necessary apply several coats. Ceilings should be painted.

(2) J. W. G. writes: I want to make some photo-chromos. Will you tell me through your valuable columns what will make the paper transparent? A. Allow the photograph to remain in water until thoroughly soaked, then place it between blotting paper, and let it remain until just damp enough to be pliable. Then coat the face of the picture with good starch paste and lay, face down, on the glass. Commence in the center of the picture and rub outward toward the edges to dispel all air and excess of paste, care being observed not to get paste on the back of the print. While rubbing keep the paper damp with a sponge. When dry lay on a heavy coat of castor oil, and after a time rub off the excess of oil with a cloth. After standing a day or two it may be colored. Cover the back with a thin plate of glass, and bind the edges.

(3) F. H. B. asks: How can I make or obtain a clay or other suitable substance for modelling, which will not crack on drying? A. Try adding a little glycerin to the clay paste.

(4) C. N. asks for a recipe for destroying vermin on trees and plants? A. The solution obtained by agitating together a quantity of water and recently slaked lime, and permitting the mixture to stand for a few hours in a covered vessel, is said to be excellent for this purpose, and very cheap. It may be sprayed on and around the twigs, using a small syringe with a finely perforated rose nozzle. A decoction of the dried leaves of the sumac tree is also said to preserve vines and plants from the attacks of insects. The application must be repeated occasionally. Besides these, sulphur, alkaline sulphides, calcium sulpho-carbonate, etc., are used with satisfactory results.

(5) P. E. T. asks what the solution is which is used for crystalizing grasses, bouquets, etc.? A. Use strong solution of gum arabic, white sugar, and salt.

(6) E. T. H. writes: What can I do to keep my hair from turning red? A short time ago it was of a black color, but it is now fading into a reddish tinge. A. The red color may have been caused by free alkalies in the oil or pomatum used, or the excessive use of these in washing. Apply occasionally cologne water mixed with a little vinegar of cantharides, and keep the scalp clean by the use of a stiff brush.

(7) C. C. asks: How can a trace of sewage be detected in well water without going to a costly analysis? What is the nearest distance a cesspool should be to a well 50 feet deep? A. Add to a sample of the recently drawn water enough solution of potassium permanganate to impart to it a faint pinkish tinge. If the coloration disappears immediately, or within half an hour, the water may generally be considered unfit for drinking and cooking purposes. One grain of the permanganate will distinctly color 1½ gallons of pure water. Make a saturated solution (in cold water) add 1 fluid oz. of this to 6 fluid ozs. of the water to be tested, and set it aside for 24 hours; a turbidity or curdy precipitate indicates the presence in the water of organic impurities. See p. 296, vol. 36, SCIENTIFIC AMERICAN. Evaporate a quantity of the water to dryness and heat the residue slowly to redness, noting at the time the character of the residue and odors. It is not safe to trust the water from wells located within 200 feet of a cesspool.

(8) L. F. says: Parties here are selling an article for cleaning windows, etc., which resembles whiting. It is made into balls and colored. Can whiting be pressed into balls, and how is it done? A. We have not seen the preparation referred to. Whiting can be pressed into balls by moistening it with thin gum water.

(9) Onyx asks for a good flavor for cigars? A. Try cascarilla bark or vanilla bean.

(10) T. E. asks for a recipe for making a cheap sealing wax? A. Resin 4 lbs., shellac 2 lbs., Venice turpentine and red lead, each, 1½ lbs. Mix and melt.

(11) O. W. O. writes: The water we are using for domestic purposes comes from a river on which are several woodworking establishments, and our wood pulp mill is above the locality whence the water supply is taken. The water is drawn from a wooden tank containing three feet of coarse gravel, the supply coming in under the gravel, and the suction pipe of a common double plunger pump being inserted above the gravel or filter (capacity of pump 12½ gallons for each revolution or complete out and return stroke of both plungers). From this pump the water is distributed. This arrangement has been going over a year without the gravel in the filter ever having been changed. Recently the water was drawn off and the gravel washed, since which time the water has had a very milky appearance at times. What is the cause? A. The milky appearance of the water is most likely owing to the imperfect washing and cleaning of the gravel, and the disturbance of the salts or "brack" that after so long an exposure probably coated every grain of the sand. It would have been much better to have provided fresh gravel, well washed, from the bank; and if the water is used for culinary purposes, this had better be done now.

(12) H. L. C., who sent us a photograph of a curiously marked stone, is informed that the corrugations in the stone were doubtless the work of small rills of water on the yielding surface of a fine deposit of clayey soil, deposited behind some dam in a shallow muddy stream. On drying, cracks were formed, and these subsequently filled with crystalline carbonate of lime, or other substance.

(13) D. H. D. says: How can I set a 21 inch turbine water wheel in a quicksand bottom to a depth of say 2 feet into the quicksand? If I once get the box down and the wheel set, how can I hold it down? The fluid sand pushes it up just as water pushes up an empty barrel. A. You must weight the box sufficiently to keep it down.

(14) D. F. H. asks: How can I construct an electric apparatus for blasting purposes? A. Arrange two pieces of copper wire about 3 inches long, and rather stout, say No. 16 gauge, side by side, and parallel, but separated, and insulated by a strip of wood similar in size and shape to an ordinary lucifer match; bind them firmly by wrapping with cotton thread, and to the two upper ends solder a shred of platinum, or piece of fine platinum wire, so that it will be in circuit between the two copper wires; this constitutes the "fuse," and, when the insulated copper wires, called leading wires, are connected with its two lower ends, it is placed in the cartridge and surrounded with powder; all that is necessary to fire is simply to connect the two ends of the leading wires with a galvanic battery, composed of one or more cells of Grove's battery, when the platinum shred immediately becomes white hot, and ignites the powder.

(15) G. McN. asks for a recipe for making gelatin, such as is used in making moulds for casting plaster of Paris ornaments? A. They are made of good glue dissolved in hot water containing from five to fifteen per cent of glycerin. Glue thus made, on cooling, gelatinizes, but does not dry or harden.

(16) J. F. T. says: I have a 120 ton schooner. It is necessary for me to go into many small harbors, where I have great difficulty in getting out on account of light winds. Could I have a small steam engine put in, which would not take up much room, that would drive my vessel about 4 or 5 miles per hour? A. You could have auxiliary steam power, with a screw that could either be hoisted or disconnected from the engine. By inserting a notice in our "Business and Personal" column, you will doubtless obtain estimates from reliable builders—or you can entrust the matter to an expert.

(17) C. D. W. writes: I want to make a compound magnet of five on six, and I have some bars of very good spring steel. Will it do, or must I use cast steel? A. Spring steel, after it has been hardened in water, will magnetize very well.

(18) J. W. R. asks: 1. Which is the better positive pole for a single acid battery, a carbon plate or a platinized silver plate? A. A platinized silver plate. 2. Which gives the better results, a bichromate of potash solution or sulphuric acid solution? A. That will depend on the style of battery in which the solution is used: bichromate of potash, or chromic acid, in a weak solution of sulphuric acid, is best for the Grenet battery, whereas a weak solution of sulphuric acid is better for the Smee battery. 3. How can I platinize copper? A. Have it silver plated, then roughen with platinum black.

(19) J. D. S. asks how to determine the slip of side wheels in steamers? A. If you know the distance the vessel runs for a certain number of revolutions of the engine, the difference between the distance passed over by the center of pressure of the wheel and the above is the slip.

(20) J. W. and M. H. ask for opinions on the following assertions: 1. It is not actually necessary in long stroke expansive engines to open the exhaust valve before the stroke is completed. A. It is usually desirable. 2. It is more necessary to close the exhaust valve a trifle before the stroke is completed in order to cushion the piston. A. A certain amount of cushion is generally desirable. 3. It is customary in Corliss engines to open the exhaust valves late in order to make them close early. A. You are wrong.

(21) H. H. C. asks: What is the proper solution for a battery composed of carbon and zinc without the use of the porous cup usually used therewith? A. In a battery composed of a plate of zinc, faced by one or more plates of carbon, a solution of the sulphate to the ounce of water may be used; or a weak solution of bichromate of potash or chromic acid in water, to which is added one twentieth of its weight of sulphuric acid.

(22) C. R. P. says: I have a steamboat 53 feet long, 10 feet beam, draught 17 inches. It has side wheels each 6 feet 6 inches diameter; paddles 3 feet long. How wide should the paddles be, and how deep in the water should they run to get the best speed? There are two engines 6 x 18 inches geared to run two and one third revolutions to the wheel's one. A. Make the paddles from 6 to 8 inches wide, and immerse them from 12 to 14 inches.

(23) J. A. K. asks how to remove ink stains from clothing? A. Wash first with pure water, then with soapy water, and lastly with lemon juice, but if old use oxalic acid and wash well afterwards.

(24) D. P. asks: Do you think that the use of petroleum as a preventive of scale is likely to cause foaming in the boiler? A. No.

(25) G. M. asks for a cheap way to build a furnace to melt cast iron; one large enough for 100 lbs. of metal? A. You will find a good description of a blast furnace in the SCIENTIFIC AMERICAN SUPPLEMENT for December 8, 1877.

(26) F. J. S. asks: Can I make my main driving belt run well by carrying from the main wheel (9 feet diameter) to a vertical shaft having a 4½ feet pulley? Distance from center to center of shafts or pulleys about 25 feet, main belt 14 inches wide and 70 feet long. My idea is to do away with gearing and use belting, so that I can ship and unship my mills without stopping. A. You can make this change without any difficulty if the belt is of sufficient size to transmit the power.

(27) E. A. writes: 1. Please describe the nature and workings of the electric pen? A. It is simply a tube used as a pen, having in it a very fine needle, whose point has a very rapid motion (of $\frac{1}{5}$ of an inch) in and out the tube or pen; the needle receives its motion from a little electric engine mounted on the upper end of the tube, and having attached to it two flexible conducting cords, that conduct the current of electricity from the battery that drives it. You simply write with it (as you would with pencil), on waterproof paper, having the needle point against the paper; and the writing consists of an immense number of perforations very close together, caused by the rapid motion of the needle piercing the paper; this motion is so rapid that it does not interfere with the movement of the point over the paper. Now all that is necessary is to moisten one side of this waterproof paper with some fluid color, and enough of the color will strike through the perforations to print one sheet after another of ordinary paper placed under it, and then pressed in a common letter press. 2. Was the enclosed specimen made by its means? A. No.

(28) H. R. & Co. write: Could you please inform us by what plan we could remove the lime from our water which we feed our steam boiler with, as there is considerable deposit of it each time we clean the boiler out? A. The best way to cure this evil is to use water that is free from lime: but as this cannot always be obtained, the only remedy left is to free the water from the lime: and one convenient way to do this is to run the water through two boilers; the first, in which the water is heated to boiling point, serves as a trap for the lime, and the water is pumped from this to the other boiler, which furnishes steam. Can you not collect sufficient rain water to feed your boiler?

(29) C. W. D. asks: In making a pony telegraph sounder or relay, the bobbins or arms of the magnet to be ¾ inch long and ⅝ or ¾ inch diameter, what diameter should the iron arms be, and what number wire, and how many courses, must I use to give strong clicks? A. The iron arms of the magnet are called cores, and if the spools are ¾ inch long and ¾ inch diameter, they should each be made of a piece of soft round iron, 1 inch long and ¼ inch diameter; and the spools should be formed of six or eight layers of No. 30 copper wire, either silk or cotton insulation, for a sounder, and of from twelve to fourteen layers of No. 36 copper wire (silk insulation), for a relay.

(30) J. A. C. writes: 1. Will you please inform me what number of copper wire I should use to form the outdoor line connecting two telephones, about 200 feet apart, the helix formed of No. 36 insulated wire wound on (⅛" x 4") round steel magnets? A. Use No. 16 Brown and Sharpe's gauge, of either iron or copper wire. 2. Also if the copper wire outdoor should be insulated or not? A. Naked wire, on glass insulators, will answer. 3. Also, should I use two wires or ground connections? A. Use ground connections, if they consist of either gas or water pipes; if not, use two main lines.

(31) J. W. N. asks (1) for a simple method of treating or tanning sheep skins intended for glove leather? A. The skins are first soaked in water and handled, and are then hung up in a close warm room to putrefy. The exudation is afterwards scraped off, and the skins are steeped in milk of lime for a month or six weeks, after which they are smoothed on the fleshy side by a sharp knife. They are now to be steeped in a bath of bran and water, where they undergo partial fermentation and become thinner in substance. Immersion and agitation follow in a bath composed of 3 lbs. alum and 4 lbs. salt, dissolved in water, per 120 skins. Another washing in another bran and water bath succeeds, and the skins are then trodden in a wooden tub with a solution of eggs in water, previously well beaten up to give them a gloss. The pelts are then drained, dried, and then smoothed with hand irons. 2. Also, how to color the same? A. Stretch the skins and brush them with any strong liquid dye of the proper color, used for cloth dyeing.

(32) W. W. asks for the particulars as to the process that is adopted in New York for bending the plumber's seamless lead traps, that are made from 2 inch and 4 inch lead soil pipe? A. A new apparatus has been devised for bending pipes, which is probably used in the instances you refer to. The pipe is filled with water under heavy pressure, and the tube is then bent without its trickling or becoming otherwise injured.

(33) D. F. asks how to make mercurial soap? A. Beat into a homogeneous mass in a mortar Castile soap, 1 lb.; protochloride of mercury, ½ oz., dissolved in 4 ozs. of alcohol.

(34) M. B. asks how to remove yellow iron stains from linen? A. Use hydrochloric acid or hot solution of oxalic acid, washing well in warm water afterwards.

(35) C. L. says: 1. Will you please tell me what is meant in note 4, p. 251, of SCIENTIFIC AMERICAN of October 20, 1877? In describing how to make an induction coil, it says, "use for secondary coil enough wire to bring outside of coil 2 inches from cover." What is meant by the outside of the coil, and what by cover? A. You should read core, not cover. 2. About what number of feet will it take, proportionally, to make an induction coil (for primary No. 16, secondary No. 32)? A. The proportion of primary to secondary wires depends upon the size of core used and the strength of battery employed. For small coils it may be as 1 foot of primary to 15 feet of secondary wire.

(36) E. H. L. asks: 1. What battery power, kind, and number of cells is necessary to run an ordinary sewing machine? A. Twenty cups of gravity battery. 2. How can the power be most conveniently applied? A. Through an electric engine. 3. Please state size and length of core and wire for the electro-magnets? A. That will depend on the style of engine.

(37) H. asks: What is the best length to have my rifle barrel, caliber $\frac{1}{10}$, to shoot accurately from 200 to 300 yards? What is the shortest barrel I can use, for that distance, to do good shooting? Which is the best ammunition, metallic cartridge or P. B. for muzzle loader? How short can I have a shot barrel breech loader, ¼ to ¾ inch bore, to do good shooting

A. Barrel 26 to 32 inches for the rifle. The recent international match demonstrated the superiority of the metallic shell (for breech loaders) provided the loading is done by the individual. Factory cartridges are not reliable. For general use for a 12 gauge gun, 28 or 30 inches is the best length; but for a 10 or 8 bore duck gun, 32 inches is a good length for the barrel.

(38) C. A. T. asks how to stereotype ordinary sized letter heads; has tried plaster of Paris and paper, but the metal will not go down in the impression. A. Paper makes an excellent matrix if rightly applied. Oil the form and place on it first a sheet of tissue paper, then a sheet of soft printing paper, which must be pressed evenly on the tissue. Cover with a damp rag and beat the paper evenly in upon the type with a stiff brush. Then paste on a piece of blotting paper and repeat the beating, after which three more pieces of soft tenacious paper must be pasted on and used in a similar way. Finally back up with cartridge paper and dry under moderate heat.

(39) A. G. asks: What is mixed with the white of eggs for size in gilding edges of books? A. The edges of the leaves are gilded while in the hydraulic press. The composition applied is 4 parts Armenian bole and 1 of candied sugar ground together with water and laid on with the white of egg with a brush.

(40) C. H. D. asks how to lay out steam ports in trunnions of oscillating cylinders of two inch bore? A. The ports should be proportioned in a similar manner to those for other engines, that is, they should have such an area that the velocity of the steam shall not exceed 100 feet per second.

(41) T. R. & Co. ask (1) how fast a lathe should run to grind skates? A. It depends on the kind of emery wheel used, the speed varying between 3,000 and 5,000 circumferential feet per minute. 2. What is the size and grade of emery wheel best adapted to the purpose? A. The size of emery wheel depends upon the amount of concave you want; we should say about 4 inches for edge and about 15 inches for sides of blade. Grade number, 50 for roughing and 120 for finishing.

(42) W. B. writes: Will you tell me of a simple plan to construct a galvanic battery? A. Into an ordinary glass tumbler drop a few crystals of sulphate of copper until the bottom is just covered, and on this lay a disk of thin sheet copper, having metallic contact with an insulated copper wire, running up and over the edge of the tumbler and forming the positive terminal, or pole, of the battery. Sprinkle a few more crystals of the sulphate of copper on the disk, until its surface is covered; and about one inch above this, suspend a disk of ordinary stove zinc, similar in size and shape to the copper disk below it; and suspended by a strip of zinc running up and over the edge of the tumbler: this strip forms the negative pole of the battery; the zinc disk with its strip can be cut at once from a sheet, so as to save joining the strip to the disk. Now pour in clean cold water until the zinc disk is covered; it is in fact a miniature gravity battery, and will give give quite a good and steady current in about one or two hours.

(43) C. H. B. writes (1) for a list of the different conductors and non-conductors. A. We have not room to mention all, but as conductors, silver, copper, gold, all the metals, then the acid and salt solutions. As non-conductors or insulators, hard glass, silk, hard rubber, shellac, etc.; for a more complete list, see "Parker's Philosophy." 2. Also, is there any non-conductor that would do for the cylinder and other parts of a little electrical engine that I am making that have to be non-conductors? A. Hard rubber is the material most generally used as an insulator, in any form of electric engine.

(44) L. I. F. asks: How can I make a smal battery suitable for plating, out of a stone jar and earthen pot? A. Place within the jar a porous cup of earthenware containing a strip or roll of zinc; fill up the space between the cups with a strong solution of copper sulphate (blue vitriol) in water, and immerse in this a sheet of copper bent around the cup. Fill up the inner cup with water containing about 10 per cent of zinc sulphate in solution. The current will pass from the copper to the zinc through a wire and other conductors joining them.

(45) L. R. asks: What length should the wire in the coil of a Bell's telephone be? A. That will depend on the gauge of the wire? See previous answer in this column.

(46) W. writes: I wish to build an electro-medical machine of such power that, when a man of ordinary strength takes hold of the handle and the full force of the battery is turned on, it will knock him down. I wish to know: 1. What number of wire shall I use (22, 32, 44, etc.) and how many lbs. of that number shall I use? Will the machine exert more power if I wind my wire into a long thin coil, or *vice versa*? A. 15 lbs. of No. 44 silk-covered; wind in three short coils, whose aggregate length shall be 8 inches. 2. How much battery power shall I have to use, and what kind of battery is best for my purpose? A. Three cups of Grove.

(47) I. R. B. asks: Is eating thirty quail in thirty days, one bird each day, a difficult task to accomplish, and why? A. The eater becomes greatly nauseated, the flesh probably having some medicinal action. It has been accomplished, and accounts can be found in our back numbers.

(48) J. M. asks for a recipe for syrup for popcorn balls, that will stay sticky when cool? A. Use molasses, or boil the syrup but slightly.

