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Purifying Rancid Butter.

Calvin Peck some ten years ago obtained a patent for restoring and preserving butter; his invention relates to a new process for purifying butter, having especial reference to arresting fermentation and restoring rancid butter. His process consists in melting the butter in a clean vessel under a slow and regular heat, and while it is melting he adds two ounces of pulverized alum to every five pounds of butter, the butter being stirred gently while melting. When thoroughly melted it is strained through a fine strainer into clean cold water. The butter will rise to the surface quite pure and transparent. The alum coagulates the albumen, the caseine, and other foreign matter, all of which are retained in the strainer, leaving the butter perfectly pure and clean, and of uniform consistency.

When the butter is sufficiently cool to be in good working order, it is carefully taken out and thoroughly worked, adding to each five pounds of butter three ounces of good dairy salt, one ounce of clean saltpeter, and one ounce of pulverized white sugar. The butter is then packed in clean vessels, and is fit for use.

By covering it with strong brine and keeping it in a cool place, it is claimed it will remain sweet for any desired length of time.

Apropos to the above a correspondent in *Land and Water* answers an inquirer in its columns who wants to know how to sweeten rancid butter, as follows: If her butter is very bad, premises the writer, I cannot promise that the following plan will entirely restore it; but I can at least describe a process which I once watched at an agricultural show, where a machine for washing butter was at work and where some very horribly odorous butter was in a few minutes rendered edible. It did its work very quickly and by the simple turning of a handle, and the same sort of process might be accomplished by means of a wire sieve or a strainer anywhere. The butter was forced through a finely perforated receptacle into a large tub of fresh cold water. It came rapidly raining down in a fine capilliform shower, lying upon the clear water in a tangle of golden filaments, singularly beautiful, till the water was all covered with them. When the whole lump had been thus transformed into yellow threads, they were stirred and beaten about in the water with a wooden beater; then collected and pressed into a fresh lump of greatly improved appearance, and again forced through the machine in another shower of delicate filaments. This process was repeated several times, till the butter had been washed literally through and through.

Shoeing Horses.

The Rev. W. H. H. Murray, whose advice is worth heeding, says about shoeing: The nails should be quite small and driven in more gently than is the custom. There is no reason why the smith should strike a blow at the little nail head as strong as he would deliver at the head of a spike in an oak beam. The hoof of the horse is not an oak stick, and the delicately pointed and slender headed nail is not a wrought iron spike, and yet you will see the nailer whack away at them as if it was a matter of life and death to get them entirely set in at two blows of his hammer. Insist that the nailer shall drive his nails slowly and steadily, instead of using violence. In this case, if his nail is badly pointed and gets out of proper line of direction, no great injury is done. It can be withdrawn and a new one substituted, without harm having been done the foot. But the swift, blind, and violent way prevents all such care, and exposes the horse to temporary, if not permanent injury. Gentleness should be exercised in clinching the nails. Never allow a smith to touch a rasp to the outer surface of the hoof. Nature has covered it with a thin filament of enamel, the object of which is to protect the inner membrane and fiber from exposure to water and atmosphere. The enamel is exactly what nature puts on the surface of your finger nail, reader. Under no circumstance should it ever be touched. If it is removed nature will be wickedly deprived of her needed covering, and cruelly left exposed to the elements.

AMERICAN INDUSTRIES, NO. 13.

THE MANUFACTURE OF WIRE.

Wire rope has become an important article in almost every branch of industry, and its uses are constantly multiplying. Strength for strength, it is now cheaper than the manila or ordinary hemp cordage used for hoisting or rigging purposes, and when used as a substitute for belting or shafting in conveying power long distances, the cost is trifling when compared with them. The use of galvanized ship rigging is rapidly increasing, and a majority of all vessels which have been built within the last ten years have been fitted throughout with wire standing rigging. Its elasticity is about the same as that of hemp, while its lasting qualities are equal to that of the ship it is used on. In our present issue we give a brief description of the methods followed at

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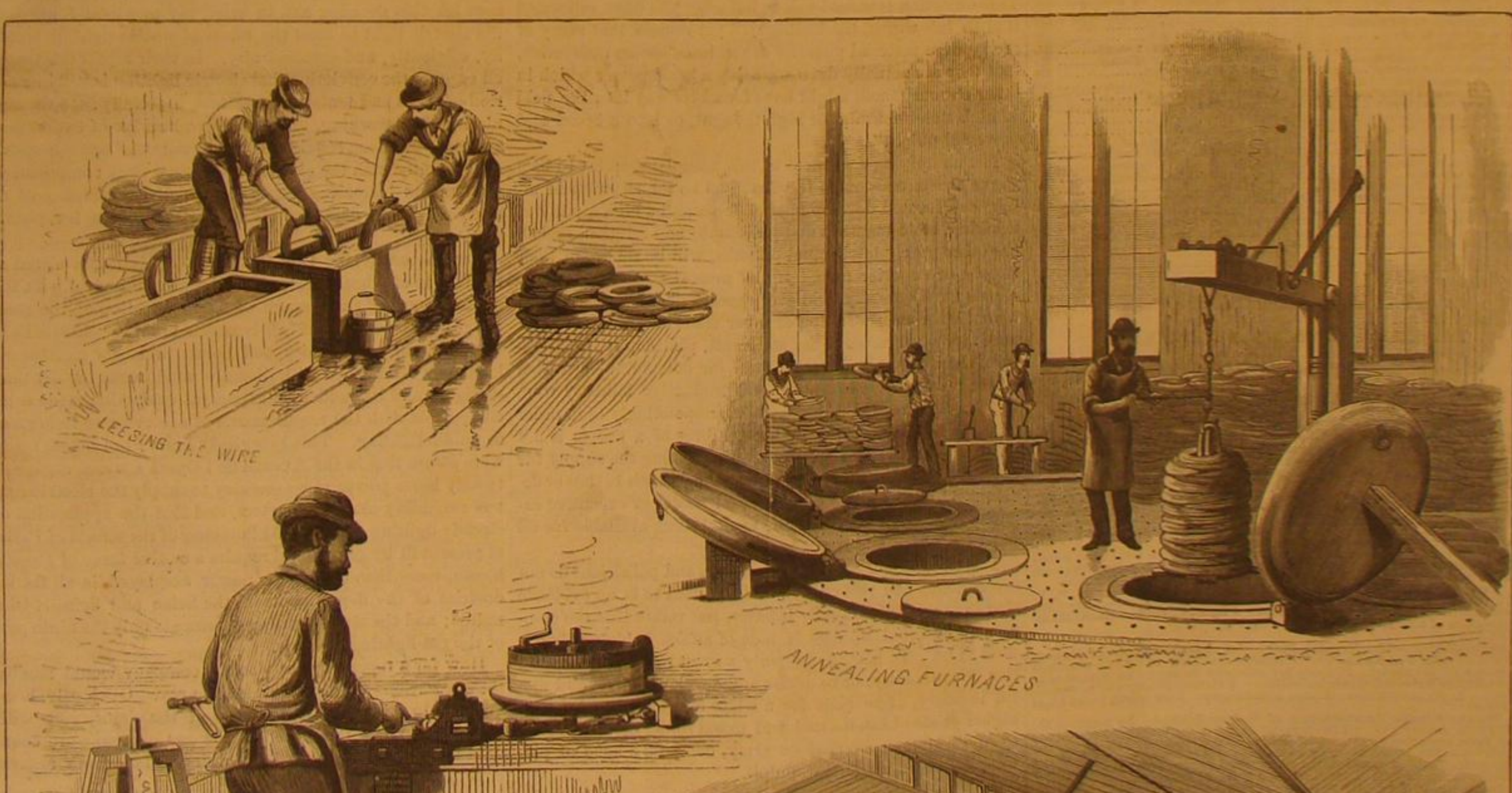

Fig. 1.—THE MANUFACTURE OF WIRE.

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NEW YORK, SATURDAY, MAY 24, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 177.

For the Week ending May 24, 1879.

THE MENTAL REQUIREMENTS OF MODERN ENTERPRISES.

Formerly the art of war, statecraft, the bar, the pulpit, poetry, and philosophy monopolized the brains of mankind. In these professions and pursuits men of superior mental force found expression for their thoughts; and besides these there were few occupations likely to invite or to develop the higher order of minds. The magnitude, complexity, and scientific character of modern material enterprises—commercial, constructive, manufacturing, agricultural, and the like—have well nigh reversed the old state of things. The learned professions, so-called, no longer offer the only nor even the most inviting fields for intellectual effort; nor do they furnish the most effective means of mental development and culture. As an inevitable result, professional men no longer overtop their fellows in intellectual stature. Indeed it is sometimes asserted that the highest order of minds are now drawn to practical affairs, leaving to the professions only those of inferior rank. Relatively this may be largely true; yet it by no means follows that the leading men of to-day in the purely intellectual callings are in any way inferior to the average of their predecessors. They are tried by a higher standard; they are surrounded by non-professional men of a mental stature impossible in former times; and so, although really great, they seem relatively small. Many a soldier, statesman, jurist, priest, or writer, vastly famous in his day, owes his historic greatness rather to the littleness of his neighbors than to his own intrinsic nobility.

Speaking of the requirements of modern transportation, Prof. David Swing remarks that men are giving to railways now a mind which travel and carriage could never have thus diverted from learned pursuits when men journeyed on horseback or carried goods in pack saddles. In those days only a few boys who could feed horses, and a few drivers who could flourish a whip, were absorbed by the carrying business. The railway, with the pomp and circumstance of its engines and palace cars, its vast machinery and money power, now attracts and employs men who would have been Pascals and Newtons, and Wesleys and Washingtons a hundred years ago. The external management of the railway has created, he says, the "railway king" of to-day, who had and could have had no counterpart in the days of the pack-horse; and as a consequence we must admit that "the steam car diverts great brains, and places upon the railway throne men who would once have been princes in statesmanship, or literature, or religion."

"Of course," remarks Professor Swing, "to this statement the objection is ready that perhaps the railway is making men of large brains out of those who would have been only teamsters in the mountains or sleepy drivers along a canal. This objection is indeed valid; but after you have estimated it at its full worth, the feeling will yet remain that many of the modern material pursuits are so immense and attractive, that they are actually drawing away a brain power which in other circumstances might have found its way into the field of high statesmanship, or high thought, or into a broad and powerful pulpit."

The underlying sentiment of this complaint seems to be a vague and unreasonable fear that just so far as practical affairs call for and develop mental force and a high quality of thinking, statesmanship and philosophy and religion, and all the other purely intellectual pursuits, will be robbed of their supply of superior men. If the mental force of the race were a fixed quantity, and every great mind employed upon invention or transportation or other material pursuit must of necessity be diverted from statecraft, philosophy, or literature, there might be some ground for complaint—provided it were certain that invention and productive industry were less beneficial to the race than a correspondingly high order of closet thinking. But the mental force of a people is not a fixed quantity; and instead of diminishing the supply for any particular calling, every new calling which invites or develops a higher order of intellectual power or executive capacity practically increases the mental force available for all pursuits, ultimately if not immediately.

The circumstance that our preachers and politicians do not tower above the rest of men as they used to is no evidence that they are intellectually inferior, but rather that the common intellectual average of men of affairs is higher than it used to be. To manage properly a great railway, steamship line, manufactory, or to devise and develop a novel and useful industry, often calls for a wider range of knowledge, a higher grade of intellectual and moral force, than is needed to rule a state, command an army, compose a book of philosophy, or fill the loftiest pulpit.

THREE SUCCESSFUL EFFORTS.

Three notable feats of human effort and endurance have just been brought to successful issue. The first was of questionable utility in spite of the possible advantage of knowing the maximum capacity of the human frame for long-continued and severe exertion. In the six days' walking and running match, in London, ending April 26, the winner's score was 542 miles, beating by 21 miles the best previous record in a similar contest. During the first three days the winner, Brown, made 300 miles, a feat never before achieved. It is said that he left the track at the close in excellent physical condition.

The second achievement was also of doubtful utility. As a means of advertising his already sufficiently advertised swimming suit, designed for life saving in case of disaster at sea, Capt. Paul Boyton undertook last winter the terrible task of floating and paddling from Pittsburg to New Orleans. The Ohio was full of ice when he started, and the venturesome swimmer was often in imminent peril from being crushed in the ice floes as well as frozen by the intense cold. The voyage of 2,342 miles was completed in 80 days, the voyager being reduced almost to a skeleton by the severity of his self-imposed task.

Of a very different nature was the splendid feat of the Sugar Notch coal miners, who, to rescue seven comrades—six men and a boy—buried in a mine, accomplished the great work of driving and timbering a passage way of 1,200 feet through rock and coal, mostly rock, in the brief space of four days and nights. The imprisoned miners were found alive and well, notwithstanding their confinement of five and a half days. The party had been shut in by the falling of some acres of mine roof, caused, it is said, by a reckless stripping of the supporting pillars of coal; and luckily the door boy, who had gone in to warn the miners of their danger when the roof began to give way, rode a mule, which the men killed and ate after they found they could not get out. There was plenty of pure water in the mine, and, though gas accumulated somewhat in places, a spot was found where the air was fairly good and it was safe to build a small fire for cooking their mule meat.

It must not be forgotten that the noble band of rescuers toiled with slender hope of finding their buried comrades alive. If the latter had not been crushed by the falling roof or drowned by water, there was a strong probability that they had perished by the fire which broke out in the mine when the roof fell, or had been smothered by the liberated gases of the coal. Yet the bare possibility of saving life urged the generous toilers on, and happily their efforts were rewarded by the highest success.

The men who planned and cut the relief drift were not surrounded in their labors by admiring crowds, like the contestants for pedestrian honors; they had not the almost daily "grand receptions," "ovations," and the like which gave the river swimmer an abundance of noisy notoriety and substantial encouragement. They were probably unconscious of doing anything specially commendable; anything more than any miner would do for a comrade in distress. Yet who will say that the achievements of Brown or Boyton, however plucky or enduring, were not trivial in comparison?

THE ELECTRIC LIGHT IN PARIS.

The application of the General Electric Light Company for a three years' concession of the lighting of a number of public ways in Paris was rejected by the Municipal Council, January 28; and it was decided, at the same time, that the city should no longer contribute pecuniarily or otherwise to the experiments of the company. The reasons for this decision are, in brief, the practical failure of the electric light to meet the wants of public lighting steadily, efficiently, and economically. In their report the Council express the conviction that electric lighting is still in a period of trials and tentative processes, especially as to the regularity of its working. The frequent number of extinctions and their duration require the maintenance of gas apparatus concurrently with the electric apparatus, thus complicating matters and increasing expense. Finally, the high cost of electric lighting does not allow of its adoption for public uses.

Very naturally the City Gas Company is much elated at the failure of what threatened to be a serious rival. In the annual report of the Council of Administration of the company, presented March 27, it is asserted that the electric light was unequal in intensity and color; in foggy weather its brilliancy diminished with distance much more rapidly than gaslight; and its sudden and frequent extinction made it incompatible with the requirements of a service so important as public lighting. This everybody knew; but not so many were aware that in the Avenue de l'Opera a steam engine of twenty horse power was necessary to supply the electric centers extending along 360 meters, and that the application of electric lighting to the 1,800 kilometers of the streets of Paris, at present lit by gas, would require a motive force of 100,000 horses, more than double the power employed in all the industries of the departments of the Seine and Seine-et-Oise united; and the street lighting represents only the ninth part of the gas lighting in Paris.

How far a report by the electric company would modify these assertions we do not pretend to say. Obviously, however, up to this stage of the contest the victory rests with gas. At any rate the officers of the gas company are confident that the gas industry has nothing to fear from electric experiments thus far conducted.

NEW PROCESS FOR PRESERVING AND ORNAMENTING IRON.

We recently published an account of the Barff process of preserving iron by forming upon its surface an enamel of iron oxide by means of superheated steam and a high temperature.

We have now to describe another process, discovered by M. Dodé, by which iron is not only preserved from rust, but its surface may be ornamented, so as to resemble gold or silver, all at a comparatively small expense.

In the Dodé process the iron article, cast or wrought, is first dried, and then dipped in or painted with a composition of borate of lead, oxide of copper, and spirits of turpentine, which soon dries on the surface of the article. The objects are then passed through a furnace and heated to cherry red, the highest temperature being from 500° to 700° F. At this heat the metallic pigment fuses, enters the pores of the iron, and becomes homogeneously adherent thereto. Iron articles so heated are rendered impervious to rust. The process is superior as a preservative to galvanizing, while the cost is estimated at only half a cent per superficial square foot. This coating is of dark color.

The above is the foundation process, after which other processes, which give ornamentation to the article, may be added as follows: After the iron has been treated as just described, it may be enameled, so as to have a smooth polished surface, by painting it with a compound made of borate of lead, litharge, and essence of lavender. An extensive variety of colored enamels, of great durability and fine polish, may thus be produced. The cost is two to three cents per superficial square foot.

When an ornamental surface resembling dull silver is wanted, the iron article, after having been treated by the process first above described, is now painted with a mixture of dry chloride of platinum dissolved in ether. The article is then again heated to 350° to 400° Fah., whereby the platinum becomes incorporated with the inoxidated surfaces, and a firm, durable, and excellent dull silvered appearance is attained. The cost of this last process is stated to be from three to six cents per superficial square foot.

When a highly polished silver surface is wanted, two coats of the enamel, before mentioned, are first given, and an increased quantity of the platinum solution is used.

A golden surface, instead of silver, may be obtained by preparing a compound in which chloride of gold instead of platinum is used.

A paper on this discovery was lately read before the Society of Arts, London, followed by a very interesting discussion, all of which are given at length in our SUPPLEMENT for the current week, No. 177. Many splendid specimens of iron articles treated by the process were at the same time submitted for inspection.

WHO ORIGINATED THE ATLANTIC CABLE?

The recent cable celebration has called out a claim for the late Col. John Henry Sherburne, of Washington, D. C., as deserving the honor of originating ocean telegraphy. The claim is based on the following entry in the journal of the Senate of the United States Senate for the second session of the XXXth Congress. to wit: "Monday, January 28, 1849. The Vice President presented the memorial of John Henry Sherburne and Horatio Hubbell, praying the aid of Government in the establishment of a telegraphic communication across the Atlantic Ocean, which was referred to the Committee of Commerce."

In the memorial referred to the geographical points are indicated from which the communication can be most conveniently made between Newfoundland and Ireland, the distances given, the probable existence of soundings quite across suggested, or the possibility of anchoring buoys without soundings, and the apparatus necessary to effect the design.

The sudden death of Colonel Sherburne is claimed, by his son, to have prevented the carrying out of his father's favorite project.

The right of Cyrus W. Field to the honor of inaugurating the first Atlantic cable does not seem to be in any way lessened by the earlier project of Colonel Sherburne and Mr. Hubbell. The idea of ocean telegraphy was not original with either. As early as 1842, Professor Morse telegraphed through insulated wire, a submarine cable, stretched between Castle Garden and Governor's Island. And with reference to later investigations, Professor Morse wrote in a letter to the Secretary of the United States Treasury, under the date of August 10, 1843, these memorable words: "The practical inference from the law just elucidated is that a telegraphic communication on my plan may with certainty be established across the Atlantic! Startling as this statement may now seem, the time will come when the project will be realized."

