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[NEW SERIES.]

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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 in-

jury 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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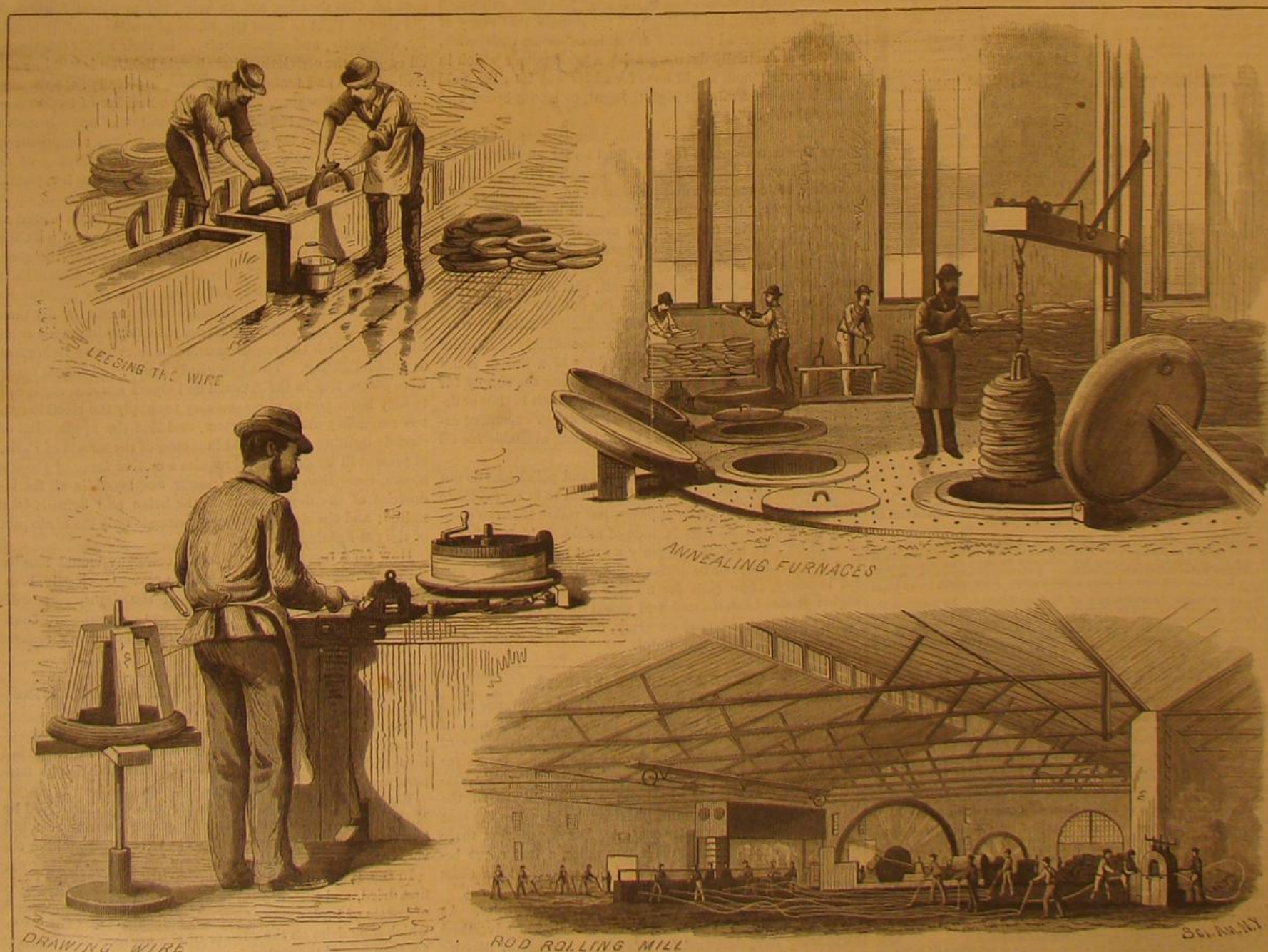


Fig. 1.—THE MANUFACTURE OF WIRE.

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- ASTRONOMY.**—The Evening Star. An elaborate study of Venus. By CAMILLE FLAMMARION. 1 figure. Showing the four principal phases of the planet. Reasons for believing Venus to be climatically adapted for comfortable habitation. Extreme changes of temperature. Lofly mountains. Dense atmosphere. How earth looks from Venus. On the Minute Measurements of Modern Science. By ALFRED M. MAYER. Article XIX. On the measurements of the length of the waves of light, preceded by short accounts of the undulatory theory of the light and the phenomena of diffraction and interference of light. 2 figures. Table of wave lengths of principal Fraunhofer lines. Rutherford's ruling engine. How diffraction gratings are made.
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- AGRICULTURE, FOREST CULTURE, ETC.**—France. Cork oak. Sweden and Denmark. Portugal and Spain. Our own forests. "Arbor Day." New Way to Sow Grain, as practiced in California. Aberdeen Cattle Exhibited at Paris. Large illustration of prize cattle. Alligator Perfume. Musk glands and secretions.

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 Pittsburgh 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 inoxidized 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: $85 \times \frac{2}{3} = 104$, 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 $15 \times \frac{2}{3} = 10$, 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 manufactures, 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 tea-cupful. 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 $1\frac{1}{4}$ or $1\frac{3}{4}$ 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

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 $16 \times 4 \times 75 = 4,800$ 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 quo-

tain safely at center when there is supposed to be no support at its center? If horizontal and 16 feet long, the safe center weight = $2 \times 16 \times 90$ 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 416 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



Fig. 2.—DRAWING STEEL WIRE.

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 "Leasing 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 $\frac{1}{4}$ 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.

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.

tent 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.....	100
Swamp ash.....	80
Black ash.....	60
White beech.....	60
White cedar or arbor vitae.....	50
Walnut.....	50
Tamarack.....	40
Spruce.....	30
Maple.....	110
Hickory.....	140
Rock elm.....	70
Locust.....	130
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 $4 \times 36 \times 90$ divided by $12 = 1,080$ pounds.

(2) If the depth be 4 inches and the breadth be 6 inches, the center load is $6 \times 16 \times 90$ 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, sus-

tain safely at center when there is supposed to be no support at its center? If horizontal and 16 feet long, the safe center weight = $2 \times 16 \times 90$ 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.

Example.—What sized pine beam, 16 feet long, will safely support 1,000 pounds at its center? 1,000 divided by 90 equals 11.1, 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.....	3,300
Elm.....	1,300
Hickory.....	2,300
Maple.....	2,000
White oak.....	2,000
Pine.....	2,000
Walnut.....	1,800
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 SACHEL 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

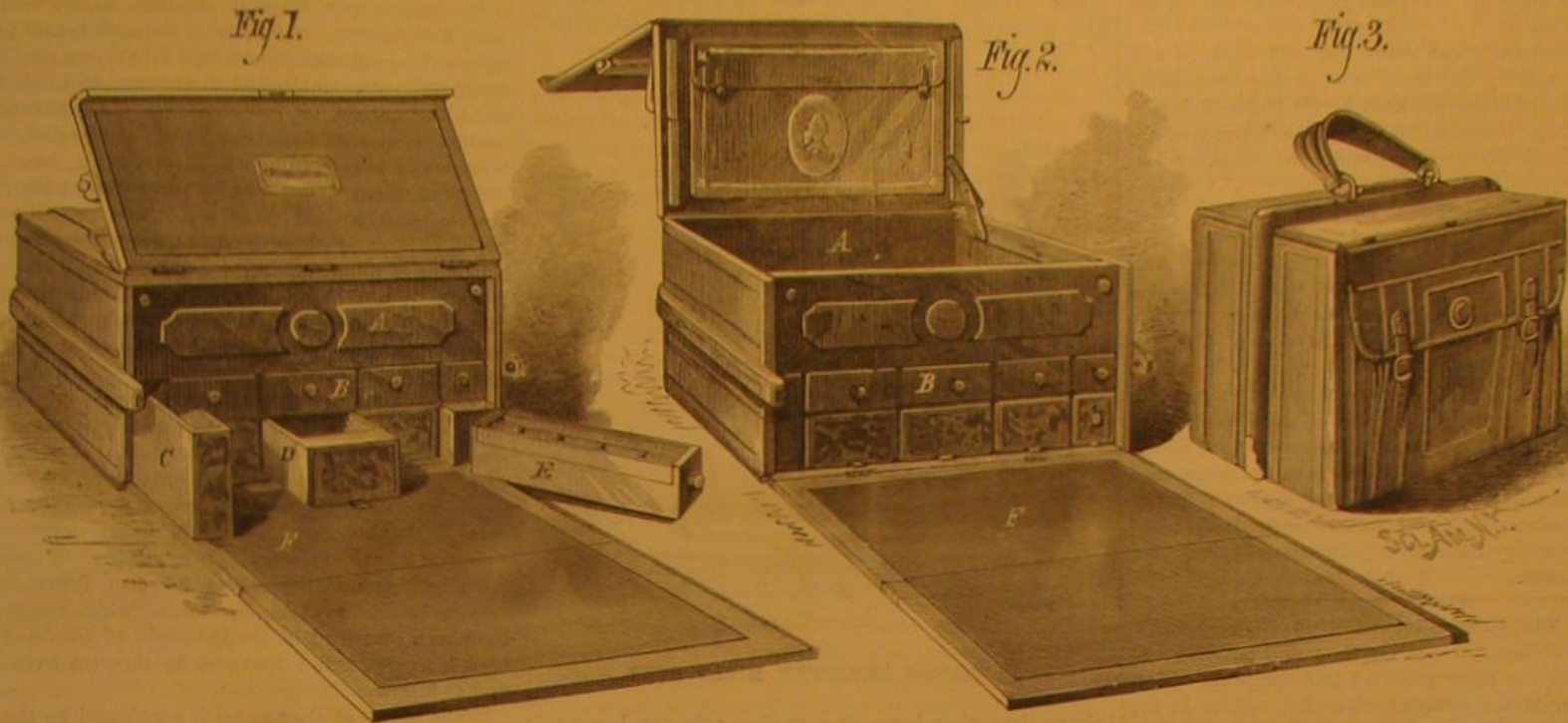
in case of fire it can be carried out without the least trouble or damage, thus making the satchel desk a more secure place for valuables than a bureau, strong box, or even a safe under certain circumstances.

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

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



THE KAPLAN SACHEL DESK.

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 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 convenience 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

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.



Fig. 2.—Surface Cutter.



Fig. 3.



Fig. 4.

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.

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 the 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.

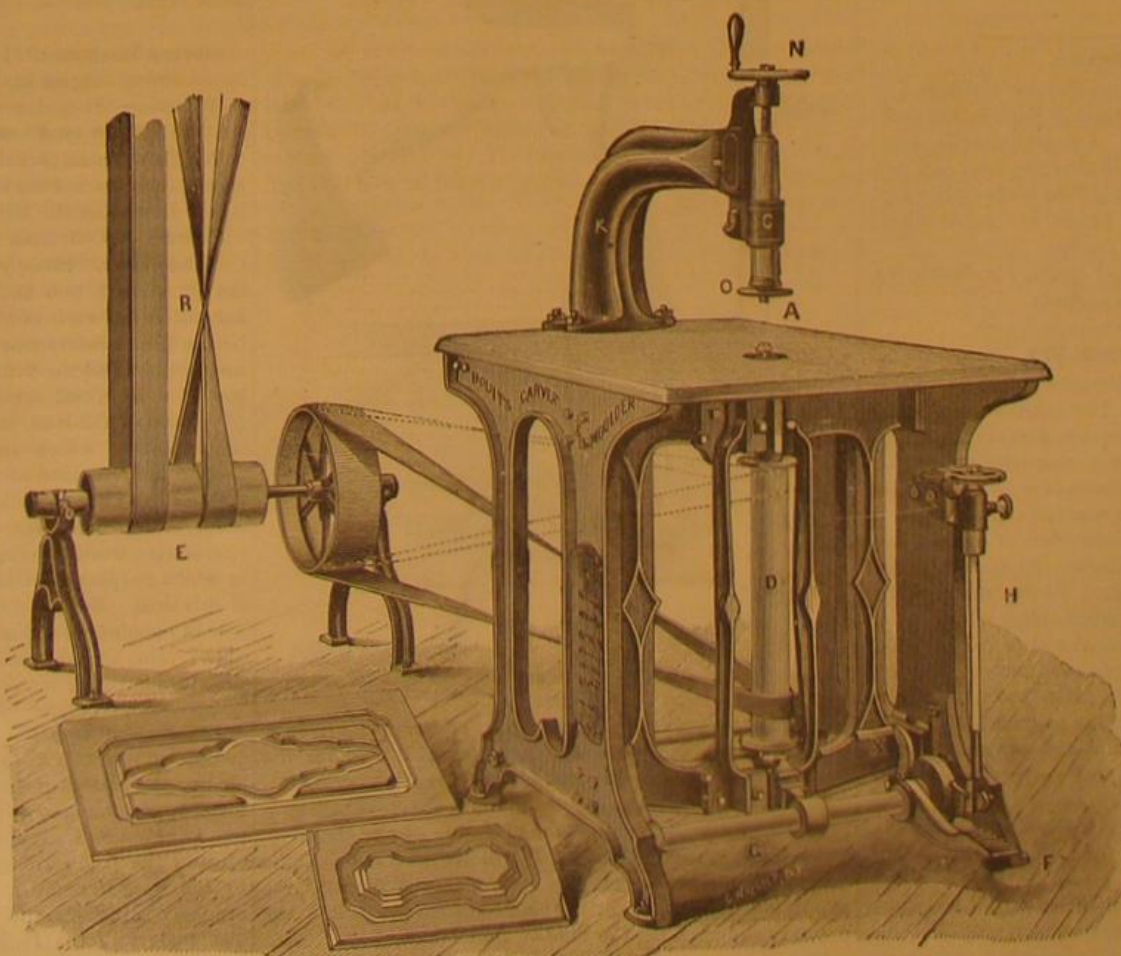


Fig. 1.—BOULT'S MOULDING, CARVING, AND PANELING MACHINE.

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.

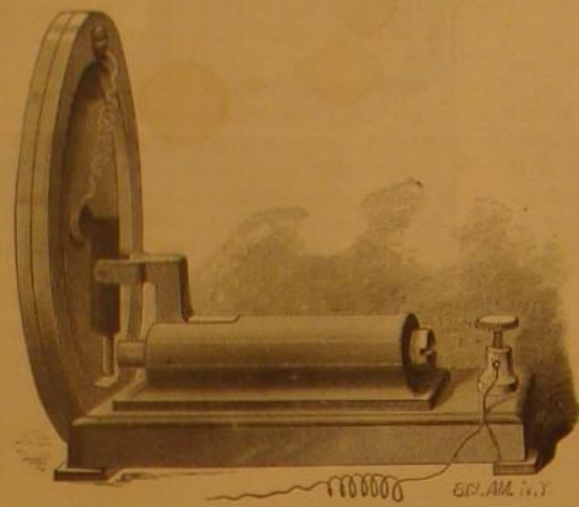
For transmitting speech it is preferable to have the diaphragm in a vertical position, but for experiments it is horizontal.

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.

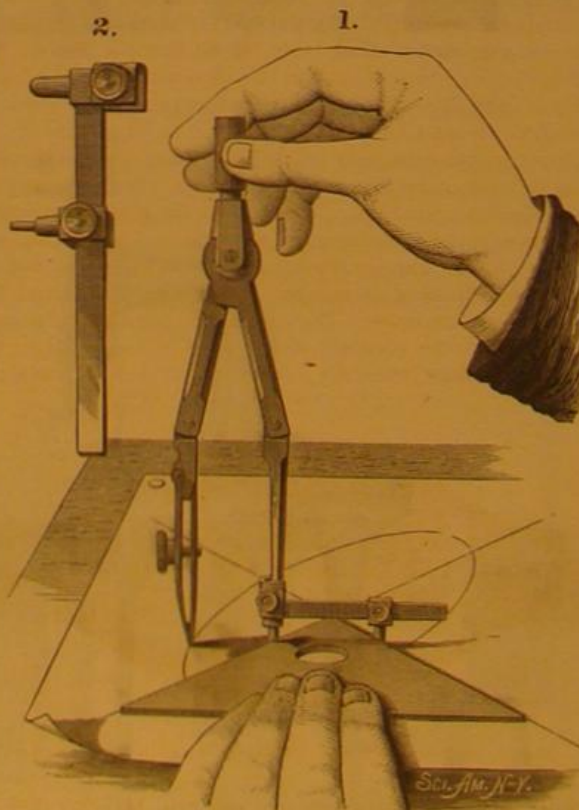
balance the carbon lever on a vertical axle, the lower axis being pointed and working on a plate. The magnet tends to draw this against a carbon block.

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 $\frac{1}{8}$ inch (cube) in size, being covered with paper, wires being placed against opposite sides. The usual size is $\frac{1}{4}$ 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



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 R. 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 $2\frac{1}{2}$ 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 \$30,000, 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.

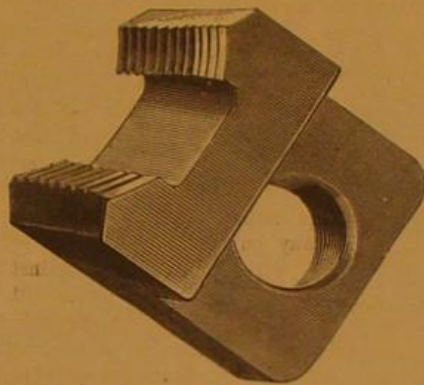


Fig. 2.—DIE FULL SIZE.

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

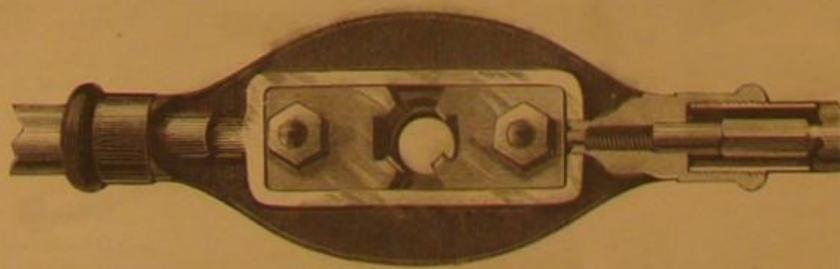


Fig. 1.—ARMSTRONG'S IMPROVED STOCK AND DIES

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.

Scented Crematory Urns.

An interesting archaeological 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 dur-

ing the progress of the cremation. Herr Dahlem, a well known German archaeologist, 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 *Tempeponia 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.

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

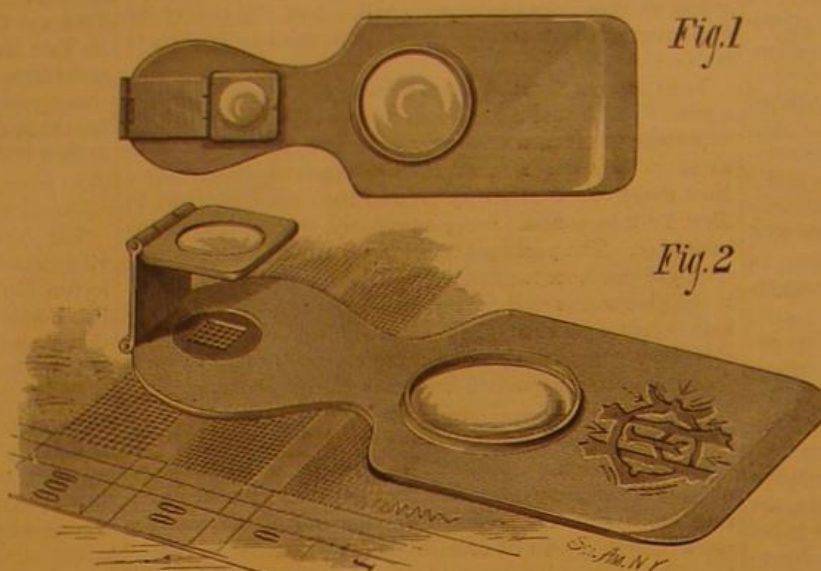
made in two diameters, the smaller fitting the solid hub or boss, A, secured to the engine shaft, the larger receiving the sliding wings or pistons, B, during one half of a revolution. Upon each side of the hub there are flanges which are grooved to receive pistons, and are packed around their peripheries 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.

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.

**DEAL'S FLOUR GRAIN AND BOLTING CLOTH INSPECTOR.**

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

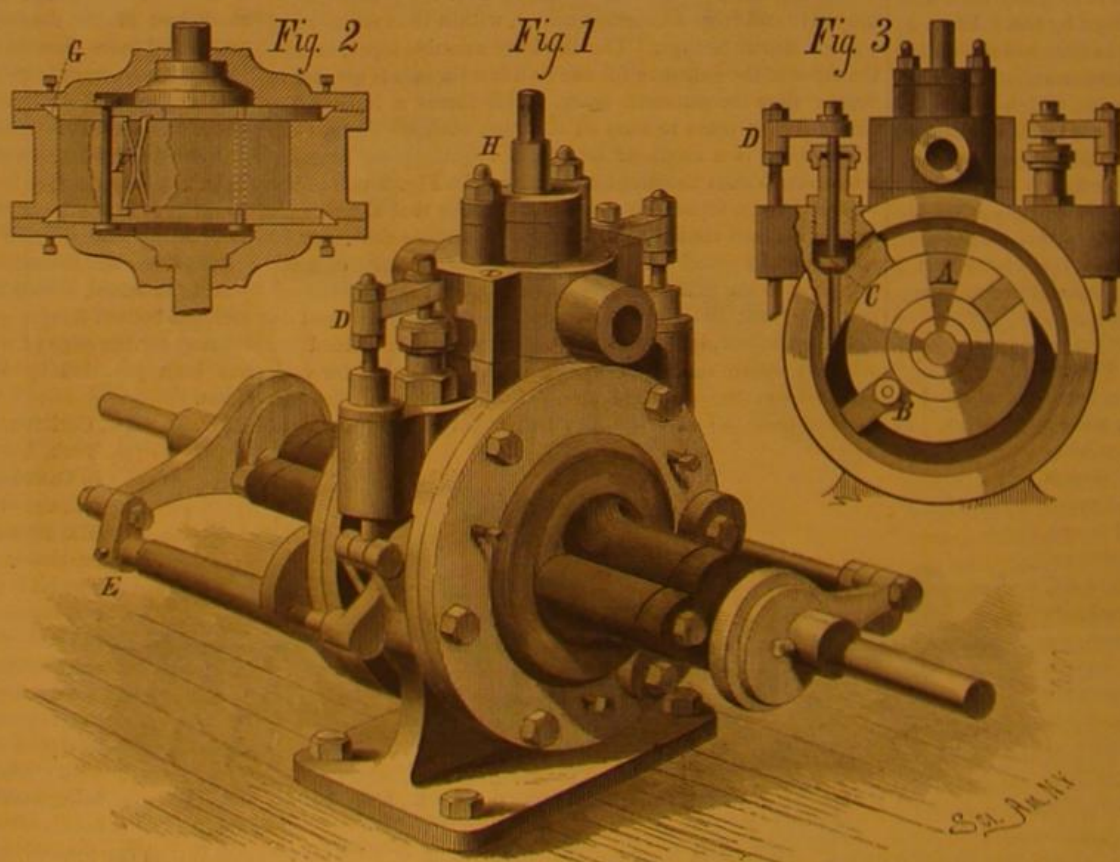
ship thus exposed, when the speed attained was 110 feet per minute. The screw was then removed $1\frac{1}{2}$ inch forward, or $\frac{1}{2}$ inch from the end of the wood, and the speed was only 48 feet per minute. It will be seen that in both cases the highest speeds were attained with the screw in 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 nitrobenzene. 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 embolla and the introduction of air into the veins. Thus may prob-

ably 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 especially 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*.