(49) W. T. asks in regard to the telephone: 1. How much copper wire is needed for a pair? A. About 4 ozs. 2. Is it necessary the copper wire should come in direct contact with permanent magnet? A. No, it must not. 3. Is it necessary permanent magnet should move endways to be adjusted, as in a relay? A. No. 4. What are the collars made of that hold the copper wire in position? A. Either wood or hard rubber. 5. Is copper wire wound on haphazard or in layers? A. The same as a spool of cotton is wound. 6. How can I make the iron rod become a permanent magnet? A. You cannot; it is a rod of hardened steel, and can be magnetized by drawing it in one direction over one pole of a permanent horseshoe magnet; or by placing it in a helix and then connecting the helix with a battery and breaking the connection before removing the steel from the helix.

(50) W. S. H. asks how the bluish white color is given to gun locks and mounting? They have a grayish white frosted appearance. A. The colors appear from the case hardening process, which consists of heating the articles sealed in a box containing bone dust and charcoal to a red heat, maintained for two or three hours, and then dipping them in water.

(51) R. W. S. asks: 1. What kind of a stove or heater, and how should I arrange the pipe and heater, to warm a poultry house 100 feet long, 10 feet high, and 10 feet wide? A. Use a hot water apparatus, such as are provided for graperies and greenhouses. There are some that are very simple, consisting of a stove and large cast iron circulating pipe, that give a continuous but low degree of temperature. 2. Also, what can be used instead of blacking? A. An application of asphalt might answer the purpose. Pipe of galvanized iron does not rust so easily as the common pipe.

(52) L. E. asks how blue vitriol can be dissolved for electrical purposes? A. In either hot or cold water.

1. It is said that if kerosene oil be allowed to run through a hot tube it will turn into gas. Is it true? A. Yes. 2. If so, what is the name of it? A. It is one form of carburetted hydrogen. 3. Will it burn? A. Yes, in the presence of air or oxygen. 4. Is it explosive? A. Yes, when it is mixed with certain proportions of either air or oxygen.

(53) A. S. says that his plow castings were recently rusted by the flood in Richmond, Va., and asks how to clean them? A. Retumble them in broken glass.

(54) P. S. asks: 1. Is the hissing sound made by steam escaping from a boiler through say a 4 inch valve that is one turn open, a certainty that the steam is perfectly dry? Will not any steam, wet or dry, escaping through a small opening into so large a pipe and being constantly consumed before it has time to fill the said pipe, will it not make the same hissing sound? A. Either wet or dry steam, escaping through a small orifice, will produce sound; but the sound produced by dry steam will be of a higher tone than when it is produced by wet steam. 2. Are the Harrison boilers, which are made of cast iron and are put together in globe-shaped sections, a first class boiler as regards economy, safety from explosion, and for making the best, that is the dryest, steam for running machinery? A. They are a very good boiler, as far as safety is concerned, but we believe they will not furnish as dry steam as the ordinary tubular boiler.

(55) W. A. B. asks how to make a wire of a gradual taper? A. You might try passing the wire under tension through a bath of heated lead or through some gas or other flame, reducing the speed gradually to increase the taper.

(56) W. S. asks how to harden a piece of steel 9 inches long by ½ inch square, so that it will not warp in hardening? A. Heat it in red hot lead, dip it endwise and vertically, and hold it quite still in the water.

(57) C. M. F. H. asks: What would prevent a steel plate from corroding, and cause it to retain its high polish? A. A thin coat of Canada balsam varnish, or possibly warming the plate and applying a little paraffin, rubbing the wax well in, would answer.

Is it possible to make asbestos, mixed or saturated with silicate of soda, pliable, when pressed or roelld out, it being thoroughly dry? A. This can best be determined by experimenting.

(58) W. J. G. asks for the composition of the white lead mixture applied to bright metal work to keep it from rusting? A. Mix white lead, tallow, and linseed oil to a thick paint.

(59) Mack asks for the degrees of expansion and contraction by heat of the different metals? A. The length of a bar at 32° Fah. being 1, its length at 212° would be as follows: Bismuth, 1·00139; brass, 1·00190: cast iron, 1·00111; wrought iron, 1·00125; steel, 1·00118; platinum, 1·00095; silver, 1·00201; tin, 1·002; zinc, 1·00294; copper, 1·00174; gold, 1·00149; lead, 1·00284.

(60) Dr. T. D. offers the following suggestion for opinion: To so attach the water spouts to side walls as to insure always complete isolation by glass rings or other device of non-conductor, as in the manner of lightning rods proper. As now arranged our water spouts attract toward the interior of the houses the electricity, whereas they might act as protectors (by extending upper and lower ends) always quite as well and at less outlay than by the rods. A. The interposition of glass or other non-conductor, to insulate lightning conductors, is not only useless, but undesirable—the discharge from a large induction coil easily pierces blocks of glass several inches in thickness, and the tension of atmospheric electricity during a thunderstorm is vastly greater than that from the coil. Metal leaders seldom have adequate connection with the earth, and are therefore not only incapable of properly diverting the charge, but are in many cases sources of danger in the absence of a good rod. If the the leader is used as a lightning conductor, it must terminate in moist earth, with an exposure of surface not less than 100 square feet, and must be joined, by means of stout copper wire, with the gas and water pipes, and other metal work of the building. This arrangement may afford protection, but it would be safer to provide the rod also.

(61) O. F. asks for rules for making a cone pulley (or pair of pulleys) so that a belt will be equally tight on the different sides of the cone? A. First assume the radii of one driving pulley and the corresponding driven pulley, measure the distance between their centers, and find the length of belt required. Then assume values for the radii of the successive pulleys on the driving cone, and calculate the values of the corresponding radii on the driven cone by the following rules: I. Having assumed the value of one radius, it is first necessary to ascertain whether the one to be calculated is greater or smaller: (1) Multiply the assumed radius by 3·1416 and increase the product by the distance between the centers of the pulleys. (2). If the quantity obtained by (1) is greater than half the length of the belt, the assumed radius is greater than the one to be determined. (3). If the quantity obtained by (1) is less than half the length of the belt, the assumed radius is less than the one determined. II. *When the assumed radius is greater of the two, to find the other one.* The distance between the centers, and the length of the belt are supposed to be given. (1). Multiply the assumed radius by 6·2832; subtract this product from the length of the belt, and divide the remainder by the distance between centers. (2). Add the quantity obtained by (1) to the number 0·4674 and extract the square root of the sum. (3). Subtract the quantity obtained by (2) from the number 1·5708, and multiply the difference by the distance between centers. (4). Subtract the quantity obtained by (3) from the assumed radius and the remainder will be the required radius. III. *When the assumed radius is the smaller of the two, to find the other one.* (1). Same as (1) of preceding rule. (2). Same as (2) of preceding rule. (3). Subtract the number 1·5708 from the quantity obtained by (2) and multiply the difference by the distance between centers. (4). Add the quantity obtained by (3) to the assumed radius; the sum will be the required radius. These rules apply to an open belt passing over any two stepped cones.

(62) S. S. B. asks: What is the so-called "madstone," supposed to be a cure for hydrophobia, and what are its virtues? A. The madstone of the Southern States is an aluminous mineral, and its charm lies in its power of absorption. The Ceylon madstone or "pombo kaloo" is a black highly polished substance which, when applied to an open wound, rapidly imbibes the blood, and with it the poison. Faraday analyzed it and found it to be a bit of charred bone. The Mexican madstone is charred deer horn. The efficacy of the remedy resides simply in the stone being porous and withdrawing the blood. Sucking the wound would accomplish the same result.

(63) C. H. M. says: In your "Notes and Queries" you frequently refer to back numbers or to the SUPPLEMENT. Can you furnish these, and at what price? A. In most cases we can. By referring to our advertising columns you will see that an unusual opportunity now exists for purchasing a large number of bound back volumes of the SCIENTIFIC AMERICAN at about the cost of the binding. We can supply all the back numbers of the SUPPLEMENT, bound or unbound.

What is the chemical called "colgate"? A. We know of no such substance. Send us a specimen for examination.

(64) A. W. asks if there is any way of making autograph letters other than by lithography? A. The electric pen furnishes a simple means of obtaining any number of copies. The letter is written with the pen which forms the characters by minute perforations, so that the sheet serves as a stencil plate over which an inked roller is passed, the ink marking through the holes upon a sheet of paper placed beneath.

(65) A. G. C. asks how to cut stencil plates otherwise than by chisels. I have coated my brass with wax, scratched through to the metal, covered the letters with sulphuric, nitric, and muriatic acid, but neither of the acids named will cut through the plate. A. There must be something wrong with your acid. Generally nitric acid diluted with ½ water is used. The best plan is to etch the plate as much as possible with the acid, and then clear the cutting with the graver. To obtain clean cuts the back of the plate should be smeared with oil.

(66) H. L. C. writes: 1. I am making a new electric engine in which I have three pairs of electro-magnets wound with 1¼ lb. of No. 16 cotton insulated copper wire to each pair; it will be necessary to have all three pairs in the same circuit at one time. Now if they are all set in a brass plate that makes connection with the cores of all the magnets—but not with the wire direct—will such connection carry the current across from one to the other of the outside magnets, so as to affect the strength of the middle magnet? A. No. 2. Would iron be better than brass? Wood is not strong enough. A. Brass is the best metal to use in this case.

(67) W. T. K. asks if there is a locality on the globe where the sun jumps a day; where at high twelve Sunday, noon ceases, and instantly Monday meridian begins, or where Sunday comes into a man's house on the eastern side, and becomes Monday by the time it passes his western door? A. The sun does not jump a day anywhere. Navigators in sailing around the world, provided they use the time of any given locality, gain or lose a day in their reckoning, and by common custom it is usual when not already done to adjust time pieces for this error on passing the meridian of Manilla. But as a rule clocks are adjusted aboard ship daily, the local time being determined by observation.

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

T. A. A.—It is lignite in a gangue of ferric sulphide—marcasite—and sandstone. The mineral is of no practical value, but if obtainable in larger samples might be of some interest to the mineralogist.—B. B.—They are fine specimens of what are known as claystones—concretions formed by the tendency of matter to collect about a center. They are usually flattened, and at the center there is most commonly some foreign object, a fossil, shell, twig, or the like, which was the nucleus of the crystallization.—E. A. J.—It is a banded agate. It is composed of silicic acid. The colors are caused by traces of organic matter, oxides of iron and manganese, and by the difference of density of the siliceous rings. As regards your other question, there must exist some outlet for surplus water, if the measurements were properly made.—A. W.—It is not brown coal, but a slaty shale.—The color is due to oxide of iron.—W. P. McC.—The silicious clay does not contain coloring matter other than a little oxide and silicate of iron—it is not valuable.—We have received an unlabeled sample of ore rich in zinc and lead—probably from Connecticut.—Will M. S. send other samples of his ore?

COMMUNICATIONS RECEIVED.

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

On the Theory of Universal Gravitation. By J. McC.

On Algebraic Equations. By J. T.

HINTS TO CORRESPONDENTS.

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

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

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SCIENTIFIC AMERICAN

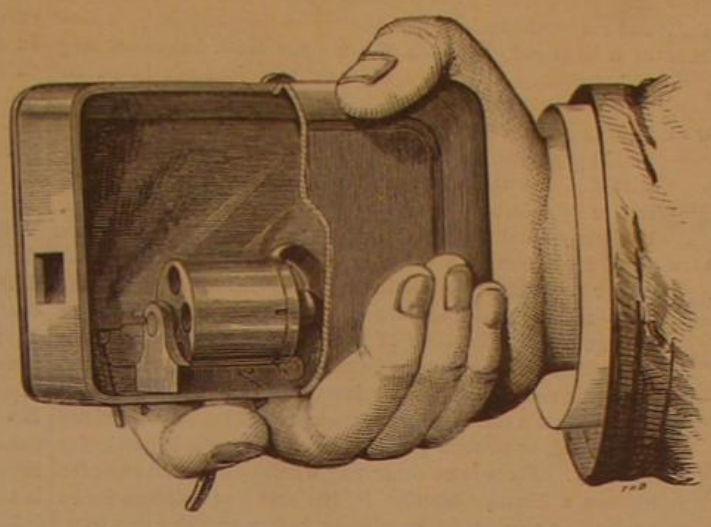
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Vol. XXXVII. No. 26. [NEW SERIES.] NEW YORK, DECEMBER 29, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

A CURIOUS POCKETBOOK.

We illustrate an ingenious combination in which the frame of a pocketbook, a cigar case, and a revolver are united. The advantage of such a pocket article will be readily perceived, as it forms a convenient mode of carrying a revolver for protection, especially when attacked, as it can be fired at a highwayman when handing the pocketbook. The revolver is arranged at the interior, and is attached to the frame, being separated by a metallic partition from the folding pocketbook, which does not appear in the illustration, being on the other side. The trigger is made to swing downward for firing, and can be bent upward into a groove, secured by a catch when not in use. The opening in the side of the frame, shown in the engraving, is closed by a hinged cap, which is opened and shut by the action of the trigger.

Patented November 6, 1877, through the Scientific American Patent Agency, by Oscar Frankman, of Nuremberg, Germany.



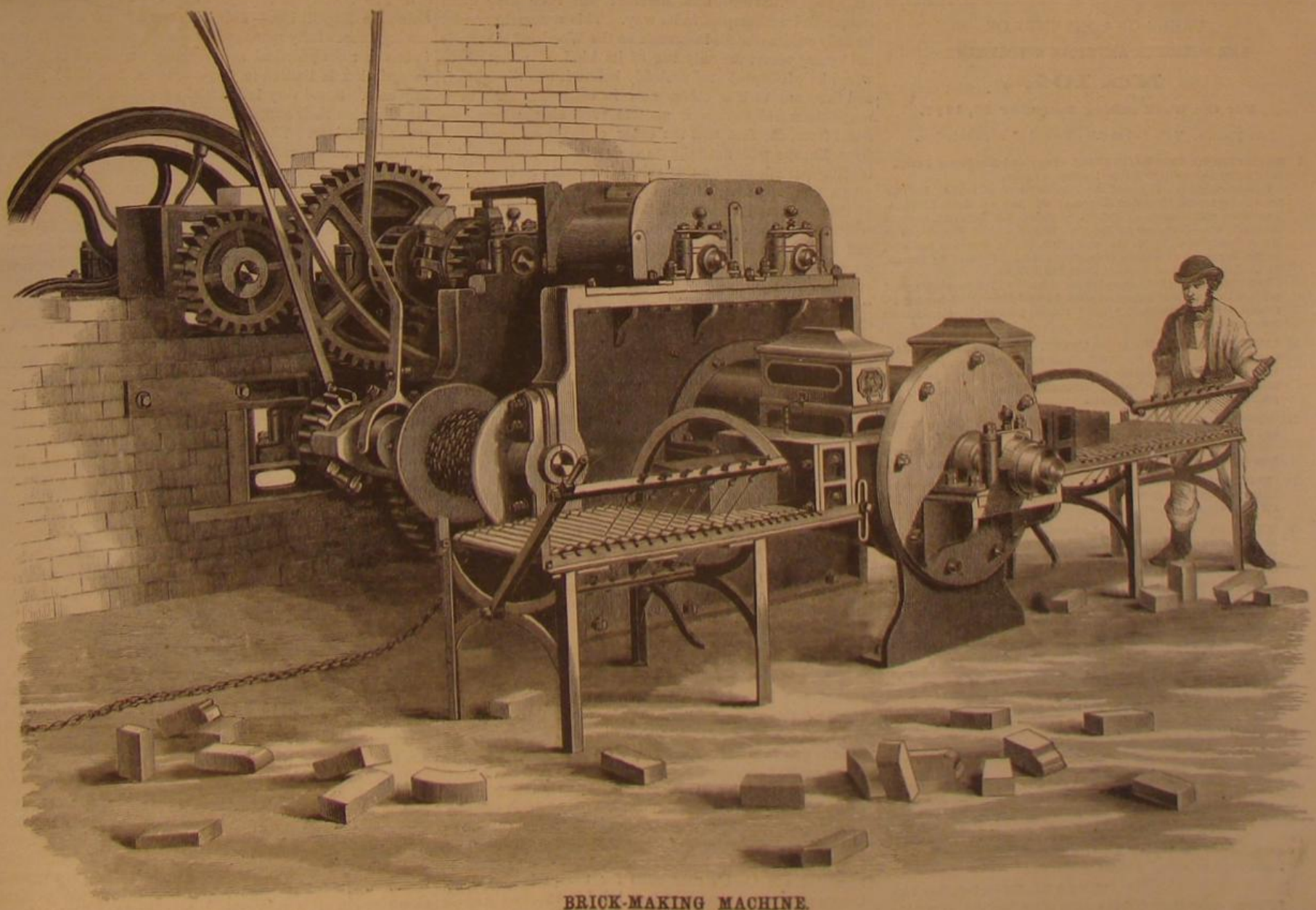
A CURIOUS POCKETBOOK.

BRICK-MAKING MACHINE.

There are several distinct classes of machines in brick-making, which are respectively indicated by the character given to the clay before arriving at the stage of finished bricks. There are the dry and pulverized, the semi-dry, and the wet or plastic machines, each of which claims to have special advantages. Probably, however, the medium condition of the clay will give the most satisfaction in the after burning, and to secure this is the object of the machine of which we copy the illustration and description from *Iron*.

The clay is filled into wagons and hauled to the machine by a winding drum of the machine itself. The power (about 14 horse) is communicated from the engine flywheel to the pulley, of considerable diameter, upon the small countershaft seen in the extreme left of the illustration. This countershaft will run as fast as 120 revolutions per minute, and is fitted with a small flywheel to steady its motion. The shaft is carried by one outside plummer block, and a plummer block and wall box in the wall. On the end of this first shaft is a strong cast iron pinion gearing into a cogwheel upon a second countershaft, which is carried at one end by a plummer block and wall box in the wall, and a bearing on the other end in the main frame of the machine. Upon this countershaft is a friction clutch, which connects another pinion to this shaft, and from this pinion the two crushing rollers are driven. This second countershaft also drives, by a very massive flanged pinion, a large pitched and heavy cogwheel upon the pug shaft, which is a forging of Bessemer steel, and runs through the machine, pugging and working down the clay to the die chamber at the right. The clay is here forced from the two sets of dies on either side of the die box, where the continuous rectangular blocks are received upon roller tables. Across these tables the cutting knives, in a frame, oscillate on a hinge below, and are worked by hand in the usual way. Upon the die boxes are situated two lubricating closets containing water, whence a constant stream is conducted to the dies through small tubes.

The interior faces of the dies are composed of best hard gun metal plates, overlying one another. Sheets of felt at the back absorb the flowing lubricant, and by transferring it to the passing clay between the orifices of the plates keep the sliding surfaces perfectly smooth. A special mixture of metal, harder than steel, is used for the rollers. The hauling drum shaft is carried at one end in a plummer block fixed in the wall, and at the other in a bearing and strong cap against the side of the main framing. This drum shaft is driven by a pinion from the large cog wheel on the pug shaft, and is connected to the drum by a dog clutch or carrier. The pinion drives the carrier through a friction band. The hauling drum has the carrier clutch movable, sliding on a feather key, and fitted with a long shifting lever, projecting upwards to the loading platform. The hauling drum can thus be readily thrown in and out of gear, and at the same time a strap brake is fitted to the drum shaft with a long upright lever, to give command of the load or trucks in running back.