Possibly, if Colonel Sherburne had lived, he, and not Mr. Field, would have been the founder of the first Atlantic Telegraph Company. Possibly also he might have fought the enterprise through to successful issue. This, however, is a question of fact, not of possibilities. Col. Sherburne proposed—and died. Mr. Field proposed, and happily lived to see his plans succeed.

THE WORLD-CIRCUIT AND TIME PUZZLE.

The everlasting problem of the two men traveling in opposite directions around the world and meeting to find their time reckoning at variance, must be the source of much revenue to the postal department. Sooner or later every youth falls foul of it, and, getting into a dispute over it, appeals to his favorite newspaper for a decision. The number of such communications coming to the office of the SCIENTIFIC AMERICAN is in one sense highly gratifying, in that it shows no small percentage of the youth of the country to be among its friends. Nevertheless the incessant repetition of even an interesting question becomes monotonous in the course of years. In the hope of setting the matter at rest for a little while, to the saving of time and correspondence, to say nothing of disputation, the question may properly be taken out of the department of "Notes and Queries," and considered at greater length than would be possible there.

The great trouble with the question clearly arises from the circumstance that it involves two different ways of noting time—by sunrises, and by actual duration as measured by the clock—while those who attempt its solution do not always keep the two ideas of time distinct and separate.

Sometimes the journey is supposed to be made in one day; at others a year is allowed. Let us begin with the first case. Assuming it possible to travel at the rate of 15° an hour, so as to make the circuit of the world in twenty-four hours, we will consider the cases of A, B, and C, the first going westward, the second eastward, the third remaining at home. The time of starting is, say, noon, January 1, and each is provided with an accurate calendar clock.

At noon, January 1, A starts on his journey, travels with the sun, and makes the circuit of the world in twenty-four hours by the clock.

B, starting at the same instant, travels eastward at the same rate (15° an hour), and completes his journey in twenty-four hours by the clock.

C remains at home.

When it is noon, January 2, by C's reckoning, both by the sun and by the clock, the three men compare their reckonings. Obviously the three clocks will agree in indicating noon, January 2. During the preceding twenty-four hours, however, the sun, to A, has been steadily at the meridian, and utterly useless as an indicator of time movement. A has seen neither sunrise nor sunset, and in comparison with C's sun reckoning, he has missed one sunrise, and has accordingly lost one day. Meantime B has seen the sunrise twice, once more than C, and twice more than A. By sun reckoning, therefore, A and B are two days apart.

Suppose the time of the journey prolonged to a year of 365 days, the calendar clocks not being interfered with. Obviously all three clocks will register the same absolute duration, and stand, at noon, January 1, one year later than the time of starting.

Assuming A's progress westward to be uniform, he must, by the direction of his travel, lengthen each day (in other words, put back sunrise) nearly four minutes, the aggregate for the year making one whole day; and of course, if his speed is variable, that would be the average gain—that is, to each day's length, making the aggregate number of days for the year one less than if he had stood still. As a consequence, he will see the sunrise but 364 times in 365 days by the clock; in other words, his date by sun reckoning will be noon, December 31, the year of starting.

The days of B, on the other hand, will be similarly shortened. He will see the sun rise 366 times in 365 days by the clock, and his date, by sun reckoning, will be noon, January 2, the year after starting.

Thus, reckoning by sunrises, A will be one day behind C, and B one day ahead of C. The reckoning of A and B will, therefore differ by two full days.

Since the meridian of 180° E. or W. of Greenwich falls in mid Pacific, touching no land of consequence, it is usually chosen as the line for time correction, the day lost or gained being there added or dropped, as the case may require.

PROF. BERT'S NEW ANÆSTHETIC.

Not long since we called attention to an important paper read by M. Paul Bert before the French Academy, and in which the author suggested the benefits to be derived in surgical operations from the use of nitrous oxide as an anæsthetic, when combined with oxygen and administered under tension. M. Bert's conclusions were drawn solely from experiments that had been made by him on the inferior animals.

The first trial of the new anæsthetic on a human being has recently been made in Paris, and has proved so successful in every respect that it deserves to be made known in all its details. The experiment, according to the Paris correspondent of the *Lancet*, was performed on the 13th of February, in the "Aeropathic" establishment of Dr. Daupley, Rue Malesherbes. Dr. Labbé, surgeon to Lariboisière Hospital, was to operate on a young woman of twenty for in-growing nail; and M. Préterre, who has great experience in the use of nitrous oxide, was to apply the gas. The other persons present were Prof. Paul Bert, and MM. Reynard, Laffont, and Blanchard. At 11 o'clock the party entered the large compressing bell of the establishment, and the patient reclined on some mattresses on the floor. At ten minutes past eleven the pressure had increased to 17 centimeters without any of the party having experienced any discomfort, except some noises in the ears and a feeling of tension in the membrana tympani, but which were easily removed by a movement of deglutition. At this moment M. Préterre applied to the patient's nose and mouth the apparatus which he is in the habit of using, and which communicated with a large bag containing 120 liters of the following mixture: Nitrous oxide, 85 parts; oxygen, 15 parts. After a few seconds of hesitation the patient began to breathe deeply, and in about a quarter of a minute insensibility and muscular relaxation were complete. Dr. Labbé then leisurely performed the operation, during which the patient never gave a single sign of pain or reflex action. Her eyes were shut and insensitive, the pupils slightly contracted. About the fourth minute, as Dr. Labbé was beginning the dressing, there were a few contractions of the hands and feet; but this was all, and, as the operation was now over, the apparatus was removed.

It was then fifteen minutes past eleven. The contractions ceased, and the patient remained motionless and asleep for half a minute. She then complained of pain in her toe, and cried a little. Less than a minute afterward she sat up, and declared she had felt nothing during her sleep, but that (to use her own words) "she had gone to heaven, and had seen everything blue with stars." She declared she felt no pain, except slight headache, to which she is subject. Nothing could be more striking than this calm and quiet awakening, compared with that which follows chloroform. Her pulse had been constantly calm, and her complexion natural and rosy.

The following technical figures given by Prof. Bert are of scientific interest: The depression commenced at 11:15 o'clock, and ended at 11:19. The total pressure having ascended to 75 c. + 17 c. = 92 c. The tension of the nitrous oxide was expressed thus: $85 \times \frac{92}{75} = 104$, or, in other words, was slightly above that of pure nitrous oxide breathed in the open air under normal tension. The tension of the oxygen was $15 \times \frac{92}{75} = 18 \cdot 4$, or, in other words, slightly below that of ordinary air (20·9). But the difference is too slight to be of any consequence.

This experiment has successfully shown that Prof. Bert's mixture, which does not produce any anæsthetic phenomenon under ordinary pressure, has the effect when applied under tension of producing complete insensibility. Prof. Bert, therefore, claims for the new anæsthetic that its application is simple, that it is easily dosed, that it is perfectly harmless, and that it is not preceded by a period of excitement, or followed by the stage of reaction.

The Microphone in Mine Disasters.

The buried miners at Sugar Notch tried very hard, by pounding on the walls and doors of their rocky prison, to let their friends outside know they were alive, but did not succeed. The question is raised whether the long and distressing uncertainty as to their fate might not have been relieved had a microphone been employed. Also whether it would not be possible to devise and make known to all workers underground a simple code of microphonic signals, to be communicated by rapping and heard by means of the microphone, whereby some sort of intercourse might be kept up between those without and those within a mine under such circumstances.

International Postal Cards.

The Post Office Department has approved a design for the new international two cent postal card provided for by the Universal Postal Union and the recent act of Congress. On the upper left corner are the words "Universal Postal Union, United States of America," in English and French, the Postal Union requiring that the inscription shall be in the language of the country from which the card is sent and in French. On the right upper corner is the stamp, consisting of the head of Liberty copied from the gold double eagle, surrounded by a ribbon border, with a monogram "U. S." at the top and a buckle at the bottom with the figure "2" in octagon blocks on either side. In the upper half of the circle are the words "postal card," and in the lower half "two cents." The card has also, to more clearly define it from the ordinary one cent card, a neat border around the edge on the address side.

Hand-Training in Education.

In a paper on hand-training in the public schools read before a Massachusetts County Teaching Association, the reader, Rev. G. L. Chaney, laid special emphasis on the need of giving public school children the proper bias toward, not against, manual labor. At present children are taught in such a way that they look down upon manual labor. Education should not thus be prejudicial to the laboring interests of the country. Industrial education is absolutely necessary for us as a people. Hand-training is in reality mind-training, or "brain-building by hand." Mr. Chaney argued that special trade schools should be maintained by manufactories, for which the public school training should be a preparation. The work of the Industrial School Association in Boston was alluded to as an example of what might be accomplished in the manipulation of tools common to all the trades.

Antidote to Arsenic.

Dr. James B. McCaw, according to the *Canadian Journal of Medical Science*, remarks that dialyzed iron (which has recently been recommended as an antidote to arsenic) is simply a peroxide of iron, and exceedingly sensitive to oxygen. Hence, on slight exposure to the atmosphere, it unites with the oxygen of the latter, forming a solid oxide. He suggests the following formula as one not generally known for an antidote to arsenic, and claims for it precedence over all others; first, because it forms the surest antidote; and second, because the ingredients are always readily accessible, even to the country physician who carries saddle bags: Tincture of chloride of iron, one drachm; bicarbonate of soda (or potash), one drachm; tepid water, a teacupful. Mix. The sesquioxide of iron is immediately formed in a solution of chloride of sodium. Give this mixture almost *ad libitum*. It is a perfect antidote to arsenic.

American Coal in Switzerland.

The *Continental and Swiss Times*, published in Geneva, contains the following suggestive advertisement:

"American anthracite coal for sale at 50 francs per 1,000 kilos. Carriage free. Apply J. Lafond, 10 Rue Bonivard."

If American coal can be sold at a profit in Geneva, we see no reason why a more advantageous market may not be found at Marseilles and other ports on the Mediterranean, thus furnishing an opening for another of our products.

PROFESSOR LEWIS SWIFT, of Rochester, has been elected a Fellow of the Royal Astronomical Society of England, as a token of appreciation of his astronomical discoveries.

THE MANUFACTURE OF WIRE.

[*Continued from first page.*]

the works of "The John A. Roebling's Sons Company," at Trenton, N. J., for preparing the wire used in the manufacture of wire ropes and bridge cables.

The first operation necessary in making wire of either iron or steel, is that of rolling a wire rod from a solid bar, which usually is either 1¼ or 1¾ inch square. These bars are heated in a furnace to a welding heat if of iron, or to a bright cherry-red heat if of steel. They are then passed through the rolls a number of times—the size each time reducing—until the short thick bar becomes a very long round rod. As the size is reduced and the length is increased, it becomes possible to have the rod in several sets of rolls at the same time, and each of the rolls is reducing the size. This rolling mill, which is shown in our engraving, is arranged on the Belgian system, and is the first one introduced in the United States. It is capable of rolling rods which will make a piece of telegraph wire half a mile in length.

After the rolling the reductions of size are accomplished by cold drawing through a steel die. This operation is shown in the sketch entitled "Wire Drawing." The coiled iron rod is placed on a reel, and is drawn through the die by a wire block, which winds it again into a compact coil. After being drawn cold once or twice the wire becomes very stiff and hard, which makes it necessary to anneal it and get it in such a soft condition that it will admit of further cold drawing if desired. The annealing ovens are represented as being discharged in the upper right hand view. The wire is allowed to remain in the annealers at a dull red heat for twelve hours. All the labor and hoisting in this department are done by hydraulic machinery. After being annealed the wire has a very thin coating of oxide of iron on its surface, which it is necessary to remove before the wire can be further reduced by cold drawing. The oxide is dissolved in a weak solution of sulphuric acid, and a coating of lime water is then put on to keep the surface of the wire bright and prevent it from rusting. This operation is shown in sketch entitled "leesing the wire." The method of drawing steel wire is substantially the same as that for iron, the difference being that it requires more care and greater experience. The size to which wire is drawn is regulated by the size of ropes it is intended to make; this ranges from No. 3 wire gauge, which is ¼ inch in diameter, to No. 36 wire gauge, which is of the thickness of a hair.

The best wire ropes for general use are made of Swedish iron, while in special cases ropes made of fine crucible steel wire are necessary for economical work. For hoisting ropes, which have to stand constant bending and twisting, the lower grades of steel, such as Bessemer, have proved themselves to be almost worthless. Where only a tensile strength is required, as in bridge work, Bessemer steel can be made fully equal to any other quality.

Fig. 2.—DRAWING STEEL WIRE.

Rules for Finding the Weights that Timber of a Given Size, Supported at Both Ends, will Sustain.

R. C. Carpenter, of the Michigan State Agricultural College, communicates to the *Post and Tribune*, of Detroit, the following useful table:

1st. If a weight be uniformly distributed from end to end of a horizontal beam it produces the same effect on a beam as though one half the weight were gathered at the center of the beam.

Example.—A horizontal beam, 16 feet in length, sustains a floor 2 feet each side of it—if the weight of floor and load that may be expected to get on it be taken as 75 pounds per square foot, we should find the total load sustained by the beam to be its length, multiplied by the number of square feet sustained, multiplied by the load on each square foot, or 16 x 4 x 75 = 4,800 pounds. This would be equivalent to a center load of 2,400 pounds.

2d. (Converse of first.) If a beam sustain a certain load at the center, it will sustain twice as much load, provided it be uniformly distributed.

3d. The safe load should not exceed one fourth or one fifth the breaking load in bridges, or in floors subject to much vibration from moving bodies. In roofs the safe load should not exceed one fourth or one third the breaking load. (These precautions are necessary for two reasons: timber is injured by a load much below the breaking load, and imperfections in workmanship and materials are constantly occurring.)

4th. (The safe load is assumed to be one fifth the breaking load.)

To find the safe load that a horizontal pine beam, supported at both ends, will sustain:

Rule.—Multiply the breadth of a beam by the square of its depth, and that product by the number 90; divide this result by the length of the beam between the supports, and the quotent will be the number of pounds in the load that the beam will safely carry at the center. If the load is uniformly distributed it will be twice the safe center load, and the foregoing result may be doubled to obtain the total distributed load. (See rule first and second.) If any material besides pine is used instead of the number 90 must be used the numbers in the following table:

Material.	No.
White oak	120
Red or black oak	110
White ash	130
Swamp ash	80
Black ash	60
White beech	90
White cedar or arbor vitæ	50
Walnut	90
Tamarack	80
Spruce	90
Maple	110
Hickory	140
Rock elm	70
Locust	120
White pine	90

Example.—What will be the center safe load of a pine beam, 4 by 6 inches, supported in two places, and 12 feet long between the supports?

(1) If the depth be 6 inches and the breadth 4 inches, the center load will be equal to 4 x 36 x 90 divided by 12 = 1,080 pounds.

(2) If the depth be 4 inches and the breadth be 6 inches, the center load is 6 x 16 x 90 divided by 12 = 720 pounds. From these examples it is seen to be always most economical to set a horizontal beam on its edge, or place it so that the greatest dimensions shall correspond to its depth.

5th. To find the weight that an inclined beam (as a rafter) will safely bear at the center distance between supports:

Rule.—Find the center weight by the fourth rule—that a beam of length equal to the horizontal span or spread of the inclined beam, will safely sustain—divide this result by the horizontal span of the inclined beam, and multiply it by the length of the inclined beam.

Example.—What will a pine rafter, 20 feet long, with 12 feet rise and horizontal span of 16 feet, of 2 by 4 inches, sustain safely at center when there is supposed to be no support at its center? If horizontal and 16 feet long, the safe center weight = 2 x 16 x 90 divided by 16, or 180 pounds; dividing this result by 16 and multiply by 20, the safe center weight is 220 pounds. This would correspond to a uniformly distributed load of 440 pounds. If the rafter be supposed to carry two square feet for each foot in length, the load would be 104 pounds to each square foot.

Note.—A rafter of these dimensions would need a support at the center; in that case its horizontal span would be 8 feet instead of 16. The result would be a safe center load of 440 pounds, or a safe distributed load of 880 pounds; but this is distributed over a rafter 10 feet long instead of 20, so that on the same supposition as before the safe load becomes 41·6 pounds per square foot; a safe load for any roof.

Remark.—This rule, although sufficiently exact for ordinary purposes, and safe for ordinary roofs when the factor of safety, five, is used, must be replaced by more exact and complicated rules when very exact results are required. This is safe for all farm buildings.

6th.—When the dimensions of a horizontal beam that will safely carry a given load are wanted, the following rule must be used:

The product of the breadth into the square of the depth equals the load at the center divided by 90 for pine, or by the numbers given under the fourth rule for any other material. By assuming the depth the breadth can be found.

Example.—What sized pine beam, 16 feet long, will safely support 1,000 pounds at its center? 1,000 divided by 90 equals 77·1, equals the breadth multiplied by the square of the depth. If we assume the depth to be 3 inches, its square is 9 and the breadth 11·1 divided by 9, = 1·3.

Hence the answer is a piece 1·3 by 3.

When the load is distributed over a number of square feet the center load must first be found by multiplying by the number of feet and dividing by 2.

7th. If the beam is inclined divide the center load by the length of the beam. Multiply this quotient by the horizontal space, and proceed as in the sixth.

8th. The amount an upright beam will safely carry when subjected to a pulling strain can be found by multiplying the number of square inches of its cross section by the strength of one square inch.

The following table gives the safe strength of different woods:

Woods.	Safe strength, pounds per square inch.
Ash	3,200
Elm	1,300
Hickory	2,200
Maple	2,000
White oak	2,000
Pine	2,000
Walnut	1,600
Poplar	1,400

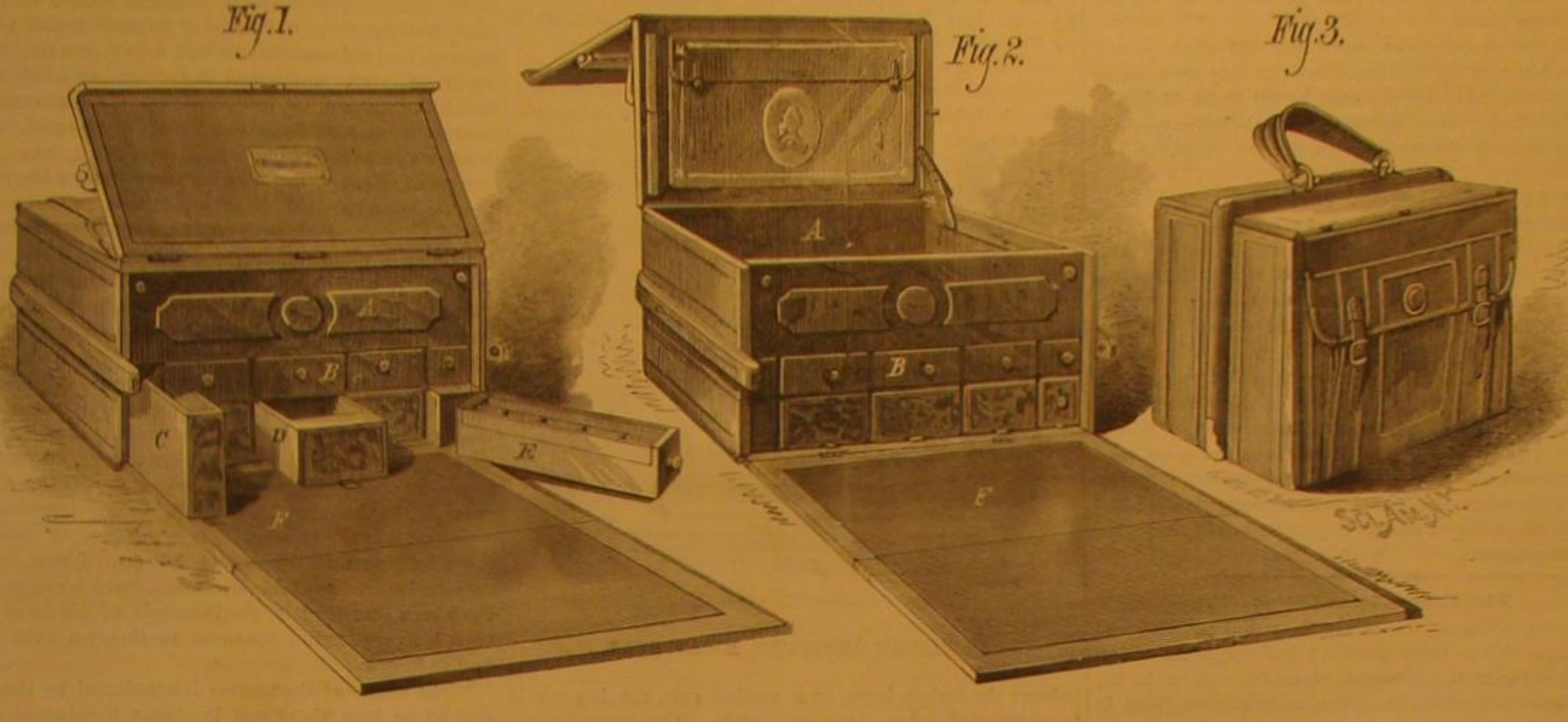
9th. The amount an upright post loaded at upper end will sustain can be found approximately in the same way as the tensile load; the amount per square inch should be taken about four fifths that given in rule eight. This is an approximate rule that cannot be relied on in cases where very accurate results are required.