**HENDERSON'S ROTARY ENGINE.**

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.

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-lobed 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 neottia, 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 stamens arrive 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

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 subterranean roots.

The leaves vary greatly in form and size. In some genera, as *Vanda*, *Agrostis*, *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



THE ORCHIS FAMILY.

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

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 hot-houses at a temperature corresponding to that under which they live in natural conditions. Due attention must be also

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 orchidaceae 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*, *Aerides*, *Agrostis*, *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 orchidaceae 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*, *Macula*, 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 repertory 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 *Compositae*, 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 involucre 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 passerby; 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 *Euphorbiaceae*, 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 *geranium*; 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 coconut 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 scyamore (*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 prootic bones to the jaw. This, like a *ligamentum nucha*, 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 plicae 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.

A Long Bridge.

The bridge across the Volga, in the government 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 workmen 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



EBONY CHAIR.—SIXTEENTH CENTURY PATTERN.

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.

The Electric Light in Cleveland.

The regular lighting of Monumental Park, Cleveland, O



THE BROWN DESMOGNATH.

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 (*Artocarpaceae*) 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 *Tabernaemontana utilis*, and to the natives as "Hyahya." It belongs to the same natural order (*Apocynaceae*) as the Penang India rubber tree and the poison tree of Madagascar (*Cerbera manghas*), 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 *Asclepiadaceae*, which also includes our common milkweeds or silk-weeds. 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 dulce" (*Euphorbia balsamifera*), of the Canaries. This plant again belongs to a different natural order from any of the foregoing, namely, the *Euphorbiaceae*, 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 personality 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 "apthite," 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 "siderapthite" (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 dynamo 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.

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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 $\frac{1}{16}$ ounce, apothecaries' weight. The German pound contains 5,524.96 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. "Radimentary 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 $\frac{1}{2}$ 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 $2\frac{1}{4}$ inches, and weighs 2 lbs.; the lever is $3\frac{1}{2}$ inches from fulcrum to valve stem, and weighs 6 lbs. The weight is 73 $\frac{1}{2}$ 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? 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 99, 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 23d, 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. 4,354 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 silica. 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.]

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

Advertising device, F. J. Bailey	214,275
Air compressor, A. Spencer	214,465
Air heater and cooler, W. Pickhardt	214,443
Amalgamator, Foster & Firmin	214,280
Annunciator, electric, H. B. Porter	214,261
Attrition mill, H. A. Due, Jr.	214,243
Attrition mill, J. J. Hayes	214,256
Axle box, vehicle, J. A. Mackinnon	214,435
Axle, vehicle, Reichelderfer & Wertz	214,449
Bagasse furnace, O. W. Hawk	214,397
Bale band tightener, F. M. Logue	214,256
Bale tie, J. L. Sheppard (r)	8,679
Baling press, P. K. Dederick	214,282
Basket, A. Ulrich	214,265
Bedstead, cabinet, J. M. Montgomery, Jr.	214,416
Billiard table, H. W. Collender	214,268
Bolt cutter head, Morgan & Anderson	214,306
Book cover, copy, J. W. C. Gilman	214,291
Book, memorandum, and account, Lee & Carroll	214,303
Boot and shoe heel burnisher, J. Murray	214,430
Boot and shoe heel, T. Cowburn	214,369
Boots, rubber, G. Watkinson	214,332
Bottle filler and corker, M. E. B. Miller	214,436
Bracket hinge joint, J. Barelay	214,351
Bracket stand, A. B. Denison (r)	8,699
Brake regulator, automatic, G. Westinghouse, Jr.	214,337
Breakwater or pipe, J. Johnson	214,299
Brush, shoe, G. D. Mitchell	214,419
Bucket, well, A. Zimmerer	214,342
Buckle, F. W. Johnson	214,397
Buckle, N. F. Revell	214,315
Bugs from vines, apparatus for removing and collecting, Wood & Smith	214,478
Can heading machine, W. J. Gordon	214,292
Can head maker, C. P. Babcock	214,230
Candle, F. Maguire	214,258
Candy, medicated, G. P. Brown	214,330
Car brake, J. Meissner	214,418
Car coupling, J. J. Christie	214,364
Car propeller, D. Spill	214,406
Car spring, R. Vose	214,328, 214,329
Car, stock, J. Miller	214,472
Car, street, J. A. Ayres	214,347
Car, card holder for street, C. Q. Ring	214,316
Car reclining seat, C. Koehl	214,301
Carbureters, air force for, E. A. C. Pew	214,443
Carriage wrench, E. A. Robbins	214,456
Carriage canopy top, children's, J. M. Crosby	214,361
Cartridge primer, J. Gardner	214,392
Caster for tubs, C. F. Rapp	214,313

Centrifugal machine, Walker & Patterson	214,267
Chains, link for drive, C. W. Levalley	214,409
Cheese hoop, G. L. Freeman	214,381
Churn, M. S. Lyon	214,413
Churn, J. W. Rogers	214,457
Churn, J. W. Wilson	214,268
Clay pulverizer, W. L. Gregg	214,384
Clock for utilizing watch movements, J. Camichel	214,362
Clothes drier, W. H. Uren	214,474
Clothes rubber, Burkhardt & Hopkins	214,361
Clover hulling concave, Lippy & Stocking	214,254
Coal breakers, cylinder teeth for, E. H. Jones	214,388
Coat, N. Malmar	214,431
Cook, gas and water, M. R. Colvin	214,367
Coffee mill, H. Matkin	214,429
Coffin plate, R. J. Howdon	214,292
Colters, hub for plow, S. J. Adams	214,229
Combination chair, C. J. Higgins	214,297
Core anchor and stud, C. D. Woodruff	214,270
Corset, L. H. Foy	214,247
Corset steel, J. Beckel	214,352
Cream from milk, separating, G. A. Kennedy	214,401
Cream raiser, J. J. Lockwood	214,410
Cultivator, W. H. Dickey	214,373
Cut-off, adjustable, T. E. L. Collins	214,396
Ditcher, road, I. Karsner	214,329
Dough kneader, Dows & Berkeley	214,374
Drawer pull, G. W. Tucker	214,473
Electric light apparatus, P. Diehl	214,242
Elevator, S. A. Bates	214,233
Elevator, G. Muller	214,397
Fan or fly brush, automatic, J. B. Powell	214,445
Fare box, C. T. Yerkes, Jr.	214,341
Farm gate, E. L. Ragg	214,319
Fence post, E. C. Sturdivant	214,323
Fence, wire barbed, A. M. Munson	214,417
Field roller, T. S. Monger	214,428
Fifth wheel for vehicles, M. J. Kauffmann	214,400
File, paper, D. W. Lapham	214,405
Firearm, sight for, O. D. Warfield	214,331
Fire kindler, G. W. Stoker	214,467
Fruit cans, cleaning tops of, S. T. Strang	214,468
Gas, purifying and increasing the illuminating power of, O. Lugo	214,412
Gas retort, A. W. M. Maass	214,414
Gas washer, J. M. Hartman	214,293
Glass mould, Atterbury & Beck	214,274
Glassware shaper and finisher, T. B. Atterbury	214,273
Glassware shaper and finisher, W. Beck	214,276
Glassware, machine for shaping and finishing, Atterbury & Beck (r)	8,677
Glassware, machine for shaping and finishing open-ended, Atterbury & Beck	214,245
Globe and shade holder for gas, etc., J. Breeden	214,357
Grain drier, Buhler & Pye	214,237
Grain drill, P. E. Browning	214,358
Hame strap and pad, J. M. Sharp	214,460
Harrow, C. D. Price	214,446
Hat and cap, A. Rosenbluth	214,438
Hat or cap, A. Meyerling	214,423
Hay, etc., stacker, J. Dill	214,284
Hay elevator, A. H. Mason	214,434
Heating apparatus, W. Duryea	214,276
Holting jack, A. Gorrell	214,249
Horse hitcher, J. A. Field	214,245
Horseshoe nail finisher, J. B. Wills (r)	8,673
Hose coupling, vacuum brake, H. H. Westinghouse	214,334
Hydrant valve, Elliott & McCool	214,378
Ice apparatus, water agitator for, F. N. Mackay	214,425
Indicator, G. A. Brady	214,234
Ironing machine, G. Wright	214,340
Knitting machine, J. Nelson	214,308, 214,309
Ladder, step, F. Dyer	214,377
Lamp, F. A. Taber	214,470
Lamp burner, Beeman & Ramsey	214,333
Lamp, carriage, F. C. Cannon	214,277
Lamp globe, H. E. Butler	214,238
Lamp, street, J. Irwin	214,394
Lamps, drip dish for, Clark & Kintz	214,365
Lantern, E. P. Follett	214,379
Lantern, road, L. G. Macauley	214,422
Lath, metallic, C. H. Carter	214,378
Letters in gold or silver leaf on glass, etc., making, M. D. L'Amoreaux	214,233
Loom shuttle, T. E. Roberts	214,317
Loom temple burr roll, Prouty & Sprague	214,447
Lubricator, C. H. Parshall	214,311
Mangle, C. Reese	214,448
Marble and stone, artificial, W. C. Baker, Jr.	214,348
Medical compound, W. H. Ridgway	214,453
Metals by electrolysis, separating, E. Andre	214,344
Metals, composition for cleansing the surfaces of, A. B. Brown	214,300
Microscope for examining flour and bolting cloths, H. J. Deal	214,283
Middlings purifier, J. H. Redfield	214,314
Middlings separator, C. B. Hill	214,388
Mining machinery, R. Cotter	214,241
Monument, J. H. Wimer	214,339
Mower, lawn, W. Lorey	214,411
Muffler, head, S. K. Troelicht	214,326
Nail distributor, A. Morrison	214,335
Nursery chair, A. B. Stevens	214,479
Nut lock, H. W. Layton	214,408
Oat separator, J. Magone	214,415
Oils, case for retailing, A. Reynolds	214,450
Ordinance, L. A. Merriam	214,280
Ovens, regenerative hot blast, J. M. Hartman	214,294
Overalls, S. Lasky	214,406
Pail fastening, butter, C. D. Westlake	214,338
Paper box, G. L. Jaeger	214,336
Paper box machine, E. M. Thompson	214,235
Paper or board, compound, J. O. Gregg	214,256
Paving and roofing compound, A. T. Perry	214,312
Paving block, F. Geib	214,383
Piano and organ case, H. W. Smith	214,322
Pipe coupling, brake, G. Westinghouse, Jr.	214,335
Plant irrigator and propagator, C. A. Smith	214,333
Planter, cotton and corn, T. V. Cardwell	214,331
Plow, W. B. Allen	214,272
Plow, Melkile & Coleman	214,259
Plow, A. W. Washburn	214,476
Plow, snow, Osgood & Morse	214,310
Plow, sulky, T. E. Jefferson	214,396
Plow, sulky, J. M. Payne	214,440
Power transmitter, E. H. Drake	214,375
Prison lock, L. M. Ham	214,251
Pump and water pipe safety regulator, T. J. Smith	214,463
Punch, ticket, Hall & Furlong	214,385
Rag or waste picker, J. T. Slack	214,462
Rocking chair, S. Willershausen	214,477
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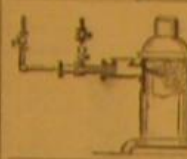


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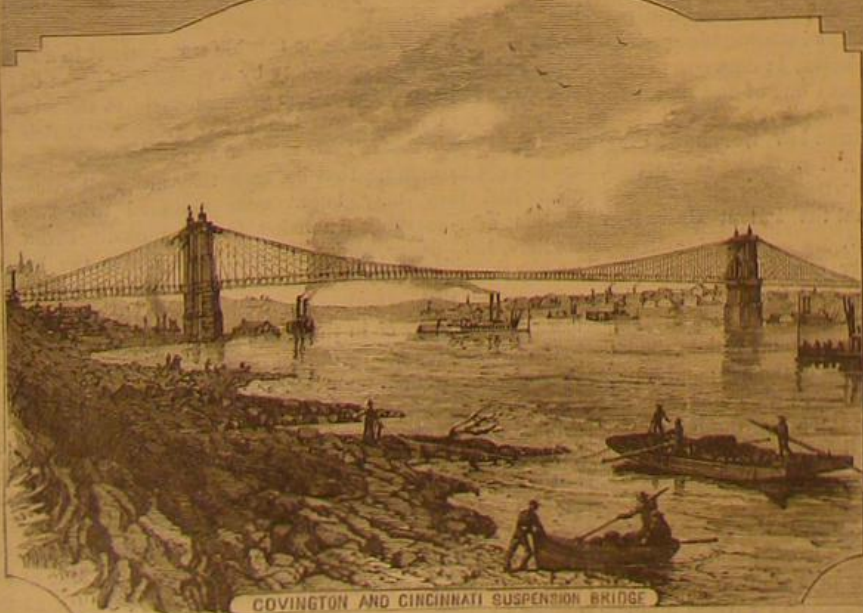
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NEW YORK, SATURDAY, MAY 31, 1879.

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DESIGN PATENTS.

The following is the text of the principal part of the existing law in relation to patents for designs:

"Any person who, by his own industry, genius, efforts, and expense, has invented and produced any new and original design for a manufacture, bust, statue, alto-relievo, or bass-relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture; or any new, useful, and original shape or configuration of any article of manufacture, the same not having been known or used by others before his invention or production thereof, or patented or described in any printed publication, may upon payment of the fee prescribed, and other due proceedings, had the same as in cases of inventions or discoveries, obtain a patent therefor.

"Patents for designs may be granted for the term of three years and six months, or for seven years, or for fourteen years, as the applicant may, in his application, elect."

The government fee for a design patent of 3½ years is \$10; for 7 years, \$15; for 14 years, \$30.

The interpretation and practice of the Patent Office in respect to that portion of the above law which we have italicized, has varied from time to time according to the particular views of the individual who happened to occupy the chair of the Commissioner of Patents. For several years past, however, the Patent Office has held the words italicized to mean that the new shape or configuration of the article must be ornamental, otherwise no patent could issue. Accordingly it has been the custom for the Patent Office to reject all applications for design patents for new forms of articles, unless such forms were ornamental.

We are glad to observe that the present Commissioner of Patents, General Paine, has set aside this old practice, and adopted a more liberal and evidently more correct interpretation of the law, whereby design patents will hereafter issue for any new, useful, and original shape or configuration of any article of manufacture, as stated in the law.

Commissioner Paine's decision to the above purport was announced in the recent appeal case of Shoeninger. The Commissioner says: "The examiner's objection in this case is, not that the design is for a shape or configuration wholly useful, but that it is not for a shape or configuration wholly ornamental. He thinks the presence of utility as one of the qualities of the design renders it unpatentable, notwithstanding the simultaneous presence of beauty as another quality. But I think that if the design is new and original, and also useful, it is patentable under the law, whether it be or be not ornamental or beautiful. The examiner will conform his action in the case to the foregoing opinion."

We think that this decision of Commissioner Paine will be generally received with satisfaction and that it will be upheld as correct by the courts. We regard it as a decision of considerable importance and far reaching in its scope.

Not only may inventors obtain patents in the usual manner for improvements of every kind; but they may further fortify themselves by taking design patents upon original forms or shapes of any of their articles. It is oftentimes the shape given to any article of manufacture that determines its popularity or governs its saleability in the market. Any one who can produce a new design for the shape of a plow, a fence, a chair, a dish, a garment, or other useful article, would appear to be entitled to a design patent for such novel shape, under this ruling of the Commissioner; and such patents may prove to be of intrinsic value.

For several years past there has been regularly introduced in Congress, but always defeated, a bill to so amend the patent law as to make it an offence for anybody to use a casting as a pattern for making other castings, except by consent of the maker of the original pattern. We have always felt constrained to oppose the enactment of this law, and have shown that while it is very annoying in some cases to pattern makers to have their unpatented designs appropriated by others, still it is one of the conditions of trade. Whatever is good and popular others will, of course, desire to imitate; but it would be iniquitous, as was intended by the proposed law, to empower the owner of a wooden pattern of an old stair plate, for example, costing him perhaps a dollar, to collect hundreds of dollars in damages of any poor fellow simply because he used one of the plates for moulding.

In discussing this proposed pattern law we showed that the design patent law as it stands, if properly interpreted, would be adequate to protect the owners of original and useful patterns; and we are glad that the Patent Office now adopts substantially the same view.

Pattern makers have no further occasion to grumble or seek for special legislation. The Patent Office, as we understand it, is now ready to grant proper claims for anything that is original and useful in the shape of any article. This is a broad, liberal, and encouraging view of the law; and is likely to give a renewed stimulus to the art of designing, not only in decorative applications, but in the proportioning of patterns, goods, and manufactured articles of every description.

THE IMPATIENCE OF YOUTH.

Not long since the SCIENTIFIC AMERICAN ventured to suggest that in the matter of education a late beginning was better than none, and that not a few men whose early advantages had been small had by diligence and earnest application in maturer years achieved an enviable degree of scholarship. A far less hopeful view of the advantages of trying

to make up in later life for opportunities missed in youth is taken by a correspondent, who prints his name in very large letters at the top of his paper, and under it the words "Lecturer and Essayist," but does his writing with a lead pencil. He says:

"True it is, that the young men who regret educational deficiencies are legion. Many make no effort to remedy the evil, and it is little wonder they do not. There is but little encouragement given the young man who does strive to better his education. I cite my own experience as an instance: I am a young man, and have employed my spare moments, since beginning active life at 16, in the acquisition of knowledge. I apply for a situation requiring a knowledge of one of the branches I have studied and am asked for my 'diploma.' I have none, am self-educated. I am not wanted. A person who has a certificate of ability from some school takes the situation. Is it, then, strange that so many young men cease to strive for knowledge? Especially when they apply, as I have done, for a place at manual labor and—because they are known to be students—are told that 'no dreamers or theorizers are wanted.' And that, too, when they were strong, active, and willing, when they could have brought to bear on the work a superior muscle, operated by a good intellect. Around me to-day I see ignorant men, unable to read or write, basking in the smiles of Dame Fortune, while with great effort only I keep a crust in my mouth for my pains to cultivate body and mind. Now when such encouragement as this is given to him who improves spare time, is it strange that many decline to tread the thorny way up the hill of science?"

This is a characteristic plaint of youthful eagerness and impatience. The ambitious stripling, whether self-taught, college-taught, or not taught at all, is confident of his ability to fill any position, and marvels that the world does not hasten to set him to work on his own terms. And not unfrequently his lofty estimate of his own merit is the sole bar to his getting a chance to show what stuff there is in him. From a purely business point of view we confess that with all our regard for culture, perhaps because of it, we should hesitate to engage for manual labor a young man, however muscular, who wrote "Lecturer and Essayist" after his name. This not from any feeling of disrespect for reading and writing, but rather the contrary. What right-minded man, for example, would enjoy having a Tyndal or a Tennyson to black his boots, let the work be done by him never so cheaply or skillfully?

That, other things being equal, the man with a diploma will ordinarily be preferred for the work covered by the diploma is very true. In many cases the intending employer has no other means for estimating the fitness of a candidate. Any lack on this score, however, so far from deterring a youth from study, should incite him to study the more, that he may the more speedily overcome the obstacle thus opposed to his progress in life. But our young friend must not think that the self-taught are peculiarly afflicted in having to wait overlong for a public recognition of their deserts. Speaking of the conflict between general and special education, a clever writer touches this very grievance as one particularly felt by young men fresh from college. He says:

"It has been said that the higher education of the period scatters too much—that it gives the aspiring youth much that is of no practical value and little that is. This is not so. There are few graduates of our colleges who cannot take up a specific business as soon as they get their sheepskin, and follow it much more to their own satisfaction than anybody else can, however extended the latter's experience and however great the sacrifice of time and money he has been at to fit himself for that particular branch. The young collegian feels hurt if he is not granted at once all the emoluments which belong to the older person alluded to, and frequently hopes, and says as much in forcible and elegant language, that the time will speedily come when people will appreciate the general education more and the specific less. This shows that he is adapted to everything from the word 'go'—if we may be permitted the expression; that there is no limit to his powers in any branch of business or in the professions, from the matter of sawing wood to that of presiding on the bench."

Another phase of the same trouble was noticed in a recent address before a college society by a prominent jurist of this city, who remarked that "one great obstacle to the advance of young men in political life is the arrogance which too many of them affect in their relation to public affairs. They are too apt to assume that because they are well read and cultivated they may be at once assigned to command without ever carrying a musket in the ranks. From old soldiers, hot, dusty, and begrimed with battle, the brightness of the new uniforms commands but slight respect."

It matters little whether the aspiring youth acquired his learning in college or in the solitude of his own chamber, he is too apt to overrate its amount and importance, and to feel very much sat down upon by the world when it manifests no urgent desire to furnish him free scope and vantage ground for the exercise of his peculiar talent, which too often exists only in his own imagination. "Knowledge comes, but wisdom lingers," and it is ever the sore affliction of impatient youth that the world cares most for wisdom. Ten years from now our correspondent, if he does not give over his efforts to grow in knowledge, will probably smile at the narrowness of his present view, and possibly laugh at the callow foolishness of his fancy that the world offers no encouragement to such as patiently strive to better their intellectual condition.

COMMON MISTAKES IN HOUSE BUILDING.

A writer in the *American Architect and Building News* has recently directed attention, with considerable truthfulness, to certain mistakes of plan in house building, which too often occur in this country. These mistakes, he says, have their origin outside of the profession of architecture, and are due to the ignorance of those who build. It is certainly reasonable to expect that a person who is about to build should know such simple matters as the number and character of the rooms he will have; yet this is just what many people do not know, and here is where the first mistake is made. People in their ignorance err in wishing too many rooms. Many people, with a desire to imitate the nobleman's mansion, decide to have a jumble of hall, drawing-room, morning-room, dining-room, library, study, boudoir, billiard-room, breakfast-room, music-room, reception-room, and so on; and to these they add others of their own invention, till there is a separate room for the performance of almost every act of daily life. As all this costs, and there is a limit to every man's purse, economy is attained by copying the stone wall of their model in wood and plaster, woodwork in paint, cheapening the foundations, and making thin walls that keep out neither cold nor wet.

A sensible man in building his house proceeds on a different plan. He wants just such accommodation as he needs, and no more. He knows that for the average American family in good circumstances three principal rooms are sufficient: drawing-room, library, and dining-room—these he has use for. He also needs a hall by which to reach the others, and a vestibule or porch, as a shelter to the hall. He omits the "family sitting-room," knowing that the three other rooms will serve that purpose, and that any room too good for daily use has no right to exist. The habit of keeping shut-up parlors for occasional company is so absurd that it is difficult to give people who practice it credit for common sense.

Another common mistake is the small scale of the kitchen and offices as compared with family rooms. A kitchen, if work is to be well done in it, and the dinner to be well cooked, should not be less than the equivalent of 15 feet square, and should be still larger in a house employing many servants. The communication between the kitchen and offices and the family apartments, and the concealment of the former from public view, are matters which are much neglected. The usual arrangement of placing a butler's pantry between kitchen and dining-room, with doors to both rooms, often directly in line, makes the best possible conveyance for odors from the kitchen to dining-room, and thence to the rest of the house. In the case of a basement kitchen the same result follows from having the basement stairs open instead of inclosed, as they should be. The English manage better: they put next the dining-room sometimes the butler's pantry, but oftener a small serving-room, opening not to the kitchen, but to a passage leading thither; and this passage is made the only means of access from the family rooms to the kitchen and offices, which, if not in the basement, are in a wing under a separate roof from the main building, so that by closing one door (or two at the most) all communication is cut off, and the odors from the kitchen do not annoy the family.