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Scientific American.

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VOL. XXXVII., No. 26. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, DECEMBER 29, 1877.

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SCIENTIFIC TRAVELING EXPEDITIONS.

The Woodruff Scientific Expedition, which some months ago was reported to be actively fitting out with a view to departure in October last, has, as our readers are doubtless aware, been postponed, and will not start until some time next spring. Among other claims which the projectors of this scheme put forward was one to the effect that this plan originated with them, and therefore was something quite unique and unexampled in its way. This statement cannot be fully substantiated, inasmuch as the Woodruff scheme is not by any means the only one of its kind. In fact there were like plans projected probably before it was thought of, and there are various others now in existence. As in a round-the-world voyage it matters very little where one starts from, the fact that the other expeditions are to sail from Europe will not militate against their benefits to intending participants on this side of the water. Hence we give a brief summary of the objects and purposes of each of these schemes, in order that our readers, in the interval which must now elapse prior to the departure of the Woodruff vessel, may have an opportunity of making comparisons and a judicious selection of the particular scientific expedition which they will patronize. We use the adjective "scientific," not because the projectors of the schemes other than Woodruff's lay claim to it, as does that gentleman, but rather because it is fully as applicable to their plans as to his.

In England, there are now three expeditions under way, namely, that of Messrs. Cook & Sons, of Gaze and Sons, and of Grindlay & Co. In France there are two, that of La Société des Voyages (joint stock concern), Paris, and that of Captain Radou. In Germany there is one, that of Herr Karl Stangen, of Berlin. In order to consider these scientific expeditions scientifically, they may be classified first with those which do not possess private means of locomotion, but propose to travel by existing means of intercommunication, and second, into those which will possess separate vessels, to be at the disposition of passengers during the entire voyage. Of the six above mentioned, three, Cook's, Gaze's, and Stangen's, schemes belong to the first, and the rest to the second class.

I. Cook's Scientific Expedition.—The firm of Thomas Cook & Sons is so well known as tourists' agents that it is here deemed quite useless to explain their general mode of operations. In fact circulars, etc., in voluminous quantities are obtainable at the office of the concern in this city. To Mr. Cook a round-the-world voyage is a mere bagatelle, and he sells tickets which are good for traveling expenses in Maine or Hindostan, and for hotel charges in Alaska or Australia—or any other parts of the globe the purchaser may desire to visit—so that the traveler has only to make out his own itinerary, and he may pay a sum in gross for the entire trip and go alone: or he may join an expedition, pay so much for the privilege, and have his goings out and comings in regulated per Cook's time table for the period enjoyed. Cook's sixth round-the-world tour left Liverpool on August 25th last, and will return on March 25th, 1878. Price $1475. Route same as that of Mr. Phineas Fogg in Jules Verne's "Round the World in 80 days," which see for further particulars. It will be observed, however, that in this scientific expedition out of six months 3½ are spent at sea and 2½ utilized in excursions in the United States and Asia.

2. Gaze's Scientific Expedition is organized on the same plan, but is not to furnish a conductor who travels with the party. Tickets alone are issued good on railroads and steamers over a given route.

3. Stangen's Scientific Expedition.—Stangen used to conduct expeditions for Cook, and knows the business. Participants (we quote from the prospectus) are expected "to belong, without exception, to the best society." The voyage is to last eight months, and the expedition is to depart in May, 1878. Price $2,930, including a "banquet at the Kaiserhof Hotel, Berlin, of all the members who have taken part in the expedition," when they get back. The route is about the same as that of Cook, that is, across the Atlantic, across the continent, across the Pacific, and then a general skirting of Asia, a journey through the Suez Canal, across the Mediterranean, and so home. Mr. Stangen proposes that he shall have absolute power "to do whatever is necessary for the amusement and instruction of the voyagers." In this respect he surpasses Woodruff. Next we come to Grindlay's plan.

4. Grindlay's Scientific Expedition.—Grindlay intended to depart last April, but analogously to Woodruff he put it to August, and then didn't go. But like Woodruff, he has not renounced the scheme. He has the steamer Sumatra; duration of voyage, nine months; route, coasting along the Mediterranean, through Suez Canal, around Asia, cross over the Pacific to San Francisco, down along the coast of South America, around the Horn, up along the coast again of both continents, and then across the Atlantic. Price $2,500. Travelers pay their own expenses when ashore. *La Nature*, from which we are taking this information, naively presents three reasons why Grindlay's ship did not sail. First, the Russo-Turkish war; second, because Grindlay wanted fifty subscribers and could not get them; and, third, because five months of the time is spent at sea. The relation of the first is obscure; the rest are amply sufficient.

5. Radou's Scientific Expedition.—Captain Radou wants to take young people around the world and complete their education, for the small sum of $1,200 each. When it is considered that the vessel is to be propelled only by sails, and is to occupy fifteen months in traversing the shores of North America and British India, besides doubling the Capes of Good Hope and Horn, this sum seems quite moderate. The difficulty with M. Radou's plan is that he thinks sixty travelers can be stowed away comfortably in an 800 ton vessel, which he proposes to buy for $18,000. He has not gone yet, and fails to state exactly when he proposes so to do.

6. The Society-of-Voyages of-Study-Around-the-World's-Scientific Expedition.—This concern has the advantage of having successfully managed one expedition, and it seems to be the most practical and sensibly organized of all. Its subscription is limited to 66 passengers, but if 30 join the ship sails. Some very influential people in France are giving the plan their support. The price varies according to accommodations. The average charge is $3,400, but this includes all the expenses of extensive shore expeditions, so that the traveler's actual outlay for the trip proper is not more than $800. The vessel is a fine fast steamer, and her route lies to the eastward. It embraces the journey through the Mediterranean, the Indian Ocean, Malayan Archipelago, across the Pacific, along both shores of the American continents, and finally across the Atlantic. This expedition will start on June 1, 1878.

THE AMERICAN MACHINERY AND INVENTIONS, WANTED ABROAD.

The State Department is rendering very valuable service to the country by requiring our consuls to report as to the condition of trade at their respective posts, as well as to make suggestions as to the best means of increasing our foreign commerce. Some of these reports bear the mark of being the result of thorough and systematic researches, giving valuable lists of goods that are likely to find a sale, and hints as to the means of developing trade. The system, although in its infancy, has proved very valuable, and our manufacturers are already reaping the advantage of it. We give below a condensation of several of the reports lately received, in hopes that our readers may profit by them and thus, by developing a foreign market for their wares, hasten the approach of the "good time "that seems so long in coming.

The Consul-general at Berlin in one of his reports gives three lists of American manufactures, as follows:

Articles that find ready sale: Fine castings, bronze or maroon-colored; breast drills and wrenches; circular and butcher's saws; try squares, trowels, plumbs, and levels; augers and auger bits; mouse and rat traps: door bolts; cast iron stable fittings; shovels; hickory handles: chisel, file, and auger handles; oilstones and grindstones; padlocks; box scrapers; can openers; gas tongs; mincing knives; shoe brushes; leather; boots and shoes; pressed glassware. Our agricultural implements have long been favorably received, but recently imports of inferior articles have injured their reputation. The following articles are steadily gaining on the market: Hickory wheels, spokes, and wheel rims; windmills; ventilators; steam pumps; gas fittings; portable steam engines; woodworking machinery; cheap clocks; housekeeping and kitchen utensils, especially novelties.

Articles that can be made salable with proper effort: Wood planes, by altering the shapes; wrought iron hinges, by lowering their price; scythes, by conforming to the required shape; machines for making tacks and nails; cheap furniture.

Unsalable articles: Hand, back and panel saws, too high priced to compete with the French, who control the market; draw knives, chisels, gauges, and plane irons, too dear to compete with the English; cooper's tools—not the required shapes; cast iron hinges; harness and horse brushes, too dear; curry combs, too light; sewing machines.

In connection with the last article on the above list, the Consul-general at Vienna makes a novel suggestion as to our patent system to the effect that our laws should be so changed as to allow any citizen the privilege of manufacturing patented articles for exportation to any country where they are not protected, so as to be able to enter freely into competition with foreigners in their own open markets. The consul argues that as under our present system the inventor having the monopoly of a vast home trade is careless of foreign markets and does not care to relinquish any of his large profits to encourage a foreign trade, his product is imitated abroad and sold at a less price, and a trade thus built up which our home manufacturers find it very difficult to compete with after the patent has expired. This has proved to be the case with the sewing machine, the manufacture of which is now so thoroughly developed in many of the German and Austrian cities that the American manufacturers cannot compete with them successfully.

The Consul at Chemnitz, in Saxony, states that, owing to the fact that the majority of the inhabitants of his district are primitive manufacturing peasants, the prospect of doing much trade with them is not very good, yet he thinks there are many American articles that could be sold there, if proper steps were taken to introduce them. Among these may be cited wooden ware, mechanical tools, spun cotton, muslins, calicoes, baking powder, dried and canned fruits, lard, cured meats, butter (at certain seasons), agricultural implements, carriages, harness, and stoves. To introduce these the Consul thinks that merchants and manufacturers, by combining to establish a general depot at Hamburg or Bremen, and employ skilled travelling agents, might build up considerable trade in time.

Our Consul at Cologne advocates a similar style of proceeding to develop trade, and suggests Berlin, Cologne, and Frankfort as the proper places to establish manufacturers' agencies, inasmuch as Berlin controls the trade of northern Germany, Cologne that of the Rhine and central Germany, and Frankfort that of the south. It is suggested, however, by the Consul at Leipsic, that as the great spring and fall fairs of that city attract buyers from all parts of Saxony and central Germany, a sample depot of American goods, especially at the spring fair, in charge of a skillful salesman, would do more to open a market for the manufactures of the United States than weeks or months of the scattered efforts of travelling agents. The same gentleman states that a great interest has sprung up in his district since the Centennial Exhibition brought our products to the notice of intelligent German visitors, notwithstanding that the people generally are slow to accept innovations on established usages and are distrustful of foreign importations, yet the little knowledge they have of our manufactures has created considerable inquiry and demand on the part of consumers which the dealers must satisfy. As instances, it is stated that the hardware dealers are compelled to keep many American tools in stock, as they are considered the best; stationers sell our gold pens and knicknacks; shirt makers have to keep American shirting cottons; our silver ware has a high reputation, and one dealer has just successfully introduced our paper hangings.

Denmark being, says our Consul at Copenhagen, a large exporter of agricultural produce, affords a poor market for this class of goods from the United States, with the exception of corn and meal, butter and cheese. The mineral products of Denmark are limited, so that iron and steel and most manufactures thereof have to be imported. All her coal comes from England, and as the prices of coal in England and the United States are about equal, the experiment of supplying the Danish market with American coal could be tested. American butter, although not so good as the Danish, is beginning to rival it; and the Consul thinks that if our dairymen understood the preparation and packing of butter for export as well as the Danish, they would not only command the Danish market, but that of most other countries as well; he therefore suggests that some intelligent American dairyman should visit Denmark to acquaint himself with the Danish practice. American cheese is well liked in Denmark, and its trade could be greatly increased. The same is true in regard to our agricultural machines, sewing and knitting machines, mechanic's tools and implements, leather, cotton, and linen manufactures, leaf tobacco, sugars, molasses, etc. Direct steam communication is recommended as one of the many things necessary to establish this trade.

The Consul at Bristol, England, also advocates the combining of merchants and manufacturers to establish agencies for the sale of such articles of American manufacture or growth as through their superiority or cheapness will be likely to find a market there. He mentions that the main articles of export from the United States to that port are beef, butter, bacon, cheese, canned meats and fruits, flour, grain, oil cakes, oils, sugar, tallow, clocks, melodeons, wooden ware, leather, and some little machinery.

From Leeds, the Department has received a lengthy report which, besides giving statistics of the harvest, importation of wheat, etc., has some additional information relating to our manufactures, from which it appears that the importation of American watches has assumed respectable proportions, with good promise of further development, as they are looked upon as superior to the Swiss, but very little dearer, as equal to the English and very much cheaper—a happy medium, which enables them to sell rapidly. The Consul says he feels assured that a good trade in American shoes could be established in England, if our manufacturers would study the especial requirements of the market, sending nothing but just what the English taste demands. He also thinks that when our wine makers learn how to properly prepare their wines so that they will assume a fixed and stable character, England will purchase largely from us; and suggests that as the English sell vast quantities of what is known as "British spirits," made from our corn, to the wine makers on the continent of Europe for giving additional strength to their wines, that our distillers should manufacture this article and export it direct to the wine producers.

From Japan our Minister writes that there is a fine chance for our manufacturers of cotton goods, as well as woolen cloths and yarns, to introduce their wares. The present market is largely controlled by English houses, but the quality of their goods is inferior to American fabrics, though the prices are the same or higher.

Similar reports come from our Consul at Demarara as to our cotton goods in British Guiana, where it appears that our manufactures are somewhat known, but strange to say, writes the Consul, all the American favorite brands reach the colony through England. Our willow ware, cutlery, tools, leather, boots and shoes, etc., are thoroughly appreciated and command ready sales; but it is thought a much larger trade could be had if we had direct communication by steam, instead of sending the goods through English houses.

From Central America our Minister states that our productions are of a kind that are much sought after there, but that our merchants and manufacturers do not seem to make the same exertions to control trade as do their European rivals. Their price lists are incomplete, their commercial representation imperfectly conducted, their packing more expensive and yet inferior. The German merchants take advantage of this and successfully rival us in the trade of that region, controlling the trade of Central America. They appear to conduct their business more systematically, and their representation is much more efficient from their prevalent custom of sending out young clerks to be educated to the business until they become resident partners.

From Buenos Ayres, the Consul reports that loud calls are being made for the abolition of the discriminating tariff against the United States, which was fixed by a commission of which one of the members was a British merchant in active trade who managed to value American manufactures so high as to make it impossible for them to compete with those of Great Britain. The superiority of our cotton fabrics is fully recognized in the Argentine Republic, and this is the plea for their high valuation. As a result of this the British manufacturers counterfeit by wholesale the brands of favorite American goods, but get them in under the low valuation as British goods, and then sell them in the north as American, so that from the comparatively low price at which these counterfeit American goods are sold, the genuine articles have no chance of being sold.

CUCA AS A STRENGTH SUSTAINER.

In many callings it is occasionally necessary for a man to put forth extra exertion for protracted periods of time; as, for example, a sailor during a storm, a soldier on a forced march, an engineer in case of accident or impending disaster. Frequently, at such times, it is impossible to procure or to prepare suitable food for the increased demands of the system, or to obtain the sleep which both body and mind require. Yet it is desirable, perhaps imperative, that both body and mind shall be kept up to their best working capacity. In every part of the world and in all stages of civilization, men have discovered means more or less efficient, more or less harmful, for meeting such emergencies; and one of the hardest lessons of human life and experience has been to learn how to use such aids to endurance without abusing them. Even the most useful and least harmful of them—tea, coffee, wine, tobacco, and the rest—are mischievous if not worse when used habitually or in excess; while others, like the various alcoholic beverages, are apt to disturb what is so essential in critical emergencies, the proper action of the brain. It is natural and proper, therefore, that those who recognize the practical need of the race for what may be called special foods, should take a lively interest in the demonstration of means for securing the good results aimed at by all of them, with the least possible physical and mental risk. The latest claimant for this responsible position is the leaf so long used by the mountaineers of South America—*cuca*; and perhaps the most instructive test of its virtues thus far made is to be credited to the Toronto Lacrosse Club, a company of intelligent gentlemen, most of them occupying high social and professional positions, and all of sedentary occupation. The latter point is important, since men of indoor life are not the most favorable subjects for occasionally putting forth violent and protracted physical effort; while the matter of intelligence is not less important in determining the value of their estimate of the aid received by the use of cuca.

In the spring of 1876 several of the members of the club began to use cuca as a strength-sustainer, with results so satisfactory that nearly all the "first twelve" used the leaves during all their important matches. There were ten in number, and some of them lasted for several hours. The club, it will be remembered, held the championship of the world and maintained it throughout against all comers, Indians as well as whites.

Their practice was to serve out to each man at the beginning of a match about a drachm or a drachm and a half of the cuca leaves, to be chewed in small portions during the progress of the game, the saliva to be swallowed. The effect, the experimenters report, was a sensible increase in muscular force and an almost entire exemption from fatigue. The pulse was increased in frequency, and perspiration was augmented; but no mental effect was observed beyond the natural exhilaration of contest and vigorous exercise. There were no subsequent disagreeable effects; and no alkaline matter was used with the leaves, as is the practice in Peru.

On one occasion, in midsummer, the thermometer marking 110° in the sun, a match was played with a club of mechanics and other out-door workers, of sturdy build and in fine condition. The cuca chewers came out of the game as elastic and apparently as free from fatigue as when they began, while their opponents were thoroughly exhausted.

The experience of the past season, so far as reported, substantially confirms that of the preceding year. Nearly every member of the club is confident that the cuca has been of great assistance in sustaining strength. Two or three are doubtful; not one finds it injurious. It is proper to add that among the South American natives, by whom cuca is used with lime and to excess, its effect is often disastrous, imbecility being a common result of its protracted use.

Harvard Observatory.

Professor E. P. Pickering, director of the Harvard Observatory, in his report says that the great equatorial telescope has this year been employed mainly in a new and highly important work—that of measuring the relative brightness of various celestial objects. To effect this, new photometric apparatus had to be invented and adapted to the telescope. Among the most interesting results of the work may be mentioned those derived from a long series of measurements of the brightness of the satellites of Mars discovered last summer by Professor Hall, of Washington. From these measurements it may be inferred with considerable confidence that the diameter of the inner satellite is about seven miles, and that of the outer and smaller satellite about six. Accurate photometric measurements have also for the first time been obtained of other very faint objects, as well as of several planets (including asteroids), satellites, and double stars. Besides the photometric observations of the satellites of Mars, their positions were measured with the filar micrometer by Mr. Waldo, who obtained a series of observations of this kind which is believed to be second only to that made by Professor Hall with the 26 inch telescope at Washington.

The meridian circle has been kept in constant employment by Professor Rogers, who has continued his series of observations of the fixed stars between 50° and 55° north of the celestial equator. This work constitutes the share taken by the observatory in the general revision of Argelander's great catalogue of all the stars of the northern hemisphere visible with small telescopes. Besides these observations, Professor Rogers has made others of an extensive list of the brighter fixed stars, and has determined the apparent places of the planet Mars with respect to the stars surrounding it at the time of its recent opposition.