These rules give accurate results with the exception of rules fifth and ninth. The results given by rule fifth are safe and do not differ much from the true results. Those given by rule ninth for the size of posts are very near correct when the posts are of moderate length.

A NEW SATCHEL DESK.

This is a unique and novel portfolio, stationery repository, and "grip sack" combined; a sort of portable office and wardrobe, which comes nearer meeting the actual wants and comforts of persons whose vocations or inclinations call them away from home than anything of a similar nature that has come under our notice.

The patent combines a valise and desk; each independent of the other. Its exterior size, appearance, and finish are that of the ordinary sixteen inch satchel, weighs but little if any more, and locks with a spring.



THE KAPLAN SATCHEL DESK.

The case is opened by placing it sidewise on a level surface, with the pocket side, A, uppermost, and unfastening the little catch attached to the movable side, then the lock knobs on the cover are pressed toward each other, releasing the top, which may be swung upward against the pocket side. The writing tablet, F, may then be turned down, and the device is ready for use.

When open it displays a drawer, B, of sufficient size to contain legal cap paper without folding, an envelope and card case, C, an inkstand drawer, E, a pen and stationery tray, two pigeon-holes for files and correspondence, a drawer in the middle for sundries, and a folding tablet, F, covered with velvet or desk cloth on one side and with silicate for pencil memoranda on the other. The valise pocket is opened by pressing the knobs of the catch and then raising the lid, which reveals the clothing compartment, A, and the collar portfolio attached to the under side of the cover. This valise pocket contains a space equal to if not larger than one side of the ordinary 16 inch satchel. It occupies one half the capacity of the satchel desk.

Persons who wish to write while "on the road," or while stopping at pleasure resorts, or while camping out or visiting, will find the satchel desk, duly equipped, a covenience of no mean nature. It seems to be just the thing for a large class of travelers, tourists, and pleasure seekers abroad or at watering places.

The necessity of borrowing writing materials or putting up with inferior ones will be dispensed with, order and system in correspondence can be maintained, and the conveniences incidental to writing at one's own desk at home may be enjoyed at any place or under almost any circumstances.

For domestic use as a lady's secretary, this "satchel desk" should become popular, inasmuch as it costs less than an ordinary desk, takes up no appreciable amount of space in a room, and can be easily carried to any part of the house. It may also be made the receptacle for jewelry and other valuables, because its compactness permits it being stored away in any safe corner or hiding place where burglars could not reach it without being discovered, and in case of fire it can be carried out without the least trouble or damage, thus making the satchel desk a more secure place for valuables than a bureau, strong box, or even a safe under certain circumstances.

The inventor informs us that the patent covers an endless variety of interior arrangements, so that by suitably altering the stationery portion of the satchel desk, or sub-dividing the clothing compartment, the device can readily be changed into a sample case for groceries, liquors, drugs, jewelry, etc. The satchel desk is made in a handsome style. Its body or interior casing is constructed of dark and white woods, handsomely veneered and mounted, drawers lined, and due precautions taken against warping or splitting by means of cross paneling. The exterior of the desk is covered with imitation leather, cloth, or real leather, according to taste of the purchaser.

For further information see advertisement on last page of this number, or address the patentee, Mr. A. O. Kaplan, No. 24 West 4th street, Cincinnati, Ohio.

STICKY FLY PAPER.—Boiled linseed oil and resin; melt and add honey. Soak the paper in a strong solution of alum and then dry before applying the above.

MOULDING, CARVING, PANELING, AND DOVETAILING MACHINE.

We present herewith an engraving of one of the most useful of recent machines for woodworking. It is capable of performing a great variety of work, such as the shaping and edge moulding usually done on shapers; surface paneling, or ornamentation of almost any design or size; moulding scroll or bracket work; and dovetailing on any thickness, from a cigar box corner to an inch and a half plank. In fact almost all the ornamentation formerly done on wood by hand can readily be done on this machine at a cost but very little greater than plain work; giving a richly ornamented surface at slight cost.

In its construction it is very simple and substantial, and is just as complete and well adapted to any of the various kinds of work it is capable of doing as though made for one variety of work only. It is easily understood and operated by any good mechanic.

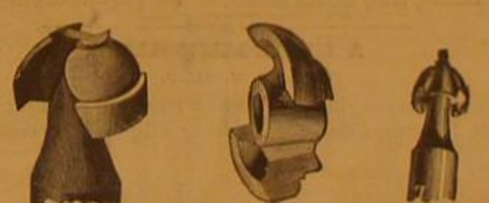


Fig. 2.—Surface Cutter. Fig. 3. Fig. 4.

The spindle, D, which carries the cutter at the upper end, is arranged to be raised and lowered by the pressure of the foot on pedal, F, and this motion is regulated by the adjusting screw and hand wheel, H. The cutter projects through the table from below, and penetrates the lumber like an auger, and cuts when revolving in either direction. Above, and in same axial line with tne cutter, the guide and pressure plate is supported by the bracket, K, and adjusted to the required height by the hand screw, N.

Reverse motion is given to the spindle by shifting belts on countershaft, or by the use of friction pulleys, either of which is furnished with the machine.

Some of the cutters used with this machine are shown in Figs. 2, 3, and 4. Fig. 2 shows a surface cutter for cutting panels on the surface of lumber. Fig. 3 shows a cutter made from solid steel, and used for moulding the edges of plain or irregular work. Fig. 4 is used for moulding the openings of scroll or bracket work.

This machine is now so well and favorably known as to need no special commendation from us. We are informed that it is not only used in all parts of this country, but that it has also found its way into every quarter of the globe, being at present used in Canada, Australia, Chili, Peru, Brazil, Denmark, Sweden, Russia, Germany, Switzerland, Cuba, Jamaica, England, Scotland, India, China, Japan, in Asia, and in Africa.

Manufactured only by the Battle Creek Machinery Co., of Battle Creek, Mich., U.S.A.

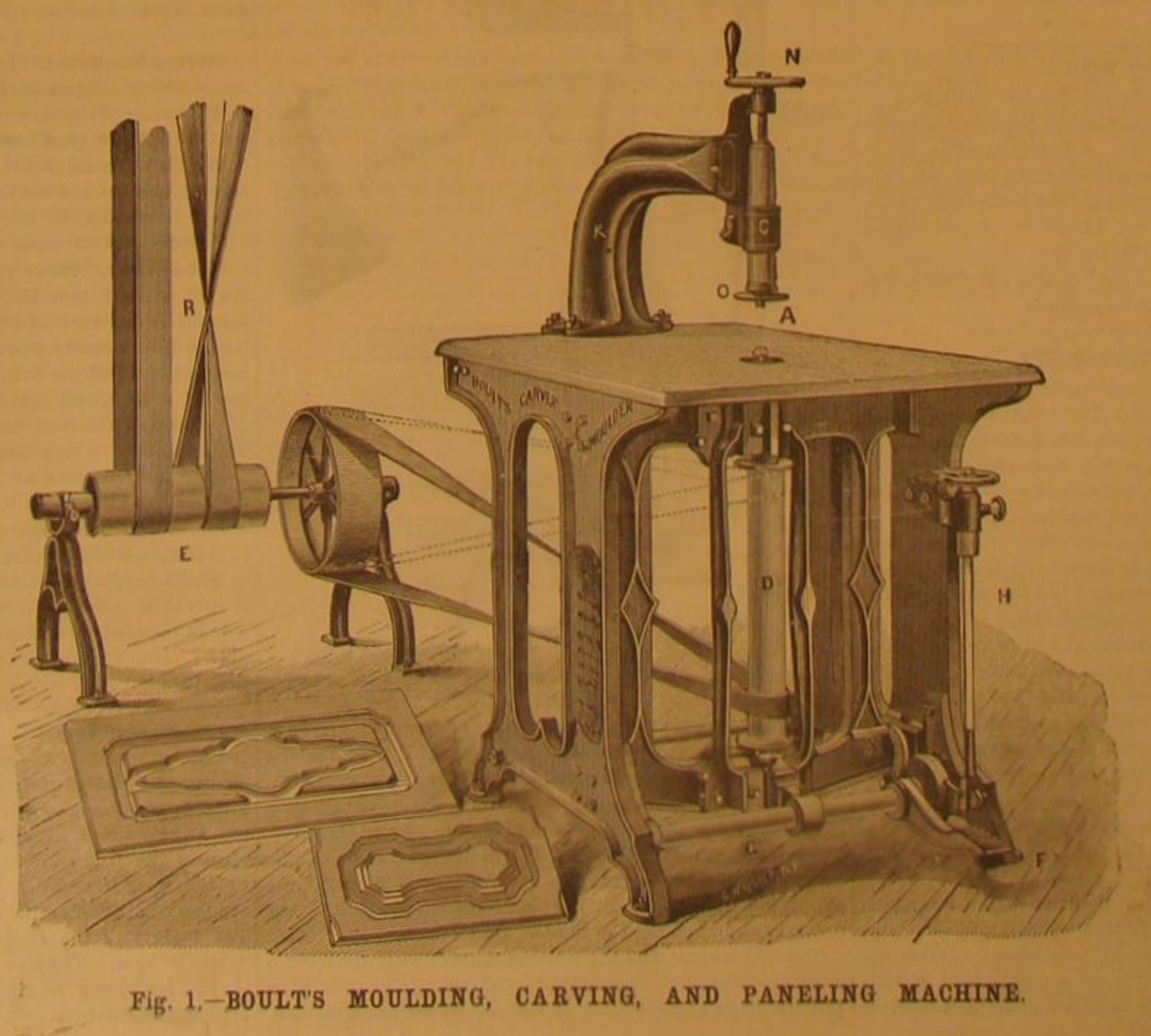


Fig. 1.—BOULT'S MOULDING, CARVING, AND PANELING MACHINE.

ENGINEERING INVENTIONS.

Mr. William J. Orr, of Rock Hill, S. C., has patented an improved car coupling, the principal feature of which is a bumper having a recess in its upper side to receive a link of approximately rectangular form, and hold it for engagement with another bumper of similar form.

An improvement in hydraulic engines has been patented by Mr. James Talley, Jr., of Kansas City, Mo. The novelty of this invention lies in an arrangement of parts for regulating the volume and force of the water allowed to act on the wheel or rotary piston.

A simple and effective car brake, that will apply as well to wheels when running on curves as when they are running on a straight line, has been patented by Mr. John Meissner, of New York City. It is stated that the efficiency of the brake increases with the increasing weight of the car and its load.

Mr. T. S. La France, of Elmira, N. Y., has devised an improved steam boiler, which consists in an arrangement of a cluster of flues in the fire chamber, joined at their upper ends to a single pipe passed through the crown sheet. It is stated that a great extent of water surface may be exposed to the heat without taking up too much of the crown sheet and limiting the space for smoke flues.

An improved safety regulator for pumps and water pipes has been patented by Mr. T. J. Smith, of New York City. The object of the invention is to avoid the necessity of a separate line of pipe from the water level to a pump on each floor, and to automatically cut off the communication with the street main when the water pressure exceeds the usual point, while admitting of the use of pumps during the period of increased pressure.

The Prospects of Cotton.

Mr. Edward Atkinson, one of the shrewdest business men of New England, has lately made a trip through the cotton States to investigate the prospects of cotton culture in the South. The results of his investigation have been given in the *Herald*. Touching the main point of his inquiry, he says:

"I consider an ample supply of cotton as sure or even more sure than that of any other crop. So long as the cotton States can buy from the West corn and bacon at such prices that forty cents will pay for all that an adult laborer can eat in a week—about three and a half to four pounds of bacon and a peck of meal—the South will raise cotton. It is their money crop. It is now the product of the farm and not of the plantation. The farmers of northern Georgia make a hundred bales of cotton where they made ten a few years since, and the increase of cotton by white labor in Georgia, North Carolina, and Texas will offset any possible decrease in Louisiana and Mississippi, even if the exodus amounts to a severe drain on labor. Moreover, the value of the seed of cotton has hardly begun to be known. Within ten years the seed will be worth half as much as the bale, if not fully as much. The lint left on the hull by the gin is useful for batting; the hull for tanning or for the extraction of dyestuffs; the spent hull for paper stock, for which it is admirable; the kernel first for oil and the residue for feed. There are new methods lately disclosed for extracting every particle of oil, which leaves the residuum sweet, dry, and extremely nutritious for food for sheep or cattle—more nutritious than beans; and if the residue be fed to sheep on the cotton field the crop of cotton will be doubled and the clip of wool added thereto."

A Suggestive Device.

Mr. George Wall, of the Peradeniya Botanic Gardens, Ceylon, has devised an ingenious method of fumigating coffee trees for the cure of the leaf disease. A paper umbrella, with a curtain hanging from it, is dropped over the tree, and fastened by the handle; a lighted sulphur fuse is then placed underneath, and it is said that the fumes are retained long enough to attack the spores of the fungus.

Possibly the plan might be found useful for destroying, by fumigation the parasites of other plants.

IMPROVED MICROPHONES.

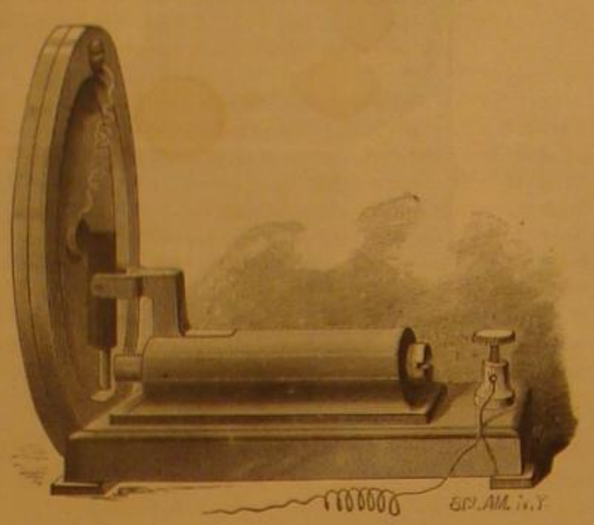
A new and improved form of microphone has lately been devised by Mr. Frank Dowling. The improvements, says the *Electrician*, consist mainly in the use of a thin diaphragm to take up the sound waves, and a magnetic adjustment with which the pressure of the carbons may be varied. The diaphragm may be of animal or vegetable parchment, or thin India-rubber, or it may be a thin plate of metal. The vibrating disk is two or three inches in diameter, and screwed firmly between two boards. To the center of the disk is fastened a small piece of carbon, from which a thin wire passes to one terminal screw. A rod of carbon about an inch in length, having a piece of iron or steel rod fixed in one end, is balanced on its axle, and rests lightly against the carbon block. A small bar magnet is adjustable by a brass screw either to or from the rod projecting from the balanced carbon, and thus the pressure between the carbons may be regulated.

For transmitting speech it is preferable to have the diaphragm in a vertical position, but for experiments it is horizontal.

This microphone is much more sensitive and of less resistance than others, and transmits speech perfectly and distinctly. Speaking at a distance of about 200 feet from the transmitter can be heard, and some sounds about a mile distant. With a battery of two cells it will act as a receiver having a similar transmitter. This microphone will receive speech and other sounds. Mr. Dowling considers that this is due to vibrations imparted to the carbon and diaphragm by the current itself, the current and vibrations being varied by the transmitter. He is of opinion that this is also the cause of the "singing noises" observed sometimes.

In another speaking transmitter the diaphragm causes a small carbon ball to vibrate in a carbon tube or case. This requires no adjustment, and may be used in any position.

The magnetic adjustment may be applied to ordinary lever microphones, and Mr. Dowling finds it preferable to



DOWLING'S IMPROVED MICROPHONE.

balance the carbon lever on a vertical axle, the lower axis being pointed and working on a plate. The magnet tends to draw this against a carbon block.

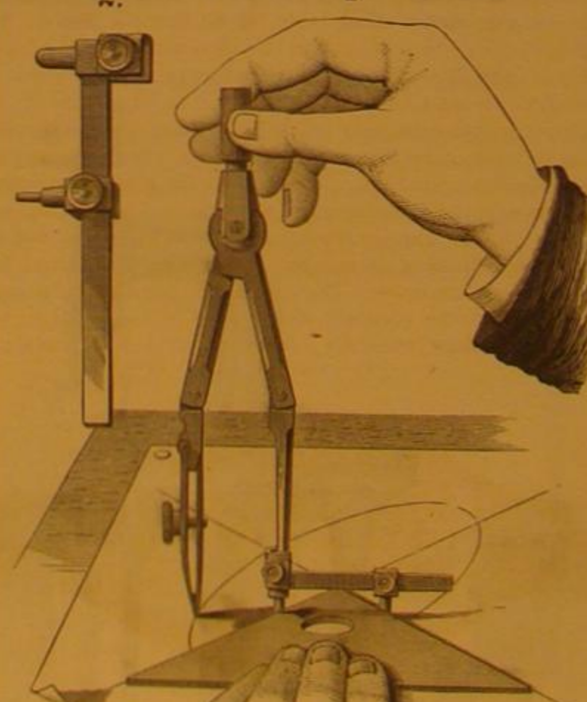
Mr. Dowling has also devised a remarkably small microphone. It consists of two small blocks of carbon, having a cup shaped hole in each, and a small carbon ball placed inside. The blocks are insulated by parchment or some other non-conductor placed between them. One of these in a case, having a binding screw at each end, forms a very portable microphone. The ball is, in this case, the vibrator, making contact between the carbon blocks. A microphone has been made in this way only ⅛ inch (cube) in size, being covered with paper, wires being placed against opposite sides. The usual size is ¼ inch (cube), either with or without a casing of wood. The speaking microphones mentioned above come nearer to perfection as transmitters than any others, and, unlike others, do not get out of order.