A common thing in country houses, though often omitted in the city, is a servants' staircase. People of small means, who can afford but one servant, insist upon the separate staircase for that one, while many a city family with three or four servants gets along perfectly well without it. This hobby with country people amounts almost to fanaticism. The second staircase, a great convenience in large houses, is out of place in a small one, there being nowhere to put it; to a small family it is unnecessary, and therefore wasteful.

The place of a veranda may seem a thing of small moment; yet it may prove either a great comfort or a great nuisance, according to its position. Most people seem to suppose it should be on the sunny side of a house, where it darkens the rooms, itself being ablaze with light and hot as a furnace. But the object of a veranda is not to keep the light out of the room, because this can be done better by the window hood or shutters, but to afford a cool, sheltered, shady place out of doors for summer use. Hence it should be on the shady side of the house—on that side that is shady in the afternoon. To prevent the rooms behind it being too much shaded they should, if possible, have one or more windows on the side not covered by the veranda; or, if this cannot be, the windows looking upon it should be made very large, and the veranda itself of light construction and painted as light a color as the rest of the house will admit. No one should worry about too much light in the house; there are many days when there cannot be too much, and when there is, it is easy to shut it out.

CHICLE, OR MEXICAN GUM.

The great interest which has for some time past been manifested by technologists in the search for substitutes for India rubber and gutta percha has led Drs. Prochazka and Endemann to undertake the examination of a Mexican product, known in the United States for some years under the name of chicle and sapota. The latter name would imply that the product is derived from one of the many species of the order Sapotaceae, to which belongs also the tree producing the balata gum. The difference in the manner of obtaining the material is evident from the chemical composition. While balata is an almost pure hydrocarbon, chicle contains, also, the various impurities of the juice from which it is derived. The only description that has been given of this material seems to be that of Mr. J. R. Jackson, who states that it is probably derived from *Chrysophyllum glycyphallum*, of the

order sapotaceae, that it is also known under the names of Mexican gum and rubber juice, and that it resembles gutta percha in appearance, but is more friable and brittle.

The material examined was in the shape of rectangular cakes, of light chocolate color, which was deeper on the surface owing to atmospheric influences. It crumbled between the fingers, but had a certain degree of softness and tenacity, which was more perceptible after heating. Taken into the mouth it disintegrated, united again after chewing, forming a soft plastic mass. The latter quality has made it a favorite material for "chewing gum." On heating, it first evolved a sweet caramel odor, after the disappearance of which there was perceptible the peculiar smell that is generated when caoutchouc or gutta percha is treated in a like manner. Boiled in dilute acids the substance disintegrated, the brown solution containing oxalic acid and saccharine matters. The residue, subsequently boiled with dilute solutions of caustic alkalies, united again, forming a doughy mass. The authors found the following constituents (the figures being approximate): Chicle resin or gum, forming 75 per cent of the crude material; oxalate of lime (with small quantities of sulphate and phosphate), 9 per cent; arabin, about 10 per cent; sugar, about 5 per cent; salts, soluble in water (chloride and sulphate of magnesia, small quantity of potash salts), 0.5 per cent.

As the results of their investigations (which was the subject of a paper read before a recent meeting of the American Chemical Society, of this city) the authors draw the conclusion that chicle is merely the product of direct evaporation of the juice, without attempt at separation, as practiced in the case of gutta percha and India rubber. They have no doubt that by proper treatment of the raw juice a far more valuable product can be obtained than the chicle gum now found in the market. Whether the product, then obtained, will be one similar to gutta percha, balata, or India rubber, must be left to future examination of the raw juice, which, so far, they have been unable to obtain.

THE CAUSE OF CONSUMPTION.

Dr. Rollin R. Gregg, of Buffalo, New York, is confident that he has solved the mystery of consumption. Regular physicians will be apt to say that he has mistaken a condition for a cause; nevertheless we are inclined to think that good may come from the emphasis he lays upon that condition, since it seems calculated to work a beneficial change in the customary treatment of the disease.

Dr. Gregg argues that as the loss of albumen from the blood through the mucous membrane of the kidneys in Bright's disease, rapidly and fatally depletes the system, much more must the more rapid loss of albumen through the mucous membranes of the lungs be serious in all its stages and speedily fatal in its results, if proper measures are not taken to stop such waste before fatal conditions have arisen. The expectorations of consumptives, and all their other catarrhal or mucous discharges from whatever organ, are mostly albumen and a direct loss of so much of this constituent from the blood. It is this wastage which causes the great emaciation characteristic of consumption, and not, he thinks, any failure of the system to assimilate food. And this loss of albumen does mischief not only in robbing the muscles of their proper nutrition, but also in throwing the constituents of the blood into disproportion. The loss of one ounce of albumen destroys nearly a pound of blood for all purposes of healthy nutrition, and leaves in the blood a relative excess of $5\frac{1}{2}$ ounces of water, 7 ounces of blood corpuscles, 9 grains of fatty matter, 15 grains of fibrin, and 41 grains of salts. These elements in excess act the same as foreign matters in the blood, and disturb the entire economy of the system. Night sweats and dropsy are the result of the excess of water. The blood corpuscles left in excess are decolorized by the too watery blood, and are deposited in the capillaries or smallest blood vessels, where they shrivel and become tuberculous corpuscles, so called; the fatty matters in excess cause the fatty livers and other fatty degenerations attending the disease; the excess of fibrin causes the adhesion of the pleura to the inner surface of the ribs, the heart, or to each other, often among the most serious of the complications of consumption; and, finally, the excess of salts causes calculi, enlargement of the joints, ossifications, and similar morbid developments.

In such cases of consumption as are characterized in their earlier stages by an absence of profuse expectoration, Dr. Gregg would attribute the beginning of the disease to a loss of albumen through some other organ or organs, the shriveled blood corpuscles lodging in the lungs, starting tubercles there and setting up a dry cough, with the resultant irritation of the mucous membrane and outpouring of mucus. From this point of view, there is but one source of hope to the consumptive in any stage of the disease, and that is through the healing of the mucous membranes and the stopping of the waste of albumen. By this means, in the earlier stages of the disease—with all who have not inherited the most feeble constitutions—there is much to hope from judicious treatment.

Whatever may be the primary cause of consumption, it is pretty evident that the mucous discharge which attends the disease and finds relief in expectoration is to be repressed rather than encouraged; and to do this must radically change the usual treatment of the disease, at least in its early stages.

FUMIGATING PAPER.—Apply to bibulous paper a strong ethereal or alcoholic solution of benzoin, tolu, storax, oil-banum or labdanum. To burn well the paper should first be impregnated with an aqueous solution of niter and dried.

AMERICAN INDUSTRIES.—NO. 14.

SUSPENSION BRIDGES.

We present our readers with engravings of four of the great suspension bridges of the United States, and give a history of each as furnished by the eminent engineers and constructors, the John A. Roebling's Sons Company, of Trenton, N. J. The fact that this establishment is the largest of its kind in this country, and probably the largest in the world, adds interest and weight to the particulars given below.

THE NIAGARA BRIDGE.

This bridge was constructed by John A. Roebling between the years 1852 and 1865.

It has a span of 821 feet 4 inches between centers of towers. It has two floors, an upper and a lower one, suspended separately to separate cables, but connected with each other by two longitudinal trusses. The railroad track, which is over the roadway, is 245 feet above the river.

The base of the tower at the level of the lower floor measures 60 feet by 20 feet, and is pierced by an arch 19 feet in width, which forms the entrance to the lower bridge. Above the level of the railroad track each tower forms a single column, 60 feet high, which is 15 feet square at the base and 8 feet square at the top.

This bridge has four cables, each 10 inches in diameter, composed of 3,640 wires, No. 9 gauge. The suspenders, 624 in number, are placed 5 feet apart. The floor is further supported by 64 diagonal stays, and there are 56 under floor stays, fastened to the rocks underneath the bridge.

THE COVINGTON AND CINCINNATI BRIDGE.

Work on the Cincinnati Bridge was commenced in September, 1856. The financial crisis of 1857 stopped the work, and owing to the civil war which soon followed work was not resumed again until 1863, and the bridge was completed in 1867. Since January 1st of that year it has formed the great public highway between Covington and Cincinnati. It cost one and a half million of dollars.

This bridge has a single span of 1,057 feet from center to center of towers, and two half spans of 281 feet each. The total length of the bridge, including its approaches, is 2,252 feet. Its height is 103 feet above low water.

The floor of the bridge is composed of a strong wrought iron frame, overlaid with several thicknesses of plank and fastened to the cables by means of suspenders. The suspenders are arranged between the roadway and the sidewalks. The roadway is 20 feet wide, the sidewalks 7 feet each. The whole width of the floor is 36 feet.

The towers rest on timber platforms, 110 feet long, 75 feet wide, and 12 feet high. These platforms are composed of 12 courses of timber. The excavations for the platforms were carried 12 feet below extreme low water mark, where a bed of gravel and coarse sand afforded a good foundation. The bases of the towers are 82 feet long and 52 feet wide. Above the floor of the bridge the tower is divided in two solid shafts, connected above by a semicircular arch. The total elevation of the towers is 230 feet above low water mark. Each tower contains about 400,000 cubic feet of masonry, mostly sandstone from the Buena Vista quarries. The base and upper cornice are of limestone.

The floor is supported by two cables, $12\frac{1}{2}$ inches in diameter, containing 5,180 No. 9 wires. The cables at a medium temperature have a deflection of 89 feet. The total quantity of wire worked into these cables, including the wrapping, amounts to 1,050,183 pounds.

The principal vertical rigidity of the floor is obtained from the two trusses which separate the roadway from the sidewalks. They are 10 feet high, and are formed of top and bottom chords, connected by vertical posts and diagonal ties. Each chord consists of two 9 inch channel bars, separated by the upright 7 inch I-posts. The flat bars which form the diagonals are 3 inches wide and $\frac{3}{4}$ of an inch thick.

The flooring of the roadway consists of three thicknesses of plank, making a total average thickness of 8 inches. The general appearance of the floor is that of an easy curved arch, having its apex in the center of the main span. The grade is from 3 to 4 feet in 100 feet.

THE ALLEGHENY BRIDGE.

This bridge was begun in the year 1858 and finished in the year 1860.

The length of the bridge is 1,037 feet 5 inches, divided into two main spans of 344 feet each, one half span of 117 feet 5 inches, and another half span of 171 feet.

It was built for heavy road travel. The width of the platform is 40 feet, divided into a roadway 20 feet wide, and two sidewalks each 10 feet wide.

It is supported by four cables, of which the two outer ones incline outward from the towers, and the two inner ones incline toward each other, giving lateral stability to the structure. The outer cables, which support the sidewalks, are $4\frac{1}{2}$ inches in diameter, and composed of 666 wires, No. 9 gauge. The inner cables are $7\frac{1}{2}$ inches in diameter, and contain 1,926 wires, No. 9 gauge. The deflection of the cables is 30 feet.

The towers are 45 feet high. They are composed of four inclined cast iron columns, braced together by latticed castings, and crowned with an ornamental cap.

The bridge has two longitudinal iron lattice girders which give it stiffness.

THE EAST RIVER BRIDGE.

The bridge now in process of construction connecting the cities of New York and Brooklyn will have the longest single span of any bridge in the world. The main span will be 1,595 feet 6 inches, and the land spans 930 feet each.

This bridge was designed in 1867 by John A. Roebling, but he died in 1869, before any work on it had begun, and it has been built entirely under the guidance of Washington A. Roebling, the present Chief Engineer.

The bridge extends from the junction of Sands and Fulton streets, in Brooklyn, to Chatham street, in New York—a total length of 5,989 feet, the Brooklyn approach being 971 feet, the suspended part 3,455½ feet, and the New York approach 1,502½ feet.

The approaches will consist of a series of brick and granite arches, which, when finished, will be ornaments to the two cities. It has taken nine years to complete the towers and anchorages, construct the cables, and get everything ready for the suspension of the floor.

Preparing the foundations for the towers was one of the most difficult parts of the work. Huge timber caissons, each 170 feet long, 102 feet wide, and 25 feet high, containing over 1,600,000 feet of timber, were sunk below the bed of the river until they rested on rock or on an equally firm stratum. On the Brooklyn side this was reached at a depth of 45 feet below high water; but it was necessary to go 78 feet below high water on the New York side. The pneumatic method of sinking caissons is not new, but the operations here surpassed by their immensity everything of this kind that had ever been done before.

The towers are 278 feet high. The anchorages are 129 feet by 119 feet at the base, 117 feet by 104 feet at the top, and 89 feet high.

The total quantity of granite and limestone in the towers and anchorages is about 145,000 cubic yards, and it required the continuous work for four years of over 20 quarries in Maine, Massachusetts, Rhode Island, and New York to furnish the necessary supply. In the summer of 1876 the masonry was completed.

On the 29th of May, 1877, the first wire for the cables was stretched across the river. There are four cables, each consisting of 19 strands, each strand containing 280 galvanized cast steel wires, No. 8 gauge. These cables are 15¼ inches in diameter. For wrapping the cables galvanized annealed iron wire was used. March 1, 1879, the four cables were completed just 21 months after they were commenced.

The platform of the bridge, which is 5 feet wider than Broadway, is sustained by the iron cross beams, and stiffened by six longitudinal trusses. It is divided into five parts, two outer ones intended for horse-cars and general vehicle traffic, two intermediate divisions intended to accommodate the rapid transit passenger cars, and a central promenade, a little above the level of the main floor, and intended for pedestrians. The stiffening trusses will be of iron, six in number, the two outer ones 9½ feet high, the other four 16 feet each in height. The total weight of the bridge will be 13,300 tons. It is proposed to move the cars on this bridge by means of wire ropes and stationary engines. This method is considered preferable to the use of locomotives on account of the steep grade of the bridge.

It is estimated that the bridge, when completed, will have cost \$13,500,000, of which \$9,500,000 will be spent on the bridge itself, and \$4,000,000 in acquiring the necessary real estate. It is hoped that in 1881 the bridge will be open to the public.

All of the twisted cables, stays, and suspenders used in the construction of these four bridges were manufactured at the John A. Roebling's Sons Company's works, at Trenton, N. J. Some of the stays are so large that special machinery has been built for the purpose of making them, and no other establishment possesses the facilities for doing such heavy work properly.

Education in China.

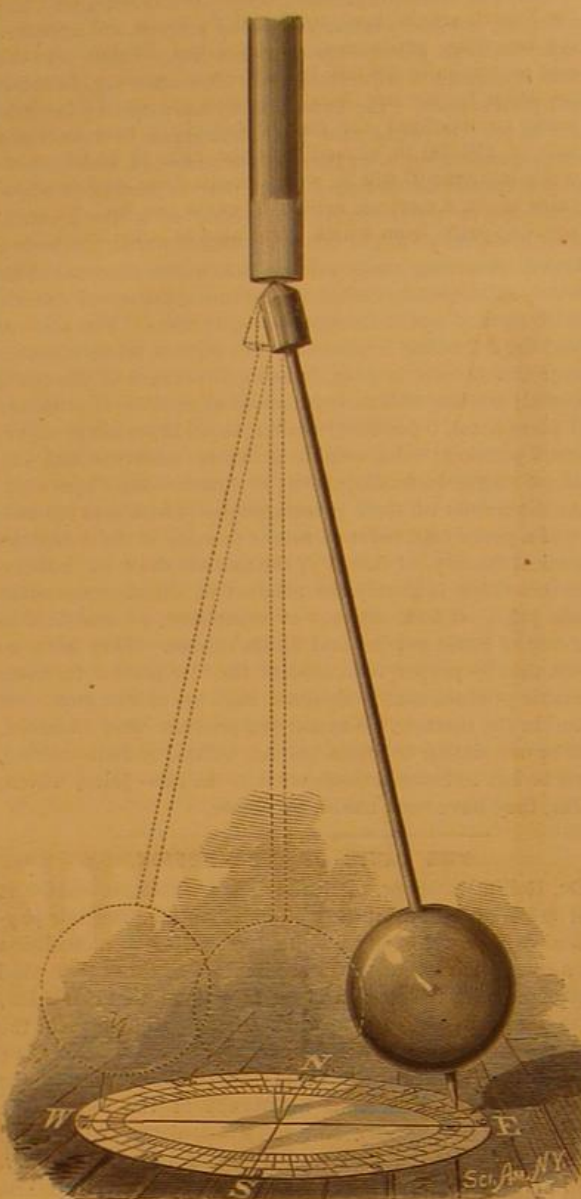
We have been apt to consider China as a heathen country, and such it is from our Christian standpoint, but it is far from an ignorant land. It has, without doubt, according to *Barnes' Educational Monthly*, over 400,000,000 people, of which vast number there is scarcely one who cannot read and write. It has 2,000 colleges, and their libraries outnumber ours ten to one. There are in that land of pig-tailed Mongols 2,000,000 highly educated men, while there is hardly a woman who is educated of all the vast number of its people, and not one who is thought to have a soul. Education is principally a discipline of the memory, and their schools are based upon an entirely different idea from ours. A live Yankee schoolmaster would find little employment in China, even though he understood the Chinese language and literature perfectly.

THE Water Commissioners of Troy, N. Y., have awarded the contract for the extension of the water works of that city to the Holly Manufacturing Company, of Lockport, N. Y., for the sum of \$235,000.

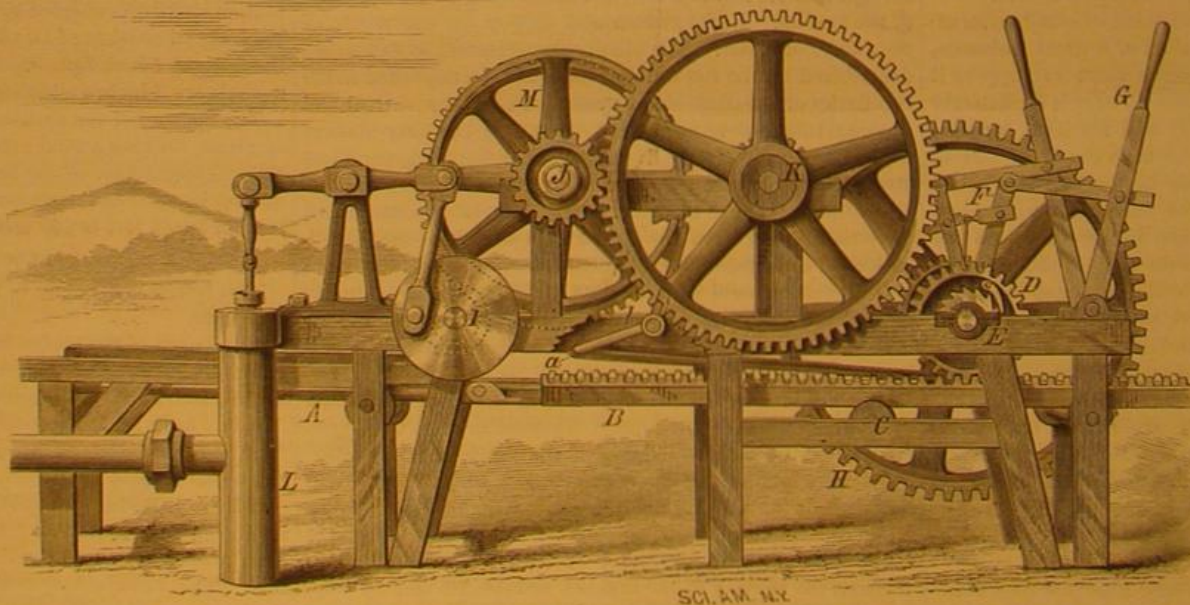
Pendulum for Showing the Rotation of the Earth.

To the Editor of the Scientific American:

The following description of a simple device for indicating the rotation of the earth on its axis may be of interest to



some of your readers. I secure a large permanent magnet to the ceiling of a room or a steady tripod, and from it suspend a wooden pendulum rod of any length, having at the top a cone-shaped tip of soft iron, which is turned to a smooth round point to allow it to swing freely in any direction. To the lower end of the rod is hung a ball of one half the weight required to pull the rod from the magnet. This pendulum, once set in motion, will swing in the same plane for 30 hours. By placing a dial under the pendulum the apparent change in the plane of oscillation of the pendulum may be observed. However, this change of position is



PLATTENBURG'S MOTOR.

not in reality in the pendulum, but in the dial, which is moved under the pendulum while the latter preserves its plane of motion. Placed at the poles, this simple instrument would indicate 15° per hour, which is exactly the rate of the earth's rotation. In this latitude it would indicate an hourly motion of 9° 47'. With this simple instrument, which any ordinary mechanic can construct at a small cost, the movement of the earth may be clearly demonstrated in fifteen minutes.

April 5, 1879.

W. W. LE GRANDE.

Employment and Labor in Massachusetts.

Discussing the present condition and the future prospects of labor, with reference to past and possible Congressional action, the *Boston Journal of Commerce* remarks that since the date of resumption, January 1, the leading industries in that State have continued to show improvement in many instances and to hold their own in all. In all the great manufacturing centers there is an increased activity and a consequent improved demand for labor. In Massachusetts the improvement has become remarkably conspicuous. The Lowell factories are all busy, and several are on extra time; the Essex county mills are, with one or two exceptions, kept fully employed on orders; and throughout the shoe towns there is, late as it is in the season, plenty of employment for willing hands. The great paper mills of Western Massachusetts experience so active a demand for their goods as to stimulate new enterprises in this line, which we may be assured have not been undertaken without a mature survey of the field of operations. In a word, manufacturing help is well employed, at prices which, if not up to the high rates prevailing a few years ago, are far preferable to the wages of idleness.

Manufacture of Tin Plates in New York.

The Monitor Tin Plate Company of New York occupies a building in Horatio street, where the tinning is done; but the iron is rolled at a mill in Pittsburg. The tinning house is 100 feet square, fitted with every modern appliance. The sheets are rolled in the ordinary way, then cut or sheared to size, and immersed in a pickling bath. They are then cold-rolled again, annealed and pickled, and put into baths of Russian tallow or palm oil. Then they pass through several baths of tin melted at a high temperature, and again through sawdust and bran to cleanse the surface. Finally, they are polished with lamb's wool buffers, and assorted, ready for boxing and shipping.

A NOVEL MOTOR.

Our engraving illustrates a simple and manageable motor recently patented by Mr. Joseph Plattenburg, of Allegheny, Pa. It depends for its action upon a series of contractile rubber springs put under tension by an arrangement of pawls, ratchets, pinions, and racks, and the power is conveyed from rubber springs to the machinery to be driven, through a train of gearing, and the motion is controlled by a very simple and ingenious governor.

The rubber springs, A, are rigidly secured at one end to the main frame of the machine; their other ends are attached to the ends of the racks, B, which rest upon rollers, C, and mesh into pinions, D, placed loosely on the shaft, E. To one side of each pinion is secured a ratchet wheel, and upon the opposite side there is a pawl which engages a ratchet wheel keyed to the shaft, E. It will be understood that there is one rack, one pinion, and two ratchets to each rubber spring, and for each set of apparatus of this kind there is a stout lever, F, fulcrumed on the shaft, E, and carrying a pawl that engages the ratchet fixed to the side of the pinion, D. The lever, F, is connected with a longer hand lever, G, by which, through the agency of the parts just described, the springs are put under tension.