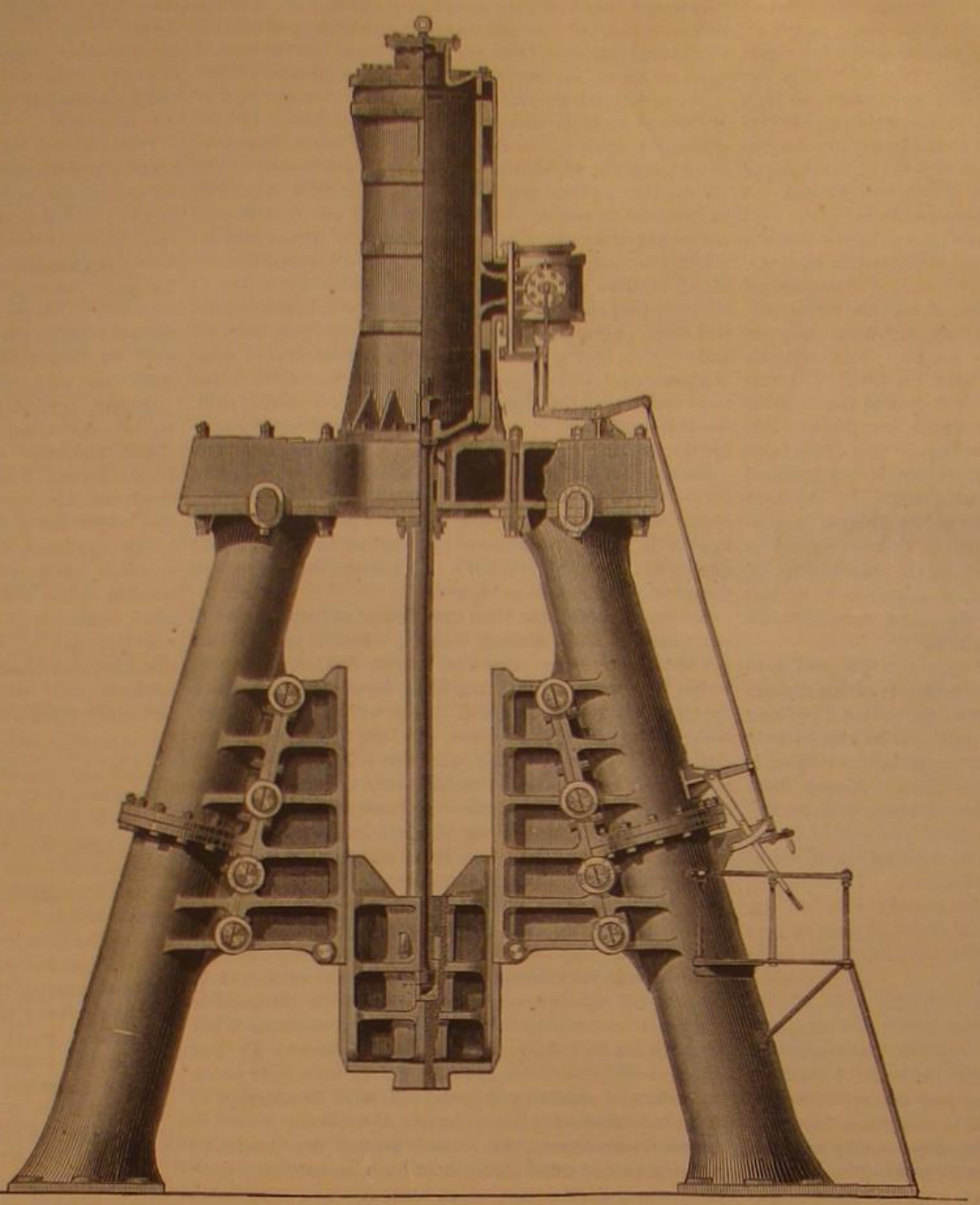
Many geodetical observations were made by Professor Pickering during the summer, chiefly for the purpose of determining the effect of atmospheric refraction upon the measurement of altitudes. These observations were made with instruments of Professor Pickering's invention, which are very portable, while at the same time they promise to yield results of great accuracy.

Singing Mice.

In *Nature* was recently published an account of a singing mouse. A correspondent of the SCIENTIFIC AMERICAN gives us his testimony to a fact which is rare, though as certain as that canaries sing. A few winters since, while one of his family was amusing herself at the piano, a mouse made his appearance on the threshold of the apartment, and, undismayed by the light or the presence of the family, chirped and carolled with intense satisfaction to itself, and to the great delight of its audience. Frequently afterward, but always in the evening, the rare songster repeated his performance. The piano keys were never struck that the mouse did not follow; but when the instrument was not touched, the music from the mouse would come, as if for a reminder. Sometimes the little animal made himself visible and sometimes was hidden in the pantry which, for reasons obvious to housekeepers, he, she, or it had selected as an abode. One evening the mouse was traced to the stairway. Under the carpet sat the little creature, throwing his soul into his song. A lamp was placed beside him, and the family stood and looked and listened for half an hour or more. His head was up, and the movements of the muscles of his throat were plainly visible. Unfortunately our correspondent undertook to capture the singer. Many mice were caught and each was given twenty-four hours grace to sing for its life. But never after the treachery of the trap was the sound of the mouse's carol heard. If caught he died and made no sign.

30-TON STEAM HAMMER.

At the works of Sir William Armstrong & Co., at Elswick, England, is a thirty-ton steam hammer, which was constructed by the Messrs. Thwaites and Carbutt, of Bradford, England. The hammer has a 30-ton tup with 12 feet stroke, and the steam cylinder is 48 inches in diameter. As will be seen in the engraving (taken from *Engineering*) the frame is of a very simple and massive design, it consisting of two standards of circular section, slightly tapering in diameter and inclined inwards towards the top. These standards, which are each made in two sections, are 25 feet high, and the total height of the hammer, from floor line to top of cylinder cover, is 42 feet 9 inches, a dimension which will give some idea of the enormous size of the structure. The clear span between the standards at the floor line is 19 feet 10 inches.



IMPROVED THIRTY-TON STEAM HAMMER.

STEVENSON'S SUSPENSION RAILWAY.

At a meeting of the British Association, Mr. G. Stevenson read a paper on "Street Locomotives," in which he described the somewhat singular system of constructing railways, of which we copy an illustration from the *Engineer*. The engraving almost explains itself. The rails are supported by strong wrought iron clips suspended from brackets projecting from upright columns fixed on the out edge of the pavements in streets, while the cars are also suspended from the rails by means of steel carrying rods descending from the axles of small traveling wheels. Either horse or steam power can be used, the engine being suspended in the same manner as the cars. Among the advantages claimed for it are that the roadway is not cut up, and that the resistance to draught is materially reduced.

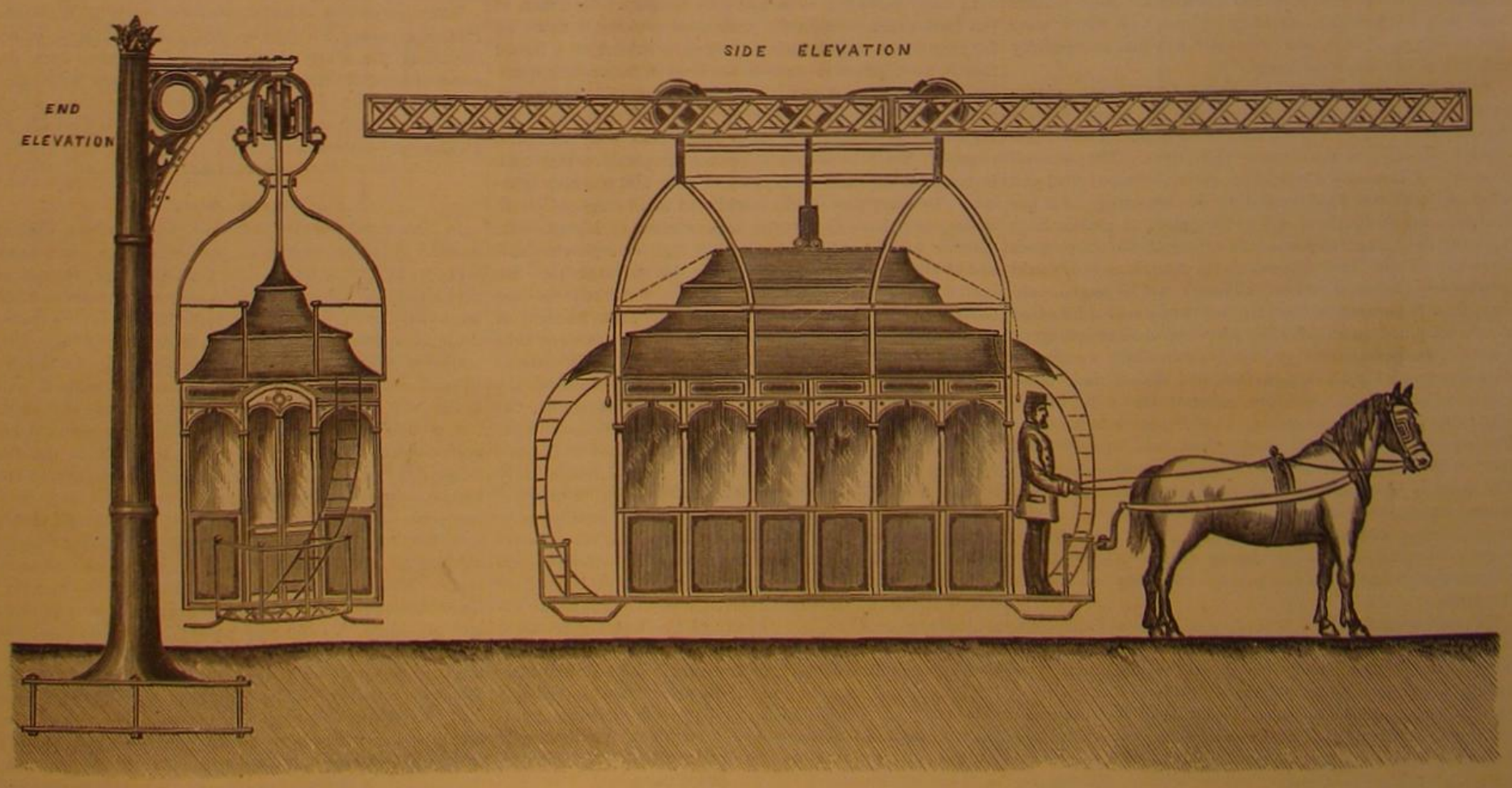
Rhizopods.

Professor Joseph Leidy, the eminent comparative anatomist and microscopist, made his second visit to the West the past season, under the auspices of the Hayden survey. He made a careful exploration of the country about Fort Bridger, the Utah mountains and the Salt Lake basin, in search of rhizopods. He has been engaged for a long time on a memoir on this subject, which will eventually form one of the series of the quartos of the survey.

The rhizopods are the lowest and simplest forms of animals, mostly minute, and requiring high power of the microscope to distinguish their structure. While most of them construct shells of great beauty and variety, their soft part consists of a jelly-like substance. This the animal has the power of extending in threads or finger-like processes, which are used as organs of commotion and prehension, often branching. From the appearance of their temporary organs, resembling roots, the class of animals has received its name of rhizopoda, meaning, literally, root-footed. In compensation of the smallness of these creatures, they make up in numbers, and it is questionable whether any other class of animals exceed them in importance in the economy of nature. Geological evidence shows that they were the starting point of animal life in time, and their agency in rock making has not been exceeded by later and higher forms. With the marine kind, the foraminifera, we have been longest familiar. The beautiful, many-chambered shells of these—for the most part just visible to the naked eye—form a large portion of the ocean mud and the sands of the ocean shore. Shells of foraminifera likewise form the basis of miles of strata of limestone, such as the chalk of England, and the lime stones of which Paris and the pyramids of Egypt are built. Fresh water rhizopods, though not so abundant as marine forms, are, nevertheless, very numerous. They mainly inhabit our lakes, ponds, and standing waters, but they also swarm in sphagnous swamps, and ever live in newest earth. Professor Leidy has devoted several years of study to the fresh water rhizopods of the eastern portion of our country, and his especial object in the past expedition was to investigate those which are to be found in the elevated regions of the Rocky Mountains.—*Mining and Scientific Pre s.*

THE San Francisco mint is the most productive institution of the kind in the world. Its coinage last year amounted to $42,704,500 more than the aggregate production of the three largest mints in Great Britain.

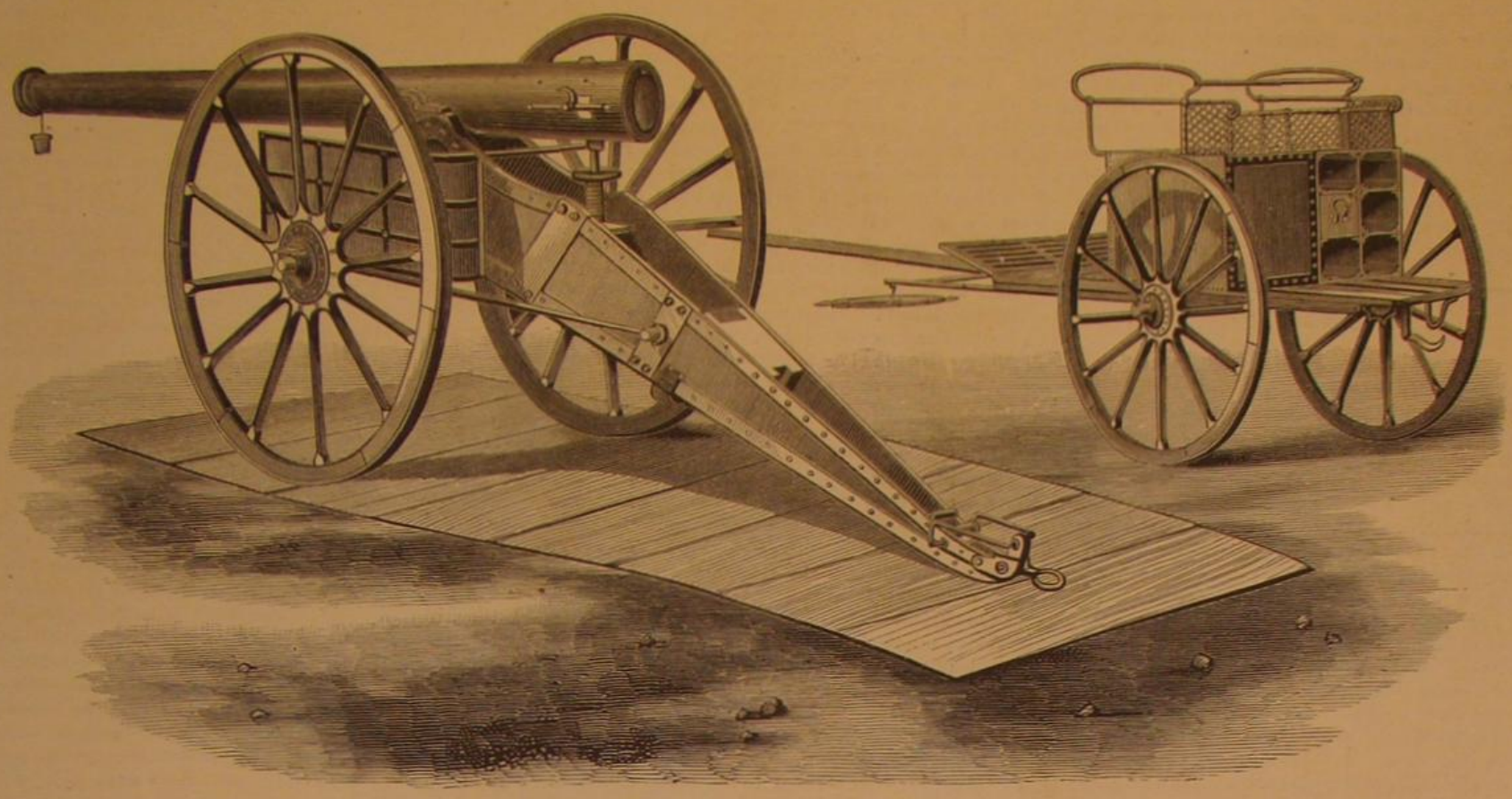
IT takes 80,000 feet of lumber per day to run the Consolidated Virginia and California mines. One half of this goes down the old shaft and one half through the C. & C. shaft. The total requirements are 2,400,000 feet per month.



STEVENSON'S IMPROVED SUSPENSION STREET RAILWAY.

THE UCHATIUS BRONZE STEEL GUN.

The Uchatius bronze steel gun is cast by placing in the center of the cast iron mould a cylinder of copper, which, by absorbing part of the heat of the molten metal, causes rapid chilling of the central portion. Both the interior and exterior portions are thus formed of the same quality of metal. In five minutes the entire mass solidifies. It was, however, found that a deep recess was formed in the top of the casting, as shown in Fig. 1.

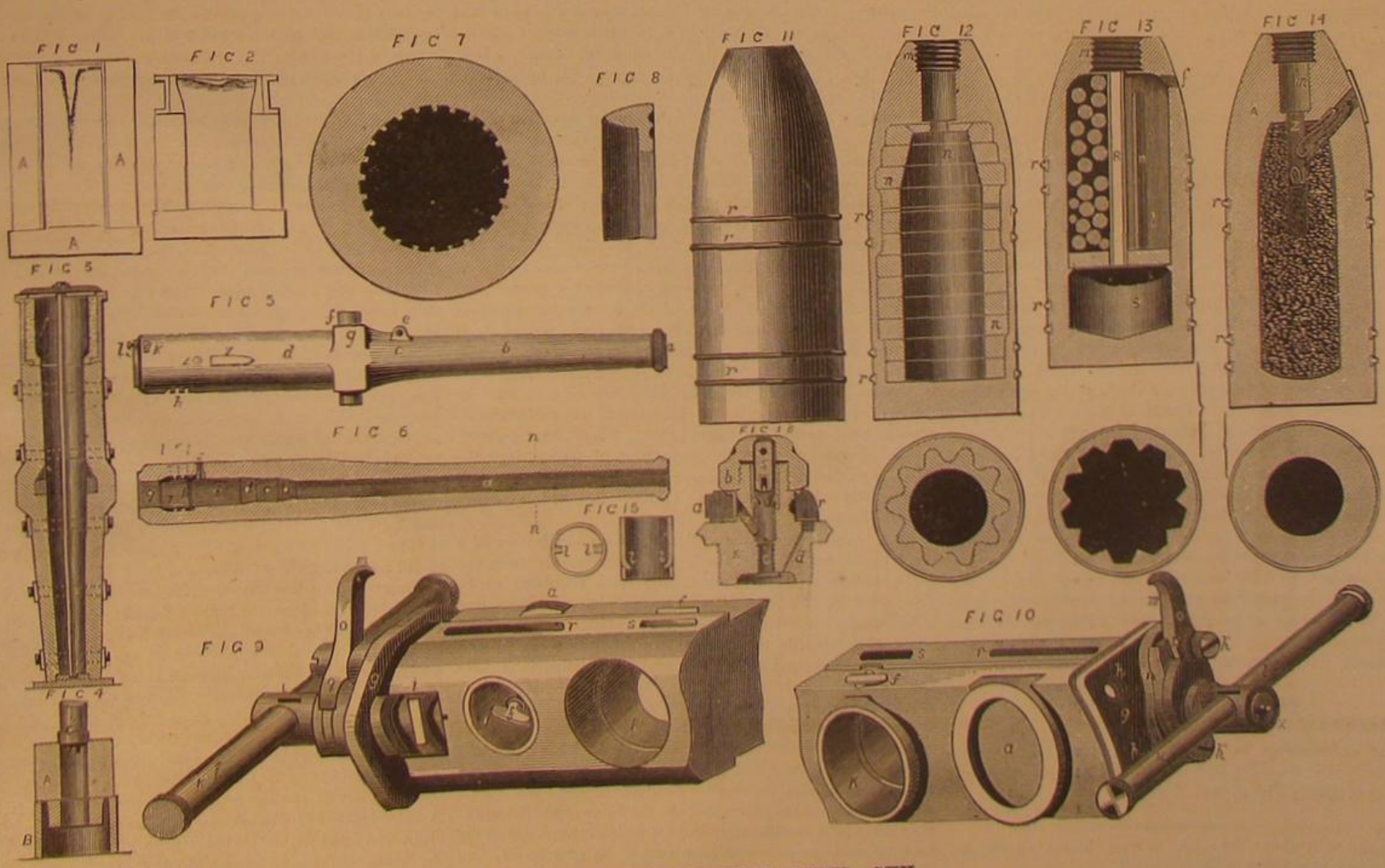


THE UCHATIUS BRONZE STEEL GUN.