A SIMPLE ELLIPSOGRAPH.

BY S. W. BALCH.

The accompanying illustrations represent a simple attachment for compasses for drawing ellipses. It consists in

2. 1.



adding an extra point to the compass and then employing it in a manner similar to the way the trammel is used for the same purpose. From the consideration that the draughtsman does not have many ellipses to draw, the cross bars have been dispensed with for the sake of simplicity and the triangle made to take their place. It will be observed that the point inserted in the compass leg, and also the one on the sliding piece, are blunt at the end, so as not to catch on the paper in sliding along the edge of the triangle.

This instrument has the disadvantage of only drawing a quarter of the ellipse at a time, and of requiring a little practice in its manipulation on the part of the draughtsman. On the other hand, it possesses the advantages over the trammel of a greater range of work, of not requiring an additional pen and pencil to keep in order, of compactness, of simplicity, and cheapness.

Professor Morton on the Gary Motor.

The following note from Professor Morton was lately read at a meeting of the Franklin Institute, Philadelphia:

Dr. Isaac Norris, Secretary of the Franklin Institute:

In reply to your favor of the 10th, asking for a note on the "Gary motor," to be read at the next meeting of the Institute, I would say, that though I have not time at present to go into any lengthened discussion, and indeed do not think that such a subject merits so much attention, I will with pleasure contribute the following remarks to the proceedings of next Wednesday.

This so-called "Gary" motor comes before the public in a double character. First as a perpetual motion machine, which is to do work without transformation of energy. In this light I think we may at once dismiss it as a fraud or blunder, to take its place with materialization of spirits, and other matters which are not subjects for the investigation of scientific students, but rather in the line of the police detective.

Secondly, however, Mr. Gary appears as the supposed discoverer of some new facts in reference to the action of magnets, which, though they certainly can no more enable us to create energy than to create matter, may add to our means of utilizing natural forces and existing sources of energy. In this view his claim of discovering what he calls a neutral line round magnets is worth investigation.

On looking into this matter, however, I find that he has only reobserved a set of phenomena, which are so old as to have been described in the Principia of Sir Isaac Newton, book ii., prop. xxiii., scholium to theorem xviii., where I find as follows:

"The virtue of the magnet is contracted by the intervention of an iron plate, and is almost terminated at it; for bodies further off are not attracted by the magnet so much as by the iron plate."

All Mr. Gary's experiments which will work are readily explained by the well known principles of magnetic induction, by reason of which a piece of soft iron near a magnet is inductively magnetized by the same, and rests upon it, and thus "contracts the virtue of the magnet" and neutralizes its action on exterior bodies.

There is no evidence whatever of the existence of any neutral line about a magnet, but the very experiments cited by Mr. Gary as proving it simply demonstrate that in certain relative positions the opposing actions of a permanent magnet and a piece of soft iron magnetized by induction from it, neutralize each other's effects upon a third magnetic body, such as a piece of iron or a compass needle.

Fully to work out all the relations between the mutual actions of three such bodies in any case is of course a problem of considerable complexity, but by no means a new one, and among many others a very able discussion will be found in the "Philosophical Transactions" for 1831, page 501 *et seq.*, by Sir Wm. S. Harris, under the title "On the Power of Masses of Iron to Control the Attractive Force of a Magnet." Also an earlier memoir by the same author in the Edinburgh Philosophical Transactions, 1829. This subject is also fully treated in Harris' "Rudimentary Magnetism," published by John Weale, London, 1850. Very truly yours,

HENRY MORTON.

Stevens Institute of Technology, Hoboken, N. J.,
April 12, 1879.

A Plan to Flood the California Desert.

Within a recent period, geologically speaking, a large portion of Arizona and the Colorado plateau has been converted into a desert by the drying up of an arm of the Gulf of California, cut off from the sea by silt brought down by the Colorado river. Some years ago it was proposed to refill the old sea bed, now known as the Valley of Death, by turning into it the water of the Colorado. General Fremont has been urging another plan. He says that a canal ten miles long would lead the waters of the Gulf of California to the bed of a lake, and another cut-off, fifteen miles from the upper end of the lake, would admit the waters to the great basin, parts of which are 350 feet below the sea level. Six months are estimated as the time required for the work, and the cost one million dollars. General Fremont, as the Governor of Arizona, lays great stress upon the value of this engineering work in reclaiming desert land in that Territory, in which purpose the United States is not strongly interested at this time. But the new inland sea might prove serviceable in opening up a water route through Southern California of value to commerce, and in this respect of some national importance.

THE Russian Imperial arsenal at Petrozavodsk has just completed its 40,000th cannon. The works, which are situated on the shores of Lake Onega, in the Olonetz government, were founded in 1774, since when it has been the custom to brand each cannon cast with a consecutive number. Most of the field artillery of native manufacture employed by the Russian army is cast at Petrozavodsk, the heavier ordnance being manufactured at Perm or St. Petersburg. The budget of the foundry mostly amounts to a million rubles a year. The iron used at the works is brought from the half a dozen mining establishments that exist in the province of Olonetz.

Correspondence.

Alleged Vermont Marble.

To the Editor of the Scientific American:

I see that in your last issue you quote a report on marble, by Professor J. P. Henderson, of Loyola College, Baltimore, and Professor J. E. Watson, of Oberlin College.

Permit me to say that no such person as J. E. Watson has ever been connected with this college in any way, and the president of Loyola College denies that any such man as Henderson was ever there.

I suspect that the paper which you quote is a fabrication of some marble company in an endeavor to create a prejudice against dark colored marbles.

I have no pecuniary interest in the matter, but I think a fraud ought to be "spotted." I have seen a copy of the *Rutland Herald* for April 5, which exposes this pseudo-scientific report.

ALBERT A. WRIGHT,
Prof. Geol. and Nat. His., Oberlin College.
Oberlin, Ohio, April 29, 1879.

Preparation of Nitric Oxide.

BY S. K. HITCHINGS.

This gas as usually prepared, by the action of nitric acid on copper, contains nitrous oxide and some free nitrogen, as is well known; but the extent of this impurity, I think, is not generally known.

I have in a number of cases observed failures in class experiments with it, by its supporting ordinary combustion brilliantly instead of extinguishing it, as it should. This fact led me to make a quantitative examination of it, in which I found that the gas first formed in the reaction contained about 95 per cent of nitric oxide, but as the solution in the generator became saturated with cupric nitrate, the quantity of impurity gradually increased, and when it became nearly saturated, an analysis resulted as follows: Nitric oxide, 53·6; nitrous oxide, 31·6; nitrogen, 14·8; total, 100·0. This would, of course, account for its supporting combustion so readily and causing so much trouble to teachers, and I would suggest that a piece of apparatus might be easily made, which would avoid getting so much of this impurity, by simply introducing a siphon tube through the cork of the generator, and attaching a piece of rubber tubing and a compressor to the delivery tube, so that when the acid became somewhat saturated the delivery tube could be closed and the solution drawn off, then more acid added and the process go on. By this means, I think, a gas sufficiently pure for ordinary experiments could be obtained.

A Cheap Greenhouse.

The *Germantown Telegraph* says: The cheapest plan of erecting a greenhouse that we have any knowledge of—and we used one successfully for many years—is to dig out a pit in a side hill, where the upper end will be just above ground and the lower end will be two or three feet above ground, where the door must be, with two or three steps down for an entrance. Wall up, roof the wall, and cover the whole with sash, as in hotbeds, the sash having more fall, say three feet in a width of two, the house being fifteen by ten. Erect in this the stand of shelves, and when it is time to take up the summer flowers, bulbs, etc., store them here. The glass should be covered with thick straw mats, which can be removed even when the weather is coldest, in clear weather, for an hour or two at midday, to get the warmth and influence of the sun. At such times ventilation also should be attended to, by slightly opening a sash or two. No fire is needed. Nearly all readily flowering plants will bloom, and there will scarcely be a week during the winter that a bouquet may not be gathered, if the house is properly managed.

Asphalt and Timber Floors.

A new method of laying down floors has been adopted in France, and is said to have obtained a wide application. It consists in putting down flooring, not as hitherto, on joists, but in embedding the boarding in asphalt. The new floors are used mostly for ground stories of barracks and hospitals, as well as churches and courts of laws. Pieces of oak, usually 2½ to 4 inches broad, 12 to 30 inches long, and 1 inch thick, are pressed down into a layer of hot asphalt not quite half an inch thick in the well known herring bone pattern. To insure a complete adhesion of the wood to the asphalt, and obtain the smallest possible joints, the edges of the pieces of wood are planed down, beveling toward the bottom, so that their cross section becomes wedge-like. Nails, of course, are not necessary, and a perfectly level surface may be given to the flooring by planing after the laying down. The advantages of this flooring, which only requires an even bed on which to rest, are said to be the following:

1. Damp from below and its consequence, rot, are prevented.

2. Floors may be cleaned quickly and with the least amount of water, insuring rapid drying.

3. Vermin cannot accumulate in the joints.

4. Unhealthy exhalations from the soil cannot penetrate into living rooms. Asphalt being impermeable to damp, rooms become perfectly healthy, even if they are not vaulted underneath. In buildings with several stories, as in hospitals, the vitiated air of the lower rooms cannot ascend, an object which it has hitherto not been possible to attain by any other means.

5. The layer of asphalt will also prevent the spreading of fire from one floor to another in case of conflagration.

The Interlocking of Homes.

The Springfield *Republican* remarks that the houses in American cities are fast coming to be, in a sense, like the rooms of a big hotel, having a call bell in every room to reach the office, and a way in the office to reach every room. The telephone puts people in such easy communication that it is easier to talk to a neighbor through it than to go to him; as men having offices in the same building find it more convenient to talk to each other from their desks, by way of the telephone office, than to cross a hall. And this is only the beginning of the means by which the homes in a city are to be interlocked.

The Chicago *Times*, eighteen months ago, announced with a great flourish that it had connected its office by pneumatic tubes with the Western Union office at an expense of $20,000, so as to save ten minutes' time in receiving its messages. Now the streets are torn up around the City Hall Park in New York to connect every newspaper office there in the same way. The packages travel about a mile in three minutes, and announce their arrival by an automatic arrangement. If the plan works well for this special purpose, it will not be long before a pneumatic express tube for all the lighter articles of daily marketing and convenience will come to be as frequent in well appointed houses as the telephone.

IMPROVED STOCK AND DIES FOR PIPES AND BOLTS.

The tool which we illustrate is intended to meet the requirements of those who have been annoyed with the numerous inconveniences arising from the use of the common stocks and dies. In its construction the inventor has aimed to retain all the advantages of the old methods, while at the same time gaining many others in addition.

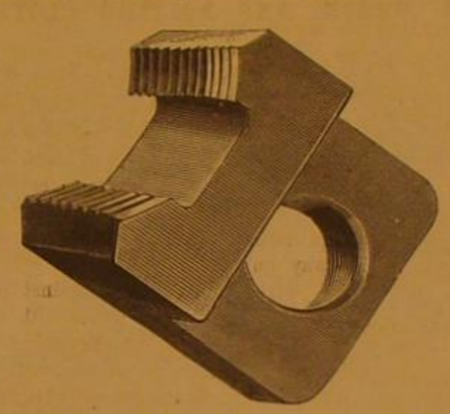


Fig. 2.—DIE FULL SIZE.

The tool belongs to the class of divided dies, and by means of the adjusting screws, as shown in Fig. 1, the dies can be moved to and from a common center, within the variations of a given size of fittings. The dies have a double taper, that is, the taper at the entrance for the first few threads is greater in degree than the standard taper, which forms a lead to the dies, causing them to start on the pipe without filing, even when there is a swell or burr, and requiring no pressure whatever to start the dies on the pipe. In Fig. 2 one of the dies is shown separately. It will be seen that the threads can be reached readily, and that the dies, when dull, may be sharpened by grinding. This obviates the necessity of sending them to the manufacturer—a saving both in time and expense. These dies are interchangeable in the stock, and do not need adjusting to cut the standard size of thread for which they are made. They are made adjustable for variations from the standard size. Both stock and dies are marked to show when the dies are set for cutting standard sizes. Altogether, the new tool seems to be a very useful and desirable one. Any mechanic who has had experience with ordinary solid dies will readily appreciate the advantages possessed by this improved tool. Mr. F. Armstrong, Bridgeport, Conn., and 347 Broadway, New York, Room 15, is the manufacturer.

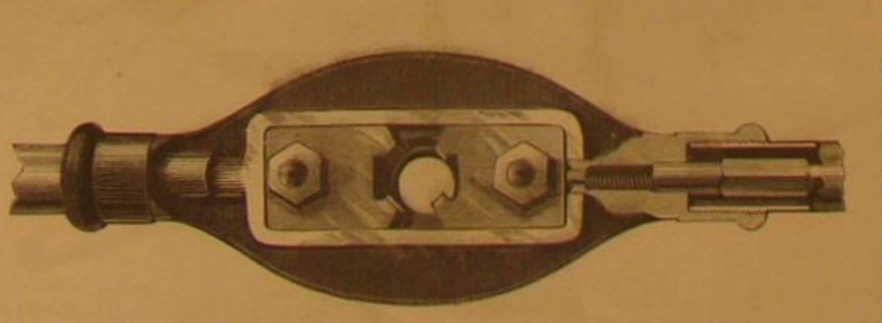


Fig. 1.—ARMSTRONG'S IMPROVED STOCK AND DIES

Scented Crematory Urns.

An interesting archæological observation has recently been made quite accidentally. It is well known that the urns found in Roman burial grounds, and containing the bone remains of cremated bodies, are often covered with clay cups or dishes. The object of these dishes was supposed to have been to contain spices, which sent forth agreeable odors during the progress of the cremation. Herr Dahlem, a well known German archæologist, was able to verify this view in the following manner: He had obtained a dish of this kind which was broken, and, after cementing it, had placed it upon a stove for the purpose of drying the cement. Shortly afterwards he noticed a strong and by no means unpleasant odor proceeding from the heated dish. It seems, therefore, that the ingredients burned in the dish some fifteen centuries ago had left traces behind, which announced their presence upon becoming heated. Herr Dahlem remarks that the odor was not unlike that of storax.—*The Nation.*

A New Iron Firm.

Mr. Richard Pancoast, for several years the New York manager of the well known Philadelphia house of Morris Tasker & Co., has formed a copartnership with Mr. H. G. H. Tarr for the transaction of business in pig and manufactured iron. The new firm, in addition to a general commission business in iron and piping, have been appointed agents for the Reading Iron Works. The office of Messrs. Pancoast & Tarr is at 28 Platt street.

Underground Telegraph Wires.

The favor with which underground telegraph wires are viewed in Europe does not prevail in England. In a recent lecture before the Society of Arts the Electrician of the English Postal Telegraph Department, Mr. W. H. Preece, said that there are 10,000 miles of underground wires in Great Britain, but the system does not prove economical.

There is an increase of three or four times in the cost of the underground lines. Their capacity for carrying currents is reduced three or four times. The gutta-percha coating is attacked not only by rats and mice, but very largely by an insect called the *Tempeltonia crystallina*, and is also influenced by a fungus.

RECENT AMERICAN PATENTS.

Mr. Albert Whiting, of Rochester, N. Y., has devised an improved machine for raising and floating hides in tan vats. This is an improvement on patent 205,596.

A lantern, combined with a hood to be worn by a horse, has been patented by Mr. L. C. Macauley, of Augusta, Wis. The inventor claims that both driver and horse can see the condition of the track to better advantage than when the lantern is placed on the carriage.

Messrs. P. J. Clark and Joseph Kintz, of West Meriden, Conn., have patented an improved drip-dish for lamps. It consists of a dish to be screwed on the lamp bracket or stand, and provided with a metal fount holder, which securely holds the lamp.

An improvement in boot and shoe heel burnishers has been patented by Mr. James Murray, of East Orange, N. J. It is especially adapted to work on concave French heels.

An improvement in breast-yoke connections, patented by Mr. J. W. Vineyard, of Gallatin, Tenn., consists in a socket piece for attachment to the neck yoke, in which is fitted a ball on the end of a metal loop or eye for supporting the tongue. The ball and socket give perfect freedom to the movement of the tongue; and the connection is said to be neater and more durable than leather.

An improvement in steels for long corsets has been patented by Mr. Joseph Beckel, of New York city. The lower ends of the steels are bent inward and provided with pads, which prevent them from hurting when the wearer sits down.

An improved device for preventing the sand and dust from working in at the inner end of the hub of a carriage wheel and cutting and wearing the axle and axle box, has been patented by Mr. Robert Schnell, of St. Paul, Minn.

A knife board, which consists of a box provided with an inclined bottom having a concave upper surface, forming a bearing for the edge of the knife while it is being polished, has been patented by Mr. A. M. Ward, of New Haven, Conn.

Mr. David C. Carleton, of 121st street and 3d avenue, New York, has patented, both in this country and in Canada, an improved bridle bit, which is calculated to give perfect control of the horse. The arrangement of the bit and bridle cannot be clearly described without an engraving. The bit is supported by a nose band and a strap passing to the crown piece of the bridle, which prevents it from dropping from the horse's mouth when the check rein is unfastened.

An improved carpet stretcher, consisting of two arms connected together by a pivot and having T-shaped heads, one being provided with hooks for engaging the carpet, the other being adapted to a jointed extension piece, has been patented by Mr. J. D. Whitney, of Plover, Wis. The stretching of the carpet is effected by straightening out the toggle formed by the two pivoted pieces.

An improved coat, supplied with an extra lining which may be readily detached and replaced by another one, has been patented by Mr. Nils Malmar, of Brooklyn, N. Y.

Mr. Cornelius Barnhart, of Walker Valley, N. Y., has patented an improved heating stove, which may be used for heating several rooms, and is so constructed that the parts most liable to be burned out may be easily removed and replaced.

An improved machine for filling and corking bottles has been patented by Maria E. B. Miller, of Omaha, Neb. This machine is designed to fill the desired number of bottles simultaneously, and with exactly the same quantity of liquor.

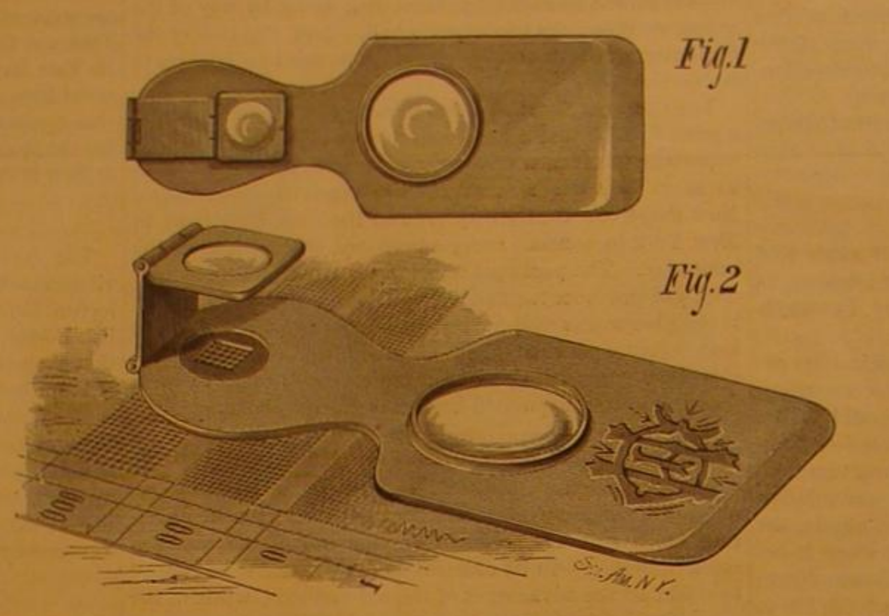
A NEW FLOUR, GRAIN, AND BOLTING CLOTH INSPECTOR.