Upon the shaft, E, there is a spur wheel, H, which drives the crank shaft, I, through intermediate wheels and pinions on the shafts, J, K. In the present instance the power is employed for working the pump, L, but the inventor does not confine himself to this application.

As this apparatus, without some kind of a governor, would run with great speed when first set in motion, and with a rapidly diminishing speed toward the end of the work given out by the spring, the inventor has devised a simple contrivance for controlling the action of the machine with regularity. It consists in elastic rubber strips, a, attached to the free ends of the racks and connected with an angled lever, I, fulcrumed in the main frame, and carrying at its longer end a brake shoe, which bears upon the friction wheel, M, with more or less force according to the tension of the rubber strips, a. When the rubber springs, A, are under the greatest tension the strips, a, are also under their greatest tension, and the brake exerts its greatest pressure on the friction wheel.

And as the springs, A, contract, the brake pressure is diminished while the speed remains unchanged. The inventor claims that, for running machinery of any kind, this motor is more economical both as to its first cost and maintenance than other motors made for a similar purpose, and he states that it is especially adapted to pumping oil or water, and to the performance of other continuous work where steam is not available.

Further particulars may be obtained from the inventor, or from Mr. F. J. Hoyt, 733 Broadway, New York.

THRASHER, STRAW SCALE, AND SHEAF BINDER.

The apparatus shown in the accompanying engraving is a combined thrasher, straw scale, and sheaf binder, of French manufacture. The straw, as it is forced out by the teeth of the thrasher is received on the straw scale, which is formed on an axle, and consists of iron wires crossing each other at right angles. On the arms so formed the straw is deposited by the arms of the thrasher. The axle on which the scales are secured is supported by the lever of a steelyard, sufficiently weighted to prevent the axle from turning until the quantity of straw thrown on the arms of the scales has attained the prescribed weight. The rotation of the axle, which is limited to a quarter of a revolution, permits of one set of arms replacing the others. This also imparts motion to the sheaf binder, the arms of the thrasher and those of the scales together compressing the straw to prepare it for the binding. Near the middle of the inclined grate, at the bottom of the apparatus, there is a bobbin of fine wire. As soon as the bundle is prepared, the wire is carried around it after having passed through the sheaf binding apparatus, and meets the part opposite the bobbin, where it is twisted and cut off.

The bundles follow each other very regularly, without any great trouble, and the services of five or six persons, necessarily accustomed to the binding of straw in sheaves, are dispensed with.

The thin metallic wire forms a strong band, which, however, is very easily cut by an instrument which also pulls it out of the bundle, so that the cattle may not be injured.

Rock Drilling by Electricity.

In a recently published work of M. Gaston Planté, "Recherches sur l'Electricité," noticed in one of our French exchanges, the author mentions a new application of electricity which had not been hitherto published by him, and which is of considerable interest.

After describing the process of engraving on glass by electricity, that he made known in 1877, and the account of which has been so widely copied by scientific papers, M. Planté goes on to say: "We have seen that one of the electrodes conducting an electrical current of a certain tension being brought in contact with glass, in the presence of a saline solution, it acts like a graver or diamond by tracing grooves in the surface of the glass, and even digs into it quite deeply. In spite of its great hardness, rock crystal can also be attacked by the same method; and, if not engraved regularly, it at least cracks into small fragments, and is finally disintegrated." In view of this, M. Planté suggests that the electric current, under conditions analogous to those above described, might be substituted for diamonds in the operation of drilling rocks. He states that electrodes of platinum would not be necessary, for here it is not the metal of the electrode that is affected, but the silicious matter in contact with a saline solution. Metallic points or projections suitably located at the extremity of the drill, isolated on a part of its length and actuated by a rotary movement, would lead the electric current to the surface of the rock to be pulverized, and would thus replace those numerous and expensive diamonds which are set in the head of the drills employed in the present system of rock boring.

New American Industries.

The recent rapid increase in American chemical manufactures, in many cases from native crude materials, is a very encouraging feature of American trade.

The *Grocer* notes that six years ago we imported from France cream of tartar to the extent of 6,000,000 lb. yearly,

but so successfully has the manufacture of it in this country been carried on, that last year not a single pound was imported. Notwithstanding that the crude materials have at present to be imported, the price of the manufactured article has been reduced from 32 cents per pound, the rate for the French article here, to 23 and 24 cents per pound for the American production. France and England formerly sent us annually 500,000 lb. of tartaric acid, while the importation for the last fiscal year was 183 lb. England formerly monopolized our market for citric acid to the extent of 250,000 lb. annually, at the rate of \$1.30 per lb., while last year 27,013 lb. were imported and sold at the same price as the American article, 57 cents per lb. At present the lime juice from which citric acid is made has to be im-

An improved bin, or receptacle for flour, sugar, and similar articles in bulk, for stores and households, has been patented by Mr. Edward S. Bliss, of Richburg, N. Y. It consists of a bin having a front curved rocker and a curved top, the bin being arranged to tilt in casing so as to render its contents easily accessible.

An evaporating pan, in which the heating pipes alternate, one half being supplied with steam at the center and one half at the circumference, has been patented by Mr. H. O. Ames, of New Orleans, La. The object of this peculiar arrangement of pipes is to perfectly equalize the heat throughout the entire mass of boiling sirup.

Mr. G. V. Sheffield, of New York city, has patented an improvement in the manufacture of leather articles, which consists in stretching the raw green hide upon a last or form, and subjecting the hide to a tanning process while on the form. Before removing the article from the form it is dressed and colored.

A toy, composed of two or more pieces of veneer, cut and embossed to imitate an animal or other object, and provided with a strengthening backing, has been patented by Mr. Charles Schwartz, of New York city.

Mr. S. C. Buchanan, of Camden, Ark., has patented an improved liniment composed of fusel oil, arnica, acornite, camphor, and sassafras combined in proper proportions. It is designed for the relief and cure of rheumatism, neuralgia, and other similar diseases.

An improvement in finishing yarns of wool or soft hair, such as camel's hair, mohair, and alpaca, or yarns composed of a mixture of two or more of these, has been patented by Mr. Charles Hastings, of Bradford, England. The object of the invention is to give the yarns additional strength and to otherwise improve their quality.

A hot air furnace, constructed entirely of refractory bricks or clay, has been patented by Mr. Thos. Crooke, of Newark, N. J. It is claimed that this furnace is free from the objections which are urged against cast iron furnaces.

An improved board

for ironing shirts has been patented by Mr. John Boger, of Powhatan Point, Ohio, which is so constructed as to give a swell to the shirt bosom when it is ironed, and it admits of ironing the neck band in an erect position.

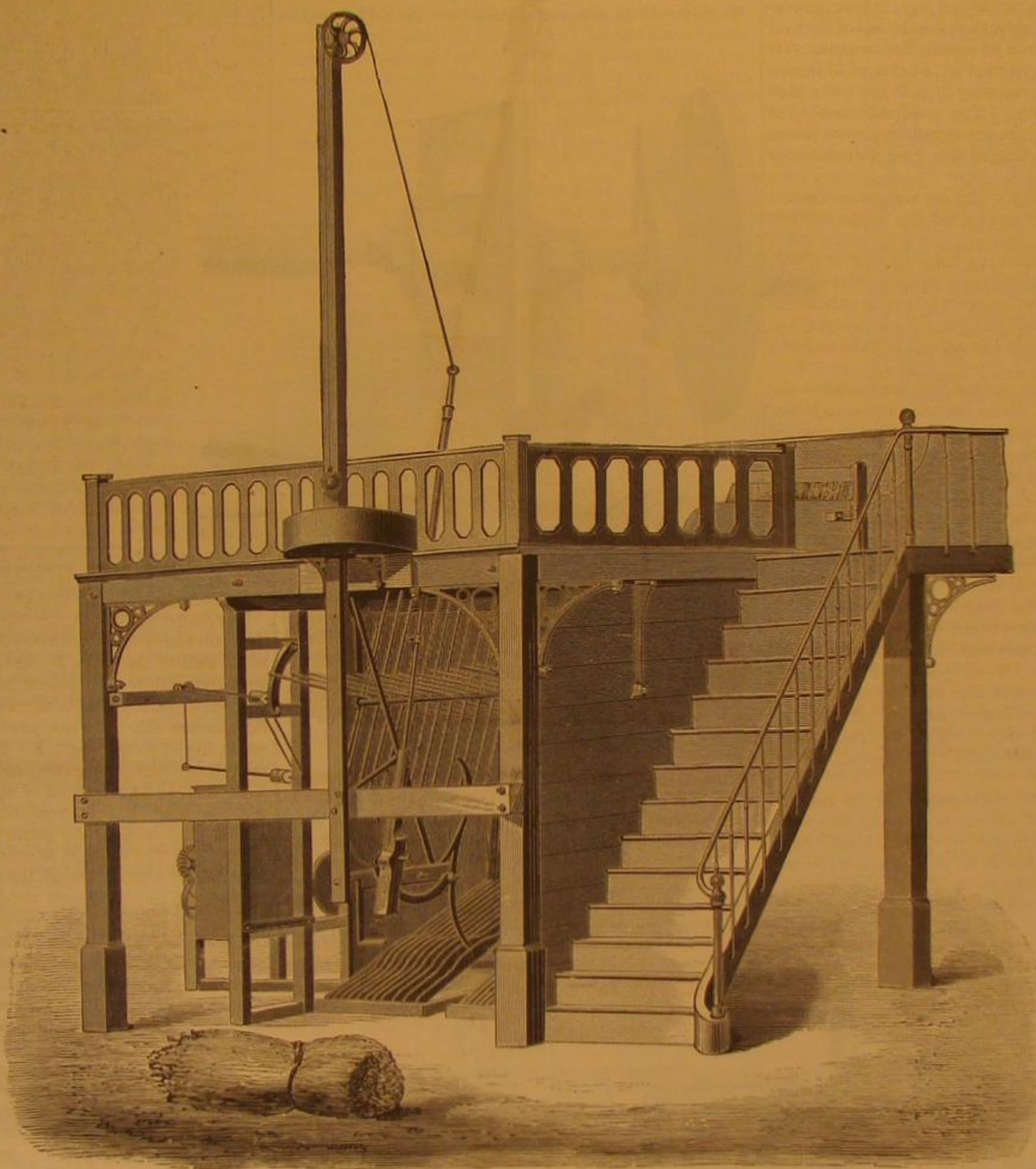
A sash tightener, consisting of two sheet metal tubes, closed at one end and adapted to slide one within the other, the closed end of the inner tube being forced against the sash by means of a coiled spring contained within it, has been patented by Mr. Frederick J. Hoyt, of New York city.

Mr. Ernest T. Gennert, of New York city, has patented an improvement in processes for extracting saccharine matter from vegetable substances. The invention consists in moistening the dried beets or other vegetable substances with a solution of superphosphate of lime just before the water is introduced into the extracting vat.

An improved truss hoop, having a metal strap fitted to the outer side of a wooden body, and extending from the end of the inner lap to or a little beyond the end of the outer lap, has been patented by Mr. John W. Maltby, of Rochester, N. Y.

An improvement in heating pots, patented by Mr. H. J. Nelson, of Pentwater, Mich., consists of a water receptacle provided with a central chimney, which rests on the flange of a lamp burner. The water receptacle is provided with suitable supporting legs.

Mr. Thomas M. Richter, of Sandy Run, Pa., has invented an improved sheave for wire ropes or cables. It consists of sector shaped sections of wood, clamped between suitable heads, with the grain running in a radial direction.



THRASHER, STRAW SCALE AND SHEAF BINDER.

ported, but it could easily be produced from fruits grown in Florida, if only sufficient energy were put into the work. If the lemon and lime growers of the South can be induced to prepare the lime juice, the entire production and manufacture of citric acid will be kept in this country, saving hundreds of thousands of dollars annually and developing another great industry. Borax was formerly brought from England at the rate of from 600,000 to 1,000,000 lb. every year. Owing to the development of borax mines in Nevada this importation has largely fallen off, and the report for the last fiscal year showed only 3,492 lb., and the price of the refined article, which is now prepared in this city, is only from 8 to 9 cents per lb., when formerly it was 35 cents, England being now among the buyers where she was the principal seller, both of the crude and refined product.

MISCELLANEOUS INVENTIONS.

An improved cancelling stamp, patented by Mr. George W. Stephens, of Denison, Ia., is designed for post offices and business purposes generally. It is simple and rapid in its operation.

Mr. Samuel F. Leach, of Boston, Mass., has devised an improved gas regulator, which is combined with a gas burner, for automatically regulating the gas as it is consumed.

An improved flexible printing film for use in artistic and decorative purposes, and for printing and the preparation and finishing of drawings, has been patented by Mr. Benjamin Day, of West Hoboken, N. J.

AMATEUR MECHANICS.

ROTARY CUTTERS.

The saving of files, time, materials, and patience, by the employment of such rotary cutters as may be profitably used in connection with a foot lathe, can hardly be appreciated by one who has never attempted to use this class of tools. It is astonishing how much very hard labor may be saved by means of a small circular saw like that shown in Fig. 1. This tool, like many others described in this series of articles, can, in most instances, be purchased cheaper than it can be made, and the chances are in favor of its being a more perfect article. However, it is not so difficult to make as one might suppose. A piece of sheet steel may be chucked upon the face plate or on a wooden block attached to the face plate, where it may be bored to fit the saw mandrel, and cut in circular form by means of a suitable hand tool. It may then be placed upon the mandrel and turned true, and it is well enough to make it a little thinner in the middle than at the periphery.

There are several methods of forming the teeth on a circular saw. It may be spaced and filed, or it may be knurled, as shown in Fig. 2, and then filed, leaving every third or fourth tooth formed by the knurl; or it may, for some purposes, be knurled and not filed at all. Another way of forming the teeth is to employ a hub, something like that used in making chasers, as shown in Fig. 3; the difference between this hub and the other one referred to, is that the thread has one straight side corresponding with the radial side of the tooth. The blank from which the saw is made is placed on a stud projecting from a handle made specially for the purpose, and having a rounded end which supports the edge of the blank, as the teeth are formed by the cutters on the hub.

The saw, after the teeth are formed, may be hardened and tempered by heating it slowly until it attains a cherry red and plunging it straight down edgewise into cool, clean water. On removing it from the water it should be dried, and cleaned with a piece of emery paper, and its temper drawn to a purple, over a Bunsen gas flame, over the flame of an alcohol lamp, or over a hot plate of iron. The small saw shown in Fig. 4 is easily made from a rod of fine steel. It is very useful for slitting sheet brass and tubes, slotting small shafts, nicking screws, etc. Being quite small it has the advantage of having few teeth to keep in order, and it may be made harder than those of larger diameter. A series of them, varying in diameter from one eighth to three eighths of an inch, and varying considerably in thickness, will be found very convenient.

These cutters or saws, with the exception of the smaller one, may be used to the best advantage in connection with a saw table, like that shown in Fig. 8. This is a plane iron table having a longitudinal groove in its face to receive the guiding rib of the carriage, shown in Fig. 9, and a transverse groove running half way across, to receive a slitting gauge, as shown in Fig. 8. The table is supported by a

standard or shank which fits into the tool-rest socket. The saw mandrel is supported between the centers of the lathe, and the saw projects more or less through a slot formed in the table. The gauge serves to guide the work to be slotted, and other kinds of work may be placed on or against the carriage shown in Fig. 9.

It is a very simple matter to arrange guiding pieces for cutting at any angle, and the saw table may be used for either metal or wood. The saws for wood differ from those used for metal; the latter are filed straight, the former diagonally or fleaming. Among the many uses to which metal saws may be applied we mention the slitting of sheet metals, splitting wires and rods, slotting and grooving, nicking screws, etc. Fig. 10 shows a holder for receiving screws to be nicked. It is used in connection with the saw table, and is moved over the saw against the gauge.

To facilitate the removal of the screws the holder may be

by employing a V-shaped cutter and using a holder (Fig. 7) having an angular groove for receiving the cylinder on which the cutting edges are formed. The blank can be spaced with sufficient accuracy, by means of a fine pair of dividers, and after the first groove is cut there will be no difficulty in getting the rest sufficiently accurate, as a nib inserted in the side of the guide enters the first groove and all of the others in succession and regulates the spacing.

One of the best applications of this tool is shown in the small engraving. In this case a table similar to the saw table before described is supported in a vertical position, and arranged at right angles with the cutter mandrel. The mandrel is of the same diameter as the cutter, and serves as a guide to the pattern which carries the work to be operated upon. The principal use of this contrivance is to shape the edges of curved or irregular metal work. The casting to be finished is fastened—by cement if small, and by clamps if large—to a pattern having exactly the shape required in the finished work.

By moving the pattern in contact with the table and the mandrel, while the latter revolves, the edges of the work will be shaped and finished at the same time. By substituting a conical cutter for the cylindrical one, the work may be beveled; by using both, the edge may be made smooth and square, while the corner is beveled.

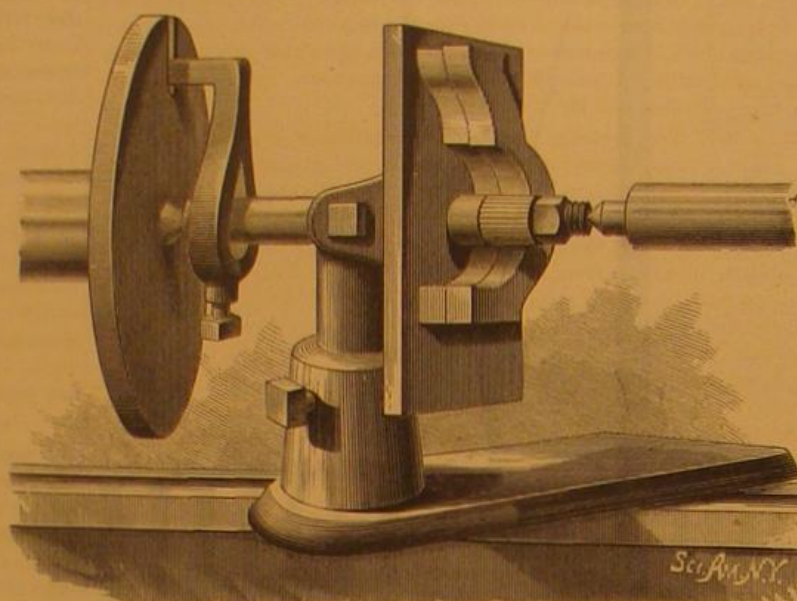
The tool shown in Fig. 12 might properly be called a barrel saw. It is made by drilling in the end of a steel rod and forming the teeth with a file. To avoid cracking in tempering a small hole should be drilled through the side near the bottom of the larger hole. To insure the free working of the tool it should be turned so that its cutting edge will be rather thicker than the portion behind it. This tool should be made in various sizes.

Tools for gear cutting and also cutters for wood have not been mentioned in this paper, as they are proper subjects for separate treatment. M.

The Ventilation of Ships at Sea.

The Board of Naval Officers, consisting of Commander Beardslee, Medical Inspector Gibbs, and Naval Constructor Mintonye, commissioned to test and report upon Dr. Thiers' new apparatus for ventilating ships, have pronounced the principle of this apparatus, in ejecting the air, as the only true method for securing perfect ventilation in ships.

The apparatus consists of a copper cylinder attached to the ship's rudder, extending seven feet below the water line, and five above it, to which are connected two sets of valves opening into pipes running to all parts of the ship. The motion of the ship in rising and falling with the waves pumps the foul air out of the ship. The principle is simple, and the apparatus would seem to be efficient wherever there is much motion to the water. Whether it would work as well in still water, where ventilation is most needed, as in the calms of the tropics, is rather doubtful.

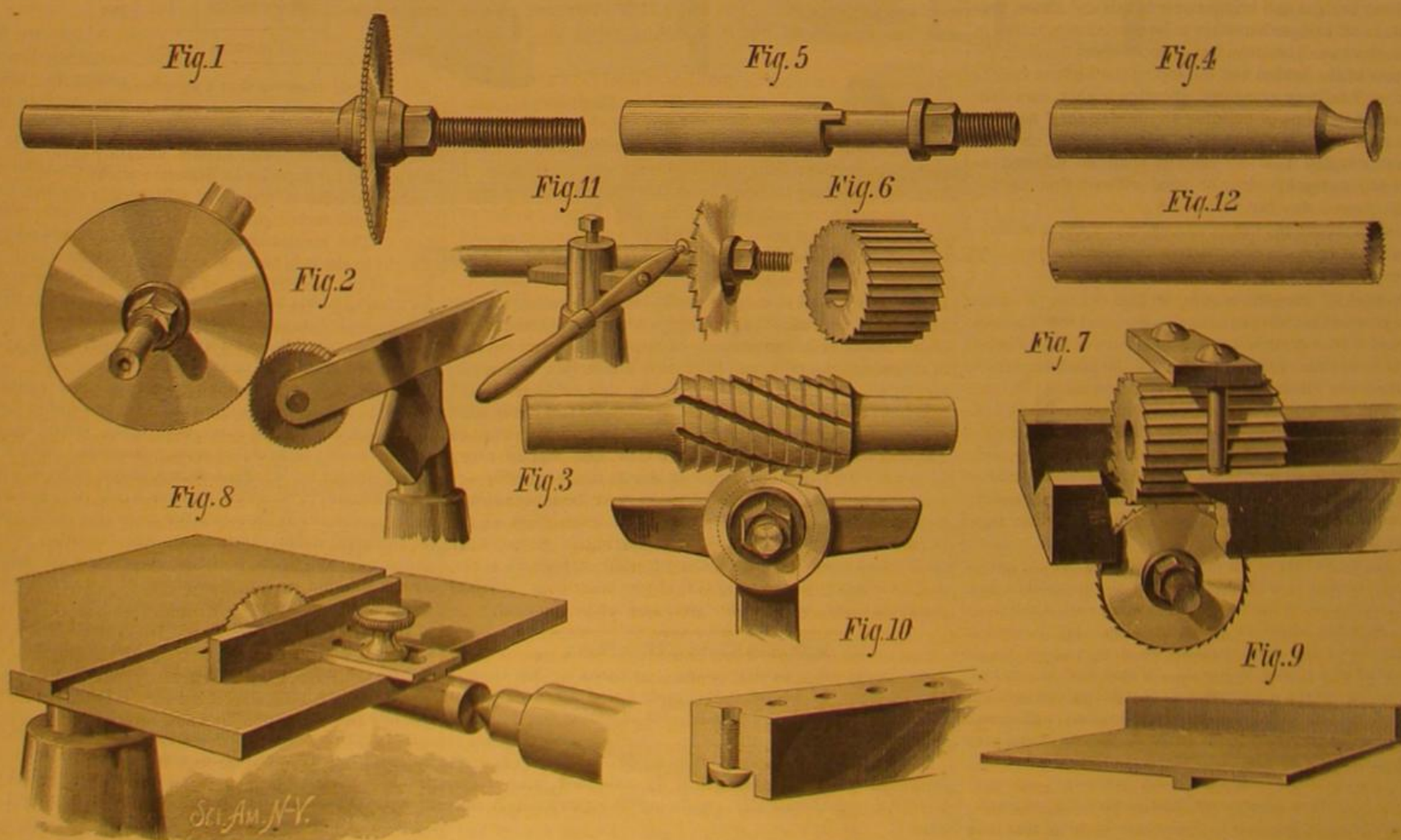


METAL SHAPING.

split longitudinally and hinged together. Another method of nicking screws is illustrated by Fig. 11. A simple lever, fulcrumed on a bar held by the tool post, is drilled and tapped in the end to receive the screw. After adjusting the tool all that is required is to insert the screw and press down the handle so as to bring the screw head into contact with the saw.