General Uchatius met this difficulty by the addition of a sand mould, so as to form a dead head, in which the metal remained in the molten state for a comparatively long time, and so filled up any recess (Fig. 2). In Fig. 3 is shown the mould ready for casting a field gun with the interior copper cylinder. The core is eventually entirely removed by the boring bit. In a gun whose bore is about 3¼ inches, the bronze is compressed by the introduction in succession of six steel mandrils (*c*, Fig. 4), which are forced home by hydraulic pressure. The mandril is formed at the end in a truncated cone, so as to force the metal outwards and enlarge the bore, giving a calibre of 3⅓ inches. B, Fig. 4, represents an annular support on which the gun rests. Figs. 5 and 6 are the section and external forms of the gun, and the large cut shows both the gun and its limber.

The axis of the trunnions is in the same horizontal plane as that of the piece, and the trunnion arms themselves are hollowed out conically on the face. The piece is vented vertically a little in front of the breech-block slot. The latter is cut laterally near the breech and right through the piece. The gun is sighted at the right side with a small screw sight, screwed into a patch on the gun in front of the trunnions, and a tangent sight, R, at breech end of the piece. Looking at Fig. 6, we see that the bore, shot and powder chambers have different calibres, and that only the bore proper is rifled. A copper bush is screwed into the breech end of the powder chamber, for the reception of a copper Broadwell ring (Fig. 8). The breech block, Figs. 9 and 10, is also of bronze steel, and rectangular. Along the upper and under surfaces run a projection and deep groove, ensuring, together with the ribs, *l*, a perfect fit when the block is home. The loading cylinder, *k*, is dovetailed into the breech block, as shown, so as to be capable of movement forwards and backwards. To the left of the breech block is attached the arrangement for moving it. This consists of the plate, *g*, through which passes the spindle of the square-threaded screw, *i*, in Fig. 9, which carries the cross handle, K, which is itself secured by a catch, *m*. A slight pressure on the long arm, *o*, of the catch releases the nose, *q*, when the handle is free to move until it becomes horizontal, when the spring presses on the second nose, *p*, and secures the handle in a new position. As the thread of the screw is now withdrawn into the block, the latter can be moved outwards, towards the left, and when the loading is completed, the arm, *o*, is again pressed and the movements reversed, and so on.

The projectiles are of four kinds—common shell, shrapnel, carcase, and case. Rotation is given by means of four copper rings pressed into undercut rings around the projectile. The common shell, Figs. 11 and 12, is of the so-called double wall description, which has for its object to give as many splinters as possible of a size sufficient to kill a man. The inner wall is cast so as to consist of twelve horizontal and parallel rings, grooved longitudinally by deep lines of weakness. The fuze hole is separated from the interior by a diaphragm cast into the neck of the fuze hole. The shrapnel, Fig. 13, has the powder charge at the bottom, separated



THE UCHATIUS BRONZE STEEL GUN.

from the bullets by a thick diaphragm and ignited through a tube passing down the center of the shell from the fuze hole. The carcase, Fig. 14, is cast with very thick single walls, and its original head has three firewalls covered with pitch plaster. The interior is filled with a carcase composition, and a channel down the center, as well as other channels leading to the fuze holes, are filled with mealed powder, with quick-match leaders. The case consists of a zinc cylinder filled with bullets composed of lead and antimony, between which molten sulphur is run. Percussion and time fuzes, Figs. 15 and 16, are used. The gun carriage is made of thin Bessemer steel, strengthened with angle iron. The limbers of light and heavy guns are interchangeable. The heavy gun throws a common shell of 16.1 lb., and at 2,000 yards it has 40 feet more velocity than the 15·4 lb. shell of the Krupp gun. The light guns are, however, inferior to the Krupp guns of the same calibre. Krupp guns also cost three or four times as much. The Austrians are highly satisfied with their guns, which are considered quite equal, and probably a little superior, to the German Krupp steel guns of latest pattern. We are indebted to the *Engineer* for our illustrations.

Communications.

What the Telephone Heard.

To the Editor of the Scientific American:

A prominent drug firm having a store in each end of this city, being two miles apart, have recently established a telephonic connection, and have now in daily use a set of Bell's new telephones, which seem to work admirably. They are so well pleased with the new communicator that the old system of telegraphy heretofore in use has been entirely discarded. But the purpose of this note more especially is to inform you of the singular freak, or wonderful power and capacity of this little telephone, exhibited here a few weeks since. An accurate and experienced Morse sound reader chanced to be in the down town store of the above firm, and while having the telephone to his ear heard what he thought to be the clicking of an instrument. He took pencil and paper and wrote what he heard, which proved to be a message from the Western Union office there, which was passing over their wires. He went immediately to that office and asked the operator if he had just sent the message which he then read to him from his telephonic notes. The Western Union man replied that he had, and could not possibly conceive how this gentleman had obtained it.

All the explanation that can be given in regard to this is that for a short distance both the telephone wire and those of the Western Union main line are strung on the same poles. Will Professor Bell explain to us this strange conduct of the child of his genius? This may not be the first instance of the kind, but I do not remember to have seen any record of the like before. H. HENDRICKS.

Kingston, N. Y.

A Brilliant Meteor.

To the Editor of the Scientific American:

Noticing the communication of Mr. Robert C. Hindley in your number for December 1, page 342, current volume, with the above caption, I turned to my journal to examine a memorandum made by me of a meteor seen about the same time. The entry in my journal and the account of Mr. Hindley agree so closely in everything except the date—mine being on the 12th, and his being on the 11th of November, that I am persuaded that we saw one and the same phenomenon, and that one or the other of us has mistaken the date. I transcribe my entry, which is as follows: "On leaving Mrs. S.'s this evening, as I came out the front door I was startled by a sudden glare of light, which seemed to come from right in front of me. Throwing up my eyes I saw a large and very brilliant meteor in the northeast, falling apparently near straight downward, with a slight deviation to the east. When I first saw the meteor it was about 30° in height and, judging from the length of time it took to traverse the remainder of its course, it must have already fallen three or four degrees. It fell through an arc of about 12° or 15° in all, and was about ten seconds falling. When I first saw it it had a golden hue, which suddenly changed to green of that peculiar shade produced by burning chlorate of potash with nitrate of barium and sulphur. The light shed by it was pulsating and sufficiently powerful to light up the Tennessee shore and the sand bars, so as to show every log and stump. On looking at my watch, I found that it was 36 minutes past 6 o'clock."

I do not write up my journal every night, and make entries only when something occurs which I wish to record: hence I may have made a mistake as to the date. The peculiar green hue of the meteor struck me as strange, and immediately suggested the green fire produced by pyrotechnists by a mixture of barium nitrate, potassium chlorate, and sulphur. FRANK L. JAMES, Ph.D., M.D.

Osceola, Ark., Nov. 26, 1877.

Blister Beetles: Correction.

To the Editor of the Scientific American:

The explanations to Figs. 1 and 2 in my blister beetle article in your issue for December 1, got transposed. Fig. 1 is that of *Meloe*; Fig. 2, that of *Sitaris*.

C. V. RILEY.

GLAZIERS' PUTTY: Whiting, 70 lbs.; boiled oil, 20 lbs. Mix, and add whiting or oil as needed.

New Inventions.

Mr. John W. Wallace, of New York city, is the inventor of a new Jack Clip or Thill Coupling, which is noiseless when in use and which enables the thill or pole to be readily attached or detached.

An ingenious combined Cane and Umbrella has been patented by Mr. Alexander Mungle, of Newark, N. J. There is a tubular umbrella stick into which the cane is inserted and retained by a hollow split handle, made of a fixed and hinged section, locked in suitable manner. The runner is locked to recessed or perforated catches of the stick by an axially turning spring sleeve. The arrangement seems to be simple, compact, and convenient.

A new Traction Wheel, patented by Mr. William Trenwick, of New York city, improves on the device patented by him December 3, 1872. The invention consists essentially of a movable web or center section supported on rollers or wheels arranged within a revolving traction wheel of larger diameter, the web supporting an axle made of two symmetrical sections, to one section of which suitable operating mechanism is applied. When traction is applied the position of the inner wheels is changed so as to throw their weight, together with the superincumbent weight of the vehicle and its load forward or backward of a perpendicular line dropped through the axes of the axle, so that the gravity of the load is utilized in moving the vehicle.

A new Truss, designed for supporting abdominal hernia, which may be securely held to the body without liability of becoming displaced or causing irritation, has been patented by Mr. Barak T. Nichols, of Hastings-on-the-Hudson, N. Y.

Messrs. Luther Jones and James Stroud, of New York city, have devised a new Sash Fastener, which consists in a curved spring plate, secured at one end to the edge of the sash, and having lugs formed upon the side edges of its other end, overlapping the sides of the sash. The ends of a roller are so pivoted that its sides may project through a slot in the said spring plate to bear against the casing.

A very handsome and ornamental Glass Panel has been invented by Mr. George Bassett, of Chicago, Ill. It consists of pieces of plain, ground, or colored glass, interposed between face layers of ornamentally cut-out wood.

Mr. Adolph Merkt, of New York city, is the inventor of an ingenious Leaf Turner for music. It consists of a slotted guide casing secured to the piano or music stand, and having a reciprocating rack bar with hinged fingers, worked by suitable mechanism either by pedals or a front button, in connection with an angular projecting center portion of the slot. The guide casing has a hinged front portion that may be opened to swing the fingers into horizontal position for arranging them in the leaves of the music.

PRODUCING CUTTING EDGES FOR TOOLS AND INSTRUMENTS.

BY JOSHUA ROSE, M.E.

No mechanical operation can appear to be more simple than that of grinding a tool to a cutting edge, and hence it is that very few persons have any idea of the large amount of knowledge as well as the skill that may be displayed in simply sharpening a tool. In the first place, to give a tool a suitable cutting edge, one must thoroughly understand the nature of the material to be cut, and must have had some experience in cutting it so as to know what variation to make in the tool to suit the variations in texture, closeness of grain, hardness, etc., which are always to be found in different specimens of the same material.

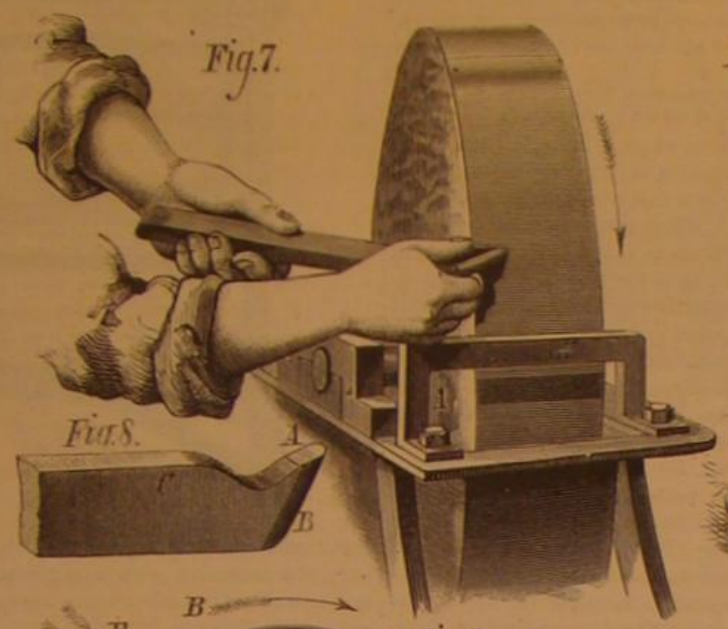
A cutting edge is formed by the line of junction of the two facets at the point of a wedge. The angle of these two facets one to the other, determined by considerations of strength, and the shape of each facet is determined either by considerations of strength or of shape. As a rule the harder the material to be cut, the more the approach of the two facets to a right angle, one with the other; and so likewise the greater the strength required, the nearer the facets to a right angle. Thus, while the facets of a graver may stand at an angle of 50°, those of the cutters for a pair of shears or a punching machine will stand at an angle of about 85°, though both may be used to cut iron and steel. In this latter case, the strength being the main consideration, it must be obtained at a sacrifice of keenness, whereas, if we take the case of a razor or a lance, sharpness is the main consideration, and strength is disregarded. There are, however, certain considerations in the production of the cutting edge itself, regardless of the angles of the facet, which affect all cutting edges, and these considerations it is which we propose to discuss.

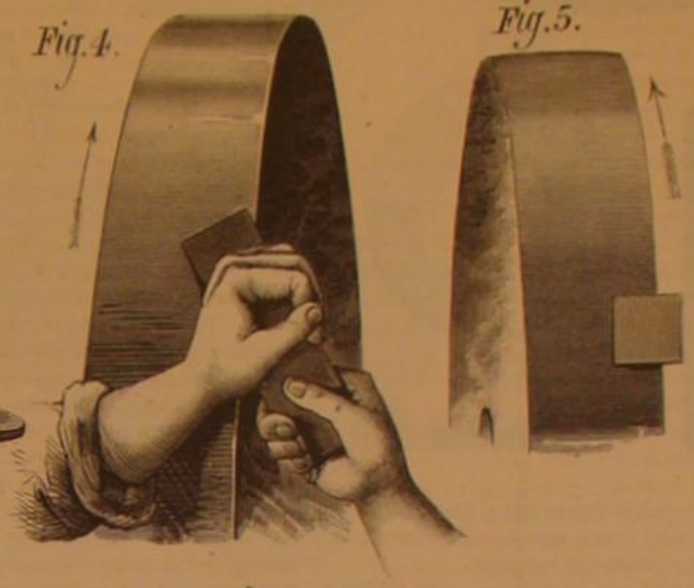
First, then, comes the question as to on which side of a stone a tool should be ground, and this depends upon the shape of the tool, the amount of metal requiring to be ground off, and the condition of the grindstone. If the tool is held in such a position that the revolving surface of the stone runs towards the operator, the operation can be performed quicker, and as a rule better; but it is in many cases quite dangerous, because the edge of the tool is liable to catch in any soft part or a spot in the stone and to be dragged from the fingers, carrying them with violence down to the rest (every grindstone should be provided with a rest) and rendering them very liable to injury by being caught between the rest and the stone. In determining upon which side of the stone any given tool should be ground, the workman takes into consideration the following: the shape of the tool, the amount of metal requiring to be ground off, and the condition of the grindstone.

Upon the edge of a tool which *last* receives the action of the stone, there is always formed what is termed a feather edge, that is to say, the metal at the edge does not separate from the body of the metal, but clings thereto in the form of a fine ragged web, as shown in Fig. 1, in which A represents a grindstone running in the direction of the arrow, B, and C represents a tool. If now we take a point on the circumference of the stone, as say at F, it should leave contact with the tool at the point of the tool denoted by D; instead of doing this, however, the metal at the extreme edge gives way to the pressure and does not grind off, but clings to the tool, leaving a web, as shown from D to E; whereas, if the same tool were held in the position shown at G, the point, F, upon the stone would meet the tool at the edge first, and would cut the metal clear away and not leave a feather edge. Now the amount of the feather edge will be greater as the facets forming the edge stand at a greater angle one to another, so that, were the facets at a right angle, instead of forming an acute wedge, as shown in Fig. 1, the feather edge would be very short indeed. But in all cases the feather edge is greater upon soft than upon hard metal, and is also greater in proportion as the tool is pressed more firmly to the stone; hence the workman conforms the amount of the pressure to suit the requirements by making it the greatest during the early grinding stage when the object is to grind away the surplus metal, and the least during the later part of the process, when finishing the cutting edge, and hence he obtains a sharper tool, because whatever feather edge there may be breaks off so soon as the tool is placed under cutting duty, leaving a flat place along the edge. It would seem, then, that faces which can be ground in the position, relative to the stone, shown in Fig. 1, and upon a tool of shape similar to that shown in the figure, should always be ground with the stone running toward the cutting edge, as shown in Fig. 1, at the position denoted by G; and so they should, providing that the stone runs very true and contains no soft or hard spots of sufficient prominence to cause the cutting edge to catch, which would render the operation dangerous. These unfavorable conditions, however, are always more or less existent, under average conditions and to such an extent as to forbid the holding of the tool to the stone with the amount of pressure necessary to remove a quantity of metal, as is necessary in the earlier stages of the grinding operation. Furthermore, if the edge of the tool does catch in the stone, the damage to that edge is very serious and entails a great deal of extra grinding to repair it, and at the same time incurs a rapid using-up of the tool. Another consideration is that it is much easier to hold the tool steady, under ordinary circumstances, in the position shown at H, than in that shown at G; and with a bad stone it is altogether impracticable to hold it as at G. Here, however, another consideration occurs, in that the surface of a grindstone is rarely level across the width of the perimeter of the stone, unless the stone has a truing device attached to the frame, which at present is very largely the exception. As a rule the face of the stone is made rounding in its width because there is the most wear in the middle, and it is very undesirable to have the stone hollow across. Suppose, for example that in Fig. 2 we have a stone that is hollow, and in Fig. 3 one that is rounding across the perimeter; then to grind such a tool as is shown in Fig. 1, as say a plane blade, we may move it slowly across the width of the stone, and the highest part of the stone will act upon all parts in the width of the blade: but we cannot, by any method, grind such a tool upon the hollow stone without leaving the cutting edge rounding in its length.

So far, however, we have supposed the stone to have an even surface; but very often this is not the case, and then the operator, no matter which side of the stone he is using, holds the length of the cutting edge of the tool at an angle to the width of the stone, as shown in Fig. 4, placing the tool in the most level part of the grindstone surface. By doing this he effects two objects: first, he obtains a level spot upon the stone more readily, and secondly, he diminishes the formation of a feather edge. The first is because it follows that, in removing a given amount of metal, there will be more abrasion upon the stone in proportion as the operating area of the stone is diminished, hence the workman selects the highest part of the stone whereon he can find a suitable surface, and by moving the tool across the face wears down the asperities while he is roughing out the tool so as to obtain as smooth a surface as possible for finishing process. If he held the tool still instead of giving it lateral motion, it would grind away in undulations or grooves conforming themselves to those on the abrading surface of the stone and have but very little tendency or effect in leveling the the same. Referring now to the second advantage named, it will be readily observed that, if he held the length of the cutting edge in a line with the revolutions of the stone, there would be no tendency to leave a feather edge, except at the corner of the edge where the stone leaves contact with the tool, and this would be of little or no consequence. The question naturally arises, then, why not grind the tool in that position, that is in the position relative to the stone shown in Fig. 5, which would require a very small flat or smooth space in the width of the stone and would avoid the formation of a feather edge. The answer to this is that it is so difficult to grind the surface of the tool level, as will be seen in the side view of the operation as shown in Fig. 6, in which A represents the tool enlarged so as to make the engraving clear, and from B to C, the length of the cutting edge. To bring the whole length of the cutting edge to bear upon the stone it is necessary to move the tool from C

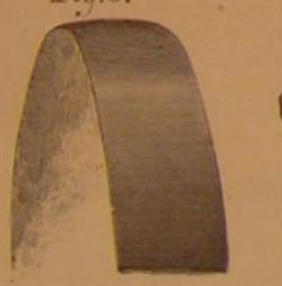
to D, and from B to E, as denoted by the dotted arcs at D, E; and if during this operation the tool remains an instant longer in any or either of the positions indicated by the dotted lines, G, H, a hollow spot will be ground upon the tool at the point of contact between the stone and the tool; furthermore the grinding operation is not very accessible to the eye and hence any irregularities are not very easily corrected. For these reasons it is impracticable to grind in this position any cutting edge requiring to be a straight line and having sufficient length to render much motion in the direction of D, E, a necessity. Furthermore it is very difficult to hold a tool steadily in position shown in Fig. 6, and as a consequence no satisfactory result can be attained unless by the aid of a device whereon to rest the hand; such a device is called a rest and is shown in Fig. 7, at A. Now suppose we have a tool of the form shown in Fig. 8, requiring to be ground on the faces, A and B; then it is evident that A can only be ground with the body of the steel, C, out of the way of the body of the stone and hence in the position shown in Fig. 7, in which position the tool may be held firmly and pressed firmly to the stone. It is necessary, however, to rest the hand upon the rest and hold the tool exactly in the position shown in Fig. 7, so that if the tool catches in the stone and is forced from the hand it will not carry the fingers with it, and wound them by jamming either against the stone or the rest, or force them between the two. It would seem advisable to rest the tool upon the rest without the intervention of the hand, but such is not the case, because the operator would not have sufficient control over the tool and it would almost assuredly catch in the stone. By interposing the hand between the tool and the rest, the sense of feeling is brought into play, guiding the operator just how to hold the tool to prevent its catching in the stone and admonishing the operator when the conditions possess any elements of danger, which become instantly known from any difficulty in holding the tool steady against the grip of the stone or from a disposition of the upper edge of the tool, which the stone meets, to turn in towards the stone.