The accompanying engraving represents a convenient little instrument, which the inventor, Mr. H. J. Deal, calls the Board of Trade flour, grain, and bolting cloth inspector. It consists of an ivory spatula, in the center of which is mounted a fine lens of sufficient power to detect anything irregular in the flour or grain. When not in use the cloth glass, which is hinged to the handle of the spatula, is folded down, as shown in Fig. 1. When it is desired to use it it is unfolded and brought over the opposite side of the handle, as represented in Fig. 2. The length of the link which supports the glass is equivalent to the focus of the lens, so that no adjustment will be required. The square aperture in the handle below the lens is equivalent to one sixteenth of a square inch, or one fourth of an inch on each side. When the handle is placed over the bolting cloth the number of its meshes may be readily counted and its quality inspected.

In using the larger lens the flour or other substance to be examined is first smoothed with the ivory spatula; the lens is then held at a suitable distance.

The instrument is designed for the use of the Board of Trade, millers, and others who have occasion to inspect grain, flour, or any similar substance.

This invention was recently patented by Mr. Henry J. Deal, who may be addressed at 35 Union Square, New York, or at Bucyrus, O.



DEAL'S FLOUR GRAIN AND BOLTING CLOTH INSPECTOR.

A Word to Insurance Officers.

The *Plumber and Sanitary Engineer* suggests to life insurance companies, that instead of merely hammering at a man's chest to find if he has a tendency to any disease, would it not be well for the medical examiners of life insurance companies to inquire if he has not got a cesspool leaking into his well, or untrapped pipes beneath his basins and closets ?

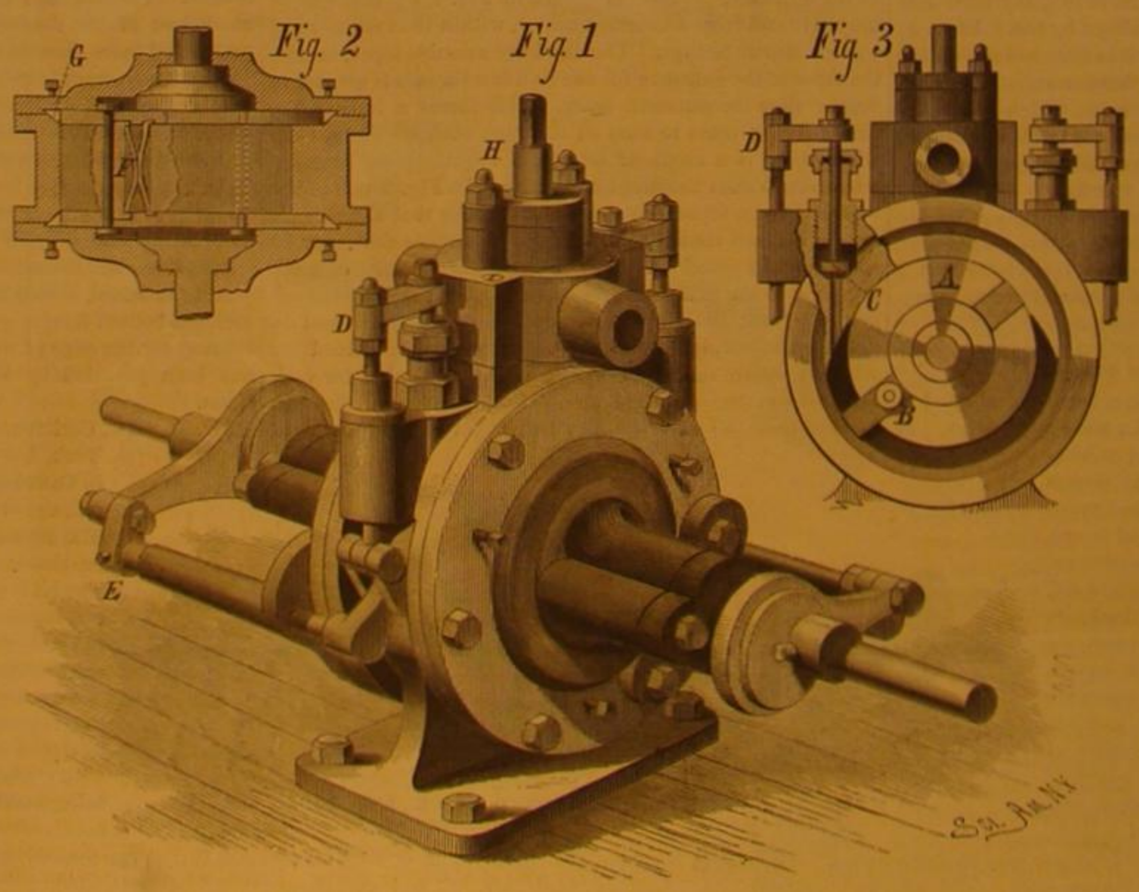
More persons die of zymotic diseases in New York than from almost any other malady, yet a man living in the midst of contagious influences, and hence daily liable to take diphtheria or typhoid fever, would yet find little trouble in getting a heavy policy on his life.

If insurance officers would give this subject their attention they might save many losses to their companies, and also benefit the public generally; for if men found that their homes were rated as "hazardous," they would soon begin to think of finding a remedy for the difficulty.

A NEW ROTARY ENGINE.

We present herewith an engraving of a rotary engine recently patented by Mr. John Henderson, Jr., of Waterbury, Conn., which possesses several novel points that seem worthy of notice. The cylinder, as will be seen in the sectional view, Fig. 2, is made in two diameters, the smaller fitting the solid hub or boss, A, secured to the engine shaft, the larger receiving the sliding wings or pistons, B, during one half of a revolution. Upon each side of the hub there are flanges which are grooved to receive pistons, and are packed around their peripheries by beveled packing rings, G, which are adjusted by set screws in the cylinder covers. The pistons are, in fact, formed on opposite ends of a single piece extending through the hub and having two mortises, F (Fig. 3), containing springs, which press outward the axles of two pairs of rollers which roll in cams formed in the cylinder heads, and move the pistons as the hub revolves, so that while one is drawn into the hub to allow it to pass the abutment, the other is projected so that it may be acted upon by steam pressure. Steam is admitted to and exhausted from the cylinder through poppet valves, C, which are operated by eccentrics on the principal shaft through the rock shafts, E, and the lifting rod, D. It will be noticed that the engine is symmetrical, that is, the valves, eccentrics, etc., are alike on both sides of the cylinder. A reversing valve, H, is placed at the top of the engine for directing the steam into one side of the cylinder or the other, as the case may require.

The inventor informs us that this engine will reverse as readily as a locomotive, and that it may be used wherever a very compact and simple motor is required. The bearing surfaces are all large and well calculated to withstand wear, and all of the parts are readily accessible and very easily adjusted. The steam joints are all arranged so that they may readily be kept steam tight without creating undue friction or wear.



HENDERSON'S ROTARY ENGINE.

MISCELLANEOUS INVENTIONS.

A lantern, for use in millstone dressing, has been patented by Mr. P. V. Coogan, of New York City. It throws a clear light upon the land or furrow of the stone, and is contrived so that the draught produced by it carries off the fine dust arising from the stone.

Messrs. P. J. Clark and Joseph Kintz, of West Meriden, Conn., have patented a novel fastening for securing the lamp fount in the drip cup. It consists in a cup having near the bottom inwardly projecting ribs or lugs, which engage a flange formed on the bottom of the fount, the flange being notched to admit of placing it in the bottom of the cup.

An improvement in the class of ice-making apparatus in which the vapor of the ammonia is driven from its solution by heat, and afterward condensed by being passed through cooling pipes, and then expanded through pipes to produce the cold by freezing, has been patented by Mr. Charles B. Lee, of Galveston, Texas.

Mr. Isaac Morgan, of Augusta, Ga., has patented an improvement in separators for flour mills. The object of the invention is to separate the half ground bran, cracked wheat cuttings, and other results of grinding from the thoroughly ground chop, and carry it off to a suitable receptacle, from which it may be taken for a second grinding.

Mr. Albert Clarke, of Sheffield, England, has devised an improvement in the manufacture of scissors, consisting in flying out scissor blanks from a sheet or strip, which has one or more projections or indentations in its sides, the projections being located so as to form the shoulder on the scissor blank.

Screw Propulsion.

A new feature in connection with the working of the screw propeller has recently been determined by Mr. R. Griffiths, whose name has long been known in connection with this method of propulsion. Hitherto screw propellers have been placed as close as possible to the stern post of vessels, but this position Mr. Griffiths has proved to be the wrong one. From a long course of careful experiments he has been led to conclude that the propeller should be placed some little distance from the stern post and close to the rudder post to get the best effect as regards speed. To demonstrate this some trials were recently made with a model boat 5 feet in length fitted with an ordinary screw driven by clockwork. The screw was four-bladed, 3¼ inches in diameter, and 3·9 inches pitch, and was, in fact, a copy of the screw with which the Peninsular and Oriental Company's new steamship, the Kaisar-I-Hind, is fitted. By fixing the screw ⅝ of an inch from the stern a speed of 100 feet per minute was obtained. By increasing the distance to ¾ of an inch the speed was increased to 104 feet per minute. Placed at 1¼ inch from the stern post, a speed of 110 feet per minute was attained. The screw was then shifted to what Mr. Griffiths considers to be the best position—namely, 2½ inches from the stern post, and this resulted in a speed of 114 feet per minute. This shows an ultimate increase of 14 feet per minute upon the first arrangement. The ordinary screw was then removed, and in its place was fitted a Griffiths four-bladed screw of similar dimensions to the one it replaced, but having the forward edge of each blade cut off. This screw was first fixed 1¼ inch from the stern post, and a speed of 116 feet per minute was made. At 2½ inches—the best position—the speed was 122 feet per minute. A part of the deadwood, 1½ inch long, was then removed from the stern, and the screw was placed 2 inches from the end of the ship thus exposed, when the speed attained was 110 feet per minute. The screw was then removed 1½ inch forward, or ½ inch from the end of the wood, and the speed was only 48 feet per minute. It will be seen that in both cases the highest speeds were attained with the screw in what Mr. Griffiths considers the best position, but that the Griffiths screw gave a higher speed than that of ordinary construction under similar conditions. So far as these experiments go, Mr. Griffiths has certainly made out a good case, and if the results of practice only correspond with those we have given, an important advance will have been made in screw propulsion.—*London Times.*

Effects of Breathing Noxious Vapors.

In some experiments lately made by M. Poincaré on the effects of poisoning by sulphide of carbon, he often found in the bloodvessels drops, apparently of this substance, condensed anew after absorption by the lungs. Still, the great volatility of the substance rendered this improbable *a priori*, and, as he had not succeeded in chemically determining what the drops were, he hesitated to express the view referred to. He has since obtained like results with other substances not miscible with blood, and which are much less volatile than sulphide of carbon, especially spirit of turpentine and nitrobenzine. The chemical determination, indeed, was as difficult as before; but from the fact that it was only in animals that had respired those vapors that free drops had been found in the circulation looking exactly like the substances furnishing the vapors, he thinks the matter worthy of attention. Workmen who respire vapors of this kind are evidently exposed to a poisonous action, variable with the vapor's composition, and also to mechanical disturbances of the circulation and nutrition, similar to those produced by embolia and the introduction of air into the veins. Thus may probably be explained the sudden deaths observed in the course of experiment with those substances; and perhaps certain fatal results from taking chloroform have been due to the same cause. The drops in question, found in nearly all the organs, are specially abundant in the liver, kidneys, and lungs.

"READ not to contradict and refute, nor to believe and take for granted; but to weigh and consider."—*Lord Bacon.*

THE ORCHIS FAMILY.

The peculiar manner in which fecundation takes place in the flowers of the plants belonging to the orchis family has always attracted the attention of naturalists, and when Darwin, a few years ago, published the results of a series of experiments and observations, made with a view to throw additional light on the mode in which mutual fecundation is effected between individuals of the same as well as different species and genera, the work was received with much interest by the entire scientific world.

Generally only one, rarely two, stamens are developed in plants of this family. The stamen is considerably longer than, but entirely coherent and confluent with, the style on which the two-celled anther is situated. The latter consists of a slender stem or caudicle, to which are attached two club-shaped arms. The glands of the stigma, to which the stalks of the pollen masses cohere, are contained in a common sac formed by a fold in the lower portion of the stigma.

The pollen grains of the orchidaceæ vary in shape as well as in structure and appearance. The pollen is sometimes pulverulent, and in isolated grains, as in some species of neottiæ, but more frequently cohering in waxy masses or clusters. To effect fecundation the pollen must, by reason of its position relative to the stigma, be forced by some mechanical means from the pouches in which it is contained, the anther being moved toward the extremity of the stigma, which, like the base of the anther, is covered at maturity with a viscid mass.

The perianth may be divided into two portions: the outer, consisting of the three sepals, and the inner, formed by three petals. Both sepals and petals are of the same texture and appearance. The upper or posterior petal appears generally, on account of the twisting of the stalk and ovary, to be the lower or anterior one, and is called the lip. To this is attached the nectary in form of a spur. The nectar contained in it serves solely to attract insects, the intermediation of which is, in the majority of the orchidaceæ, indispensable for fecundation. As soon as an insect inserts its trunk into the nectary, the anther moves forward, the pollen is forced from the pouch, and attaches, by means of the waxy mass by which it is held together, to the trunk and head of the insect. Frequently butterflies, bees, etc., are found, the trunks, heads, and fore legs of which are covered with pollen. The insects rarely effect the fecundation of a flower by its own pollen. In the majority of cases the pollen is deposited on the stigma of a flower visited afterwards, to which it adheres by means of the viscid mass covering the stigma. It happens frequently that the pollen is perfectly developed, while the female organs of reproduction are not yet ready to receive it, and it seems as if the large majority of orchidaceæ were almost entirely dependent upon the services of insects for the procreation of offspring. This may explain the great variety of species occurring, as well as the differences frequently observed between individuals of apparently the same species. This peculiar mode of fecundation led Darwin to conclude "that, according to the laws of nature, mutual fecundation must take place between individuals belonging either to the same or different species of living organisms, and that hermaphrodites are unable to fecundate themselves for an indefinite period."

As stated above, the male and female organs of generation arrive at maturity at different periods. In some the stamen arrives at maturity before the stigma; these are called protandria, while those in which the contrary takes place are called protogynia. The orchidaceæ were, together with a few plants belonging to other families, but showing similar peculiarities, formerly placed apart from the phanerogamous as well as cryptogamous plants, under the name of dichogamæ (twice married), but this classification has, of late years, been abandoned.

The non-maturity of one organ at the period of full maturity of the other naturally renders both indifferent to each other, and nature has in its wisdom remedied this evil by the intermediation of animal agents.

This has been proved beyond doubt by innumerable experiments. Hildebrand and Scott, who are among the closest and most diligent observers in this respect, found it impossible to fecundate a flower with its own pollen, but they were most successful when they fecundated flowers with pollen derived from other individuals, even when derived from different species. J. Müller states that the pollen of a species of ondidium acted like poison on the flowers of the individual that had produced it and killed them.

From this general rule there are few exceptions, of which we may mention the vanilla. Darwin admits the probability that the other members also of the order *Malaxideæ* fecundate themselves. To demonstrate this fact, plants were grown, and throughout their life completely cut off from any communication with other plants or from insects. They nevertheless produced normal seeds. Moggridge, another authority with respect to the orchid family, has observed the same in the case of *Orchis intacta*. In all those species, however, in which the aid of an insect is not required for fecundation, the pollen is not found in waxy, adhesive agglomerations, but as a fine powder, the particles of which do not cohere and easily separate and fall into the opening of the stigma.

Some orchidaceæ are devoid of the beautiful green color of other plants, and on account of this they have by some been believed to be parasites. Closer investigations, however, have shown this idea to be erroneous.

The orchidaceæ vary greatly with respect to the form of all their vital parts. While some bear tubers similar to those of colchicum, others possess a spindle or bulb shaped root, and others again rise from amidst a network of fine fibrous rhizomas. Those that, like the vanilla, climb up on trees or rocks, send out numerous aerial roots, which, even when not reaching the soil, contribute much toward the maintenance of the plant. In our greenhouses orchidaceæ are frequently met with; the rich, glossy, silvery strains of aerial roots attract general attention. Instances are not uncommon in which the connection between the plant and the soil have been gradually broken, until the plant remained suspended in the air from a wire, without any other means of support than the gases and vapors inhaled by the pores of the aerial roots. These, and especially the epidermis, are in this case altered in structure to suit the circumstances. The pores are found to be larger in number as well as in size. The epidermis becomes thicker, and the aerial roots generally become in a superior degree fitted to discharge the duties which formerly devolved on the subterraneous roots.

The leaves vary greatly in form and size. In some genera, as Vanda, Agrœcum, Phajus, they are very large and fleshy, while in others they remain quite small. Orchidaceæ of tropical climates especially are distinguished by their thick, fleshy leaves, the epidermis of which is very thick, and tough. They are very succulent, and serve as cisterns for storing water, which enables the plant to survive the heated term. Frequently the leaves are transformed into bulbs, which, apparently dead during the hot season, nevertheless send forth numerous young shoots as soon as the first rainfalls supply the necessary moisture. Of plants the flowers of which surpass in elegance and beauty of colors anything else the vegetable kingdom produces, we might naturally expect the leaves to be more or less devoid of ornamental beauty in color or shape, yet Blume met with some most beautiful species on the Malayan Islands, the leaves of which were lined on one side with a velvet-like tissue of silvery hue, while the other reflected in great brilliancy all the colors of the rainbow.

While the orchidaceæ indigenous in the temperate zones are generally annual or biennial herbs of from six inches to eighteen inches in height, the tropical zones possess a great many which are perennial; in these the stem is of a ligneous texture, and they generally climb upon trees or rocks. Their flowers emit fragrant odors, and excel all others in the variety and brilliancy of their colors as well as in shape. Some species of Sobralia, for instance, attain a length of from twenty to thirty feet; Aerides and Vanda reach a height of four to six feet. On the Fiji Islands some species are found the stalks of which are hard enough to be worked into canes and whip sockets of great durability.

A true representation of this class of orchidaceæ is the vanilla plant, which is also in fact the only one from which a product of commercial value is obtained.

The culture of indigenous as well as exotic orchidaceæ in gardens and nurseries has become both a science and an art. Large volumes have been written on the best modes of raising and propagating them.

Species indigenous in tropical zones must be kept in hothouses at a temperature corresponding to that under which they live in natural conditions. Due attention must be also

THE ORCHIS FAMILY.

paid to a proper regulation of the moisture of the atmosphere. In many cases exposure to direct sunlight must be avoided, as in the dense forests of America and Africa, or the jungles of India, direct light does not reach these plants, but they only receive it as reflected from and transmitted through the foliage of the trees.