Where a lathe is provided with an engine rest, the cutter shown in Fig. 6, mounted on the mandrel shown in Fig. 5, is very useful; it is used by clamping the work to the slide rest and moving it under the cutter by working the slide rest screw.

To make a cutter of this kind is more difficult than to make a saw, and to do it readily a milling machine would be required; it may be done, however, on a plain foot lathe



ROTARY CUTTERS.

RAILWAY NOTES.

SINCE the building of the Mount Washington Railway eight similar roads have been constructed in Austria and Switzerland. The engines for these roads were first built with vertical boilers; next with boilers that were level on an average grade; now they are built with horizontal boilers like ordinary locomotives. Various methods have been devised for enabling the locomotives to work by adhesion of their smooth wheels, as well as by means of their cog-wheel drivers, and by means of either at will. No one of these has been permanently successful, however, so that the proper construction of a double engine of this sort is still a matter of experimental inquiry.

THE Prussian Government railroad management is making great efforts to reduce the expenses of the state railroads. The principal reforms are said to be as follows: First, the construction of tunnels on new roads for a single track only. Hitherto, when a road was built, though with a single track and a very remote prospect of needing another, the tunnels on it were made wide enough for two tracks. Second, the use of steel rails exclusively, and the adoption of an iron superstructure (the Hilf system) instead of wooden cross-ties. Not much credit is claimed for the adoption of steel, the price being about the same as that of iron, but the iron superstructure is hailed in Germany as a forward step, and also likely to be a good thing for the German iron works. Third, the abandonment of optical signals for sections of the road between stations. This simply makes the Prussian practice like that of the greater part of the rest of the railroad world, in Europe as well as in America. The change is said to have been without any injurious effects, while there has been a considerable saving in the army of road guards who have been accustomed to stand along the roads and salute the trains as they pass—a saving which has been re-enforced by substituting women for men to attend the crossing gates found at short intervals along every road. Fourth, the introduction of central interlocking switch and signal apparatus, of the Saxby & Farmer or similar patterns. Not only, it is said, has this resulted in greater safety, but also, by substituting a mechanical apparatus worked by one man to set a large number of switches and signals, the number of switchmen has been considerably reduced, even at small stations. Fifth, the introduction of continuous brakes. These have been put since 1878 on nearly all the passenger trains of the government roads, pretty much all kinds being used—the Westinghouse, Smith (vacuum), Heberlein, and Steele. Experiments have been made with the Heberlein brake on freight trains, and it is said with prospects of success in economizing the number of brakemen as well as increasing safety. Sixth, the reduction of the cost of switching service by arranging sorting tracks on inclined planes, where the movement is generally made by gravity alone, without the use of an engine. This has been the practice at a few great yards in Germany for a number of years, with very excellent results, it is said. Horses have been used instead of engines in switching cars, also with economy. Seventh, the adoption of regulations for working roads with light traffic without all the precautions and appliances which are made necessary only by frequent, heavy, and fast trains.

AN act, introduced by the Minister of Public Works, for the amendment of the Canadian railway act of 1874, as regards railway bridges and bridges over canals and rivers, provides that, in all bridges hereafter to be erected over railways in Canada, there shall be seven feet clear of space between the lower beams of the bridge and the top of the highest freight cars; and any railway company adopting higher cars than those in use at the time of building any bridge shall be compelled to raise such bridge at their own cost and charges. It is also provided that no railway shall be allowed to pass over any navigable river or canal without first having built such proper flooring under and on both sides of the track as shall be deemed sufficient by the Minister of Public Works to prevent anything falling from the railway into such river or canal, upon boats or vessels navigating it.

THE Springfield Republican reports that the new 42 inch railroad car wheel is disappointing the confident expectations it awakened. Out of 80 tested on the Boston and Albany road, 22 have broken, and the expenses of the fast train which runs on them are greater than last year, when the old 33 inch wheel was used. The 42 inch wheel weighs 850 pounds, and the 33 inch wheel 450 pounds. Vice-President Reed, of the Southern road, does not think favorably of the big wheel. Possibly if the manner of manufacture could be altered, there would be less breakage. At all events, says the Republican, the idea will not probably be given up without further trial of at least six months.

THE Sacramento (Cal.) Bee reports that in the shops of the Pacific road in that city 25 new style sleeping cars for emigrants are being fitted up. The new cars are provided with upper and lower berths, somewhat after the manner of caboose cars. The upper berth swings freely on iron rods, and when not in use can be hung up on the roof of the car, where it is not in the way. The lower berths are formed from the seats, which are made up after the manner of the present sleepers, by turning down the backs, etc. Slats are then placed crosswise, and when laid out the berths are exceedingly neat and comfortable. This will be a great convenience to persons traveling third-class, as heretofore they have been compelled to sit up or make shift as best they could.

TOUCHING the recent steel rail controversy, Mr. Wm. A. Sweet, an American steel manufacturer, asserts that the

steel rails made in England and rolled on two high trains are better for wear—the chemical constituents of the steel being the same—than the rails made in this country and rolled on a three high train; not because the train is a three high or a two high train, but because the rail, when it is finished, is colder, and is left in a more condensed condition, and therefore better prepared to receive the wear of wheels. In other words, it is stronger and tougher. Mr. Sweet claims to be able to prove the correctness of this assertion, and that any steelmaker can test it for himself in a few hours. He claims also that if the American rail is rolled until the scale is set, the rail will be better than the English.

THE Journal of the German Railroad Union gives a list of the European railroads on which the Pintsch system of gas lighting is used, and the numbers of cars on each to which it is applied. The total shows 22 roads in Germany, 1 in Austria, 3 in Russia, and 2 in England, besides a sleeping car company, 2 imperial court trains (German and Russian), and 2 cars for the Crown Prince of Germany. In all, application has been made to 3,600 cars and ordered for 705 more. There are 43 locomotives that have been provided with the apparatus. It was first introduced ten years ago on the Lower Silesia and Märk road.

THE Railroad Gazette finds a statement of some of the long distance grain rates from Russia and Austria to Germany in a complaint that the rates from Russia are so excessively low that the Austrian producers have no fair chance to compete. The rates are for a car load of grain (22,040 lb. = 367 bushels of wheat) from the Russian station Brody to Leipsic, a distance of 658 miles, \$99.40, which is at the rate of 45 cents per 100 lb.; from the Austrian station of Debreczin to Leipsic, 654 miles, the rate is \$116, or 52.6 cents per 100 lb. It is years since the rate from Chicago to New York, nearly one half further (911 to 980 miles, according to route) has been as high as 45 cents on grain, and for two or three years it has probably not averaged more than 25 cents, going at times on a few shipments as low as 15 cents. The roads west of Chicago, which are often charged with "extortion" and which do usually make a profit on their grain traffic, do not get anything like the Russo-German rates. From Kansas City to Chicago, about 500 miles, the highest winter rate has been 25 cents for wheat and 20 cents for corn. On the basis of the Brody-Leipsic rate they would be about 34 cents. The Chicago-New York rate on that basis would be, by the shortest route, 61½ cents per 100 lb.

AT the regular monthly meeting of the Engineers' Club, of Philadelphia, March 15, C. E. Buzby exhibited a model of Travers' iron railroad tie, which is being tried on the Philadelphia and Baltimore Central road, near Lamokin. The device dispenses with all spikes, bolts, nuts, or fish plates, and drilling or punching the rails, avoiding fractures from such causes. The iron tie, it is claimed, will outlast twelve renewals of the ordinary tie at one half the cost to keep in repair. Each tie is recessed under its rails, and along the bottom of the recess wedge-shaped pieces are cast transversely. At the sides of each recess are crescent blocks, which form a cushion and fulcrum for two clamps, which grasp the flange and web of the rail above, bearing upon opposite faces of the wedge below. The weight of the train forces the clamps upon the wedge, spreads them at the bottom, and grips the rail. The first cost is somewhat greater than the wooden tie, but it is said to offset this in durability.

DISCUSSING the wearing qualities of steel rails at the meeting of the American Institute of Mining Engineers in Baltimore, Mr. R. W. Hunt said: "I am convinced that more rails have been broken by the treatment which they received before leaving the rolling mill than from any other cause. I allude to the injury inflicted upon them in the cold straightening press, where each blow of the gag forms a wedge of the particles of steel pressing upon the surrounding ones, and thus serving to rend the rail asunder. I am certain that of all the broken steel rails that I have seen, fully 75 per cent have been ruptured at the gag mark. So well recognized is this cause of breakage that the Troy Works and others have spent large sums in introducing machinery to more perfectly hot straighten the rails, and thus leave less work for the cold press. While I admit that Dr. Dudley's physical analyses show a difference in the broken and crushed and the unbroken and uncrushed rails, I am not prepared to accept these results as coming entirely from the chemical properties of the metal. If I mistake not, 7 of the 25 samples are from crushed rails. May not these failures have been caused by mechanically imperfect bars, piped ingots, or some other mechanical defect? Then, again, the possibility of the steel having been overheated in the rail rolling mill must not be ignored. For it is well known that the same steel worked at different temperatures will afterward yield widely differing physical results. We, who have to encounter the difficulties of manufacture, know how many and vexatious they are in their physical as well as chemical forms."

INTERLOCKING switch and signal apparatus is becoming the rule rather than the exception on many English roads, being used not at important points only, but elsewhere. The London and Northwestern has apparatus at 2,888 places, and has between 17,000 and 18,000 levers. The Chairman, Mr. Richard Moon, at a recent half yearly meeting, said that the total expenditure for interlocking and the block system had been between £800,000 and £900,000—say something more than \$4,000,000.

DISCUSSING the practical superiority of the American loco-

motive for the rough and ready requirements of ordinary railways, a writer in *Harper's Magazine* says:

"It is to the American we must turn to learn what are the requirements of the modern railway, and to get some suggestion of its future. More than this, the moment the English locomotive is taken from its island line it exhibits defects and a certain want of pliability that completely unfit it for a Continental railway. But if the English road and the English engine are the best in the world, why are they not the best for the world? Simply because they do not pay. There can be no higher reason than this. Anything that does not pay is useless, because it does not meet a human want. The cost of any operation is the measure of its value to human beings, and if the road does not pay, of what good is it? Now a railway, to be cheap, must follow the face of the country; that is, the line must go up and down hill, pass around abrupt curves, according to the lay of the land, and without much attempt at a straight line or level bed. It is upon this idea that American railroads have been built, and all Continental lines are likely to be built in the future. If a railroad can thus follow the face of the country, it will not cost so much, there being no high bridges, deep cuts, and tunnels. Of course there is a limit in this direction, and even the American engine cannot climb up the side of a house, or turn a right angle in its own length; but within certain broad limits it may be said that the future locomotive must follow lines that run up hill and down dale, and get around very remarkable corners. This being the case, what of the English locomotive? Can it travel in safety over crooked lines that wander in astonishing freedom over hill and dale through all the sinuous lines of a winding river valley? There is no need to say it ought, or it may, for it never did. It has been tried again and again, and the end of it all is, the engine is in the ditch, and the unlucky stockholders are clamoring for American engines, or at least engines built on American plans."

A TIME schedule of the special train ordered by the National Democratic Committee to bring Hon. John Whitaker, Congressman-elect from San Francisco, to Washington, in time to take part in the organization of the House, shows that the whole distance was made in 4 days 14 hours and 30 minutes actual running time. The speed of the train averaged thirty-one miles per hour between San Francisco and Ogden, and fifty-one miles per hour between Cheyenne and Sydney. The whole time is the quickest ever made between the Pacific and Atlantic.

The World's Product of Iron and Steel.

In his report on the iron and steel display at Paris, Commissioner Morrell gives the following statement of the present annual production, based on the latest statistics:

Country.	Cast and Pig Iron.			Steel.		
	Year.	Production, Tons of 2,240 lb.	Per ct. of Total.	Year.	Production, Tons of 2,240 lb.	Per ct. of Total.
Great Britain....	1878	6,300,000	45.63	1878	1,100,000	32.70
United States....	1878	2,301,215	16.97	1878	735,000	25.33
Germany, including G. Duchy of Luxembourg....	1876	1,816,672	13.16	1876	384,159	13.87
France.....	1878	1,417,073	10.26	1878	281,801	10.17
Belgium.....	1876	562,086	4.07	1877	100,000	3.61
Austria and Hungary.....	1876	443,689	3.21	1876	113,152	4.08
Russia.....	1875	420,035	3.04	1875	12,730	.46
Sweden.....	1876	346,955	2.51	1876	23,692	.86
Other countries..	1877	300,000	1.45	1877	20,000	.72
Total.....		13,807,725	100.00		2,770,534	100.00

Mr. Morrell observes that a significant fact illustrated at Paris was that (owing to the marvelous increase in the production of Bessemer steel) the manganiferous and non-phosphoriferous ores of Spain, Algeria, and Italy have been largely drawn upon for supplies to Bessemer works in countries rich in other varieties of ores. Of still greater significance was the large and varied collection of Bessemer products exhibited. The revolution which the Bessemer process has wrought in the iron trade was made strikingly manifest in a survey of the contributions of European countries, but to an American who remembered the wonderful development of the Bessemer industry in his own country, which sent no Bessemer products to Paris, these contributions were more impressive and more suggestive than they could be to any European. The Paris Exhibition showed that the progress made during the past two or three years in the manufacture of Bessemer and open hearth steel is so great that statistics fail to give any proper conception of its magnitude. The London Times remarks that "the Bessemer process has ruined the manufactured iron trade." Mr. Morrell says: "It has done more than this—it has distributed among many countries the manufacture of Bessemer steel, and thus enabled them to supply more fully their own metallurgical wants, and the metallurgical wants of other countries, in lieu of their own previous partial dependence upon Great Britain for both iron and steel products. It has thus aided not only to ruin the manufactured iron trade of all countries, but to ruin that of Great Britain particularly, and it has placed a limit upon the Bessemer steel industry of Great Britain itself. Here is a new revolution, or a new revelation, in connection with the world's iron industry which was reserved for Paris to make clearly manifest through the abundant proofs there furnished of the wide distribution of the Bessemer process and the wide substitution of Bessemer products for those of iron and other steel processes. And what has been said of the Bessemer process and of the injury it has inflicted upon the British iron trade is applicable also in a large degree to the Siemens-Martin process and its modifications."

NEW STEAM BOILER.

We illustrate one of the most recent improvements in steam engineering, the larger engraving representing a stationary boiler, and the smaller one a portable boiler, both made under a patent recently granted to Mr. Guy D. Daly, of Flatbush, N. Y. In devising this boiler the inventor claims to have effected a great saving in first cost, in repairs, in the use of fuel, and to have diminished the danger of explosion. The boiler is certainly very compact, and the water appears to be exposed to the best advantage to the action of the fire. There are two systems of pipes starting from opposite sides of the water reservoir, A, near the bottom. By tracing the course of the first pipe, B, the entire arrangement will be at once understood. It passes from the reservoir, A, outward through the brickwork which supports the reservoir, thence downward to a point just above the fire, where it turns inward and passes from one side to the other of the fire arch, forming the coil, D, and finally terminates in the steam drum, F. The pipes, starting from the opposite side of the drum, are arranged in exactly the same way, but run in the opposite direction, and discharge into the steam drum, F, on the opposite side of the arch. In the pipes that leave the boiler there are check valves, C, and in the upper terminal of each coil there is a check valve, E. These valves insure a complete circulation and facilitate the generation of steam. The drums, F, are connected by pipes, G, with a single pipe, which discharges downwardly into the reservoir, A. The coils, D, being subjected to the intense heat of the fire, rapidly converts the water entering through the check valves, C, into steam, which is discharged through the check valves, E, into the drums, F, whence it finds its way through the pipes, G, to the reservoir, A. Whatever spray or moisture is carried along with the steam remains in the reservoir, while the steam is delivered in a dry state to the engine.

The boiler shown in the smaller engraving is similar in construction to the one already described, the difference being that the brickwork is dispensed with, and a portion of the coils is used to form the side of the fireplace, and the entire series of pipes is covered with a smoke jacket of cast or sheet iron.

The reservoir, which, in the stationary boiler, virtually forms the crown sheet, is so distant from the fire that it cannot become injured by heat, and the pipes which form the coils have such a surplus of strength that it would be almost if not quite impossible to burst them. Even if one should, from any cause, give out, it cannot harm the other portions of the boiler, and it may be very readily replaced.

ENGINEERING INVENTIONS.

An improved cut-off, especially adapted to beam engines, has been patented by Mr. Thomas E. L. Collins, of Fall River, Mass. It can be adjusted without stopping the engine or changing the position of the lifter, the latter being provided with a movable lower part pivoted to the fixed upper part.

An improved road ditcher, patented by Mr. Isaac Karsner, of Florida, O., is designed for opening ditches along the sides of roads and in fields, and it is capable of forming ditches on inclined surfaces.

Mr. John Witsil, of Bridgeborough, N. J., has patented an improved car coupling. The principal feature of the invention consists in using the car platform as a draw head.

An improved lubricator for steam cylinders, patented by Messrs. John H. Taylor and Richard W. Miller, of New Haven, Conn., is arranged with a view to supplying a measured quantity of oil to the cylinder at each stroke by a forced injection.

Mr. James W. Brown, of Mayfield, Ky., has invented an improved propeller for vessels, consisting in a series of paddles of peculiar construction, which are thrust backward from the stern of the vessel.

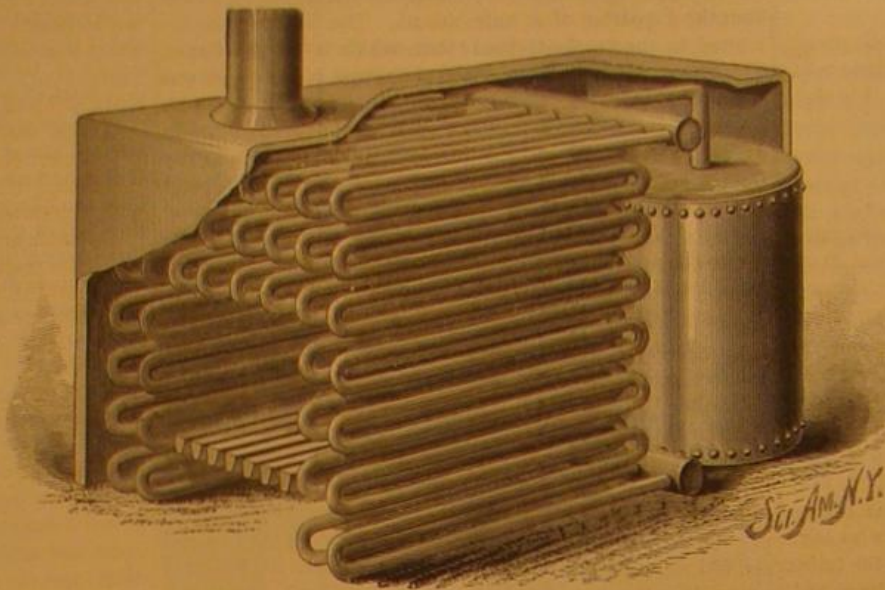
An improved water wheel, to be used in streams where there is little or no head, has been patented by Mr. John Ebersole, of Chambersburg, Pa. It is designed to be run by the current, and is not retarded by still or back water.

Mr. Andrew J. Hopewell, of Edinburgh, Va., has patented an improved turbine water wheel, in which water is admitted through laterally opening chutes or water ways. The chutes are controlled by a corresponding series of gates having a rotary adjustment.

An improved coupling for railway freight cars has been patented by Mr. Washington L. Harvey, of Danville, Va. The cars are coupled automatically, and may be uncoupled by a person standing on the top of the car.

Mr. Daniel Abrey, of Greenville, Mich., has patented an improved rotary engine. The improvement relates principally to a cut-off, and to a novel movement for the abutments.

An improved device for attachment to locomotive engines to prevent the smoke, cinders, and dust from the smoke-

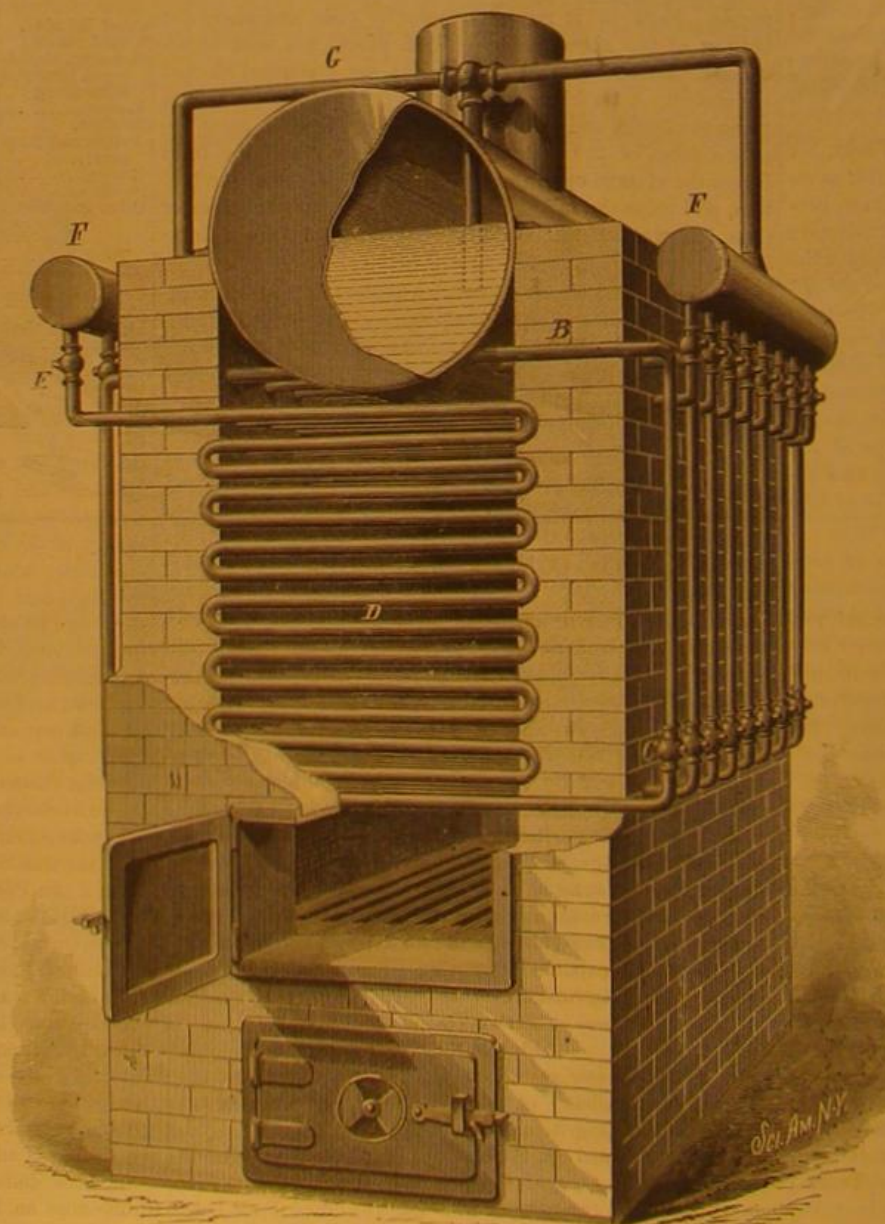


DALY'S PORTABLE BOILER.

stack from entering the cars, has been patented by Mr. T. B. Taylor, of Mount Meigs, Ala. It consists in an inclined or diagonal plate placed so as to deflect the cinders and smoke from the path of the train.