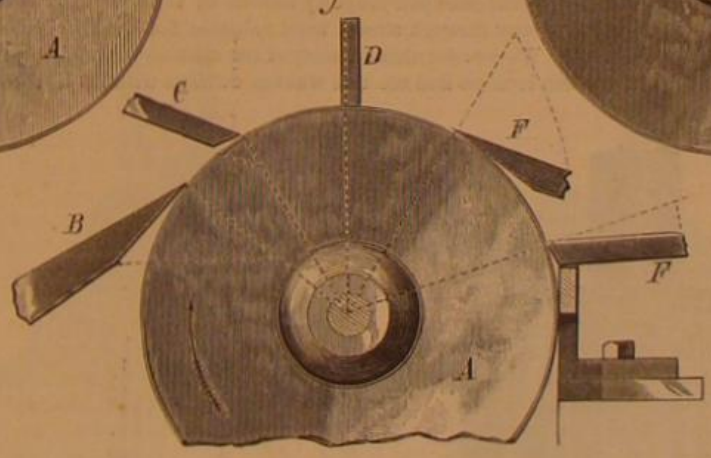














GRINDING TOOLS.

Such are the main principles involved in the art of tool grinding, and we may now proceed to make some practical applications of them. First, then, to define the point which distinguishes whether the stone is running to or from you, let A, in Fig. 9, represent a grindstone, and B, C, D, E, and F tools held thereon; and if a radial line from the center of the stone forms an obtuse angle with the face of the tool which first meets a point on the periphery, or face of the stone, as it is usually termed, then the stone is running from you; while if, on the other hand, that face forms an acute angle to the radial line, then the stone is running from you, no matter in what position in regard to the stone you may stand. But common prudence teaches one to stand as clear of the rest as possible when grinding with the stone running from you.

In ordinary shop parlance, the side of the stone on which the face of the stone enters the trough is always called the side with the stone running to you, because all grinding which requires performing with the stone running to you is performed on that side, and in conjunction with the use of the rest shown at A in Fig. 7. There is no excuse, and it is very dangerous, to grind on that side of the stone without using the rest as a steadying point, and as a safeguard. With the rest, the grinding can be more delicately, truly, and accurately, as well as expeditiously, performed, because of the extra force with which the tool can be held steadily to the stone.

In Fig. 9, B and C are ground with the stone running from you, D is neutral, and E and F are ground with the stone running to you. Hence, while with the stone running to you the greater the angle of the front face of the tool (that is, the face which has the grindstone running towards it), the greater the liability of the tool to catch in the stone and the more difficult it is to hold the tool steadily, while the reverse is the case when the stone is running from you; and it follows that as the length of the cutting tool edge is greater, the more difficult it will be to hold the tool in the positions of D, E, or F. Therefore tools having broad cutting edges formed by acute angles should be ground in the position of B, unless, indeed, the stone is very true and smooth, and has no soft spots, in which case it is permissible to grind them held in a position relative to a radial line of the stone similar to that at E in Fig. 9; but in this case it is well while holding the tool at that angle to grind it in that part of the circumference of the stone occupied in Fig. 9 by D, or between that and the position occupied by E, so that, should it chance to catch in the stone, it will not drag or force the fingers down to the rest. We may now consider what effect the size of the work has upon the position, relative to the stone, in which it should be ground, by giving a few examples of grinding. In the case of very small articles we may use almost any part of a true stone, because the hand has comparatively a thorough control of a small article.

To grind the sides of a square bar for any distance extending not more than an inch or so from the end, the position shown in Fig. 7 is correct, and the same position applies to similar work upon a round piece of work, the hand upon the rest serving to steady it while the other hand causes the object to revolve. In this way the piece can be held steadily while considerable pressure is applied. To grind the end face of any bar the bar is always placed upon the rest, as shown in Fig. 9 at F, but care should be taken to move the bar to various positions along the face of the stone or slowly to revolve it, causing it to travel across that face, otherwise a groove will be worn in the stone. To grind the surface of a bar, it should be held in the position shown in Fig. 4, because, if held square across the stone, it could not be held at all steadily, especially if pressed heavily to the stone. It is highly dangerous to attempt to grind the outside of a bar by placing it on the rest or in any position in which the stone would be running to, or, rather more properly, toward you. Any work requiring to be ground to a point must be held in the position shown in Fig. 1, at H, or in that shown in Fig. 7. In the first case, however, it should be moved across the face of the stone, as the grinding proceeds, to prevent the wearing of a groove in the stone. The surface of sheet metal or plates should be ground in the position occupied by D, in Fig. 9. The cutting edges of all blades should be ground in the position shown in Fig. 4, because they can be held steady, and, if held lightly towards the finish, with a small amount only of feather edge. All turning and planing tools should have their top faces ground as in Fig. 7, and the other faces as at F, in Fig. 9, because such tools must be held steadily and require the removal of considerable metal at each grinding. All drills should be ground upon the ends while upon the rest, excepting the faces of flat drills, as at H, in Fig. 1, while the diametrical edges must be ground as in Fig. 7. Anything that is sufficiently long to afford a *firm grip* with both hands when standing in the position of F, in Fig. 9, may be ground in that position, providing that the top of the rest is close to the perimeter of the stone. All blades requiring a keen edge must be held lightly to the stone, to avoid getting broad and thick feather edges. The edges of blades or plates not required to have a cutting edge may be ground in the position shown at I, in Fig. 6, or slanted a little, as in Fig. 4.

After a tool is ground it is often necessary to remove the feather edge without having recourse to an oil stone. Machinists often accomplish this object by drawing the cutting edge across a piece of wood, holding the cutting edge parallel with the line of motion, which removes the feather edge without breaking it off low down, as would be the case if the length of the cutting edge stood at a right angle to the line of motion.

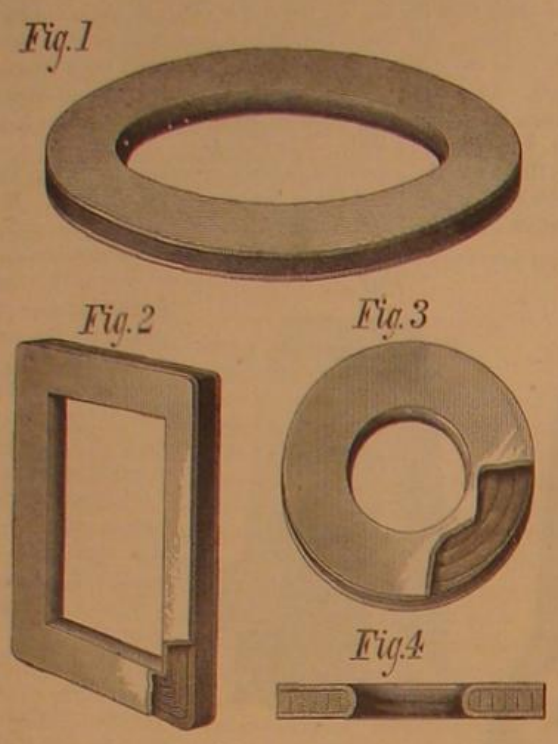
When a smoother edge than can be produced by the grindstone is required, recourse must be had to the oil stone. In using the oil stone it is highly important to keep the facets being stoned level with the face of the stone, but with the surface near the cutting edge of the tool pressed a little the hardest to the stone. Even with the utmost care we cannot avoid forming upon the tool what is termed a wire edge. A wire edge is really a burr formed of the extreme edge of the tool giving way and bending over towards the face not in contact with the stone. To reduce the wire edge as much as possible, we press the tool very lightly to the stone during the latter part of the stoning and turn the tool frequently over. If the motion of the tool upon the oil stone is parallel with the line of cutting edge, the wire edge will be greater than if the line of motion were at a right angle to it.

Again, the strokes performed while the cutting edge is advancing upon the oil stone produce less wire edge than the return strokes, hence the finishing process consists of a few light strokes upon one and then upon the other facet repeated several times. Now let it be observed that the wire edge will never be turned toward the facet last oil-stoned, and cannot be obviated by the most delicate use of the stone, but after the stoning proper is finished, the operator will lay one facet quite level with the face of the stone, and then give to the blade, under a very light pressure, forward diagonal motion, and then perform the same operation with the other facet upon the stone, the last facet operated upon being usually the straight and not the beveled one. To still further reduce the wire edge for very fine work, the operator sometimes uses a piece of leather belt, either glued to a piece of wood, as upon the the lid of the oil stone box, or some attach it at each end to projecting pieces of wood, while yet others lap the tool upon the palm of the hand. In giving an edge to a razor, the process may be carried forward in the usual way by means of straps, the first strokes being long ones made under a slight pressure, the strokes getting shorter and the pressure lighter as the process proceeds, until at last the motion and contact are scarcely perceptible.

THEOBROMIC ACID is a new fatty acid from cocoa butter.

STOY'S IMPROVED GASKET.

In the annexed illustration we present a new gasket for packing joints of pipes, hand holes, etc., which is very simply constructed, and which can be made in several different forms as called for by different requirements. Thus Fig. 1 shows the elliptical shape, Fig. 2 the square, and in Fig. 3 the circular form is exhibited, and also the interior construction, which will be more clearly understood from the section, Fig. 2. The device consists of thin annular plates having formed on their inner edges lips, by which they are united, so as to leave a thin piece between them for receiving elastic



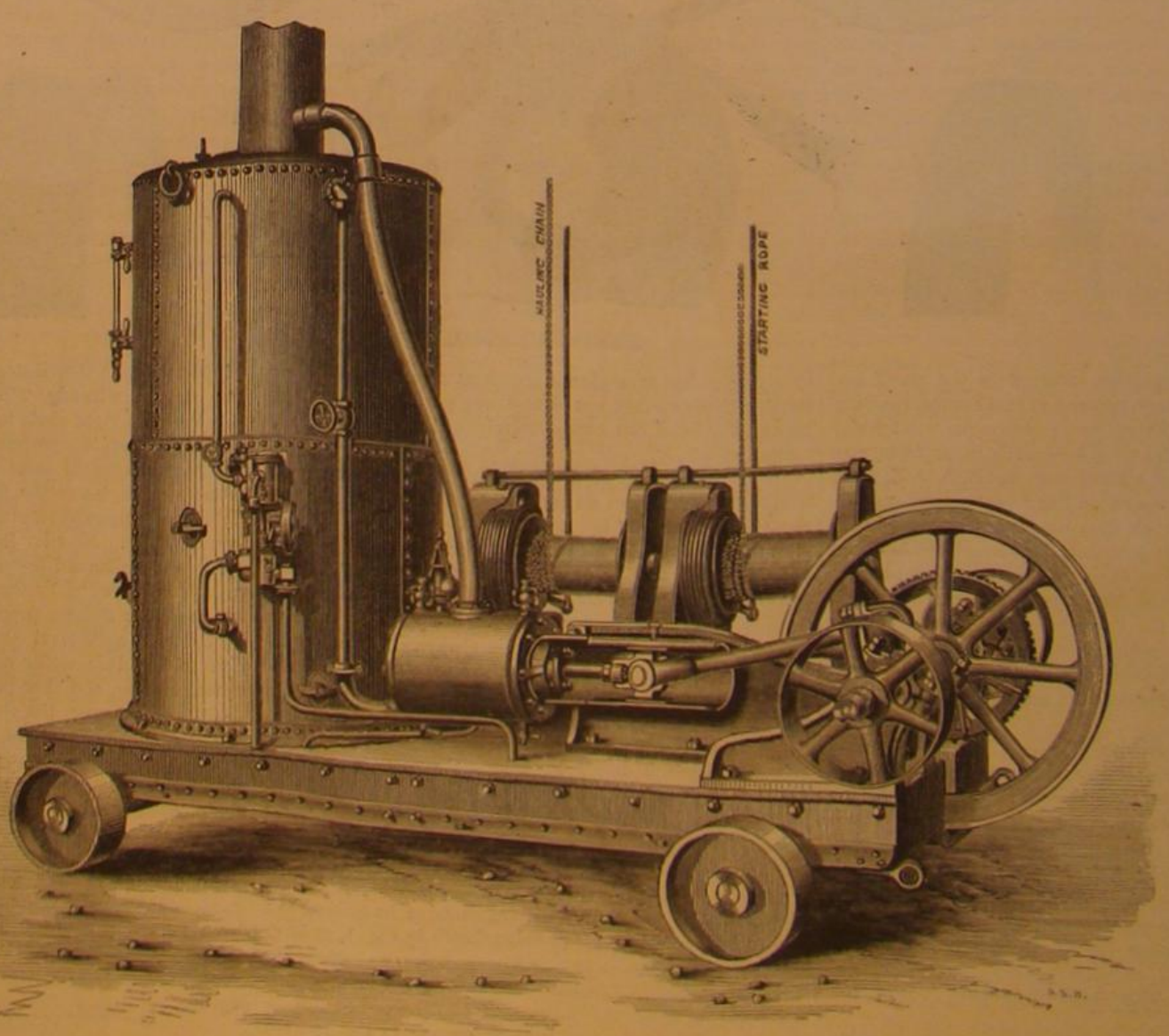
packing, which is a strip of rubber or any other suitable material. Both of the annular plates may be made from a single sheet of metal by the process of spinning.

The advantages claimed are that, when this gasket is clamped between pipe flanges, or between hand hole covers and their seats, a tight joint is formed, which cannot be blown out. The packing is protected by the metallic covering, so that it is not acted upon by steam, fluids, or gas. The joint may easily be tightened by caulking from the outside; and in taking the joint apart, there being no elastic packing in contact with the face, it may be readily removed without tearing or injury, and thus may be used for years without renewal.

Patented through the Scientific American Patent Agency, October 23, 1877. For further particulars, address the inventor, Mr. C. S. Stoy, Butler, DeKalb county, Ind.

PORTABLE HOISTING ENGINE.

This is a new type of contractor's portable engine and hoist, constructed in England. As will be seen from the illustration, which we take from *Engineering*, it consists of a cast iron frame and water tank, mounted on four wheels for convenience of transport, and for shifting from place to place on the work upon which it is employed. The boiler is vertical, 4 feet 3 inches in diameter, 7 feet 6 inches high, and fitted with two cross tubes 10 inches in diameter, and 34 hanging tubes 2¼ inches in diameter. The engine is horizontal, with a cylinder 10¼ inches in diameter, and 14 inches stroke. Two hoists are placed upon the frame, but these can be removed at pleasure. They are driven from the engine by bevel gear, and are thrown into action by means of an eccentric connected to levers, from which a starting rope can be led off to any desired position, so that the man receiving the load from the hoist has the latter under control, although not near the machine. It will also be seen that the engine is adapted for general work.



PORTABLE HOISTING ENGINE.

An American Palace Car in Norway.

In a description of the opening of the extension of the Norwegian State Railroad to Trondhjem, the *Aftenbladet*, published at Christiana, Norway, thus speaks of the palace car recently sent out by the Jackson & Sharp Company, of Wilmington, Del.:

"The royal car moved throughout the entire trip with wonderful steadiness and uniformity, in fact to such an extent that His Majesty King Oscar was able for quite a period to carry on his regular correspondence without being disturbed by any jolting or unpleasant motion of the car. In order that the public might examine the royal car, it was put upon a siding after the completion of the trip, so that ladies and gentlemen desiring to do so might have a good view of it inside and outside. It was, in fact, full of curious visitors all day and was much admired. The royal car, as is well known, is the first railroad car in this country of the American pattern. It possesses great practical advantages, both as regards comfort and convenience of passengers and the train hands."

The Elevated Railway Outrage.

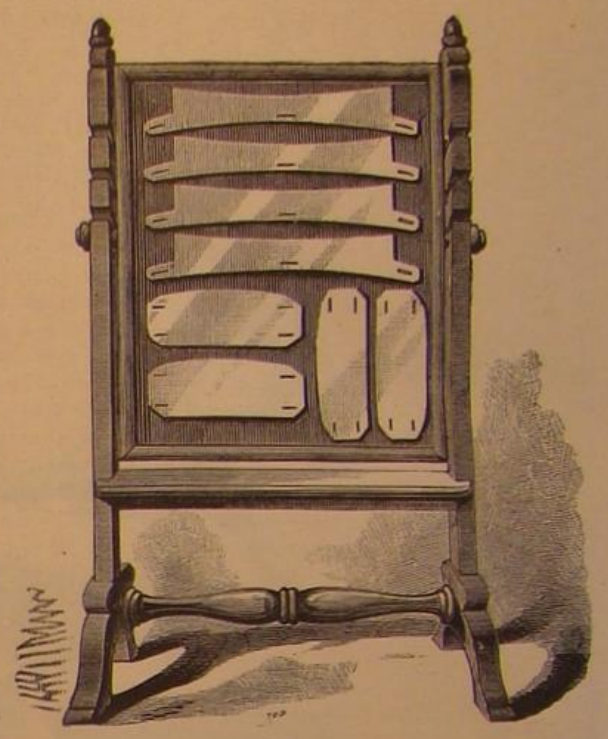
We cannot recall in our time so gross an infringement on the rights of the people in relation to their property as is now being perpetrated in the erection that is to disfigure and otherwise damage several thoroughfares throughout the length of this city, for the benefit of a clique of stock speculators and out-of-town landowners. We do not believe that this railway corporation has any legal right to erect its structure in Pearl street. When a street is opened for all kinds of public uses by compensating the landowners for the property thus taken, the government which represents the ownership of the acquired domain may authorize the erection thereupon of anything which will not interfere with such use. But when the landowners themselves open for their own convenience a thoroughfare through their property, asking no compensation for the land, all that the public can acquire by such a concession is the right of way. Pearl street was thus thrown open by a voluntary concession, and neither the city nor the State ever had the right to grant a franchise for any sort of structure on this thoroughfare without compensation there-

for to those who own the fee. But even if the government could do this, the right has been most wantonly exercised, with no proper limitations, and with a recklessness of both public and private interests which is simply astounding.