Many orchidaceæ require also a very rich humus soil. That of the forests and swamps is very rich in decaying vegetable matter, and the nearer the soil in which they are to be raised approaches to that naturally selected by them the better they will develop. In France very good results have been obtained by planting the seeds or tubers in a stratum of half decomposed moss, species belonging to the genus Sphagnum being generally preferred on account of the large quantity of water which they are able to retain. This artificial soil must be well fertilized by guano, as it contains in itself little nourishment.

The duration of flowering, as well as the time at which it begins, varies greatly with the different species, and this circumstance is one of the principal reasons for the favor with which orchids are generally regarded. Odontoglossum, Acrides, Agræcum, Vanda, Zygopetalum, Saccolabium, and others flower for periods extending from a few days to several weeks. On the other hand there are others that flower only for a single day.

The irregularity existing in this respect permits the artificial prolongation of the period of flowering of some species by the aid of another. Instances are related in which plants, which generally flower from one to two days only, were kept in bloom for some time by being fecundated with the pollen of another species flowering through a longer time. New varieties of great beauty have also been obtained in this manner.

The geographical distribution of the orchidaceæ is very extensive, hardly any portion of the globe being entirely devoid of them. They abound, however, principally in the hot zones, especially in America. During the past few years quite a number of interesting species have been discovered in Australia and on the islands of the Malayan Archipelago.

One of the most common orchids found throughout the temperate zone, on both hemispheres, the vanilla, belongs to the group Arethusea, the members of which belong exclusively to the tropical zones. Epidendrea are of American origin, it being questionable whether the few species found in Asia are indigenous there. All the other genera have members indigenous in all continents.

Excepting the pods of the vanilla plants the articles of commerce derived from the orchid family are of little importance. The tubers of Orchis Morio, Militaris, Mascula, Maculata, and other species, contain large quantities of mucilage and starch, and they were formerly largely used as an article of food. Dioscorides mentions this fact, stating that by drying the tubers lose their peculiar bitter taste. This is done to some extent at the present day, especially in Egypt, Nubia, and Abyssinia.

The tubers of orchids have, under the name of *salep*, been admitted into the recipiarium of medicine, and are highly valued, in the form of mucilage, as an emollient and demulcent in inflammatory diseases of the stomach and bowels.

The root of cypripedium, or lady's slipper, is also official, and is used as a popular household remedy in nervous and epileptic affections, but it is probably inferior to valerian. *Ophrys nidus-avis* was formerly used as a vermifuge, but seems to be of little value. A decoction of *Neottia ovata* forms a good dressing for wounds, but has been replaced by other agents of more modern origin. Many other orchids are here and there used for gout, and other diseases, but with the exception of *Spiranthes diuretica*, which seems to be a good diuretic, none of them appear to be of special value.—*T. Poisson in La Nature.*

THE NEW YORK ACADEMY OF SCIENCES.

At a meeting of the Biological Section of the New York Academy of Sciences, on Monday evening, April 28th, the President, Dr. J. S. Newberry, occupied the evening with some interesting notes on the various

"DEVICES EMPLOYED IN NATURE FOR THE DISTRIBUTION OF SEEDS OF PLANTS."

The speaker remarked, in substance, that we find among plants a host of adaptations to enable them to overcome the many obstacles that they meet with on every side in their struggle for existence. In tropical countries, where plants are most highly favored, we find their vegetative parts highly developed; but as we ascend northward and approach the arctic regions, we find the energies of the plants more and more directed toward a greater increase of the reproductive parts; so in such latitudes arboreal vegetation becomes reduced to mere shrub-like plants, yet completely loaded down with a mass of flowers and fruit. The struggle for existence in this case is aided by redundancy of fruit, for at least 99 per cent of all the seeds produced by the flora of such regions must, through the nature of the surroundings, either perish or fail to germinate.

Plants being immovably fixed to the spot where they grow, must necessarily be provided with some way of distributing their seeds, in order to insure the perpetuation and extension of their species. As a large proportion of all the seeds that are produced must, through many causes, fail to germinate, many plants make provision against such an accident by yielding these in immense quantities. The tobacco plant, for instance, produces at least 350,000 seeds in each of its capsules, and thus, by this very redundancy, is enabled to overcome a thousand obstacles in the way of its propagation.

But coming directly to the subject to be especially considered, there is a class of devices employed by plants to effect the dispersion of their species over a wide extent of country, which are mechanical; and such devices are various and confined to no particular group of the vegetable kingdom.

The first method to be considered, and the one that is most conspicuous, is that of distribution by the wind, and we see the effort constantly being made by nature to spread seeds broadcast in this way. A large number of plants depend on this method for their wide dispersion, and their seeds are so constructed as to enable them to take every advantage of it. The extensive order of plants, the *Compositæ*, depends largely but not entirely on this means. In many of the genera of this order, the one-seeded capsules remaining on the disk after flowering are surmounted by a tuft of fine hairs called the "pappus," which is really the hair-like calyx of the florets. This being persistent and increasing in size as the fruit goes on maturing, forms a feathery sail to carry the seed far away through the air. The pappus varies in different genera, both in form and size; sometimes it consists of hairs, sometimes of feathers, and sometimes it is mounted on a stipe, so that it resembles a parachute. Familiar examples of this may be seen in the dandelion, thistle, etc.; and it is by such a means that is distributed the *Erechtites*, a composite plant, which, from its habit of springing up suddenly on recently burned-over timber lands, where it was before unknown, has acquired the name of "fire weed." This device is not confined to composite plants; we find examples of it likewise in the asclepiads or milkweeds, whose seeds are provided with long silken comose appendages, by means of which they are wafted to great distances by the wind. The fruit of the virgin's bower, too, is furnished with long plumose tails, like downy tufts, which serve a like purpose in the economy of the plant. Other familiar examples may be seen in the seeds of the cotton plant, dog's bane, etc.

Another mode of wind distribution is by means of what may be called the "balloon." In many plants the seed vessels, during the progress of maturing their seeds, become greatly inflated and balloon-like; and when detached from the parent plant are readily carried through the air or rolled along the ground by the winds to considerable distances. We have familiar illustrations of this in our balloon-vine or *Cardiospermum*, which is very remarkable for its large, inflated membranous seed capsules; in the common "bladder-nut" of our woods; and in the "ground cherry" and Bougainvillea. The varieties of this sort of fruit found in nature are very numerous.

The dispersion of the seeds of still another great group of plants is effected through the aid of "wings." Appendages of this kind, both to seeds and seed capsules, are various. One of the more familiar forms is that known as the "samara," characteristic of such trees as the elm, maple, and ash. By means of their membranous, wing-like expansions (entire and circular in the elm, or two diverging "keys" in the maple) this form of fruit is enabled, when ripe, to go fluttering away through the air like bits of paper. A like device is found in the fruit of the conifers, nearly all the species of which are provided with seeds having their membranous wings.

A very large number of plants are distributed through the involuntary acts of man and the lower animals. To effect this, seeds and fruits have been provided with various kinds of appendages, and one of the commonest of these is "hooks." Familiar examples are to be seen in the involucres of the burdock, the outer surface of which is covered with scales terminating in hooks; in the "beggar's ticks" (*Bidens*), the achenia of which are two horned and adhere to every passer-by; in the clotweed, the burr of which is covered with stiff hooked prickles; and in the "hound's tongue" (*Cynoglossum*), the seeds of which are armed with hooked prickles. In the leguminous plant, *Desmodium*, the seed pod or loment is not only covered with minute prickles, making it adhesive, but it also breaks up at the constricted joints, so that the seeds have a greater chance of being still more widely scattered.

Another method of seed dispersion is by what may be termed "explosion." This, too, is exhibited under a good many different forms. One of the most curious of these had lately come under the speaker's observation, and suggested to him the subject of his present remarks. Some time ago a student had brought him from Cuba a specimen of the fruit of one of the *Euphorbiaceæ*, the "sand box" or *Hura crepitans.* This fruit is a hard and woody capsule, discoid in shape, something like a muskmelon, but very deeply ribbed, and about three inches in diameter. He laid the specimen on his writing table, and while reading the other evening he was suddenly startled by an explosion as loud as the report of a rifle, fragments of some material at the same time flying through the air to every part of the room. On examining these he found them to be the seeds and broken pieces of the sand box fruit. A study of one of these capsules shows it to be a marvel of ingenuity in the arrangement of its parts to accomplish seed dispersion. The rib-like processes are seen to consist of carpels placed parallel to a common central axis, and these on becoming dry open very suddenly with a loud detonation, the force being exerted by two strong woody springs, between which the lenticular seed is inclosed.

Other illustrations of seed expulsion by "explosion" are found in such plants as the balsams (*Impatiens*), the pods of which at a mere touch throw back their valves and eject the seeds with great violence; in the Mexican *Astragalus*, the vesicular pods of which explode when mature; in the gentian; in the common lupine, and in many other plants. In some of the cucurbits, too, we find force of this kind exerted in the expulsion of the seed, particularly in the squirting cucumber, the fruit of which when fully ripe throws out its juice and seeds with considerable force through an opening at its base. Many examples of this method of expelling their reproductive bodies are found also among cryptogams. In the liverwort (*Marchantia*) the minute spores are contained in globular capsules, and intermixed with spiral threads or *elaters*, by the untwisting of which they are ejected to some distance. In the "horse tails" (*Equiseta*) we find something analogous: the capsules of the plants are filled with minute spores, to each of which is attached (and wound spirally around it when moist) four club-shaped elastic appendages. These filaments are hygrometrical, and rapidly uncoil when they become dry and cause the spore to move about, and are admirably adapted to aid in the dissemination of the plants.

Many kinds of plants are distributed in still another way. Certain hard and indigestible seeds often accompany delicious and succulent fruits. The latter being eaten by man or the lower animals, the seeds pass through the alimentary canal unchanged and unharmed. By this means very many hard seeds, such as those of the dogwood (*Cornus*), etc., swallowed by birds, are often carried by them and deposited at a great distance from the place where they were produced.

Another method of seed distribution is by means of the "waves." A large number of tropical plants, whose seeds are so protected as to be unaffected by the action of water, are floated off to immense distances and deposited on the shores of foreign countries, where, if the conditions for it are favorable, they germinate. By this means the cocoanut has been transported from one country to another; and in this way the coral islands (which are of comparatively modern formation) have been stocked with this as well as with other tropical fruits. The well known sea beans, which grow on the river banks of Central America, are carried by the rivers to the ocean, and, transported by the waves of the latter, are often thrown on the coast of Norway.

Dr. Newberry then mentioned a method of seed dispersion common to one of our native trees, and which he stated he had never seen noticed in print. Our button-ball tree or sycamore (*Platanus*), although found in elevated places in the Eastern States, prefers the moist alluvial soil of bottom lands, and in such situations in the West grows luxuriantly and attains an immense size, the trunk sometimes reaching 10 to 12 feet in diameter. The seeds of this tree are produced in a "capitulum" or globular head attached to the branch by a stiff stem 4 or 5 inches long. In our common species these balls are solitary, but in a California species—the *Platanus racemosus*—three or four balls are borne on the same stem. These globular balls of seeds are persistent and hang upon the tree, on their long woody pedicels, throughout the winter. By the action of frost, and through the effect of alternate freezing and thawing, the woody pedicels become ultimately reduced to mere thin fibers, strong but exceedingly flexible. By the action of the winds of early spring the balls are beaten violently against the branches, and the seeds are thus detached and fall into the waters beneath. Now it so happens that all this takes place just at the season when freshets have caused the rivers to be at their highest, and as the waters afterward gradually subside the seeds are distributed far and wide over a large extent of country.

In conclusion, Dr. Newberry described and illustrated by a drawing on the blackboard the curious pods of a Western plant, the *Martynia proboscidea*, or devil's pod. This plant has large showy flowers, and its fruit consists of an oval fleshy pod terminating in a long rostrum or beak. The pods when mature are woody, and when ready to discharge their seeds the beak splits into two very rigid incurved horns abruptly bent at the ends into a very sharp grappling hook. This device is frequently utilized by the plant to effect its distribution, and the mule is made to act as the agent to accomplish it. When the animal steps on one of the pods (a matter of frequent occurrence) the pod opens, and the two rigid hooks clasp around his fetlock, and there remain until noticed by some person, for it is impossible for the mule to remove the pod by any effort of his own. In this way the devil's pod is often transported to great distances.

The speaker suggested that the devices employed by plants for the preservation of their seeds from injury would form an interesting topic for discussion, and hoped some one would bring the matter before the Academy in the form of a paper.

Wheeling as a Manufacturing City.

In a recent conversation reported in the *Tribune* of this city, Governor Matthews, of West Virginia, spoke of Wheeling as one of the chief iron making cities in the country. It turns out yearly more than one-third of all the nails made in the United States, and fully one-fifth of the annual production of the entire world.

Wheeling is also heavily interested in the manufacture of glass, which it ships everywhere —even to London. Brazil and Australia are among the best markets for its glass.

One feature of this industry is rather singular. Wheeling manufacturers make the beautiful glass chandeliers which have become so fashionable of late, but they import the cut-glass pendants from Switzerland, where the peasants make them by hand cheaper than they can be made by machinery in this country. Many of these chandeliers are sent to London, so the pendants make two voyages across the ocean.

THE BROWN DESMOGNATH.

BY C. FEW SEISS.

The brown desmognath (*Desmognathus fusca*, Rafinesque) is not described by Dr. Holbrook in his work on "American Herpetology." He seems to have considered it a variety of the black desmognath, for he gives Harlan's painted salamander (*Salamandra picta*) as a synonym, and this is certainly Rafinesque's brown desmognath. De Kay, in the "New York Fauna," calls it the painted salamander (*S. picta*). He does not say he ever saw a specimen taken in New York State, but says it has been found in Massachusetts and Pennsylvania. Professor Allen states it is very rarely met with in Massachusetts, yet Professor Verrill says it is found in Maine. In portions of Pennsylvania it is quite common. We have forty or more specimens captured by my brother and myself in the eastern part of the State. Thus far I have found but one specimen in New Jersey. They inhabit shallow and stony spring brooks of hillsides and springs. I never have found them far away from spring water. They are rarely seen swimming, but must be looked for beneath the stones. When a stone, beneath which one is hiding, is first lifted up the desmognath is generally surprised and dazed, and remains quiet for a few seconds. It must then be quickly seized or it darts off into the water and escapes.

The metamorphoses of this species do not differ materially, so far as I have observed, from our other *batrachia urodela*. The young are furnished with gill tufts, and are entirely aquatic in habits. When young they are lighter in color than the adult, and often assume the color of the mud or sand of the stream they inhabit, and are thus not easily detected.

The brown desmognath feeds upon earthworms and insects. I found in the stomach of an individual three and a half inches in length an earthworm over two inches long.

The generic name, *desmognathus*, means band, or ligature jaw, so called on account of the tendinous ligament (one on each side) passing from the atlas over the parietal and proötic bones to the jaw. This, like a *ligamentum nuchæ*, supports or rather, in this case, gives great power to the head, which is necessary in pushing up stones when in search of the worms upon which it feeds.

The stagnant water of the aquarium seems ill fitted for the life of this lover of spring brooks, for we could never succeed in keeping them alive for more than a few weeks.

The species of salamanders cannot well be identified without study of their anatomy. Thus in the genus *desmognathus* the premaxillaries are united, with a pit or fontanelle in the center; the occipital condyles are long and cylindrical; there are both vomerine and spheroidal teeth. In our present species (*fusca*) there are fourteen costal plicæ or folds from the shoulder to groin; the tail is compressed and keeled. Color above (in thirty specimens) dusky purplish brown to rusty brown; sides marbled, or "salt and pepper" marked; beneath, dull yellowish white, dotted with pale brown dots. Length of adult three and a half to a little over four inches. Some of the medium sized specimens (in life) were marked on the back with two series of subquadrate brownish-red spots, and the tail with a red mesial line. Alcohol causes these markings to fade and almost disappear in the ground color. Holbrook, it appears, has described this immature variety under the name of *Salamandra quadrimaculata*. Our red marked specimens were captured with, or in the immediate neighborhood of, the brown animals. The black species (*D. nigra*, Green) has only twelve costal folds, and is generally over six inches in length.

THE BROWN DESMOGNATH.

A Long Bridge.

The bridge across the Volga, in the goverment of Samaria, Russia, on the line of the Siberian railroad, is described as the largest in Europe. It will be completed next year. At that point the Volga is about four miles wide in the spring season, and in autumn is 4,792 feet. The bridge will be supported by 12 piers, 85 feet high, with ice cutters, 35 feet high, at a distance of every 364 feet. The ice cutters are covered with granite. A temporary colony is established for workingmen employed on the bridge; it occupies about 55 acres, and has 60 different buildings, insured at 100,000 rubles. Two thousand men are employed, and among them are 100 Italian masons. Three steamers and seventy barks are used constantly for forwarding wood, stone, iron, and other materials. The bridge will cost 4,630,000 rubles, or about $3,500,000.

A RICH CHAIR.

The accompanying engraving represents a rich chair in carved ebony, copied from a sixteenth century pattern. It contains many details of ornament which have been frequently copied. The covering is in perfect keeping with the chair, being in rich violet colored cut velvet relieved with gold thread embroidery.

EBONY CHAIR.—SIXTEENTH CENTURY PATTERN.

The Electric Light in Cleveland.

The regular lighting of Monumental Park, Cleveland, O with the Brush electric light, began at eight o'clock the evening of April 29. This was the first public lighting with the electric light of any city in the United States. Twelve electric lights were used in the place of one hundred and ten gas burners, and gave a much more effective illumination. The electric lights are furnished the city, under contract, for $100 a year less than the cost of the gas formerly used.

Vegetable Cows.

Since the reading of a paper by the chemist, Boussingault, before the French Academy, a few months ago, on the subject of the "cow tree," or *Palo de Vaca*, considerable attention has been attracted to the subject. This tree, which was discovered and made known by Humboldt, belongs to the same natural order (*Artocarpaceæ*) as the poisonous upas tree of Java. But there are other trees known (perhaps not so well known to the general reader), the milky juice of which possesses similar properties to a greater or less extent. For instance, the "cow tree of Demerara," which was first observed by a traveler named Smith, in an excursion up that river. It is described as a tree from 30 to 40 feet high, with a diameter at the base of nearly 18 inches. The tree is known to botanists as *Tabernæmontana utilis*, and to the natives as "Hyahya." It belongs to the same natural order (*Apocynaceæ*) as the Penang India rubber tree and the poison tree of Madagascar (*Cerbera tanghin*), and our common American dog's bane. It occurs in great abundance in the forests of British Guiana, and its bark and pith are so rich in milk that a moderately sized stem which was felled on the bank of a forest stream colored the water, in the course of an hour, quite white and milky. The milk is said to be much thicker and richer than cow's milk, and is perfectly innocuous and of a pleasant flavor, the natives using it as a refreshing beverage, and in all respects as animal milk.

The Cingalese also have a tree, called by them the "kiriaghuma," but belonging to a different natural order of plants, the *Asclepiadaceæ*, which also includes our common milkweeds or silkweeds. This tree is the *Gymnema lactiferum* of botanists, and yields a very pleasant tasted milk, which is employed for domestic purposes in Ceylon.