An improved car coupling, designed to automatically couple cars without the necessity of going between the cars, and which also permits the cars to become automatically disengaged in case of accident, has been patented by Mr. James D. Martin, of Johnson City, Tenn., assignor of one half his right to Mr. James R. Meek, of Carter's Depot, Tenn., to whom communications should be addressed.

An improvement in stock cars has been patented by Mr. Franklin B. Hall, of Palatine Bridge, N. Y. This invention is designed to afford rest and support for cattle during transportation.



DALY'S IMPROVED STEAM BOILER.

Dangers of Wall Street.

A New York correspondent to one of our contemporaries thinks there is not a better place in the United States to stay away from than Wall Street in this metropolis, with the exception, perhaps, of Memphis or New Orleans in a yellow fever season. I know five men, says the writer, who went there to try their luck about a year ago. One was a confidential clerk in a foreign house that operated largely in the street. He was in a good position to get "points," and the understanding was that the others should operate upon them, letting him in for a share of the profits in consideration of the information he should furnish. These five formed a little ring with a cash capital of about \$50,000. They hadn't the slightest doubt about doubling it in six months. They were to be on equal ground with the biggest operators so far as "points" were concerned, and no such word as fail could be found in the lexicon of their calculations.

Where are they now? Well, the confidential clerk is in a lunatic asylum. One of the others is a street-car conductor at \$1.75 a day. A second is clerk in an insurance office at ten dollars a week. A third made his way West toward the Black Hills, and has not since been heard from. The last of the party of five still hangs around the street, watching the indications, but unable to put up even five dollars in a bucket shop. Their whole capital melted away in three months, and they were left without a dollar.

Here is another case: A retired business man of my acquaintance considered himself too smart to be beaten at any game. He lived in fine style, kept horses and a carriage, and was well known in society.

The Wall Street fever struck him and he began to speculate. He made out pretty well at the start and that led him into larger operations. In less than six months from the day he put up his first \$10,000 margin, he was an insolvent debtor, with suits against him by the brokers through whose hands all his money had passed! He now manages to scrape up a cheap living as an insurance agent, but he is hard pressed half his time for his board.

Scores of such warnings against tempting the goddess of the Stock Exchange might be given, but so long as her snares are set, men will walk straight into them, with their eyes open, and the notes of warning will be raised in vain.

A New Apparatus for Testing Petroleum.

The uncertain and irregular results obtained by the flash test of petroleum in different hands has led to much dissatisfaction on the part of consumers, especially abroad. To get a uniform test, Mr. Holly, of the firm of Lockwood Brothers & Holly, of New York city, has devised a testing machine which was exhibited before a committee of the New York Produce Exchange, May 1, giving very promising results. By this method the poles of a galvanic battery are brought within three eighths of an inch of the surface of the oil, which is meantime being slowly heated by a lamp placed beneath a small retort. A thermometer attached gives the temperature of the oil, and at each degree of heat attained above, say, 90°, a discharge of electricity is applied, the spark at last producing an explosive flash in the gaseous fumes rising on the surface of the oil. These discharges are continued with the rising temperature of the oil until the flash extends into a flame, and the surface of the oil begins to burn.

A sample of oil, marked as flashing under the old test at 95°, flashed at 93° under the new test; and Mr. Holly stated that this test would always produce the flash on this sample of oil at a variation of not more than 2° from that point. The sample flashed at 93°, 94°, 99°, 104°, 108°, 112°, and 114°, and, finally, burned at 115°.

Subsequent experiments made by gentlemen present produced substantially similar results. All that is claimed by Mr. Holly for the machine is that it secures uniformity in the method by which the standard of the oil is determined.

The Block Island Breakwater.

The Block Island breakwater, begun nearly nine years ago, is at last completed. The enterprise has been attended with almost insurmountable difficulties, by reason of the severe storms which prevail at this place during all seasons of the year. The breakwater now affords a safe shelter for hundreds of mariners, and is a secure refuge for vessels. It extends almost due north from the steamboat landing, on the

east side of the island, a distance of 1,250 feet. The first work was done in October, 1870.

The main breakwater reaches at its northern extremity a depth of 18 feet, and contains about 65,000 tons of rip-rap. A detached pier, about 200 feet from the principal structure, is 300 feet in length, and contains about 28,000 tons of rip-rap. On the main breakwater there is a lighthouse near the 60 foot entrance to the basin. A mammoth basin has also been constructed, in which vessels drawing not more than seven feet of water may ride safely at anchor. There are contained in this structure 320,000 feet of timber (board measure) and 6,000 tons of stone. The total cost of the entire work was \$285,000.

Block Island is an isolated island in the Atlantic ocean, about midway between Montauk Point, at the Eastern extremity of Long Island, and Point Judith, R. I. It is eight miles long and from two to five miles wide.

THE EQUINE ANTELOPE.

A young animal of this species, from Nubia, has lately been added to the collection of the Zoological Society, at the gardens in Regent's Park. There was a specimen brought to London some time ago, which unfortunately died within

A Telephone Concert.

One of the most successful, and, in some of its features, peculiar, telephone concerts ever held, lately took place at the Wesley Chapel, Columbus, Ohio. Mr. Sidney Short delivered, at the church, his lecture on the "telephone." The lecture was illustrated by charts and apparatus. During the lecture demonstration of the practical operation of the telephone was given, which greatly surprised, interested, and gratified the audience. The arrangements of the apparatus were as follows:

Four Edison transmitters were placed in the Western Union main office, and two Phelps crown receivers at the church, a quarter of a mile distant. The lecture was delivered in the Sunday-school room, which is 50 feet square. The crown receivers were placed at one end of the room, and were provided with paper cones 4 feet long and 10 inches in diameter at the large end. With the apparatus thus arranged, a solo sung in the Western Union office was distinctly heard by the audience. After this, Mr. George Makepeace, of the State University, gave a cornet solo. Every note was distinct, yet as sweet and low as though heard from a distance, and coming over still waters on a quiet summer eve. When "Great Deliverer, Come," by the Wesley Chapel quartette, came through the instrument, not

lops, were described, and the species characterized. A beautiful specimen of an extinct skate, embedded in shale from Bear river, was exhibited and described. It belonged to a new genus of the family of trygons. The distinguishing characters are found in the teeth, which are like those of the genus *raia*, and in the spines of the tail, which are three in number, compressed and with one serrated edge. The name *Ziphotrygon acutidens* was proposed for the genus and species.

Professor Cope stated in this connection that, contrary to the assertion of Mr. Clarence King, no species of fossil fish was found common to the shales east and west of the Wasatch Range. The name *Amyzon* beds was given to the deposits west of the range, which were also found in the South Park.

Mr. John A. Ryder described a beautiful little crustacean found for the first time on this continent in the vicinity of Woodbury, N. J., by Mr. Seal, an indefatigable collector of the minute life of his neighborhood. The head is provided with robust claspers and two long, fleshy proboscis-like organs, which are coiled up between the claspers when at rest. The little creatures, which are about half an inch in length, are provided with eleven exquisitely delicate branchiae on each side, by means of which they float gracefully on their



THE EQUINE ANTELOPE.

two or three days of its arrival, from disease contracted before. This one seems to be doing well, like most of the other antelopes in the collection, of which they form an important and interesting feature. The antelope genus of ruminating mammals, distinguished from the ox, the deer, the goat, and the sheep, includes nearly a hundred diverse species, the majority of which are natives of Africa; a few belong to Asia and Europe, while America has scarcely any true antelopes. Among the more conspicuous and familiar instances are the Persian or Arabian gazelle, the Indian nyloghau, the ibex and chamois of the Alps, the eland, the gnu, the springbok and blesbok, and others, in South Africa.

The equine antelope grows to as large a size as the eland, sometimes measuring as much as 7½ feet in length and 4 feet in height at the shoulder, or the ordinary stature of a horse. Its color is a reddish-gray, with brown head and a white spot over each eye; the horns are large and heavy, round in shape, and marked with a series of rings, except toward the points, which are very sharp; and the entire horn curves backward when fully grown. This species is also found in South Africa, inhabiting the plains of the Transvaal and other elevated parts of the country.

We present an illustration of the individual specimen of the Nubian race which has taken up its abode in London.

only were the tones of different parts distinct, but even the words could be understood in every part of the room. As an encore, "We're Going Home To-morrow," was given. This, also, was clear and sweet. A cornet duet by Messrs. Makepeace and Hyatt, and, in response to an encore, "Old Virginia" was given with equal success. The musical programme was closed by the Doxology. After a short conversation with Mr. Ross, at the Western Union office, Mr. Short, in a glowing tribute to America's work on this, the invention of the age, brought his remarks to a close. Every word spoken or sung at the office was not only distinctly heard by the entire audience, but the voices of the speakers and singers were recognized, and could have been distinctly heard in a hall capable of seating a thousand persons.—*Journal of the Telegraph.*

Academy Notes.

The *Public Ledger* report of the recent meeting of the Philadelphia Academy of Natural Sciences, contains the following interesting items:

Professor Edward D. Cope stated that he had in his collection a large number of specimens illustrating the natural history of the extinct rhinoceros from the Loom Fork horizon and elsewhere in the West, where these remains form more than one-half of all the fossils found. Four distinct genera, *anchisodon*, *hyrachodon*, *aceratherium*, and *aphe-*

backs in the water. The specimen was named *Chirocephalus Holmanii*, in honor of Mr. D. S. Holman, the Actuary of the Franklin Institute, from whom the specimen was obtained, in recognition of the services he has rendered in devising methods for studying living objects, both large and small, under the microscope.

Dr. Chapman exhibited and described the placenta of a species of monkey (*Macacus cynomolgus*) which was remarkable in being single, and thus differing from the placenta of the other Old World monkeys, except the chimpanzee.

Dr. C. N. Pierce called attention to a skeleton of a maori, dug out of the sand on the beach of Chatham Island, South Pacific Ocean, and presented to the Academy by Mr. Wm. H. Rau. He pointed out the fact that in the lower jaw the third molar was the largest instead of the smallest, as in civilized man, thus approaching the condition in the lower animals. Other peculiarities of dentition were noticed.

American Coal at the Mediterranean.

Since referring in our last issue to the fact that anthracite coal was advertised for sale in Geneva, Switzerland, we find the following item in the *New York Tribune*: The rumor that an Italian firm was negotiating in the United States for an immediate supply of 100,000 tons of coal, in place of obtaining it from England as heretofore, has caused uneasiness in London. A cargo of American coal reached

the Mediterranean sixteen months ago, and met with a ready sale, and more than twenty cargoes have been sent over since that time. The *Globe* apprehends that before long the coal industry of Great Britain will have to encounter determined rivalry on the part of the United States. American coal will not be landed in England, but will be shipped to ports on the Continent which are now dependent upon supplies from the coal fields of the United Kingdom.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

POSITION OF PLANETS FOR JUNE, 1879.

Mercury.

On June 1 Mercury rises at 3h. 41m. A.M., and sets at 5h. 43m. P.M. On June 30 Mercury rises at 5h. 31m. A.M., and sets at 8h. 34m. P.M.

Mercury should be looked for during the last week in June, nearly in the parallel of the point of sunset; it will be in conjunction with the new moon on the 19th.

Venus.

On June 1 Venus rises at 7h. 22m. A.M., and sets at 10h. 29m. P.M. On June 30 Venus rises at 8h. 15m. A.M., and sets at 10h. 6m. P.M.

Venus passes 4" south of Pollux on June 2, and 2½" north of Regulus on June 30.

Venus will be near the crescent moon on the evening of June 23.

Saturn.

On June 1 Saturn rises at 2h. 2m. A.M., and sets at 2h. 35m. P.M.

On June 13, according to the Nautical Almanac, Saturn will be in conjunction with the moon at 5h. 31m. Washington time. The planet will therefore rise on the morning of that day, following the crescent moon.

On June 30 Mars and Saturn will rise very nearly together, at 0h. 13m., and will keep nearly the same path until they set.

Uranus.

On June 1 Uranus rises at 10h. 47m. A.M., and sets at 15m. after midnight. On June 30 Uranus rises at 8h. 58m. A.M., and sets at 10h. 23m. P.M.

Sun Spots.

The sun has been examined daily, since the first of the year, with a glass of 3 inches aperture. As late as May 8 no spot had been found. On May 9 a small spot was seen, which had developed within the previous twenty-four hours. It could not be found with the same glass on the 12th, but the large telescope showed that it had broken up into several minute sections, and was rapidly diminishing.

Mars.

On June 1 Mars rises at 1h. 20m. A.M., and sets at 51m. after noon. On June 30 Mars rises at 0h. 13m. A.M., and sets at 39m. after noon.

Mars will be near the waning moon on June 12. According to the Nautical Almanac Mars will be in conjunction with Saturn at 2 P.M. on the 30th. The two planets will therefore be seen to rise nearly together.

Jupiter.

The planets Jupiter, Saturn, and Mars are all best seen in the morning.

On June 1 Jupiter rises at 44m. after midnight.

Mars rises north of Jupiter at 1h. 20m. A.M., and Saturn rises north of Mars at 2h. 2m. A.M.

On June 30 Jupiter rises at 10h. 50m. P.M., nearly as Venus sets.

Jupiter is very brilliant. We are coming nearer to it, and its moon can be seen with very little optical aid.

The Coney Island Pier.

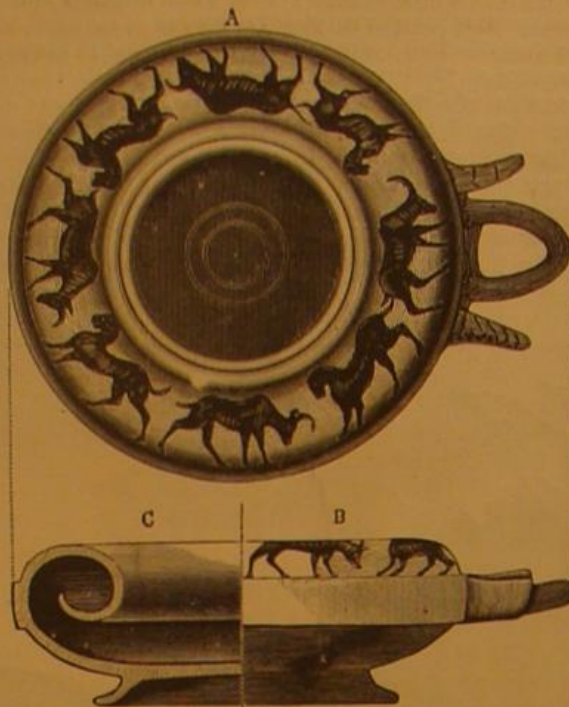
The Ocean Navigation and Pier Company, of which Mr. Jacob Lorillard is president, are erecting off West Brighton, Coney Island, an immense iron pier. The contractors are the Delaware Bridge Company, and the construction is under the supervision of Messrs. MacLay & Davies, civil engineers. The pier, when completed, is to be 1,000 feet in length, extending outward from high-water mark. Its width is to be 50 feet, with enlargements of 100 feet in width at the shore end, the center and the pier head. It is to be double-decked, with iron substructure, the whole supported by wrought-iron tubular piles 9 inches in diameter, made of one-half inch metal. These piles are arranged in rows, at distances of 20 feet longitudinally and 16 feet 8 inches laterally. Each pile has at its base a circular cast-iron disk 2½ feet in diameter, which, when sunk into the sand, acts as a supporting base, and at the depth of 15 or 20 feet insures a perfect foundation. The piles are driven by the "jet water" system.

Iron capitals are bolted to the tops of the piles, and they support 15-inch wrought-iron beams, bolted together, upon which the superstructure will rest. The entire structure is to be made more secure by being braced throughout with diagonal rods an inch and a half in diameter, and heavy horizontal struts bolted to the beams transversely. When completed, the entire structure will be supported by 260 iron pillars. The flooring of the lower deck will be well finished and inclosed in a handsome iron railing. The landing stage will be at the lower deck of the pierhead, and will be guarded by massive oak fender pieces.

More than 100 workmen are engaged in pushing forward the work. At night two electric lights, one on shore and the other on the movable derrick, are used. The first pile was driven on the 22d of April. All the material for construction is on the ground, and it is intended to have the last pile in place by the 1st of June. On the upper deck of the pier are to be spacious pavilions and saloons. The whole structure will cost more than \$150,000.—*Iron Age*.

GREEK DRINKING CUP.

The engraving represents the upper face and a diametrical section of an ancient Greek drinking cup which was used



ANCIENT GREEK DRINKING CUP.

by the soldiers for dipping up the muddy water met with in their marches. The inwardly turned rim prevented the mud from following the water as it was poured from the vessel. This vase or cup is preserved in the Pourtales collection.

NEW PROVISION SAFE.

The accompanying engraving represents a very useful household article recently patented by Mr. Samuel Inman, of 929 South Asland Ave., Chicago, Ill. It is designed for keeping bread, pastry, meats, milk, and other articles of food which require protection from insects or other vermin.

The safe is made in two parts, the upper part being made air-tight, or nearly so, for containing bread and pastry, and protecting them from the influence of the atmosphere and from insects. The lower portion consists of a light frame having a door in one side, the whole being covered with wire gauze, which permits of a free circulation of air, while it prevents the entrance of rats, mice, or insects. The shelves are formed of slats of wood, secured to end cleats. This part of the safe is intended for receiving meats, butter, milk, and other articles which require a free circulation of air around them. The safe may be set upon the cellar floor or hung up by wires, as may be most convenient.



Inman's Provision Safe.

Painting Walls—Seasonable Hints.

Of course, says the *American Builder*, everybody knows, or ought to know, that walls and ceilings are finished with plaster. But everybody may not be aware that plaster has the property of absorbing moisture. This, perhaps, will not take place in rooms where a fire is kept steadily; but in rooms left, as is often the case, for weeks without a fire, the walls will take up a considerable quantity of damp. The effect will be injurious to the health of the inmates. There are few persons who have not suffered from a mysterious cold, caught they know not how, though, perhaps, damp in the plaster had something to do with it.

The extent to which damp is absorbed in a plastered wall may be discovered by noticing what so often takes place in rooms where the walls are painted and have become chilled by a season of cold weather. As soon as the temperature becomes warmer the atmosphere is condensed on the walls, and at times in such quantities as to run off in streams. Now, had it not been for the paint, the greater portion of this moisture would have been absorbed by the plastered walls. And as a consequence the quality of the plaster would have been impaired and the room made unwholesome. In view of this defect in plastered walls, it becomes a question well worth considering, whether, in finishing a house, the walls should be papered or painted. If paint is decided on, it is highly necessary that the painting be properly done and good materials employed. White lead, which is the chief ingredient of all paint used, is of late years heavily

adulterated—a reason why some painters can do work so much cheaper than others. There are also dishonest painters who will lay on nothing but "whiting" and size for the first coat, and finish off with one coat of oil paint. It is not easy to detect the fraud at the time, but as such paint soon wears off the wall, and attaches itself to the garments of those who rub against it, the customer speedily finds out that he has been cheated. It takes three or four coats of good oil paint honestly laid on to make good work of painting plastered walls.

In painting walls there is ample scope for taste, and such colors may be chosen as are most suitable for each apartment, and in harmony with the furniture. Apartments lighted from the south and west, particularly in a summer residence, should be cool in their coloring; but the apartments of a town house ought all to approach toward a warm tone. In a drawing room the coloring should be characterized by vivacity, gayety, and light cheerfulness; by light tints of brilliant colors with a considerable degree of contrast and gilding—the walls being kept in due subordination to the furniture, though partaking of the general liveliness. The characteristic coloring of dining rooms should be warm, rich, and substantial, without vivid contrasts, and gilding should be avoided, unless in small quantities for the sake of relief. Parlors ought to be in a medium style, between that of a drawing room and dining room. Libraries should be solemn, grave, and quiet in color and finish, while bedchambers should be light, cleanly, and exceedingly cheerful. A greater degree of contrast between the room and its furniture may be admitted in the chamber than in any other apartment. Stairways, halls, and vestibules should be of a cool tone and simple in their style of coloring, being in that what they are in utility—a link between the exterior simplicity of a house and its interior richness and comfort.

Mr. Gary has the Last Word.

To the Editor of the *Scientific American*:

As your correspondent "E.," in your issue for May 17, page 304, has made some misstatements, will you allow me to correct him? In referring to a letter written by me and published by you, April 5, he says, "Mr. Gary's knowledge of history is as defective as his knowledge of magnetism and electricity," and he advises me, before I write any more history of science, to be at the pains of studying it a little more carefully.

Allow me to say that all the history I attempted in the letter referred to was the following sentence: "The law of gravitation was not discovered in a laboratory, nor was the power of steam nor electricity." This is all the history that I attempted, and the *SCIENTIFIC AMERICAN*, which your correspondent will acknowledge is good authority, remarked in regard to this, in the same number in which it appeared, that "everybody will agree with what our correspondent says about laboratory discoveries, Newton and the apple, Franklin and the kite string."

Your correspondent E. also holds up before your readers a list of honored and respected names as martyrs to "conceited ignorance, and mutilated and outraged history," and tries to vindicate history and himself by making other misstatements. He says: "Mr. Gary brags that he is ignorant of what others have done." I humbly acknowledge that I do not know it all, but I never brag about it. As to his assertion that Professor Henry advised me to buy \$50 worth of books and study up on magnetism before wasting more time, I have to say that Professor Henry never said anything of the kind. Another eminent scientist made a similar remark before he saw my discovery, but after seeing it, he advised me to go ahead.

Let us hope your correspondent's knowledge of history and science is more accurate than his assertions in regard to current events. It is to be feared that "much learning hath made him mad."

W. W. GARY.

Boston, Mass.

Malleable Nickel and Cobalt.

Fieitmann has succeeded, by a very simple device, in obtaining cast nickel in a malleable and ductile form, even when cold, while cobalt prepared in the same manner possessed such hardness when cold that he expects it can be used for cutting instruments, while hot it is both malleable and ductile. His process consists in adding to the fused metal, through a hole in the lid of the crucibles, 1½ per cent of metallic magnesium, which possesses a remarkable power of destroying carbonic oxide. The author is of the opinion that the porous and crystalline character of cast nickel is due to its absorption of carbonic oxide gas while in a molten state. It is not impossible, however, that owing to the great affinity of magnesium for nitrogen, its action may be due to the destruction of cyanogen in the metal.

Cobalt prepared in this manner possessed none of the reddish color attributed to it in the text-books, but actually excelled nickel in whiteness and brilliancy.

He also welded these metals on to iron and steel at a white heat, and strips thus welded were rolled out to the finest number without separating from each other.—*Berichte d. d. ch. Ges.*

SOOT FOR ROSES.—Collect some soot from a chimney or stove where wood is used for fuel, put into an old pitcher, and pour hot water upon it. When cool, use it to water your plants every few days. The effect upon plants is wonderful in producing a rapid growth of thrifty shoots, with large thick leaves and a great number of richly-tinted roses.

Plantains and Bananas.

Of all plants which are the produce of the tropics, none are superior in interest to the plantains and bananas, two closely allied species of the genus *Musa*. Of the several species of this genus, one has received the specific name of *paradisaca*, under the supposition that it was the "tree of life," or the "tree of the knowledge of good and evil," spoken of in the Scriptures. St. Pierre observes that the violet cone at the end of a branch of plantains, with the stigmas peering through like gleaming eyes, might well have suggested to the guilty imagination of Eve the semblance of a serpent tempting her to pluck the forbidden fruit it bore, as an erect and golden crest. Though some of the species attain a height of 20 to 30 feet, they are herbaceous plants, growing up, flowering, fruiting, and then dying down to give place to other shoots from the same root. The fruit ripens in succession from the base to the apex of the flowering stem, so that on the same plant flowers and ripe fruit will be found associated. One stalk of fruit will attain three feet, and bear from 120 to 150, even 180 plantains, the entire weight of which would be from 50 to 70 lb. Dried plantains form an article of internal commerce in India, and, in a few instances, have been exported. When deprived of their skin and dried in the sun, they are reduced to meal, in great request in the West Indies for children and invalids. A recent French exchange states that efforts are being made in Venezuela to get up an export trade for meal of this sort, the supply being much greater than the home demand. Professor Johnston states that the fruit approaches most nearly in composition and nutritive value to that of the potato, and the meal to that of rice.