Not only are sidewalks broken up, but vaults which have been constructed at great expense are wholly ruined, the foundations for the railway structure going directly through them, without reference to the damage thus inflicted on their owners. Millions of dollars will not compensate for the loss and damage brought upon property holders in thus seizing the right of way through streets most valuable for business purposes. We wonder that so many of our most substantial citizens can look on and see this wanton outrage without a protest. It needs no prophet nor the son of a prophet to predict that they will suffer from this indifference one day in the return of the cup to their own lips. The people of New York will bitterly repent some day of this gross injustice, but the monopoly they have created, having seized its prey, will care nothing for their penitence.—*New York Journal of Commerce.*

IMPROVED STAND FOR SMOOTHING FABRICS.

The invention herewith illustrated is a new device for smoothing and glossing fabrics. It consists in an adjust-



able frame or smoothing board, which is pivoted to a standard and constructed with a metallic surface, on which the moist and starched fabrics are smoothed and dried. The supporting frame is formed of two standards connected together by two horizontal bars. The inner sides of the standards have L-shaped grooves cut in them, adapted to receive pivots, which are fixed to the sides of rectangular frame surrounding a smoothing board. The latter consists of a backing of solid material which is covered on one side with prepared metal. The board is adjustable, so that it can be set at any desired angle from a horizontal plane, and raised or lowered.

The invention is used as follows: Goods, etc., being washed and starched, are spread on the metallic surface and gently smoothed from the center outwards to disperse air blisters and to cause them to adhere closely. The board is then placed near a stove or in the sun to dry, when they will come loose and drop off ready for wearing. Should a gloss be desirable, thick starch is used and the goods are allowed to dry slowly, without adding any chemicals or preparation for glossing. After use the board is washed with clean water and soap, and is then again ready to receive another set of garments.

Patented through the Scientific American Patent Agency, October 2, 1877. For further information address the inventor, J. F. Freese, N. W. cor. of Gay and Eden streets, Baltimore, Md.

THE removal of tin from copper vessels coated therewith can be easily accomplished, according to recent investigations of Professor Bottger, by immersing the vessel in a concentrated solution of sesquichloride of lime. Scour afterwards with sand and dilute hydrochloric acid.

THE FRINGED BIRTHWORT.

The fringed birthwort, of which we take our illustration from *The Garden*, is one of the large genus Aristolochia, of which there are 200 species. The greater number come from tropical America; in North America, Europe, and India a few are found. Many of these plants attain too great a size to be easily cultivated, and the generally dingy color, together with their disagreeable odor, render them undesirable. The leaves of the fringed birthwort are characterized by the nerves being surrounded on the upper surface by whitish zones, this coloring being due to the presence of a film of air under the epidermis. The outside of the perianth is greenish and the interior brown-purple crossed with greenish veins. The half-climbing stems grow from 1 foot to 2 feet long, and the flowers are produced in July and August. Being a native of Brazil, it grows best in a warm house.

A CURIOUS HYBRID.

Our engraving represents a curious family, consisting of an African zebra, an Abyssinian ass, and their hybrid foal. The young animal resembles both parents, its color being grayish inclined to fawn, and its legs showing very clearly the zebra stripes. The crossing of the zebra and the ass is in accordance with the law that the most frequent and most useful forms of hybridity occur between different species belonging to the same genus. The horse, for example, will breed with the ass, the zebra and the quagga; the dog has been certainly known to breed with the wolf, and probably with the fox; the goat with the sheep, the ram with the roe; and it has been comparatively easy to obtain hybrids from the union of the rabbit and the hare.

As a rule however hybrids are not fertile. Thus the mule does not reproduce itself, but is only obtained by a repetition of the union of the ass and the mare. Between horse and ass, however, there is a wider gulf than between the zebra and ass, and therefore the chances of the hybrid of the latter having the faculty of reproduction are more favorable.

It was noted that the period of gestation in this case extended to 11½ months, or about fifteen days longer than that of the mule. The animals are at the Berlin Zoölogical Garden.

We are indebted to the London *Sporting and Dramatic News* for our illustration.

A Decorative Process.

The latest and one of the most successful efforts in art decoration we have seen has been introduced by Mr. Aldam Heaton, of Bloomsbury square, who has applied hand painting in a way that will find favor among architects and their patrons desirous of favoring the art decoration of interiors, in contradistinction to the "manufacturing" processes. Having seen some of Mr. Heaton's work, we can explain it simply by saying it is a kind of raised or gesso painting on panel, applicable to interiors of houses of a superior class. The work we saw was done on oak and pitch pine; and for the decoration of paneled work it is extremely suitable. One panel on pine was an admirable rendering in a naturalesque spirit of the oak and mistletoe, entwined or blended in a pleasing and thoroughly artistic manner, in which the leaves and berries were raised or painted in relievo, the raised parts being discriminatingly juxtaposed with the portions flatly represented. The preparation of gilded gesso is, we believe, chiefly composed of lime mixed with oil and other ingredients, and productive of a remarkably fine surface. The colors chosen in the panel we saw were in a low scale—the leaves were of a bronze hue depicted in transparent colors or glazings upon the gilded ground, while the groundwork, or panel itself, was apparently stained with a dark color transparent enough to show the natural grain of the wood.

There is a remarkably pleasing solidity and cabinet picture-like effect in the work, which the smoothness and polish and transparency of the ground enhances. Another panel was treated with a lighter ground, the surface of the wood being apparently grounded with gold. The figure subjects treated by this process have all the beauty and finish of cameos or alto-relievos, owing to the polish of surface and reflection thereby caused. Mr. Heaton has recently executed a fine series of this panel painting for Mr. Ripley, M.P. for Bradford, for the billiard, smoking room, and other apartments of that gentleman's residence, "Acacia." The rooms are divided into panels by pilasters of conventional folial patterns, and contain subjects of rural pastimes and sports—boys climbing, hunting, fishing, shooting, etc., after the model of Luini. Above this a frieze of foliage, children, birds, etc., is formed. The process has certainly more of the finished cabinet picture of oil, than the decorative and flat treatments that have recently been introduced for woodwork. Stamped leather supplies some analogy to it. We are informed that the best and highest class of subject can be done in this manner for about £5 per superficial foot, though of course the cost varies with the subject and the labor bestowed. One immense gain in this kind of art decoration is that it cannot fall into the hands of indifferent or manufacturing decorators, as its value consists in the high class hand work of the artist.—*Building News.*



THE FRINGED BIRTHWORT.



A CURIOUS HYBRID.

Cop Waste.

Many times in walking through weaving sheds have we noticed the large amount of waste made from weft, generally called "cop bottoms." We are mostly met by the reply that this cannot be helped, and that, though excess is punished a certain amount is inevitable; still, from what we have seen, we are of opinion that the average amount of cop bottom waste is too much, and might, if properly looked into be much reduced. It is our intention in this article to inquire into the cause of so much waste, and to see whether and how this could be removed.

When we look at the way a cop is formed on the mule, where every layer of the yarn has a different position, where these layers are constantly crossing each other, and thus kept from getting entangled it looks, at first sight, the simplest thing in the world to unwind this yarn down to the last turn, and yet such is not the case. True, the yarn, after the cop has been placed upon the tongue of the shuttle, is steadily drawn through the eye which faces the point of the shuttle tongue; but though the eye and this point always retain the same position, the relative positions of this point and the yarn where it comes from the cop are constantly varying. When the cop is full, the angle from the circumference of the cop to the point of the spindle is a greater one, while the turns of the yarn round the tongue are fewer than when the cop is nearly finished; thus there is more strain upon the yarn in the latter case than in the former, and any obstacle which prevents its unwinding is of so much greater effect. When the yarn in the mule is wound upon the cop, it is guided by the faller wires, which are in close proximity to it, and give it support, but when being unwound in the shuttle, there is no such assistance, and all the pull emanates from the point of the shuttle, which sometimes is three or four inches off. There is also this difference between the winding on and the winding off of the yarn, that in the former case the spindle turns, and the yarn is more passive, while in the latter the shuttle tongue is fast, and the yarn is active. Still, there seems to be no reason why moderately strong yarn should not unwind to the last turn if the cop could be placed into the shuttle exactly the same way as it was in the mule: but, from what we have seen, we believe the cause of the waste to lie in this direction. If, in putting the cop upon the shuttle tongue, one or more of the internal layers of yarn are displaced, they must, to a certain degree, entangle the yarn there, and thus produce an extra strain, which causes the yarn to break; and we know that, though the small remaining part of the cop might sometimes be easily unwound, it is easier for the weaver to pull it off, and throw it into the waste box. It, however, often occurs that the lower or inner layers are considerable displaced, so that a larger remaining part of the cop cannot easily be unwound, and thus form a large amount of waste.

The displacement of the lower and inner layers when on the shuttle tongue seems, therefore, to be the main cause of the waste; but how is this produced? Naturally in putting the cop upon the tongue. But we ask again, Is there any necessity for this displacement, or cannot the same be avoided?

While the yarn is on the spindle in the mule there is no tendency to pull it off; rather the reverse; but in the shuttle there is a constant drag, which would take the cop at once off the tongue if it was not held by some means. This is mostly accomplished by supplying the tongue with a bow-spring, which presses upon the inside of the cop, and thus prevents its slipping from the tongue. As the tongue with its spring must of necessity, when expanded, be of larger diameter than the inner aperture of the cop, it stands to reason that a certain amount of force is required to push this tongue into the cop, the middle of the spring being higher than both ends; this force causes friction, and displaces easily any layers of the yarn which in packing or removing of the cops may have got loosened.

In order to facilitate the insertion of the tongue the weaver generally takes the cop in her left hand, and, holding the shuttle in her right, screws the tongue into the cop. It thus often happens that the lower end of the cop is compressed, and a part of it carried a little inside, which makes it quite impossible to unwind this part of the cop. It is true that, with great care, the weaver can avoid, to a certain extent, this displacement of the yarn, but such extra care can hardly be expected of her when we consider the little time she has for copping the shuttle. An ordinary cop of 42's weft, weighing about 200 grains, contains about 1,010 yards of yarn. If we take a 45 inch loom, making 40 inch cloth, and running 200 picks per minute, and allow one third for stoppages, we have a consumption of 134 picks per minute of 40 inches each, or 150 yards of weft; at this rate a cop lasts 6½ minutes.

Assuming that a weaver minds three looms, each consuming the same quantity of weft, we have three changes of shuttles in 6½ minutes, or a little over 2 minutes per loom, including piecing of warp-ends and all other eventualities We cannot, therefore, be hard with the weaver if she performs the operation of putting the cop upon the shuttle in a hurried manner, and necessarily injures the cop. A large production of cloth is more important to her than a little more waste, but it is not so to her master. We find that on an average, weavers, when moderately careful, make from 3 to 6 per cent of waste in 42's cops. This waste is sold at about 3½d. per lb., while the yarn costs about 9½d. If now a weaver makes per loom about 12 ozs. of waste, and this could be reduced, say one half, it would give at the difference between 9½d. and 3½d.., a saving of 2d. per loom per week, or £1 13s. 4d. on 200 looms per week, and £84 per year.

We think we are not wrong in ascribing a large share of this waste to the imperfect construction of the tongue of the shuttle, which, in most cases, is still in a primitive condition, and has not been improved upon during the last fifty years. From what we have shown above, it will be seen that the careful insertion of the tongue of the shuttle would be much facilitated if the former was perfectly smooth and even, and of the diameter of the spindle which—often only a few hours previously—had left the cop.

There is a tongue, patented some years ago by Messrs. Butterworth and Brooks, in which, when it is turned up for receiving the cop, the spring lies quite flat against the spindle, thus passing easily into the cop, and in which the spring only bends out when the tongue is depressed into the shuttle with its cop on. This tongue has many advantages, but still is not so generally used as one would expect, and there must, therefore, be disadvantages, or, perhaps, prejudices, with which we are not acquainted. But the ordinary tongue is, in our opinion, still very imperfect; it is forged by hand, and the spring brazed on also by hand, the whole a clumsy and unmechanical contrivance. Why cannot this tongue be made of, say, rolled steel, and the tongue attached in such a manner that the whole is turned out by a machine, even and smooth, and in such a condition as corresponds with the present advanced state of mechanics? We think when this tongue has to take the place of the mule spindle, which is highly polished and finished, it should, at least, not be inferior in finish to the latter.

Mr. Hugh Mason mentioned at the meeting of the Manchester Chamber of Commerce, on the 29th of last month, that we must have greater economy in production if we are to hold our ground; a saving of 8s. per year per loom is not much, but is still a matter important enough to be seriousiy considered, especially when we know that with many weavers the amount of waste is more than stated above.

We have thrown out these hints to induce our friends the shuttlemakers to make researches with a view to improving the tongue, for we regard it as our mission to contribute our mite in every possible way to the continued progress of the textile industries and everything connected therewith.—*Textile Manufacturer.*

New Mechanical Inventions.

James A. Albright, of Fayetteville, Lincoln county, Tenn., has patented a supplemental rock drill designed to be used after the ordinary drill, for the purpose of enlarging the hole at the bottom to form a large chamber for containing the blasting material. The improvement consists in cutting blades arranged in guides in the drill stock in connection with a spring-seated end piece, so as to be projected laterally from the stock of the drill by the impact upon the end piece, and be again withdrawn into the drill stem by the action of the spring when the drill is drawn back.

A new Carriage Axle Box has been patented by Mr. William A. Sitton, of Cleburne, Texas. The spindle has a circular shoulder or boss near its inner and larger end, and a screw hole is tapped in its outer end. A shouldered sleeve, or box, fits over the spindle, and detachable rings are also slipped on it, being interposed between its shoulder and the shoulder of the sleeve or box. The nut which holds the box on the spindle has a tap that screws into the end of the spindle and around which is formed a recess to receive detachable rings. By removal of one of the rings at each end of the spindle, the box may be adjusted on the latter to compensate for wear.

A Furnace Door for Steam Engines, patented by James M. Marshall, of Knoxville, Tenn., is opened and closed by means of a jointed and spring-acted treadle depressed by the foot of the fireman, the treadle working a slide block and moving a spiral groove of the shave or pivot rod of the door. It will prove an invention of value to engineers, affording a quick method of opening and closing furnace doors.

Jacob S. Baker, New Freedom, Pa., has patented a lift pump, in which is combined a pump with a motor for operating the same, as to permit of the storage of power in the motor and afterwards allow it to be expended for the operation of the pump from time to time as occasion requires. In attaining this end a set of spur wheels is arranged in a suitable case and geared so as to be driven either by a heavy coil spring or weight. To one of the rotating shafts of the gear wheels is attached outside of the case a disk and wrist pin, which latter through a connecting rod reciprocates the pump piston, the latter being made hollow and bent around into a spout at the top, so as to form a conduit for the water from the cylinder of the pump tube, which is located below in the well. To compensate for the increased work of the motor on the upward stroke in lifting the hollow piston full of water, a counterbalance is employed on one of the shafts to render the action of the motor uniform, and to start and stop the action of the same a detent is employed.

A Watercloset Valve invented by Paul Magnus, of New York city, consists of a valve operated by a center stem and having two interior valves, a larger one to open or close the main supply pipe, and a smaller one to supply or discharge, in connection with suitable channels, a water chamber intermediately between the larger and smaller valves. The center stem acts on the smaller valve, removing the pressure of water from the larger valve, permitting it to open. The closing of the small valve secures the filling of the water chamber and the closing of the main valve by the pressure of the water. The water supply is easily regulated by a screw plug, and any hammering is prevented.

Ralph K. Ent, of North Topeka, Kan., has patented a Millstone Balance. The millstone is fitted with a number of symmetrically arranged horizontal guide tubes with adjustable weights, and a separate number of symmetrically arranged vertical guide tubes and adjustable weights for adjusting the standing and running balance of the stone without one interfering with the other. The stone may thus be kept balanced with little trouble.

Mr. Simeon Duck has recently obtained a patent for improvements on the Mortising Machine previously patented by him (December 21, 1875). The new feature is the segmental gear which rocks upon a journal on the main shaft, and on which the table tilts while sliding freely upon it. This materially simplifies the invention.

In a new Lift Pump, Mr. Augustus Johnson, of Morristown, Ill., constructs the plunger, and also the check valve box, with two valves, all four valves opening upwards. The object is to use auxiliary valves which will check or trap the the water drawn into the cylinder and prevent it from flowing back.

A new Steam Atomizer, for impregnating the air of surgical operating rooms, hospitals, etc., with antiseptic vapors, has been devised by Messrs. Peter Rundquist and Theodore Angelo, of New York city. A vessel with antiseptic liquid is supported on clamps on a main pipe, and connected by a flexible conduit with the spray tube for raising and dissipating the liquid in the usual manner.

A new Ironing Machine, patented by Mr. Henry Monk, of Troy, N. Y., embodies numerous novel and ingenious features. The shirt, the front of which is to be ironed, is first clamped and tautened in a suitable device. It is then carried under rolls which are heated and rotated in different directions, and then returned under said rolls and polished.

A new Machine for Rolling Tubes and Bars, devised by Messrs. J. O. Butler and Ambrose E. H. B. Butler, of Kirkstall Forge, Leeds, England, is an improvement on similar devices patented in England by J. Robertson, December 20, 1869; by G. W. Dyson and H. A. Hall, October 31, 1870; and in the United States by Jacob Reese, June, 1867 A prominent feature of the invention consists in the use of a table or rocking frame on which the bars are placed after leaving the machine, and on which they are made to roll forward and backward while cooling to prevent warping, and to keep them true.

Mr. Samuel T. Shankland, of Laramie, Wyoming Territory, has improved on his Steam Plowing and Scraping Attachment to Cars, which he patented April 24, 1877, so that the scrapers may be dumped automatically at any distance from the back. By this device the men attending the scrapers have merely to fill them, and thus time and labor is saved.

In order to Protect Vessels Against Torpedoes, Mr. John H. Fisher, of Mount Washington, Ind., proposes to surround the hull with a series of pipes to be filled with air or water. These pipes, coming in contact with submerged torpedoes, cause the explosion of the same without injury to the vessel.

The object of a new Hydraulic and Wire Rope Pumping System, invented by Mr. W. P. Barclay, of Virginia City, Nevada, is to provide an economical means of raising water from mines and deep shafts. As many pumping cylinders are used in the mine or shaft as may be required to lift the water. These are placed one above the other, and connected so as to divide the pressure between them. Two series of pumps are employed, the piston rods being connected by wire ropes; and a hydraulic engine is located near the mouth of the shaft. The discharge pipe of the lower pump delivers the water to a receiver, from which the suction pipe of the next pump above takes it, and it is delivered to another receiver, and so on until it reaches the top of the shaft.

A new Oven Lamp for illuminating bakers' ovens, devised by Mr. Thoro W. Greenleaf, of Westborough, Mass., consists in an adjustable tubular bracket to which an oil reservoir is connected, outside the wall of the oven. Inside the oven wall there is a burner and reflector.

A new Saw Handle has been patented by Messrs. J. N. Dudley and John Anderson, of Petrolia, Cal. It consists of a handle attached to the saw by binding straps entering recesses of the saw blade, and being secured to the handle and saw by a clamp bolt, with lower crosspiece and upper second handle, or by a fastening nut.