There appears to be also a milk tree common in the forests about Para, and called by the natives the "massenodendron," but of which we have little definite knowledge, except that it was for a long time used on board of one of the vessels of the British navy cruising in Brazilian waters. It was said to suffer no chemical change by keeping, nor to show any tendency to sour.

Another milk tree is the "tabaya dolce" (*Euphorbia balsamifera*), of the Canaries. This plant again belongs to a different natural order from any of the foregoing, namely, the *Euphorbiaceæ*, and one containing a large number of plants with acrid, purgative, and poisonous juices. Leopold von Buch states that the juice of this plant is similar to sweet milk, and, thickened into a jelly, is eaten as a delicacy.

A species of cactus (*C. Mammillaris*) also yields a milky juice equally sweet and wholesome. The milk is stated, however, to be much inferior in quality to the majority of the above. The caoutchouc, or India rubber of commerce, as it exudes from the tree, greatly resembles milk in color and density.

Large Powder Blasts.

Some time since a blast of 12,000 lb. of powder was exploded in the quarry of the Glendon Iron Company, near Easton, Pa., displacing 60,000 tons of rock. The discharge was described in some of the newspapers as probably the heaviest charge not sub-aqueous ever fired in the country. To this a California mining journal takes exception, and says that much larger charges are frequently exploded in the gravel mines of that State. Very recently the Reservoir Ditch Company put off in their mine, at Sucker Flat, Yuba county, a blast of 50,000 lb. of Judson powder, a very powerful explosive, and by which between 200,000 and 300,000 cubic yards of gravel, some of it indurated into a hard cement, were so shattered that the most of it can be piped off under the heavy head of waters there used. Occasionally even a greater amount of powder than this is exploded by the larger hydraulic mining companies, who find it economical to employ such heavy charges, as doing more proportionate execution than small ones.

MARINE GLUE, MUCH USED IN BATTERIES.—Dissolve 1 part of India rubber in 12 parts of benzole, and to the solution add 20 parts of powdered shellac, heating the mixture cautiously over a fire. Apply with a brush.

A SENSIBLE FASHION.

A story, good enough to be true, is told of a young Englishman, who had been giving voice to the time-worn complaint of snobbish people about American society: "It is quite impossible, you know, to have a high-toned society where there is no aristocracy."

"What do you mean by aristocracy?" a lady asked. "Why-aw-you-know; I mean ten thousand people who live anywhere and have nothing to do."

"As for that," replied the lady, "we have such a class too; but we call them tramps."

The answer was something more than polite chaffing. There is a world of difference, on the score of comfort and cleanliness, between living anywhere with nothing to do, backed by a fortune sufficient to make life a pastime, and doing the same with a beggar's wallet; still, in spite of the superficial contrast, the moral difference is not so very great. The man whose only claim to consideration rests upon the circumstance that the chance of inheritance has made him able to gratify his selfish desires without personally making any return to the world for what he enjoys, is not intrinsically nobler, nor does he really play a much nobler part in life, than he who lazily sponges a precarious existence from those who have enough to do to provide for themselves. The world owes neither a living; and the fortune of the richer only adds to his moral obligation to do something useful with the superior means at his command.

The idea that a man's merit is in proportion to the cost of his keeping and the unproductiveness of his life has never thriven in this country; and it has always been common for young men of inherited wealth to take an active part in the world's real work. In the industrial, as well as in the professional world, honorable success has been won through manly exertion by many a young man who might have squandered his time and fortune in idleness or worse. And if the tendency of flush times had been to cultivate a different spirit among the sons of the suddenly rich, the financial overturnings of the past five years have shown far too plainly the risk attending a youth of dainty idleness to give the vicious tendency much encouragement. Indeed the popular current seems rather to be strongly setting in the opposite direction, and it is quite the fashion now for young men of wealth to strike out for themselves, particularly in new and non-professional fields.

From Maine to Oregon, from Michigan to Texas, young men of wealth and culture, men who might be idlers—mere society men and nothing more—are to be found among the ranks of the doers, using their fortunes only to help them to larger and more productive labors than the empty-handed could undertake. A Newport correspondent names a number of the sons of the wealthy residents and summer visitors of that fashionable watering place, who are thus employed. Agricultural pursuits attract the most of them. Several are managing farms. Two have gone into the market gardening and milk business, and are making it pay. Two are devoting their time to the raising of poultry on a large scale. Such undertakings in the vicinity of centers of population, wealth, and culture, are more likely to result satisfactorily and profitably than sheep or cattle breeding in the South or West, hitherto the more popular occupations of adventurous and active young men of wealth, since they do not necessitate the abandonment of the enjoyments and advantages of society and friends. The East is full of opportunities for men of energy and means to make money by outdoor operations, and, at the same time, to improve immensely the conditions and character of country life. The drift of young men of spirit and education has too long been toward the cities. It lies in the power of the leaders of the new fashion to set the current in the opposite direction, vastly to the benefit of both city and country.

Meteoric Dust.

Mr. Cowper Ranyard has made a communication to the Astronomical Society on meteoric dust, in which he has thrown out some interesting speculations as to the explanation of the relative distribution of land and water on the globe and as to geological climates. He says that meteoric dust exists to a much greater extent than was formerly suspected. In 1867 Dr. Phipson published the result of many experiments in many countries, which showed that, by exposing a sheet of glass covered with pure glycerine to a strong wind, he has collected on it black angular particles, which he has by chemical tests found to be iron. It is, however, only in the winter months he has found this to be the case. In 1871 Dr. Nordenskjöld collected, by a magnet, meteoric iron particles from snow which had fallen near Stockholm. In 1872 he collected much of it from snow lying on ice in Finland. The Arctic Expedition of 1872 had opportunities of collecting snow far removed from human habitations, and they found large proportions of magnetic particles. M. Tissandier, in 1874-5-6, published in the *Comptes Rendus* a series of papers on atmospheric dust, in which, among other things, he has alluded to the iron found in the dust collected on the towers of Notre Dame. Again. Dr. Walter Flight published in the *Geological Magazine*, in 1875, a paper in which he collected the evidences of iron "dust" found in holes in the ice in Greenland. In 1876 Mr. John Murray published a paper in the "Proceedings of the Royal Society of Edinburgh," in which he gave an account of his examination of the bottom of the oceans and seas visited by Her Majesty's ship Challenger. In many of the deposits magnetic particles were found. It was suggested that the nickel present prevented oxidation, while the fact that the meteoric particles which had fallen into the sea had not been washed away, was attributed to the water being deep and not near the scourings of land surfaces which would cover it up. Again, in 1876, M. Young examined the iron particles found in the snow which had fallen at the Hospice of St. Bernard. Mr. Ranyard submits that all these facts go to show that meteoric matter falling in the lapse of ages must materially contribute to the matter of the earth's crust. In the course of a year millions of meteors enter the earth's atmosphere. Most of them are "consumed" in the higher regions, but many particles reach the earth without having undergone change. There is little doubt that high above the earth's surface the air is impregnated with dust. The researches of Von Niessl show that many of the meteoric masses enter the earth's atmosphere in directions indicating that they do not belong to our solar system. It is therefore probable that a large quantity of meteoric dust is derived from sources outside our system. The earth and the planets, as they are carried along with the sun in its motion through space, would thus receive a larger proportion of meteoric matter on their northern than on their southern hemispheres, and Mr. Ranyard suggests that this may account for the preponderating mass of the continents in the northern hemisphere of the earth and for the fact that the great peninsulas all taper to the south. Another important inference to which Mr. Ranyard directs attention is that it is known that when meteoric masses are heated large amounts of occluded gas are given off. One of the results from a continuous fall of meteoric matter is that gaseous matter is probably being continually added to the atmosphere. According to whether the earth were passing through a region of space in which there are many or few meteors, the height of the atmosphere would be increased or decreased. When decreased, the temperature at the sea level would be that of our mountain tops and a glacial period would result. When increased, the temperature would probably be like that of the carboniferous period.—*London Times.*

Substitutes for Gold and Silver.

Some very beautiful alloys, applicable as substitutes for gold and silver in the manufacture of jewelry and similar purposes, have been produced by Messrs. Meiffren & Co., of Marseilles. To make an alloy having the appearance and color of gold, they place in a crucible copper as pure as possible, platinum, and tungstic acid in the proportions below stated, and when the metals are completely melted, they stir and granulate them by running them into water containing 500 grammes of slaked lime and 500 grammes of carbonate of potash for every cubic meter of water. This mixture, dissolved in water, has the property of rendering the alloy still purer. They then collect the granulated metal, dry it, and after having remelted in a crucible, they add a certain quantity of fine gold in the proportion hereinafter specified. An alloy is thus produced which, when run into ingots, presents the appearance of red gold of the standard 750·1000, and to which may be applied the name of "aphthite," or unalterable. They can change the color of the alloy by varying the proportions of the different metals. As flux they use boric acid, nitrate of soda, and chloride of sodium previously melted together in equal proportions. The proportion of flux to be employed is 25 grammes per kilogramme of the alloy. The proportions they employ, by preference, for producing an alloy of red gold color are: Copper, 800 grammes; platinum, 25; tungstic acid, 10; and gold, 170 grammes.

The alloy used in imitation of silver consists of iron, 65 parts; nickel, 23 parts; tungsten, 4 parts; aluminum, 5 parts; and copper, 5 parts. The iron and tungsten are melted together, and then granulated, as in the case of the previous alloy, except that in this instance the water into which the mixture is run contains one kilogramme of slaked lime and one kilogramme of carbonate of potash per cubic meter. The nickel, copper, and aluminum are also melted together and granulated by running into water containing the same proportion of lime and potash. Care should be taken during the melting to cover the metals contained in the two crucibles with a flux composed of one part of boric acid to one part of nitrate of potash or niter. In the crucible containing the aluminum and copper they place a lump of sodium of about two grammes in weight when treating five kilogrammes of the three metals (nickel, copper, and aluminum) together to prevent oxidation of the aluminum, and they also add charcoal to prevent oxidation of the copper. Before granulating the metal in each crucible it should be well stirred with a fire-clay stirrer.

The granulated metals are dried, as in the former case, then melted together in the same crucible in the proportions above indicated, and well stirred, after which the alloy is run into ingots. The alloy thus obtained, to which may be given the name of "sideraphthite" (or unchangeable iron), presents the same white appearance as platinum or silver, and is not more expensive than German silver. These improved metallic alloys are capable of resisting the action of sulphureted hydrogen, are unattacked by vegetable acids, and but slightly attacked by mineral acids; they are also perfectly ductile and malleable.—*London Mining Journal.*

Presence of Mind.

Professor Wilder gives these short rules for action in case of accident: For dust in the eyes, avoid rubbing, dash water into them. Remove cinders, etc., with the round point of a lead pencil. Remove insects from the ear by tepid water; never put a hard instrument into the ear. If an artery is cut, compress above the wound; if a vein is cut, compress below. If choked, get upon all fours and cough. For light burns dip the part in cold water; if the skin is destroyed, cover with varnish. Smother a fire with carpets, etc.; water will often spread burning oil and increase the danger. Before passing through smoke take a full breath, and then stoop low, but if carbon is suspected, walk erect. Suck poison wounds, unless your mouth is sore; enlarge the wound, or, better, cut out the part without delay. Hold the wounded part as long as can be borne to a hot coal, or end of a cigar. In case of poisoning excite vomiting by tickling the throat or by water or mustard. For acid poisons give acids; in case of opium poison give strong coffee and keep moving. If in water float on the back, with the nose and mouth projecting. For apoplexy raise the head and body; for fainting, lay the person flat.

A Peculiar Disorder of Bank Clerks.

According to the *British Medical Journal*, Dr. Manouvries has published, in the *Bulletin Médical du Nord*, some novel observations on a disorder to which bankers' clerks are subject under certain circumstances. It has been repeatedly noticed for years that after having handled for some days in succession large quantities of silver five-franc pieces they suffer from disturbances of the respiratory and digestive organs. These troubles have been ascribed to a dark greenish metallic dust, which is raised by taking the coins from the bags wherein they are usually kept, weighing them, and putting them back. This dust impregnates the atmosphere of the room, blackens the skin, and penetrates into the respiratory and digestive tracts together with the air and saliva. As a rule, this process is only gone through at rare intervals during the year, and lasts only a few days, so that the clerks soon recover their health and do not feel much affected by this dust. But in the years 1872 and 1874, when the money which had been paid by France to Prussia as a tribute was returned to France through mercantile transactions, the clerks spent several weeks in handling the coins which had not been taken out of their bags in some years, and the affection spoken of above was now more marked than ever.

The symptoms of this peculiar disease are frequent sneezing, coryza, and angina; the expectorations are black. There is a disagreeable metallic taste in the mouth, spoiling the flavor of food, loss of appetite, colic, nausea, and violent thirst. The bowels are mostly constipated; diarrhea seldom prevails. The blue line along the gums, which is often noticed in patients who have been subject to treatment by silver, is absent. There is great feeling of prostration and frequent headaches. Owing to the peculiar circumstances under which this affection has been first observed, there can be no doubt as to its being due partly to the copper (verdigris) and partly to the oxidized state of the silver; both metals are used in the coinage of the five-franc pieces, in the proportion of nine tenths of silver to one tenth of copper. The constipation seems to be caused by the silver, because copper invariably causes diarrhea. It is said also that silversmiths often suffer from colic, which is caused by their work. The patients were treated with purgatives and a milk diet, and the disorder soon ceased.

Kissing Pets a Cause of Sore Throat.

A writer in the *British Medical Journal*, in a communication to the editor in regard to the possible cause of the recent outbreak of an epidemic of sore throat at Darmstadt, says: "It is well known that women and children are in the habit of kissing pet cats and dogs, especially when these favorites are ill with discharge from the nose, cough, and sore throat, and even use their pocket handkerchiefs to wipe away the secretion. I have seen this done frequently. As such mistaken sympathy is exceedingly dangerous, I think a notice in the *Journal* to this effect would tend to its discouragement. It is a common saying that, 'There! the cat has got a cold; now it will go through the house;' and, as this remark has been repeatedly verified, it shows how careful people should be to avoid contact with such a mode of contagion. I do not affirm that this was the way in which the disease was contracted, either within or without the palace walls, but I feel sure the habit of kissing pets is a source of danger that should be widely known and prevented."

Electric Light in the New York Post Office.

Five of Maxim's electric lamps have been placed in the post office of this city to light the great room on the ground floor. The lamps are thought to act very well, and as they are hung high the glare is not unpleasant to the eyes. Each lamp gives about 5,000 candle power, and is connected with a dynamic machine of about four horse power. The light is that of the voltaic arc, and French carbons are used. Each carbon or candle will last about five hours, and when burnt out another lamp is swung into position in place of it. The cost of each lamp is estimated at about 3 cents per hour.

A Large Tow.

On the evening of April 20 the towboat Joseph B. Williams left Louisville, Ky., for New Orleans with 36 boats and barges, containing 645,089 bu. coal and 35,000 bu. coke—in all 380,089 bu., equal to 25,213 tons. This is the largest tow ever moved by one steamer on the Western waters, and probably in the world. The tow measured 258 feet in width over all, and with the towboat, 862 feet long. There were nearly 4 acres of black diamonds on the tow. Some idea of the magnitude of the towing service on the Ohio and Mississippi rivers may be formed from the above. H. L. B.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

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

Sutton's Patent Pulley Cover.—If you are losing power, get it again by using these covers. Calculate how much power you are losing and find the gain you will make in your work by adopting a positive remedy. Send for a circular. Address Joseph Woodward, proprietor and manufacturer, P. O. Box 3419, New York.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Try the new fragrant Vanity Fair Cigarettes, both plain and halves. Most exquisite of all.

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

National Steam Pump; best and cheapest. Send for prices. National Iron Works, New Brunswick, N. J.

Auburn, N. Y., March 1, 1878. H. W. Johns Manufacturing Co., 87 Maiden Lane, N. Y. Dear Sirs: In answer to your inquiry as to how we like your paint, we are more than entirely satisfied with it. As you are aware, we are large users of paint, and of all that we have ever used, are satisfied yours is far superior; it is put on with less labor, covers better, flows more easily, has a better body, and, as far as our experience goes, will stand the weather better than any other paint we know of. Your roof paint is unsurpassed; we used one coat on a tin roof, and to-day it looks as fresh, and the color is as bright, as when first applied, and there is no sign of its cracking. Respectfully yours, Josiah Barber & Sons, Manufacturers of Woolen Goods and Carpetings.

For Sale Cheap.—A few State Rights for a Clothes Line Fastener, just patented. John A. Worley, Cleveland, O.

Blake Crusher, Improved 10 x 4; Evans Screw Press, No. 2. Both good as new; about half price. J. E. Mitchell, 310 York Ave., Philadelphia, Pa.

Steel Stamping Figures, $1 per set; Name Stamp, 15 cents per letter. C. L. Alderson, Cleveland, O.

For Screw Cutting Engine Lathes of 14, 15, 18, and 22 in. Swing. Address Star Tool Co., Providence, R. I.

Best Turkey Emery in kegs, half kegs, and cans; liberal rates by the ton. Greene, Tweed & Co., N. Y.

Wanted—New Machinery on Commission, in large new store near Liberty St. Superior advantages. No charge for storage or cleaning. Address P. O. Box 1012, New York.

Combined Universal Concentric or Eccentric and Independent Jaw Chucks. Pratt & Whitney Co., H'tf'd, Ct.

Downer's Anti-Incrustation Liquid, for the removal and prevention of scale in steam boilers, is safe, effective, and economical. Fully guaranteed. Try it. 17 Peck Slip, New York.

Shaw's Noise Quieting Nozzles subdivide the steam into numerous fine streams. All parties are cautioned against purchasing from infringers. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Wanted.—A Second-hand Phonograph. Address, with description and price, C. H. Abbot, Lee's Summit, Jackson Co., Mo.

Agents for Patent Medicine will hear of something to their advantage by addressing F. S. Ide, Box 121, Providence, R. I.

For Sale.—A New No. 5 Stiles & Parker Geared Punching Press; latest and best; cheap; no use for it. B. D. Washburn & Co., Boston, Mass.

Lincoln's Milling Machines; 17 and 20 in. Screw Lathes. Phœnix Iron Works, Hartford, Conn.

Louisiana Sugar Growers.—Your attention is called to the advertisement of P. A. de La Nux, C.E., of Honolulu, Sandwich Islands, on page 334.

Air Guns.—H. M. Quackenbush, Manufacturer, Herkimer, N. Y.

Boilers ready for shipment. For a good Boiler send to Hilles & Jones, Wilmington, Del.

The only Portable Engines attached to a boiler having cold bearings. The Peerless and Domestic. Francis Hershey, successor to F.F. & A.B. Landis, Lancaster, Pa.

Magnets, Insulated Wire, etc., for experiments. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Shaw's Mercury Gauges, 5 to 50,000 lbs.; accurate, reliable, and durable. T. Shaw, 915 Ridge Ave., Phila., Pa.

New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. F. Burnham, York, Pa.

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Eagle Anvils, 9 cents per pound. Fully warranted.

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

Clipper Injector. J. D. Lynde, Philadelphia, Pa.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

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

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

The Ornamental Penman's, Engraver's, Sign Writer's, and Stonecutter's Pocketbook of Alphabets; 32 plates; 20 cts.; mail free. E. & F. N. Spon, 446 Broome St., N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Forsaith & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

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Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

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.