All the species contain a large number of spiral vessels, and afford a strong and valuable fiber, from which cloth and cordage are made. The substance called manila hemp, much employed for cordage in America and Europe, is obtained from one of the species (*Musa textilis*). Scarcely any parts of these useful plants are devoid of use to man. A limpid fluid issues from wounds in the body of the plant, which is used in medicine, as is also the root. It has been recently stated in a foreign medical journal that the property which these plants possess of keeping the surrounding soil moist (as pointed out by Boussingault) has been taken advantage of to afford shade and moisture to the coffee plant in Venezuela; and that the cultivation of the latter has therefore been greatly increased.

Still another industrial use has lately been proposed for the fruit in the latter country, this being the distillation of brandy. Banana brandy, even from the first distillation, is said to have a pleasant taste and smell, recalling that of the fruit. It contains 52 per cent of alcohol. As two hundred-weight of the fruit produces about ten quarts of alcohol of 96°, banana brandy may yet be destined to play as important a part in economy as the alcohol of the sugar cane.

Ramie Fiber and its Manufacture.

This fiber, the utilization of which in textile manufactures has for many years engaged the attention of practical men, still continues to command a large amount of notice. It is undoubtedly deserving of all it receives, because if the difficulties that have hitherto stood in the way of its extensive use can be overcome, we shall have at command a fiber that will do much to emancipate manufacturers from dependence upon the American cotton, the Russian flax, and the Italian and Chinese silk crops. Besides the independent position it would take on its own merits, it possesses qualities that would enable it to be substituted, by means of a little ingenuity, for any of those fibers. If it can be produced sufficiently cheap it may even become a permanent substitute for one or more of them, and to a considerable extent displace them. Whether such an occurrence would be an advantage or otherwise time only could reveal.

During the past month we have had submitted to our notice some specimens of goods manufactured entirely from the ramie plant fiber. The raw material in its dried state, as it is taken in the first process, was shown. This is a pliant, reddish brown, straw-like substance. After passing through the first stage it yields a long, light flaxen-colored fiber, of great strength and fineness, and which appears to be divisible to an extreme degree. The next forms in which it was exhibited were in wet spun and dry spun yarns. In the former it possessed a solidity which gives it a somewhat wiry appearance and great strength; in the second it is almost as soft as wool, and may almost be mistaken for it. These yarns wrought into cloth display similar characteristics. One specimen appears very much like a good brown Hessian, and another a Belfast brown linen. A third had passed through the bleaching process, and showed its capability of being adapted for table linen, napkins, diapers, etc. It bleaches clearly and evenly, coming up of a rich pearly whiteness, with a cool, pleasant feel, but with more fiber on the face of it than a linen article would possess. In each phase of it the distinguishing features are great strength and probable durability. In another case the fiber had been reduced to its finest condition, spun into a soft, pearly-white hosiery yarn, and worked into an undershirt, possessing all the softness, luster, and beauty of a similar article in silk.

So far as the samples allowed us to discover, it would appear to be free from the distinguishing fault of China grass, from which creases cannot be removed. The inventor stated that he had numerous other fabrics woven from yarns entirely of this fiber, such as dress goods, ribbons, dyed and printed fabrics, either completed or in process, and which could be shown when necessary. The specimens exhibited

formed an interesting display, the importance of which, however, depends entirely upon whether, as affirmed, they have been produced by a process and at a cost that will enable the ramie fiber to take its position in commercial markets as a practically useful article.—*Textile Manufacturer*.

THE EDIBLE MUSSEL.

The common edible mussel, *Mytilus edulis*, attracts our special attention on account of its value as an article of diet and commerce.

In the accompanying engraving, Fig. 1 shows the animal laid open to view, the left half of the triangular shell having been removed, while the brim of the mantle has been thrown back a little to allow a better inspection of the inner organs. Both parts of the shell are alike in shape and size. The hinge or lock uniting them is located in the smallest

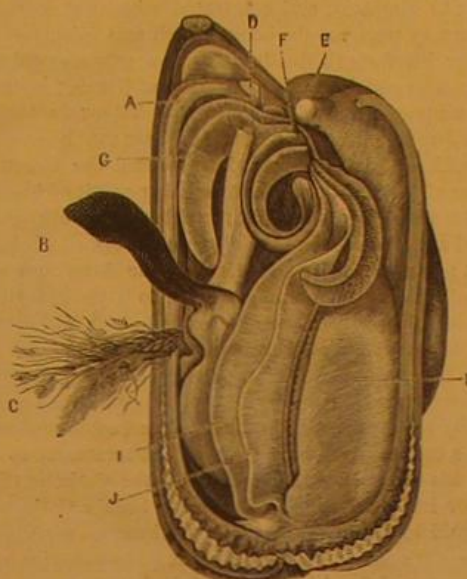
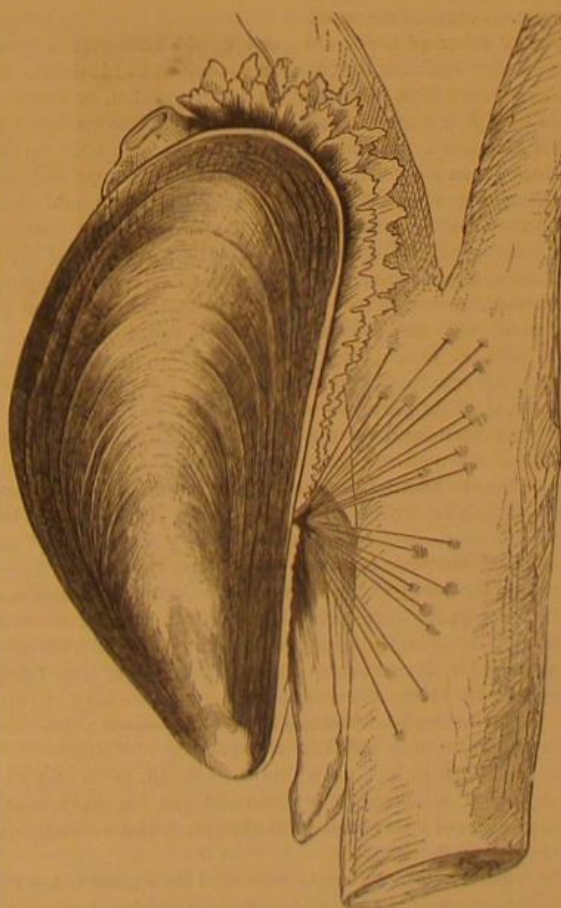


Fig. 1.—EDIBLE MUSSEL.

angle of the triangle formed by the shell, and both of the latter end at this point in short conical elevations. At the opposite end there is a small opening in the shell corresponding to the anus of the mussel; and in close proximity runs a short fringed tube connecting with the inner organs of respiration.

The peculiar digital form of the foot and the presence of a spinning gland or byssus are characteristic, and both are undoubtedly related to the stationary mode of life of the animal. The hypothenuse of the shell being the face side of the mussel, A is the brim of the mantle of the latter. On both

Fig. 2.—EDIBLE MUSSEL.—(*Mytilus Edulis*.)

sides of the mouth, F, will be noticed the long, narrow, folded tentacles, G; J is the exterior, I the interior respiratory muscle; E and D are muscles controlling the foot, B, under and behind the base of which is situated the byssus or spinning gland. From its cavity a groove extends along the lower side of the foot, and ends at its tip in a transverse cavity containing a small plate, perforated by seven small apertures, used for sucking.

By means of the foot and the byssus gland the animal is enabled to spin a net or barb, C, consisting of numerous thin threads, attached firmly to the surface of the rock or other object forming its abode. These threads are produced from

a viscid liquid substance secreted in the byssus gland, which is sucked up into the apertures of the end of the foot and drawn out into threads, which become quite firm in a short time. Once attached to a rock or log they resist the action of the strongest current and the heaviest gale. Fig. 2 is a correct representation of the mussel as attached to a fixed object.

If the mytilus desires to change its residence it draws itself forward as far as possible, and attaches a few threads as far ahead as the foot reaches. At the same time a few of the old threads are severed. This manipulation is repeated until a suitable site is reached. Although this mode of locomotion is extremely slow, the animal nevertheless manages to traverse considerable distances in this manner.

The edible mussel inhabits, by preference, those portions of the shore which are laid dry at low tide; and in the neighborhood of the mouths of rivers, where the percentage of salt in the water is low, broad thick bands may be observed covering that particular section and marking it distinctly. Sometimes as many as 2,000 individuals have been counted on an area of one square foot.

As above mentioned, the animal prefers water containing only a little salt. It abounds, therefore, especially in those European waters cut off partly from free communication with the Atlantic, as in the German North Sea, the Baltic, and the Adriatic. They have also been acclimatized in the Caspian Sea, the water of which is not extremely salt.

In northern waters the edible mussel attains its full size in four to five years, and in the Mediterranean in one to two years. When they propagate each individual produces (they being hermaphrodites) millions of offspring.

Besides being almost indispensable as bait for certain fish, they are extensively used as an article of food. They are largely cultivated in all European waters, in so-called "parks." In the North Sea these consist of large numbers of trees, from which the smaller branches only have been cut, and which are planted in the bottom of the sea at such a distance from the shore that their upper portion is partially laid bare at low water. After four or five years they are raised, stripped, and replaced by others. In the bay of Kiel, Germany, alone about 1,000 of these trees are annually planted and about 1,000 tons of mussels are brought on the market. Bad seasons occur, however, both with respect to quality and quantity, owing to various causes. In the Adriatic the mussels are raised on ropes extended between poles rammed into the ground. The ropes are raised and stripped once in eighteen months.

American Sumac.

Dr. William McMurtrie, Chemist of the Department of Agriculture, has been making elaborate investigations as to the relative amount of tannic acid and coloring matter in American and Sicily sumac. He finds the American product, when properly gathered, to be fully equal to the foreign. Samples of Winchester, Va., sumac were collected in the months of June, July, and August respectively. Of these samples those collected in June and July were mixed varieties, and of the product collected in August we secured samples of the leaves of *Rhus glabra* and *Rhus copallina* separately.

In reporting his experiments Dr. McMurtrie states that in some of the tests the precipitates obtained by means of the solution of the June collections of Winchester mixed sumac were perfectly white and very much cleaner than any obtained with the Sicilian product. "The difference in the color of the precipitates obtained from the solution of the June collection and that obtained from solutions of the samples of later collections, was sufficiently marked to prove that the great difficulty in the way of the universal employment of the American to the exclusion of the expensive Sicilian product may be obviated by making our collections early in the season—that is, in the month of June. The percentage of tannic acid is not, it is true, quite as high as obtains in July, but it compares favorably with the Sicilian product, which, be it remembered, communicates a slightly yellowish tinge to the gelatine precipitate. The amount of coloring matter found in the July collection is sufficient to account for the difference of \$50 a ton in the market values of the sumac of home and foreign growth, regardless of the proportion of tannic acid. We would therefore advise that, for the purpose of tanning white and delicately colored leather, the collection be made in June, while for tanning dark colored leathers, and for dyeing and calico printing in dark colors, where the slightly yellow color will have no injurious effect, the collections be made in July. It appears that for all purposes the sumac collected after the 1st of August is inferior in quality. In view of the facts here presented, we cannot help urging upon manufacturers the importance of encouraging the home production—of insisting that the collections be made early in the season, in order thus to bring about such a change in this matter as to prevent the annual expenditure of over \$600,000 in gold for the sumac of foreign growth."

NEW AGRICULTURAL INVENTIONS.

An improved trap attachment for corn cribs, patented by Mr. Adam Harper, of Boswell, Ind., consists in combining with the raised and slatted bottom of the corn house a series of swinging side racks that rest inwardly on a subjacent floor.

Mr. James W. Rudolph, of Carmi, Ill., has devised an improved agricultural implement, that is adapted for both hoeing and digging, and is easily adjusted for either use.

A machine for dropping corn and other seed at regular intervals, and also dropping at the same time a regulated supply of fertilizing material into the hill, has been patented by Mr. Geo. W. Miller, of Fawn Grove, Pa.

An improvement in harrows, patented by Mr. George Lettenmyer, of Little Georgetown, W. Va., consists in an arrangement of yielding teeth, which renders the draught of the implement light, and lessens the chance of breakage.

Mr. Henry M. Keller, of Newark, O., has patented an improved harrow having teeth of peculiar form, and provided with a clod crusher, that breaks up the clods as the harrow advances.

GERARD MERCATOR, THE COSMOGRAPHER.

Gerard Mercator, the cosmographer, and inventor of the map projection which bears his name, was born on the 5th of March, 1512, in the small town called Rupelmonde, in East Flanders, about eight miles from Antwerp. He was the youngest of six children of a poor shoemaker. Losing both parents at an early age, he was kindly cared for by a great-uncle, to whom he became indebted for the advantage of an education in the best schools of the Netherlands. At the age of eighteen he entered the University of Louvain, where he was eventually matriculated under the faculty of arts, which nearly corresponded with the faculty of philosophy in a modern German university. Remaining at Louvain till his removal to Germany, he at first devoted himself to philosophical studies of such abstruse subjects as the origin, nature, and destination of the physical universe, and became absorbed in the great problems of science and revelation. He found it impossible to reconcile the Mosaic account of creation with the doctrines of Aristotle. Here he began to tread upon dangerous ground, for in Louvain, as at Paris, the authority of Aristotle in the domain of physical philosophy was sacred and supreme. To dispute or question the perfect consistency and harmony of his teachings with those of the church was heresy. Finding no one to sympathize with him in his doubts, Mercator left Louvain and secluded himself for study at Antwerp for several months; but whatever skeptical views he may have had in regard to the divine inspiration of the Scriptures were dispelled before he returned to Louvain.

As Mercator grew older he began to turn his attention to the practical problem as to the best means of earning a livelihood. Having obtained permission from the Faculty of Arts of the University of Louvain to give private instruction in mathematics, he thus began to support himself; and having previously chosen for his vocation the manufacture of mathematical instruments, he was thus enabled to establish a workshop of his own, where he manufactured astrolabes, astronomical rings, globes, etc., of great accuracy.

As a cartographer, Mercator appears to have begun his career by the publication of a map of Palestine, at Louvain, in 1537. Increased interest in religious matters naturally led to an increased demand for such maps. No copy of this has come down to us; but it seems to have been well received, as it was highly praised by his contemporaries. His next work was a map of Flanders, undertaken at the request of certain Flemish merchants. He traveled over the country, making surveys and measuring heights and distances. It took three years to complete the work, and it was published at Louvain in the year 1540. A masterpiece of his handiwork, at this period of his life, was a large terrestrial globe, which he finished in 1541. This is now lost, but the original drawings for its exterior surface are still preserved at Brussels. This became the means of commending him to the favor of Charles V., from whom he received an order for a complete set of mathematical instruments for use on his expeditions. About this time he was married. In 1544, there occurred in his life an incident which has been only recently brought to light—he was imprisoned as a heretic. It appears that an imperial edict was issued at Brussels, by Mary, queen dowager of Hungary, condemning all heretics to death. Under the operation of this edict, forty-three citizens of Louvain, Mercator among the number, were accused of participation in what was styled the "Lutheran heresy."

We have no information as to the cause or circumstances of Mercator's discharge from imprisonment; all is shrouded in mystery; we can only glean from the records of the time that he must have been imprisoned nearly four months. After his release he resided at Louvain seven or eight years. He made a new set of instruments for the Emperor, to replace the former, which had been destroyed; and completed and dedicated to the Bishop of Liege a celestial globe of the same size and style as the terrestrial one which he had before presented to Granville.

In 1552 he removed to Duisburg, in Germany. Here he shortly after completed for the Emperor an astronomical ring and a set of globes elegantly equipped and ornamented. There was a celestial globe of glass or crystal, and on it were engraved the constellations with a diamond. Inside of this was a terrestrial globe of wood. Attached to this set were a compass, an hour circle, a quadrant of altitudes, and other instruments. In 1554 Mercator published at Duisburg a large map of Europe, which, more than any other work of his, contributed to his fame as a cartographer among his contemporaries. This is now lost, although a reduced copy of it published by his son still exists. In 1564 he published a map of Great Britain; in the same year, a map of Lorraine, based on a trigonometric survey made by himself. In 1569 he made his first appearance, after his removal to Duisburg, as the author of a printed book—a folio

volume on chronology, written in Latin and published at Cologne.

Even after the discoveries of the 15th and 16th centuries, and in the lifetime of Mercator, the works of Ptolemy were still regarded as the groundwork of all geographical knowledge. Mercator was a great admirer, but not an implicit follower, of this author, and in 1578 published a corrected and revised edition of the maps or charts of Agathodæmon which accompanied the work of Ptolemy. Six years later, he republished this collection of charts, twenty-seven in number, together with the text of Ptolemy's eight books on geography. This work added greatly to the reputation of Mercator as a geographer and scholar, and is still held in high estimation by modern authorities.

We now come to the work of Mercator commonly known as his Atlas of Modern Geography, and which he did not live to complete. The modern application of the word "atlas" we owe to Mercator, and originated with this work. The introductory pages of the book, which was published by his son after his father's death, contain a genealogical tree of the ancestors and descendants of Atlas of Grecian Mythology, who, as a punishment for leading the Titans in their war against Jupiter, was condemned to bear the heavens upon his shoulders. As Humboldt has adopted the Greek word "Kosmos" as a title to the crowning work of his life, so Mercator adopted "Atlas" as the title to the work which he planned and projected as the crowning work of his life. He did not mean to call it an Atlas, or the Atlas, but simply "Atlas." He never intended to give to it the generic sense in which it is now used, as applicable to any and every collection of maps; but as there was no word in the classical or modern languages that had done such service, the title was borrowed in course of time by other cartographers, until it has gradually lost its special application, and come to designate simply a collection of maps. From the treatment to which two of his works were subjected by the Catholic Church, Mercator has been supposed to have been a Catholic; but this is said to be an error. His posthumous work on the creation was condemned in the Index Expurgatorius because its treatment of the doctrine of original sin bore too close a resemblance to the teachings of Luther; and his chronology was prohibited on account of the extracts contained in it from writings that had been condemned. Mercator, having lost his wife in 1586, married again. His second wife was the widow of a burgomaster of Duisburg. The issue of his first marriage was six children, three sons and three daughters. He died in December, 1594.

The fame of Gerard Mercator rests chiefly upon his achievements in the department of mathematical geography and cartography. He is known to us, principally, as the inventor of the projection which bears his name. The value of what is now known as the "Mercator Projection" was so little appreciated at first that his successors did not deem it of sufficient account to place it in the Atlas of Modern Geography. If it ever occurred to the inventor that this rather than any other of his productions would immortalize him, he probably banished the idea long previous to his death. It seems to have been thrown aside and forgotten, or only remembered as a scientific curiosity. It is unknown exactly when Mercator's projection was first used; we only know that about the year 1630, the French seaport Dieppe was the principal emporium for the sale of nautical charts, and that those then sold at that place were mostly on this projection. The practical signification of Mercator's projection is this: He says to the mariner: "If you wish to sail from one port to another, here is a chart and a straight line on it, and if you follow this line carefully, you will certainly arrive at your port of destination. The length of the line is not correct, yet it points exactly in the right direction. Consequently, if you follow the line, you may get to your destination sooner than you expect, or you may not get there as soon. But you will certainly get there."

Such are the leading features in the life of one to whom Malte-Brun paid an eloquent and fitting tribute when he said: "Modern geography dates from Mercator." The memory of Mercator has been sadly neglected by the English speaking races, and until the recent paper of Mr. Elial F. Hall before the American Geographical Society, no full account of his life has appeared in our language. We are indebted to Mr. Hall's paper for the materials of this brief sketch of the celebrated cosmographer.

DAVID PAGE.

In the death of Professor David Page, LL.D., which occurred at his residence, Newcastle-on-Tyne, March 9, geology loses one of its most popular expositors and voluminous and practiced writers.

Professor Page was born in Fife, and the earlier years of his life were spent in literary occupations in his native country. Subsequently he entered the employ of Messrs W. & R. Chambers, of Edinburgh, and took an active part in the preparation of their large series of educational works. During his connection with this house, the once-celebrated but now half-forgotten "Vestiges of Creation" made its appearance. Although Robert Chambers has always been credited with the greater share of this anonymous volume, Page is supposed to have lent powerful assistance with his versatile pen. Leaving the service of the Messrs. Chambers, he embarked on the sea of successful authorship, and, following in the wake of Hugh Miller, kept up an interest in geological science, by his voluminous writings, which were characterized by a graceful and easy style not usually possessed by scientific men. He rewrote his "Introductory

Text-Book of Geology," and prepared an advanced text-book on the same science. He also published works on physical geography, and various popular works on geological subjects. Taking up the study originally as an amateur, he ultimately devoted himself to it professionally, although he is not credited with much original power as an observer. In fact, field work for him was almost impossible, owing to physical infirmity, yet he had a most lucid and pleasing way of presenting the discoveries of others before non-scientific readers. On the establishment of the College of Physical Science, at Newcastle, he was chosen Professor of Geology. Here he pursued his vocation with much zeal and success until within a short period of his death. He was in the sixty-fifth year of his age.

The New Northwest.

In a long review of the condition, prospects, and possibilities of the vast and comparatively undeveloped country lying to the north and west of Minneapolis, Minn., the *Northwestern Miller* says that the Northern Pacific Railroad passes nearly through the center of the finest wheat region on the face of the earth. Nearly 300 miles further north another great trans-continental railway is being constructed, and our Canadian neighbors even contemplate building a railroad having its northern terminus on the shores of Hudson's Bay. It will thus be seen that to the north and west of Minneapolis is a vast and productive agricultural region, extending far up into the British possessions on one side, and losing itself in the mountains of Montana on the other. It is capable of producing wheat enough to supply the world, and the water powers of Minnesota alone are capable of converting the larger part of its product into flour. It embraces within its limits immense forests of pine and hard wood, and mines of iron, copper, silver, and gold. Nature has provided in abundance the elements necessary to the support of a great population, and the population is now coming.

It is only within the last few years that a systematic effort has been made to develop this valuable section of the national domain. The success of the pioneer settlers has been such as to attract the attention of others seeking homes in the West, and the stream of immigration thus started has suddenly swollen to gigantic proportions. Last year the settlers poured into Western Minnesota and Eastern Dakota by thousands; this year they are coming by tens of thousands. As yet only a tithe of the magnificent wheat lands of the western portion of this State are under cultivation, and the sod of the greater part of Dakota's fertile prairie is unbroken. There is a steady exodus from the eastern part of this State and from Wisconsin and other States, of young men and old men, to the "promised land," which, if it does not literally flow with milk and honey, does promise an abundant harvest and a competence to those who are willing to work hard and wait patiently.

It cannot be doubted, the *Miller* remarks in another connection, that this great accession to the wheat growing territory of the United States will have a marked influence on the milling industry of the country. With an abundant supply of breadstuffs prices must rule low, and the margins in flour manufacturing be small. Every effort of inventive skill will be made to cheapen the manufacture and better the product. The inevitable result must be that the making of wheat into flour will be done in large mills employing immense capital, and that the class of small combined merchant and custom mills will become a thing of the past. The present high standing of spring wheat flour, which many have thought and some have hoped would be lost with the exhaustion of the Minnesota wheat fields, will be maintained through the superabundant supply of the choicest kinds of hard wheat from the new fields now being opened.