Mr. Wiley J. Johnson, of Hernando, Miss., has patented a new Gin Saw Filing Machine, by which the files may be readily adjusted to the saw teeth at the proper distance and inclination, so as to produce the most favorable action in the down strokes, and exert a less pressure in the up strokes.

Mr. William H. Lynn, of Freeport, Ill., is the inventor of a Car Starter which is an improvement upon the device in which a ratchet wheel upon the axle is combined with a segmental lever carrying a weighted pawl and a chain arranged about the segment to cause the pawl to engage with the ratchet to turn the axle at a greater advantage of leverage.

A new Machine for Scaling, Cleaning, and Polishing Wire has been invented by Mr. Nickolaus Betz, of St. Ingbert, Germany. It avoids the use of sulphuric acid, and consists essentially of a claw guide and a set of vertical and horizontal stretching and cleaning rolls, over which the wire is drawn to be cleaned of scales on all sides. The wire is then passed through a box filled with a mixture of calves' hair and sand.

NOTES OF THE PATENT DECISIONS OF THE COURTS.

The Cawood patent for an "improvement in the common anvil or swedge block, for the purpose of welding up and reforming the ends of railroad rails when they have exfoliated or become shattered from unequal wear," has again been construed and its validity sustained by the Supreme Court of the United States in five suits brought by Turrell against the Illinois Central Railroad Company and four other companies respectively.

The drawing annexed to the Cawood patent represents a bed sill on which is placed an anvil or swedge block of cast iron, across the face of which there are recesses or dies shaped like the side of the rail to be repaired. A solid and fixed block, cast as part of the anvil, is also represented with its side face shaped to the side of the rail when placed in its natural position, and a movable press block held down upon the anvil by dovetailed tongues and grooves, and operated by two eccentric cams, moving it back and forward, towards and from the fixed block. The face of the movable block is also shaped to fit the side of the rail next to it, and the blocks grasp the rail on each side while its ends are being reformed, the movable one having sufficient travel to allow the rail to be extricated without altering its vertical position.

The mode of use is as follows: The rail and the piece of iron to be welded on having been heated, the former is swung from the fire into the open space between the blocks, when, by half a turn of the cams, the blocks are closed upon it. The welding piece is then laid on top of the rail and leveled up by a swage held by the smith. The claim of the patent is for "the movable press block, having its edge formed to the sides of the rail, in combination with another block with its edges of a similar but reversed form (the movable block to be operated by two cams, or in any other convenient manner), for the purpose of pressing between them a T or otherwise shaped rail."

Viewing the claim as interpreted by the description and drawing, it is not difficult, the court thinks, to discover what the patentee supposed he had invented. It was not any kind of movable press block combined and operated in any way, with any kind of fixed block, to effect any useful result. His avowed purpose was to form a mechanism for welding up and reforming the ends of exfoliated and crushed rails, or, rather, to hold them in a convenient position for such welding and reforming, at the same time preserving their shape. His manner of accomplishing this result was evidently considered by him as of the very essence of the invention. The rail, when on the anvil, is to be confined on three of its sides, as in a mould; on one side it is to be supported by a fixed block, part of the anvil itself, shaped reversely so as to fit the shape of the rail; on the other side it is to be supported and held in place by a movable block with a face adjusted to the shape of the rail on that side, the movable block being capable of advance toward the fixed block, and of retrogation after the rail is placed on the anvil; the rail is also, when in place, to be supported under its base by the anvil. It thus has a bottom support and two side supports.

The court, having thus construed the patent, then proceeds to examine the devices which the railroad companies claimed anticipated Cawood's invention. These devices were the angle-iron machine, the bayonet machine, and the Church machine.

The angle-iron machine does not contain the principle of the invention described in Cawood's patent. There are points of resemblance between these machines, but there are also very substantial differences. While the purpose of the Cawood machine is to aid in mending rails already made, the angle-iron machine is to assist in welding together, at right angles with each other, two iron bars, making a fillet in the interior angle to strengthen the rail when made. To effect this, the fixed block on the anvil has necessarily a peculiar construction, unlike that in the Cawood machine. It is beveled or rounded off at the top of the face opposite the movable block, so as to give room for the formation of the fillet. And not only is the face of the fixed block unlike that of the fixed block in the Cawood machine, but its function is entirely different. It is to furnish support for one of the two bars designed for the formation of the angle iron. One entire limb of the angle iron is laid upon the top of the block, unconfined laterally, and there exposed to the hammer, the block being the anvil. The iron is thus left free to spread out in both directions, instead of being prevented from spreading laterally by the press block, as in the Cawood machine. Again, in the angle-iron machine, no provision is made for a bottom support for the rail.

The bayonet machine used at the Springfield Armory before and since 1850, for forging parts of bayonets, is, in form and substance, nothing but a hinge vise with a peculiar shape of the jaws, intended to facilitate operations upon the shank and socket of a bayonet, while the Cawood machine is an improved anvil, not a vise.

The Church machine, patented in England in 1846, while employed for strengthening and flattening the rails for railways, is totally incapable of performing the work of the Cawood machine. It is not an anvil. There is no fixed block cast as part of an anvil. There is a stationary die, part of a frame, against which one side of the rail is placed to resist the lateral pressure exerted upon it by a sliding lateral die on the other side of the rail, and above is a horizontal bar, which is forced downwards by a series of jointed levers, carrying another die upon the upper surface of the rail. There was nothing, therefore, in any of the three patents above named which anticipated the Cawood invention.

The court further holds that Cawood's claim for moving the blocks by cams, or "in any other convenient manner," entitles him to move the blocks by any means adapted to the work the machine was intended to perform.

The court, in conclusion, decrees that "The Illinois Central," "The Etheridge," "The Whitcomb or Cleveland Block," machines are infringements of the Cawood patent; but that the "Michigan Southern," "The Bayonet vise," "The Beebee & Smith" machines are not such infringements.

The infringement suit of Herring *vs.* Nelson has just been decided. This suit was brought on the re-issued letters patent granted to John Deuchfield for an improvement in cooling and drying meal. The main questions in the case, and those on which it turned, were whether or not the re-issued letters patent were for the same invention as the original patent, and whether or not new matter had been introduced into the specification, contrary to the provisions of section 53 of the patent act of 1870. The original claim consisted only in a combination of parts or elements. No device was claimed, as the invention of the patentee, which entered into the combination. Under the patent, as originally issued, it was therefore quite plain that no infringement could be made out without showing a use by the defendant of the complete combination with all its elements, for that was the thing patented. The combination, of course, disappeared when any element of it was omitted. In the re-issued letters patent, however, a new claim was added, for a combination of parts or elements, each of which made part of the original claim. Under this claim the operation of the re-issued letters patent was greatly enlarged beyond that of the original letters patent. It entitled the patentee to exclude everybody from using the combined elements of such new claim, while the original letters patent would be effectual only to exclude the use by others of the elements of the new claim when combined with the other elements of the original claim. It therefore enabled the patentee to make out an infringement by showing a use of the combination specified in the new claim, which omitted a number of the elements combined in the original claim. This question, namely, whether or not the reissued letters patent were for the same invention as the original patent, the court decides in favor of the complainant. It holds that a sub-combination of elements which coact in the production of a perfected joint result can be rightfully claimed in conjunction, since they constitute a true combination in the sense of the law, and not a case of juxtaposition.

In regard to the second question in the case, namely, whether or not new matter had been introduced into the specification, the evidence showed that the drawing attached to the re-issued letters patent were the same as were annexed to the original. The mechanical structure, so far as the machine came under the new claim in the re-issue, was exactly the same as was described in the original specification up to that point. Nor was anything added to the description of the further mechanical structure of the machine as originally described. Looking at the mode of operation of the machine, as set forth in the original specification, the re-issued letters patent made no alteration in it, so far as the machine came under the new claim in the re-issue. The mechanical arrangements were all unchanged, the mode of operation of the several parts was correctly described, and the results of the action of the whole was correctly stated. But it was obvious that while the combined action of all the parts produced the complete result, yet that the mere cooling and drying of the meal was the result of that part of the machinery which was covered by the new claim in the re-issued letters patent. The court sustains the re-issued letters patent on this second question, and holds that the doctrine of Vance *vs.* Campbell (1 Black, 429), namely, that the use of a lesser number of elements than are contained in the patented combination is no infringement because not the same invention, does not apply to the practice of reissuing patents; and that while it is true that the law requires that re-issues shall be for the same invention as the originals on which they are based, yet it is no departure from this law to make separate claims to sub-combinations which were originally joined in one.

New Agricultural Inventions.

George W. Gordon, of Beverly, O., has patented a novel mode of Unfastening the Latch of a Gate from either side, without dismounting from a horse's back. It consists in the employment of a lever, middle pivoted on a standard that is itself supported on the top rail of gate and connected with the latch or latches. If a horseman approaches from one side he raises, and if from the other he depresses, the lever. He then pushes with the lever until the gate is open, and closes it by reversing the direction of his push.

Willis Armstrong, James G. Smith, and John F. Armstrong, Owensville, Ind., have patented a Stump Burner, which consists of a conical sheet iron hood provided with a chimney, fuel door, draft holes, and handles. To use the burner it is placed over the stump to be burned and fuel is placed on or around the latter. The fuel is then ignited, the fuel door closed, and the draft slide opened. The fire will soon become intense, and being concentrated around the stump and the flame tending upward, and the radiation of heat being for the most part prevented, the stump will be rapidly consumed.

George H. Smith, of Freeport, Ill., has patented a Gate, which is an improvement in the class of farm gates which are supported by pivoted bars and move in a vertical frame when opening and closing, thus describing the arc of a circle, but at the same time preserving a horizontal position. The improvement relates to the construction and arrangement of the bars that support the gate, and the connection of latch or locking devices therewith in such manner that the gate is prevented sagging or swaying, operates more easily than others of its class, and is locked shut at both ends simultaneously.

Astronomical Notes.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, December 29, 1877.

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

PLANETS.

Mercury sets	6 6	evening
Venus "	8 24	"
Mars in meridian	6 06	"
" sets	0 21	morning
Jupiter "	5 01	evening
Saturn in meridian	4 35	"
" sets	10 08	"
Uranus rises	8 47	"
Neptune in meridian	7 38	"
" sets	1 15	morning

FIRST MAGNITUDE STARS.

Sirius rises	7 04	evening
Procyon "	8 39	"
Betelgeuse "	4 48	"
Regulus "	8 43	"
Spica "	1 24	morning
Aldebaran in meridian	9 54	evening
Vega sets	8 53	"
Altair "	7 40	"
Fomalhaut sets	8 18	"
Capella in meridian	11 32	"
7 stars (cluster) "	9 05	"
Vernal equinox "	5 26	"

REMARKS.

The earth is nearest the sun December 31, being 3,070,538 miles nearer than it was July 3. The sun is slowly moving northward, and the days are as slowly increasing in length and the duration of twilight lessening. The sun rises and sets 31° 18m. 20s. south of the east and west points of the horizon.

Mercury sets 1h. 26m. after the Sun, at a point in the horizon 2° north of the sunset point. It is in *Sagittarius*, and there are no conspicuous stars in the vicinity which could be mistaken for the planet. Venus is the most conspicuous object in the evening sky; she is in *Capricornus*. Mars is directly south in early evening, in the constellation *Pisces*. His position is not marked by any bright stars. Jupiter sets 1h. 21m. after the sun. He is in *Sagittarius*, 7° northeast of the "Milkmaid's Dipper." Saturn is southeast of Mars, in *Cetus*, almost directly south 10° of the second magnitude star Menkar. Uranus rises 4m. after the brilliant star Regulus in the handle of the Sickle in *Leo*.

NEW BOOKS AND PUBLICATIONS.

THE ART OF HOUSE PAINTING. By John Stevens. John Wiley & Sons, Publishers, New York. Price 75.

This is a clear and comprehensive record of the observations and experiences, during many years, of a practical worker in the art. It is full of valuable suggestions and is designed to instruct and assist in the everyday work of painters and others. Its directions and cautions for outside and inside work are very minute and particular. All who build houses, as well as those who live in them, will find many hints which they can use to their advantage.

A GUIDE TO THE DETERMINATION OF ROCKS. By Edward Jannettaz. Translated from the French by Geo. W. Plympton, C.E. D. Van Nostrand, Publisher, New York. Illustrated.

This well known and standard work of the French author has been translated with a view to supplying students with a desirable supplement to the ordinary course of geology, at the same time affording an easy introduction to the larger treatises on lithology. Its thoroughly practical character, together with the simplicity of the methods of examination, will claim the favorable notice of teachers and learners of the department of science. It embraces a description of the more important minerals from the lithological point of view; the method to be followed in practically determining rocks and a dichotomic table for determining rock species.

LETTERS TO WOMEN ON MIDWIFERY, ETC. By Joel Shew, M.D. S. R. Wells & Co., publishers. New York. Price $1.50.

This is one of Dr. Shew's best and most useful books, which has been for some time out of print. The book is particularly designed for the use of women, and it aims mainly to prevent mistakes and diseases by pointing out the proper course to be pursued in given contingencies.

Inventions Patented in England by Americans.

From October 9 to November 23, inclusive.

AERIAL BATTERY.—A. W. Gittens, New York city.
BALE TIES.—S. J. Chapman *et al.*, Charleston, S. C.
BOTTLE STOPPER.—W. Hicks, Brooklyn, N. Y.
BOBBINS.—M. J. Nealon *et al.*, Chester, Pa.
BRICK MACHINE.—H. C. Sargeant *et al.*, New York city.
BRUSHES, MANUFACTURING.—I. H. Hyatt, Newark, N. J.
BUTTON HOLE LINING.—D. Harris, Brooklyn, N. Y.
CARBURETTER.—D. E. Bangs *et al.*, Boston, Mass.
CHURN.—J. L. Sprague, Hermon, N. Y.
COAT.—J. Paret, New York city.
CONDENSER.—W. E. Sudlow, New York city.
COTTON PRESS.—S. H. Gilman, New Orleans, La.
COTTON REEL.—W. Grover, Holyoke, Mass.
ELECTRO-MAGNETIC HYDRAULIC ENGINE.—K. C. Atwood, New York city.
EMBOSSING MACHINE.—C. L. Nagel, Brooklyn, N. Y.
EYELET.—J. Whitehead *et al.*, Cranston, Pa.
FEED ROLLER REGULATOR.—C. H. Chapman, Mass.
FOOD FOR ANIMALS.—J. S. Kirk *et al.*, New York city.
GAS REGULATOR, ETC.—M. W. Kidder, Boston, Mass.
HARVESTING MACHINE.—W. F. Goodwin, Stetton, N. J.
HORSESHOE.—J. S. Williams, Riverton, N. J.
HORSESHOE, MAKING.—J. D. Billings, New York city.
HYDRAULIC MACHINE.—S. Marsden, St. Louis, Mo.
INHALER.—L. F. Fulton *et al.*, Potsdam, N. Y.
IRONING MACHINE.—T. S. Wiles, Albany, N. Y.
KEY RING.—J. S. Birch, New York city.
KILN.—Professor H. Wright, Philadelphia, Pa.
LEATHER-CRIMPING MACHINE.—S. W. Jamison, Brooklyn, N. Y.
METAL TAPPING DEVICE.—W. Doward, Rochester, N. Y.
METAL EYELETS.—J. Whitehead *et al.*, Cranston, Pa.
MECHANICAL MOVEMENT.—W. F. Goodwin, Stetton, N. J.

Business and Personal.

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Notes & Queries

(1) G. W. inquires (1) whether 100 small cogwheels be run altogether by one belt, in a circle, the object being to bore 100 holes through 1½ inch wood, ¼ inch in diameter? A. Yes. 2. How many revolutions will the cogs have to make, and what would the size of belt be? A. The cogs should make at least 500 revolutions per minute, and a 2 inch belt will answer.

(2) J. W. W. writes: 1. Is there not a substance that can be cut deeply with acids which may be photographed upon as in the "Albertype process," and a stereotype taken from it in type metal so as to be printed among types on a printing press, and what substance is it? A. We believe there is nothing better for this purpose than the bichromated gelatin film; the print being produced by inking the surface, that is left in relief, by washing the film with water after it has been placed under a negative and exposed to light. 2. Is there any combination of liquids that will cut glass and have no effect on oils? A. Water, which has absorbed hydrofluoric acid gas, will etch glass; and will have very little effect on oil. This solution must be kept in bottles made of rubber (caoutchouc). For very fine etchings it is best to expose glass to the gas itself, produced by pouring sulphuric acid on fluoride of calcium (fluorspar).

(3) C. H. H. asks for the diameter and pitch of a screw wheel that will be the proper size for two cylinders 8" x 12" with 100 lbs. pressure per square inch and connected directly to main shaft? A. Diameter 4½ feet, pitch 6 feet.

(4) W. B. asks: What is hydramyle, its uses, properties, and effects? A. Amyl hydrate or amylic alcohol (the principle of fusel oil) is a constant accompaniment of alcohol (ethyl alcohol) prepared from corn, potatoes, the must of grapes, etc. It passes over in considerable quantities towards the end of the distillation, and may be collected apart. To obtain it in a state of purity these portions are freely washed with water, the residue redistilled, and the portions passing over between 267°—270° Fah. collected separately. It is a colorless liquid having an odor peculiar to itself and a burning taste. Its chief use is in the production of several fragrant ethers, as amyl acetate, which has the odor and flavor of the Jargonelle pear. These are used largely for flavoring confectionery and liquors, and by perfumers. To the presence of amylic alcohol in cheap liquors is attributed their potent intoxicating properties.

(5) A. H. A. asks: How large a cylinder will be required with length of stroke, at 40 or 50 lbs. pressure, to propel a boat 23 feet long, 5 feet beam, and 15 inches deep, at a rate of 12 miles an hour? A. We think you will have difficulty in designing proper machinery for such a speed at the pressure of steam mentioned.

(6) W. H. writes: We have a 5 inch steam pipe running from the surface down inside a mine. I have noticed sometimes, in caulking a thimble that was leaking, something like an electric spark flit across the point of chisel. A. Electric phenomena are sometimes noticed in the case of steam escaping from small orifices, and are attributed to the friction at the point of escape.

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

H. K.—It is acetate of copper.—R. M. D.—It is sulphide of iron.—W. H. D.—The sample consists principally of ferric sulphide. It may or may not contain traces of precious metals. The sample was too small to admit of examination.

COMMUNICATIONS RECEIVED.

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

On Gas Poisoning. By N. D.
On a Preventive of Colliery Explosions. By G. W. D
On Predicting the Weather. By G. R. C.
On Hydraulic Rams. By E. B., M.D.

HINTS TO CORRESPONDENTS.

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

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

Where can I obtain a portable mill for grinding wheat?
Where can chrome steel be obtained?
Who sells simple horse powers?

OFFICIAL.

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FOR WHICH

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

November 13, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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DESIGNS PATENTED.

10,310.—MIRROR FRAMES.—J. Crawford, New York, N.Y.
10,311.—FONT OF ORNAMENTAL PRINTING TYPES.—J. Herriet, New York, N. Y.
10,312.—WHITE LINED PIPKINS.—J. E. Jeffords, Philadelphia, Pa.
10,313.—BASKET TEA POTS.—J. E. Jeffords, Philadelphia, Pa.
10,314.—WOVEN BORDERS FOR TOWELS.—R. T. Webb, Randallstown, Ireland.

[A copy of any of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

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