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

Portland Cement—Roman & Keene's, for walks, cisterns, foundations, stables, cellars, bridges, reservoirs, breweries, etc. Remit 25 cents postage stamps for Practical Treatise on Cements. S. L. Merchant & Co., 53 Broadway, New York.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

C. M. Flint, Fitchburg, Mass., Mfr. of Saw Mills and Dogs, Shingle and Clapboard Machines. Circulars.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world, to be seen with power applied, 95 and 97 Liberty St., New York. D. Frisbie & Co., New Haven, Conn.

No gum! No grit! No acid! Anti-Corrosive Cylinder Oil is the best in the world, and the first and only oil that perfectly lubricates a railroad locomotive cylinder, doing it with half the quantity required of best lard or tallow, giving increased power and less wear to machinery, with entire freedom from gum, stain, or corrosion of any sort, and it is equally superior for all steam cylinders or heavy work where body or cooling qualities are indispensable. A fair trial insures its continued use. Address E. H. Kellogg, sole manufacturer, 17 Cedar St., New York.

The 1879 Pennsylvania Lawn Mower.—Light draught and easily adjusted. Machines warranted. See illustrated editorial, Sci. Am., No. 14. Lloyd, Supplee & Walton, Philadelphia, Pa.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Wood-working Machinery, Waymouth Lathes. Specialty, Wardwell Patent Saw Bench; it has no equal. Improved Patent Planers; Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

Acme Lathes.—Swing, 7 in.; turn, 19 in. long; back geared; screw cutting. Send 3 cent stamp for circular and price, to W. Donaldson, southwest corner Smith and Augusta, Cincinnati, Ohio.

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Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN JOURNAL OF OTOLOGY. A Quarterly Journal of Physiological Acoustics and Aural Surgery. New York: Wm. Wood & Co. $3 a year.

Two numbers of this periodical have been published, giving abundant evidence of ability, strength, and practical utility. It is edited by Dr. Clarence J. Blake, of Boston, in conjunction with Professor A. M. Mayer, of Hoboken; Dr. Albert H. Buck, and Dr. Samuel Sexton, of New York; Dr. C. H. Burnett, of Philadelphia; Dr. J. Orne Green, of Boston; and Dr. H. N. Spencer, of St. Louis. Just now the department of acoustics is pushing to the front rank in importance as a field for original investigation and discovery, and is well worthy of distinctive representation in journalism. The American Journal of Otology takes a position with the highest scientific periodicals of the world.

THE COAL TRADE. By Frederick E. Saward. New York: 1879. Price $1.

This, the sixth annual review of the coal trade at home and abroad, by the editor of the *Coal Trade Journal*, is correctly described as a valuable compendium of statistics relative to coal production, prices, transportation, and related interests, the world over. The author notes that 235,000,000 tons of coal are annually used by the Anglo-Saxon race, while all the other races use not more than 75,000,000 tons together; and he ventures to affirm that it is because the Anglo-Saxon race so augments its power that it has achieved the greatest advance in material civilization.

AMERICAN CHEMICAL JOURNAL. Edited by Ira Remsen, Professor of Chemistry in the Johns Hopkins University. Baltimore: Innes & Co. $3 a vol. Single numbers 50 cents.

The avowed object of this journal is to provide for the connected publication of all good original papers written by American chemists. Hitherto such papers have either had a semi-private publication, or have been widely scattered among periodicals not specially devoted to this science. In addition the journal will reprint entire or give abstracts of the more important chemical contributions to other, especially foreign journals. It will also give reviews and reports of chemical publications, processes, and investigations. The first number (April) contains a valuable report by Professor J. W. Mallet, of the University of Virginia, on the recent important changes in the industrial applications of chemistry; a discussion of Lockyer's latest hypothesis, and other valuable papers.

APPLICATIONS OF THE PHYSICAL FORCES. By Amedee Guillemin. Part I. 40 cents.

The aim of this edition of Guillemin's admirable work is evidently to bring it within the reach of many who would not think themselves able to buy the complete work outright. It is to appear in eighteen monthly parts. Whoever wishes to become acquainted with the more remarkable applications of physical science in the arts and industries, and in the greater art of original investigation, will not find elsewhere so beautiful and attractive a presentation of the great subject. The work will be illustrated by four colored plates and nearly five hundred engravings.

THE SCIENCE INDEX. Edited by A. Hildebrandt. Manchester, Eng.: Bow Chambers, 55 Cross street. January, 1879. 19s. a year.

The object of this index is to supply a monthly guide to the more important articles of a scientific nature printed in the leading English and American periodicals. The first issue (quarto, pp. 64) covers the month of January, 1879, classifying and, in many instances, briefly describing the more valuable articles appearing in some forty different papers and magazines. The enterprise is a novel one, and promises to be extremely useful to students and journalists.

ORGANON OF SCIENCE. By John Harrison Stinson, Esq. Eureka, Cal.: William Ayres. 12mo, pp. 158.

This is an ambitious little book. The author describes it as a scientific work, and says that the science, the principles of which it sets forth, differs from all other sciences in that it shows the only keys which can be used in unlocking the mysteries of any science. Unfortunately the keys are very rusty; the print is barely legible, there is no index, and the language will have to be translated into English before many will undertake to read the work. It is asking too much of a man to expect him to learn a new science and a new language at one and the same time.

A MANUAL FOR ENGINEERS AND STEAM USERS. By John W. Hall. Providence, R. I.: Wm. A. Harris. 16mo. pp. 109. 10 cents.

Though intended primarily as a guide to the users of the Harris-Corliss engines, and an advertisement of their merits, this little manual will be found to contain considerable information of value to steam users, engineers, and mechanics.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) H. H. S. asks for the best method of hardening steel. A. It depends upon the quality of the steel. As a general rule it should be heated to a cherry red and plunged into cool (not cold) clean water and held still until cold. A little common salt is sometimes added to the water.

(2) J. A. asks what jewelers use to make hard solder glow in repairing gold or silver jewelry. A. Solder having the proper degree of fusibility is the first requisite. Use pure borax as a flux.

(3) G. J. asks why it is that, in opening the waste valve, such, for instance, in our common wash bowls, a whirlpool immediately is created. A. By the form of the bowl there is a greater or higher column above the outlet than at any other point, and the water is run from the point immediately over the opening; but what gives the rotary movement is a doubtful question.

(4) D. H. M. writes: In our mill we have a steam engine 14 inches diameter of cylinder and 28 inches stroke, making 125 revolutions per minute working under a steam pressure of 70 lbs. to the square inch. I have a single slide valve that cuts off the steam when the piston has traveled half the length of the cylinder. Please give me the horse power of the above engine. A. See p. 267 (4), current volume.

(5) P. C. asks: Do you know of any artificial device in use to create a draught under steam boilers, that will induce the smoke and heat to return and pass under the furnace so that the same can be utilized? I consider the escape of smoke and heat from smoke stacks an unnecessary loss. A. No, but by a proper arrangement and use of blast in ashpot, you can prevent the loss of heat passing off through the chimney, but in a well proportioned boiler this is not worth while; it has been frequently tried and abandoned.

(6) C. H. T. asks: 1. What book could I get that would give me the most information on steam power and the engine, and where could I get such a book? A. For a beginner, Renwick or Lardner on the steam engine; you may obtain it from industrial publishers who advertise in our columns. 2. What is high and low pressure? A. Ordinarily engines (high) exhausting into the atmosphere, and (low) exhausting into a condenser.

(7) C. W. H. asks: 1. What is meant by the pitch of a propeller? A. The advance the propeller would make in one revolution if working in a solid nut. 2. How to find the horse power of an engine? A. See p. 267 (4), current volume.

(8) E. N. asks: 1. How can I determine the amount of weight to be placed on a safety valve? A. See p. 267 (29), current volume of the SCIENTIFIC AMERICAN. 2. How much pressure will a boiler stand, ¼ inch thick, iron, and 4 feet in diameter, providing it was sound? A. If of good iron and in good condition, 60 to 70 lbs; if the boiler is old and deteriorated, not over 50 lbs.

(9) H. R. M. asks (1) for the necessary lengths of the radii for the curves of an achromatic objective to be 12 inches focal length. A. The radius of curvature for both members of the objective will be 6 inches, approximately. It will vary with different specimens of glass. 2. Do opticians use any grinding powder between the last grade of emery and the final polish with rouge? If so, what is it? A. Pumice stone is used.

(10) J. J. C. asks what is the meaning of the letters O. G., as applied to moulding. A. The ogee, or cyma recta, is compounded of a concave and a convex surface, the latter being the lowest.

(11) J. N. D. writes: Does the moon oscillate from north to south, and *vice versa*, during regular and uniform periods? A. The face which the moon presents to us is not always exactly the same, there being a slight apparent (not real) oscillation due to the real inequality in the moon's orbital motion. This apparent swaying is called libration.

(12) E. P. D. asks: What is the carrying strength of a steel cylinder; For example, take a cylinder made from one sixteenth inch steel, 4 feet in diameter and of any given height, say 20 feet, and again 80 feet, the weight to be placed on the top end. What will it carry before bending or collapsing? Of course the joints are supposed to be made equal to continuous steel. A. We know of no experiments with steel tubes that would form a basis of calculation in your case. You will find the results of some experiments with iron tubes in "Fairbairn on Iron Ship Building," page 54, and in "Clark on Britannia and Conway Bridges," vol. 1, pages 343 to 364.

(13) A. F. asks: 1. How can I make electrotypes when my mould is plaster or wax, or the way to do it in any shape or form, having impressions of every size, principally of cameos and medals? A. The solution may be prepared by agitating one ounce of powdered copper sulphate with each pint of hot water, and letting the solution cool and settle. If the mould is not saturated or coated with paraffine, stearine, or some other waterproof substance (before coating with graphite) it is apt to soften and crack or fall to pieces through absorption of the electrotype. 2. Is there any place where I can learn modeling in clay, free, except Cooper Union? A. We know of no other free institution.

(14) F. H. B. asks how to make a cement for fish vases, to set the glass perfectly water tight, and will not poison the water. A. The following is well recommended: Resin, 1 lb.; tar, 4 ounces, linseed oil, about 2 ounces, melt together over a gentle fire and pour into the angles of the aquarium while in a liquid state, but not when boiling, as this would crack the glass. The cement becomes firm in a few minutes. If too liquid after cooling under water, add more tar to the cement and heat again; if not sufficiently fluid add more oil. The cement will not injuriously affect the water.

(15) G. B. M. asks: What is the cause of the ridges on the surface of a board which has been put through a planing machine? A cylinder with but one knife seems to register as many marks to the inch as one containing six knives. A. If your knives are properly adjusted it is probable that your cylinder or knife head is out of balance.

(16) M. M. asks: 1. What gives the lifting power in hydraulic jacks, such as are used in raising locomotives? A. The difference in area of pump plunger and ram. 2. How are they constructed? A. Same principle as the hydraulic press.

(17) G. P. asks: What should be the relative proportion of the grate and the chimney or flue in a furnace for melting brass; say the furnace is 16 inches diameter and 25 feet the height of chimney? A. Make the area of the chimney about half that of the grate.

(18) C. F. asks: 1. If an electric current is used to make an induced current in a second closed circuit, will the former be any weakened or different from what it would have been if the second circuit had not been there, and the former current had not induced another current, other things being the same? A. The current will be slightly weakened owing to the contrary induced current. 2. In the Bell transmitting telephone, is the polarity or direction of the current from the battery changed or reversed at each vibration of the diaphragm; or only the intensity changed, the direction or polarity remaining the same? A. In the new transmitter the primary current is changed in intensity; the secondary current changes direction for each vibration of the diaphragm. 3. When no battery is used

but only the current induced by the diaphragm, is a positive, then a negative, current sent in the same direction, or a positive in one direction, then a negative in the other direction, for each motion of the diaphragm? A. A positive current passes in one direction, then a negative in the opposite direction.

(19) R. S. asks: What is the difference between a German "loth" and an American ounce, or between a German and an American pound? A. The German "loth" is equivalent to ½ ounce, apothecaries' weight. The German pound contains 5,522·96 grains, apothecaries' weight. The American pound (apothecaries') contains 5,760 grains, apothecaries' weight.

(20) R. A. S. asks: 1. Will you please tell me how high water will run in a siphon? A. About as high as it can be drawn with a pump, 26 or 28 feet. 2. What is the composition of which crucibles are made? A. See p. 267, vol. 39, of Scientific American.

(21) "Tinsmith" asks: 1 What is the difference between "coke tin plate" and "charcoal tin plate?" A. The terms "coke" and "charcoal" refer to the quality of iron from which the tin is made. 2. Can bright tin plate be made in this country? A. Yes.

(22) W. P. H. asks: 1. What kind of metal will demagnetize a horseshoe magnet? A. We know of none. 2. Which will run the heavier, a heavy wagon with thick heavy wooden spindles or same wagon with thin iron spindles? A. The one with the wooden axle.

(23) G. T. asks: 1. Which is best, a 6 inch bi-convex or bi-concave, to view pictures in a box? A. The bi-convex. 2. What would be the best distance for focus? A. 10 or 12 inches. 3. Will not this lens do for a camera obscura, with mirror? A. Yes.

(24) C. F. asks: 1. Would the galvanometer be deflected by a coil of wire that surrounds a strong bar magnet? A. Yes, if the bar were inserted or removed. 2. What is the change occasioned in the magnetic field in the telephone by the vibration of the diaphragm? A. The magnet is temporarily weakened by the approach of the diaphragm. 3. What are the best works on magnetism? A. "Rudimentary Magnetism" by Harris.

(25) S. Z. asks: 1. How can be determined the augmenting power of any microscope? A. It is found by dividing the minimum distance of distinct vision with the naked eye by the focal length of the lens or combination of lenses. For example, taking 10 inches as the average distance for the minimum of distinct vision, a lens of 2 inches focal length magnifies five diameters, one of ½ inch 20 diameters, and so on. 2. Can you tell me in what consists the greater value which the short horn cattle have over the common ones? A. Their bones are smaller, they fatten easier, are better milkers, and it might be said that they are generally better.

(26) A. F. H.—A new and useful combination is patentable though its elements are old, if the result of the combination is the product of the co-operative action of its elements, and not a mere aggregation of several results, each the separate product of one of the elements or groups of elements. It is immaterial whether the co-operative parts act simultaneously or successively.

(27) A. asks: Would it be any advantage for a locomotive to have a glass gauge. Provided there were plenty of gauge cocks in proper places, would it assist an engineer to prevent his crown sheet from being burnt? A. We think a glass gauge a good check upon deceptive indications of gauge cocks.

(28) C. K. asks what kind of a book to get to study cam motion, leverage, and mill gearing. A. Box on "Mill Gearing," and Fairbairn on "Mills and Mill Work."

(29) E. S. writes: I have tried to melt brass in a crucible in a common hard coal stove, but it would not melt, and not having a forge, I intend to make a small furnace to melt about 1 to 2 lbs. of brass. It is to be 5 inches inside diameter and 12 inches high, and is to be shaped like a cupola for melting iron. I intend to use coke for fuel, and would like to have your opinion of it. A. A blast furnace of this kind is not adapted to melting brass; an ordinary coal stove will answer every purpose, if the draught is good. It may be that you did not allow the brass sufficient time to melt.

(30) E. N. asks: Where shall I place a weight on a safety valve lever in order that the steam blow off at 80 lbs. pressure per square inch in the boiler? Diameter of valve is 2¼ inches, and weighs 2 lbs.; the lever is 3½ inches from fulcrum to valve stem, and weighs 6 lbs. The weight is 73¼ lbs. Please also give me the rule by which to figure the same. A. See p. 267 (29), current vol. of Scientific American.

(31) A. P. F. asks: Will a safety valve work well with a steel coil wire spring on top of valve exposed to heat of steam as soon as valve rises? A. We have one in that shape on steam fire engine, and when the steam raises the valve it will blow down the pressure 40 or 50 lbs., unless screwed down to get more tension on the spring; and if screwed down when hot from steam blowing off, will not rise until the pressure runs up 40 or 50 lbs. A. Your valve is not a safety valve, but a danger valve. You should get rid of it at once, and put in its place a properly constructed safety valve.

(32) J. H. asks: 1. In what number and volume of the Scientific American is the diagram of Haeckel's theory of evolution? A. See vol. 34, p. 167. 2. In Knight's Mechanical Dictionary, page 90, an ammonia engine is described requiring only one quarter the fuel to gain the same pressure of steam. Could I use ammonia instead of water, with a coil of pipe, for a steam carriage, as described in Scientific American, No. 8, February 22d, page 116? A. Many attempts have been made to use ammoniacal gas instead of steam for motive power, but so far unsuccessfully. It is almost impossible to prevent the escape of the gas in a working machine. This is a source of danger and is injurious to the men. Its economy in practical working has not been demonstrated. It would not suit your purpose, as you must have a condensing apparatus to recover the ammonia in a liquid state.

(33) J. W. F. asks the number of gallons a still will hold, 6 feet in diameter, 25 feet long, filled to a depth of 54 inches. Still is set horizontal. A. 4,254 standard gallons nearly.

(34) J. R. F.—You will find an excellent article on the use of petroleum in steam boilers in Scientific American Supplement, No. 82.

(35) C. K. asks what end of a telephone coil to attach to zinc pole of battery, in order to have the current increase the magnetism, when telephone and sounder of a Morse instrument are used on same circuit. A. If the diaphragm end of the magnet is north, the wire from the zinc pole of the battery should go around the magnet in a left handed direction. If it be south, the wire from the zinc pole should go around the magnet in a right handed direction.

(36) F. A. M. asks: 1. Has either the Bell or Gray telephone been operated over the Atlantic cable? A. No. 2. What obstacles, if any, would there be to the success of such an experiment? A. The slowness with which the electrical impulses follow each other preclude telephonic communication.

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

G. P. H.—It is a deposit of carbonate of lime, containing a small amount of phosphoric acid. By proper treatment it might make a good lime. The industrial uses of lime are many. Its great affinity for carbonic acid fits especially for the preparation of the caustic alkalies. Slaked lime is employed in the preparation of ammonia from sal-ammoniac and of hypochlorite of calcium (bleaching powder). Lime is used in the purification of illuminating gas from carbonic acid, etc.; in the refining of sugar; in the manufacture of soda; in tanning, to remove the hair and prepare the hide; in bleaching; in the manufacture of stearine candles; the making of mortar etc.—C. H. R.—It is not properly a clay, but a loam, a mixture of clay and sand. It forms with water a slight plastic mass, and is not very refractory. We see no reason why the loam, as represented by this sample, should not make good bricks and articles of coarse pottery if properly burned.—F. L. R. B.—It is clay, containing a large percentage of silex. It is not indicative of the presence of any of the noble metals.—H. M. C.—They are not samples of meteoric iron, but of magnetite. Some of the samples react very much like ilmenite (titaniferous iron).

COMMUNICATIONS RECEIVED.

Gary's Perpetual Motion and Neutral Line. We have at hand a few communications on the above, among them a column from Mr. Gary. The editor is, however, obliged to decline as useless the further discussion of the matter.

On the Gary Motor. By P. J. D.
On the Gary Motor. By J. A. P.
On Heat. By E. C. F.
On a Small Steam Boat. By B. J. McD.
On Dreams. By R K. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending April 15, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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