Scientific Views of Nature.

Who does not see that Galileo, Descartes, Newton, Lavoisier, Laplace, have changed the foundation of human thought in modifying totally the idea of the universe and its laws, in substituting for the infantile imaginings of non-scientific ages the notion of an eternal order, in which caprice and particular will have no thought? Have they diminished the universe as some think? For my part I think the contrary. The skies as we see them are far superior to that solid vault spangled with shining dots and upborne some leagues above us by pillars which contented the simpler ages. I do not much regret the little spirits that had wont to guide the planets in their orbits; gravitation does the work much better, and if at times I have a sad remembrance of the nine angelic choirs wheeling round the orbs of the seven planets and for the crystal sea that lay at the feet of the Eternal, I console myself with the thought that the infinite into which we look is really infinite, and a thousand times more sublime to eyes of true contemplation than all the azure circles of Angelico of Fiesole. M. Thiers rarely allowed a fine night to pass without gazing upon that boundless sea. "It is my mass," he said. In how far do the chemist's profound views upon the atom surpass the vague notions of matter on which the scholastic philosophy was fed!—*Renan*.

Clothes Moths.

To keep furs and woolen goods from moths close wrapping in paper is enough, though a little camphor may be put into the package to keep off other insects. Any paper will do if there are no holes in it, and no openings are left for the moth to creep in. Of course care must be taken to have the articles free from moths when put away.

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Linen Hose.—Sizes: 1 1/2 in., 2 in., 2 1/2 in., 3 in., 3 1/2 in., 4 in., 4 1/2 in., 5 in., 5 1/2 in., 6 in., 6 1/2 in., 7 in., 7 1/2 in., 8 in., 8 1/2 in., 9 in., 9 1/2 in., 10 in., 10 1/2 in., 11 in., 11 1/2 in., 12 in., 12 1/2 in., 13 in., 13 1/2 in., 14 in., 14 1/2 in., 15 in., 15 1/2 in., 16 in., 16 1/2 in., 17 in., 17 1/2 in., 18 in., 18 1/2 in., 19 in., 19 1/2 in., 20 in., 20 1/2 in., 21 in., 21 1/2 in., 22 in., 22 1/2 in., 23 in., 23 1/2 in., 24 in., 24 1/2 in., 25 in., 25 1/2 in., 26 in., 26 1/2 in., 27 in., 27 1/2 in., 28 in., 28 1/2 in., 29 in., 29 1/2 in., 30 in., 30 1/2 in., 31 in., 31 1/2 in., 32 in., 32 1/2 in., 33 in., 33 1/2 in., 34 in., 34 1/2 in., 35 in., 35 1/2 in., 36 in., 36 1/2 in., 37 in., 37 1/2 in., 38 in., 38 1/2 in., 39 in., 39 1/2 in., 40 in., 40 1/2 in., 41 in., 41 1/2 in., 42 in., 42 1/2 in., 43 in., 43 1/2 in., 44 in., 44 1/2 in., 45 in., 45 1/2 in., 46 in., 46 1/2 in., 47 in., 47 1/2 in., 48 in., 48 1/2 in., 49 in., 49 1/2 in., 50 in., 50 1/2 in., 51 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keep good for years. This paste is of extraordinary adhesive power, and may be used for leather, paper or cardboard with great success.

(8) St. J. asks: 1. Will you please tell me how I can waterproof some straw board, cheaply and quickly, in a small way? A. Either one of the following may suffice: 1. Take of white wax and spermaceti, each, 1 oz.; mutton suet, 4 oz.; melt in 1 pint of olive oil. Or, 2. Beeswax and yellow rosin, 2 oz. each; melt in 1 pint of olive oil. The solution should be applied warm. 3. Also if either of these hair dyes would be efficient and harmless: Red wine, 2 oz.; sulphate of iron, 18 grains? A. Will probably have no injurious effect. 3. 1 drachm sugar lead; 1 drachm lac sulphur; 1 oz. oil glycerine, and 1 pint soft water? A. Not to be recommended, as one of the constituents is plumbic acetate.

(9) H. L. B. writes: In answer to the query of H. L. V., I will inform him the steamer Mary Bell was built at Metropolis city, on the Ohio River, in 1875. She was 325 feet long, and carried 12,000 bales of cotton, being the largest boat on the Mississippi at the time. She was burned at Vicksburg when six months old.

(10) J. A. H. asks: 1. Is there any advantage in what lightning rods men call "circuit" rods—that is, two ground rods to one point? What do you think of such rods put into the ground 8 or 10 feet, ground tolerably dry? A. The only advantage in such an arrangement is that it affords a better ground surface. If the ground connections terminate in dry earth, the lightning rod will not prove effective. 2. Are horse shoe magnets better than common points, or should points be magnetized so as to lift small needles? A. There is no advantage in a magnetic point. 3. What is your opinion of tin roofs as a protection against lightning? How should they be connected with the ground? A. Tin roofs, if connected with the lightning rod having good ground connections, may prove an additional protection. The ground end of the rod should be forked and buried in earth that is continually moist. The effectiveness of the rod may be increased by filling the hole around the rod with pounded coke or charcoal. The ground end of the rod should be bent away from the house. 4. Is it safe to put a rod into a well? A. Yes.

(11) J. M. asks: 1. What is the best means of fastening rubber on an iron pulley? A. Use a cement composed of equal parts of pitch and gutta percha melted together at a moderate heat. 2. I know that a belt will run to the large part of a pulley; but if a wide belt is shorter on one side than the other, will the short side work to the crown of the pulley? A. Yes. 3. What would be the effect if the pulley was flat on the face? A. In either case the short side will do the work until it is stretched. 4. What is the crown sheet of a boiler? A. The sheet or plate immediately over the grate bars. 5. What work could you recommend for general information on the use and care of machinery, i. e., size and speed of pulleys and their proper place on shaft, where tighteners should be used, etc.? I want a work for information on the simple principles of machinery as well as the most scientific. A. We know of no one work that will meet your wants.

(12) F. D. R. asks: What is best to use to clean a person's hands of red color, such as used in coloring leather—chief ingredients of color, logwood? A. You may try weak solution of ammonia.

(13) G. M. A. writes: I have a gun which has all the browning off. Not wishing to go to the expense of putting it on again, what cheap substitute could I use to protect it from rust? A. Apply a thin coat of shellac varnish.

(14) J. W. B. asks: Can you give me a receipt for making fly paper? A. Consult SCIENTIFIC AMERICAN, page 171 (12), vol. 39.

(15) A. L. H. writes: 1. I wish to make an electro-magnet for a burglar alarm. How many feet of silk covered wire should I use on each spool? 2. How large should the coil be? A. As you do not intimate what sort of a burglar alarm you intend to make, it will be impossible for us to give you any definite information. Try $\frac{1}{4}$ cores, $1\frac{1}{2}$ inch long, wind them with six layers of No. 20 wire. 3. Will one cell of a gravity battery be sufficient, there being not more than twenty feet of wire connecting the battery and alarm? A. It is probable that one cell might do; but two would render the action of the apparatus more reliable.

(16) F. N. P. asks how to mount prints or engravings and colored prints on cloth so that they may be framed without a glass in front of them. A. Tack or glue a damp piece of cotton cloth to the edges of a suitable frame; cover the cloth with good paste; apply paste to the back of the print, and lay it smoothly on the cloth. When the print is dry coat it with a varnish made by diluting $\frac{1}{4}$ lb. of Venice turpentine with a gill of alcohol.

(17) R. J. F. asks: Which would penetrate wood farthest, a ball from a pistol held 4 inches from the wood or one from a pistol held 10 feet distant? A. The ball from the pistol held 4 inches distant would penetrate the farthest.

(18) W. & H. ask if whitewood is a hard wood, to be classed with oak, maple, etc., or a soft wood, like pine, hemlock, etc.? A. Whitewood (tulip tree, botanically *Liriodendron tulipifera*) is a deciduous tree, like the oak, maple, etc. It is not classed botanically with pine, hemlock, etc. In color the timber (having heartwood and sapwood the same color) is classed with white pine as whitewood; and in texture the wood is classed with soft woods.

(19) "A Subscriber" states that the largest steamer on the Ohio River is the U. P. Schenck, which is 5 feet shorter, but 4 feet more beam, than the Golden City, is 1,500 tonnage, and owned by Captain A. J. Schenck, of Vevay, Ind.

(20) E. C. J. writes: There are many of us mechanics in this city who own our homes, and we have a little yard and garden patch attached, but the soil is very strongly impregnated with alkali in low

places, so much so as to show white on the ground; in higher places only enough to slightly discolor the soil. What will best neutralize this alkali and be the most practicable to use? A. A heavy top dressing of manure intimately mixed with clay. The decomposition of the manure forms acids. The alkali unites or neutralizes the acids as they are formed. In consequence of this the soil becomes sweeter or more propitious to vegetation, while at the same time it will cause the vegetable matter to disappear more rapidly than would otherwise be the case. The addition of the clay is to reduce the strength of the mixture, and otherwise prevent injurious action of the strong stimulants upon growing vegetation.

(21) B. B. asks: What is the difference of the electric current produced by Daniell's, Grove's, and other cells; is it in intensity or in quantity? A. The electro-motive force of the Daniell cell is 1.079 volt, and the various sulphate of copper elements are about the same. The Grove 1956, Bunsen's nitric acid 1964, Bunsen's chromic acid 2428, Ponce's 1964, Grenet 1965. Electro-motive force and intensity are the same thing.

(22) W. H. B. asks: Can you inform me what will keep a solution of paraffine with linseed oil in a liquid state, and not destroy its drying qualities? A. Turpentine spirits, since in it paraffine is soluble.

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

J. H. B.—No. 1. Judging from your description they are probably quartz crystals containing crystals of tourmaline.—No. 2. It is doubtless banded agate; some of these stones are of value.

COMMUNICATIONS RECEIVED.

On Squaring the Circle. By G. O. v. R.
On Vehicle Wheels. By G. A. H.
On Scarlet Fever. By T. B. McC.
On the Metric System. By G. J.
Better Late than Never. By A. R. C.
On Suspended Animation. By G. F. S.
A Voice from the Dominion of Canada. By J. G.
Telephone Circuit. By F. W. W.
On Squaring the Circle. By W. D.
On Electric Light. By W. A. S.
On Solar Circulation. By E. F. D.

[OFFICIAL.]

INDEX OF INVENTIONS FOR WHICH Letters Patent of the United States were Granted in the Week Ending April 22, 1879, AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

Aerial machine, H. Badgley 214,546
Agricultural implement, J. W. Rudolph 214,709
Air brake apparatus, railway, G. Westinghouse, Jr. 214,603
Air for motive power, device for using compressed, L. Mekarski (r) 8,633
Album clasp, J. C. Koch, Jr. 214,668
Axe box, car, T. Hostetter 214,662
Axe lubricator, car, S. J. & G. J. Shimer 214,592
Bag holder, J. A. Smith 214,721
Baling fibrous material, press for, G. D. Luce 214,673
Baling press, J. Wilkes 214,540
Baling press, G. Wyckoff 214,544
Ball trap, M. E. Card 214,620
Ballot box, T. Christiansen 214,622
Bed bottom, spring, F. C. Mitchell 214,635
Beer, fining, J. Gropp 214,648
Belt fastener, W. L. Shigley 214,528
Bench knife, G. S. Derr 214,494
Binder for books, temporary, G. Kraft 214,609
Binder for indexing and preserving files, temporary, T. Orton 214,520
Boiler feeder, D. Hess 214,565
Boiler saddle, J. F. Allen 214,480
Bomb lance, T. W. Boys 214,707
Boot and shoe sole and plug, J. O. Gardell 214,502
Boot and shoe sole edge trimmer, S. S. & C. A. Black 214,611
Boot and shoe insole and welt, H. C. & A. Keats 214,606
Boot and shoe manufacture, W. R. Miller 214,684
Bosom board, J. Beger 214,614
Bottle stopper, A. E. Rich 214,585
Bottle stopper and stopper fastener, C. H. Nye 214,691
Bottle stopper fastener, T. A. McFarland 214,511
Box dressing machine, P. B. H. Smith 214,725
Bracket, F. O. Worthley 214,741
Brake mechanism, E. A. White 214,539
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the flues, which was hard to remove. After using the
Inspirator two weeks, I opened my boiler for the pur-
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little of it, and easy to cut out. With the Inspirator I
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can prove by five men who work in my mill and were
present when I had it apart. I would not take \$500 for
the Inspirator if I could not get another.
Yours truly, J. W. ARMITAGE.

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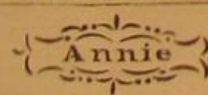
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NEW YORK, JUNE 7, 1879.

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THE AUTOPHONE.

The instrument illustrated by the accompanying engravings is the autophone, for which letters patent have been issued in the United States and Europe to Professor Merritt Gally, of New York city. This instrument is claimed by the inventor to be both original in its conception and fundamental in principle, and it is believed to be the first successful invasion of the domain of music by automatic mechanism.

The autophone is operated by a thin sheet of paper only three and seven eighths inches in width, punctured with small holes. The instrument is provided with any number of stops, and, if a reed or pipe instrument, with any number of sets of reeds or pipes. The invention is applicable to instruments of any quality, from the cheapest piano or cabinet organ to a grand church organ. The music sheet is prepared to represent not only the notes, but also the entire expression required to render the music in the most perfect and artistic manner.

The perforations in the sheet, which correspond with the stops, occupy such positions as to operate any stop, or number of stops for any passage, or note or part of a note, that will secure the best effect. It will readily be seen by a musician, says Professor Gally, that this is more than can be accomplished by the hands of the most expert performer. The hands being occupied in fingering the keys, prevents the possibility of manipulating the stops when it would often be desirable to do so.

The mechanism, which is operated by the music sheet for the stops, is as sensitive and rapid in its action as that for the note keys, rendering it possible to produce an unlimited variety of "expression."

Fig. 1 represents a cabinet organ to which the invention is applied. The woman represented at the organ is placing into its bearings the small spool containing the strip of perforated paper which is to produce the music. The mechanism by which this sheet operates is connected with the ordinary pedals of the instrument, and therefore requires no skill except to operate the bellows. To give the reader an accurate idea of the dimensions of this sheet, and the punc-

tures, notes, stops, and "expression," we show the spool partially unwound, full size, in Fig. 2, representing the entire range of notes, six stops, and the "expression" devices.

The size of the perforations, as will be seen, are exceedingly small, but sufficiently large for the perfect operation of the instrument. The mechanism is operated pneumatically,

but these small openings in the sheet are not for the passage of air to the pipes or reeds of the instrument for producing the sound. The air passing through these small punctures simply trips sensitive devices that operate the valves which, in manual performing, are operated by the ordinary finger keys. The lines of punctures in the edges of the sheet represent the stops and "expression" devices. The air through these punctures operates the stops by means of a similar mechanism to that which opens the valves to the reeds or pipes.

Although the music with its "expression" is prepared according to the rendering of the best artists, the instrument is not limited to this or any set "expression" for the piece to be performed. For those without musical skill the "expression" prepared in the

music sheet enables them to produce perfect music without requiring instruction or practice. The instrument, however, is not limited to the "expression" prepared in the music sheet, but affords to the accomplished musician the widest scope for the exercise of his personal taste and skill, the stops being absolutely under the control of the performer, so that he may vary the "expression" at pleasure. This is done with greater facility than by any ordinary arrangement of stops, being controlled by sensitive finger keys. Four of these finger keys are represented in Figs. 1 and 3, each side of the receptacle of the punctured strip in connection with button stops. Otherwise than the fact that these button stops turn to the right and left to bring in or shut off the parts of the instrument which they represent, instead of being drawn and pushed, they operate in a manner similar to ordinary draw stops.

In Fig. 4 one of the finger keys and its corresponding button stop is represented full size. Turning the button with the lettered portion toward the operator accomplishes the same result as drawing an ordinary stop, or

[Continued on page 354.]

Fig. 2.

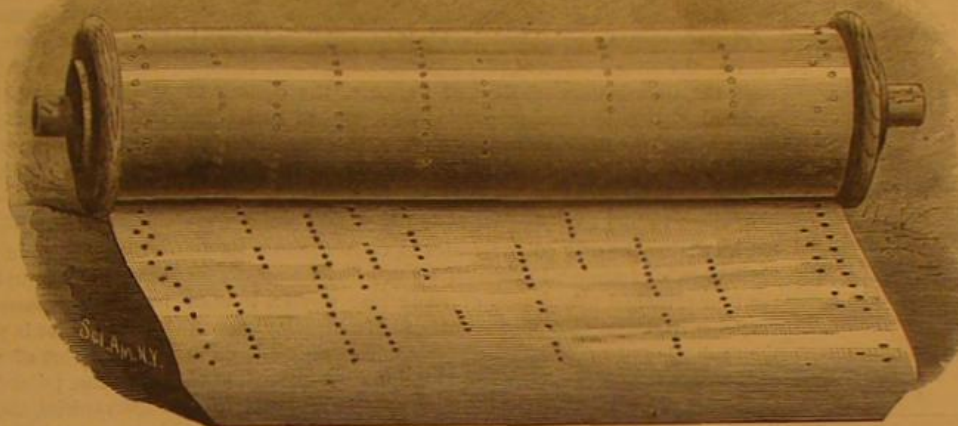


Fig. 1.—GALLY'S AUTOPHONE OR SELF-PLAYING MUSICAL INSTRUMENT.

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NEW YORK, SATURDAY, JUNE 7, 1879.

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THE TRAJECTORY OF MOLECULES.

In "The Fourth State of Matter," SCIENTIFIC AMERICAN, January 25, last, an account was given of the experiments made by Mr. William Crookes, showing the high probability of a fourth state of matter, more ethereal than the gaseous, in which matter take on an entirely new set of properties. At a social meeting of the British Royal Society, April 30, Mr. Crookes exhibited a series of experiments illustrating still further the curious behavior of electrified molecules in extremely rare media.

By the improvements made in the Sprengel pump by Mr. C. H. Gillingham it is now possible to produce vacua in which the pressure is measured in millionths of an atmosphere. It is with vacua so produced, in the more perfect of which the pressure is as low as one millionth of an atmosphere, that Mr. Crookes' investigations were conducted.

It will be remembered that the discoveries in question were made in the dark space around the negative pole within a vacuum tube and separating it from the luminous glow. This dark space was found to be a region of molecular activity similar to that in front of the vanes of a radiometer, by which activity the negative pole, when free to move, is set in motion.

The phenomena exhibited in his first published experiments—the phosphorescent effects produced by molecular impact, the illumination of lines of pressure, the casting of molecular shadows, the magnetic deflection of molecular streams, and the like—were shown anew, and supplemented by even more beautiful effects, though nothing absolutely new was developed.

In some of the experiments variously-shaped poles were used, causing the molecular streams to converge to a focus, to diverge, or to move in parallel lines. By one apparatus the four principal phenomena of molecular physics in high vacua—namely, the phosphorescent light of molecular impact, the projection of molecular shadows, the magnetic deflection of the trajectory of molecules, and the mechanical action of molecules projected from the negative pole—were beautifully illustrated.

The vacuum tube inclosed a circular concave negative electrode, and at its center of curvature a light wheel was pivoted upon a horizontal axis. The wheel was a disk of thin mica, carrying around its periphery a number of equidistant radial vanes of aluminum, making the wheel look like a water-wheel. When the tube was placed in connection with an induction coil, the stream of molecules concentrated upon the wheel fell in line with its axis, in which case no motion resulted. But on bending the stream of molecules up or down by magnetic action the focus of impact would fall above or below the axis, and the wheel would be set to spinning at a lively rate.

Very brilliant effects were also produced by causing the molecular stream to fall on naturally phosphorescent substances, as, for example, diamonds. At such times different sorts of diamonds were distinguished by different colors—blue, pale blue, orange, red, green, and pale green—African diamonds emitting a blue phosphorescence. Rubies, on the other hand, whatever their normal tint, all assumed under the molecular hail the deep "pigeon's blood" red, characteristic of a fine ruby. Even white precipitated alumina gave under the molecular stream the same ruby color, though normally without a trace of color.

Thus far these researches of Mr. Crookes seem to be brilliant rather than instructive in their results; but it is altogether too early to pronounce upon their possible value.

THE INTERNATIONAL CANAL CONGRESS.

An international canal congress, for discussing projects for the construction of an interoceanic ship canal across the American isthmus, met in Paris May 15. M. Ferdinand de Lesseps was fitly chosen president. Since the main object of the convention was to compare routes and decide upon the one to be recommended as a practical enterprise, the principal interest naturally centered in the Committee on Technique.

Up to this writing, May 22, six routes have been under examination and discussion, namely, the Nicaragua route, the Panama route, the San Blas route, the Tiati-tolo route, the Tuyra-Caquirri-Atrato route, and the Atrato-Napipi route. At first the Tiati-tolo route, known as Lieutenant Wyse's lockless canal and tunnel route, seemed to have the brightest prospects, from the strong party and personal influence known to be working in its favor. The Sub-Committee on Tunnels, however, found that its probable cost had been greatly underrated, and that under the most favorable conditions it would cost \$160,000,000. This discouraging blow was followed by such an able presentation of the impracticability of the scheme by the English engineer, Sir John Hawkshaw, that the project was abandoned.

Already the choice seems to be narrowed to two projects, the Nicaragua route and the Panama route, and a decision will probably be reached in the course of a week.

A Medal for Peter Cooper.

At the late meeting of the British Iron and Steel Institute in London, the Bessemer Medal of the institute was presented to the venerable Peter Cooper as "the father of the iron trade in America." In his presentation speech the President spoke of Mr. Cooper's half-century connection with the iron trade, his Baltimore rolling mill in 1830, his building and running the first American locomotive, his extensive iron works at Trenton, and especially the founding and direction of the great Cooper Institute in this city. In

view of the fact that it is through the efforts of Mr. Cooper and other leaders in the American iron trade that England's greatest rival in iron production has almost reached supremacy, this recognition of his labors by the English iron and steel producers is particularly handsome.

SCIENCE AS A DETECTIVE.

A correspondent tells at greater length than we have space for the story of an attempted fraud which was exposed by chemistry.

An emery wheel guaranteed to stand 600 revolutions was run at the speed, of 1000 revolutions, and burst, doing a large amount of damage. A suit to recover was instituted, based on a letter written by the seller of the wheel, in which the strength of the wheel was rated at 1,600 revolutions. While in the office of the prosecutor endeavoring to effect a settlement, the defendant observed that a certain make of ink was used, and he learned by a casual inquiry that the same ink was used exclusively by the prosecutor. The defendant had for several years used another ink. Taking samples of the two inks to a chemist, he was able after analysis to secure a solvent for the one which would not affect the other.

The case came to trial. Evidence was taken as to the kind of ink each party employed. Then the chemist was called, and in the presence of the jury applied the solvent, which removed the interpolated "1," and left the rest of the writing untouched. The proof of the forgery was sufficient, and the case was dismissed, leaving the dishonest prosecutor to defend himself from a criminal charge.

A NEW REFRIGERATING LIQUID FROM BEETS.

In Europe the principal supply of sugar is derived from beets; the annual production of beet sugar being now seven hundred thousand tons. Besides this a large quantity of beet molasses is produced, a portion of which is distilled and a coarse sort of whisky made; the stuff remaining in the retort yields potassium salts, which are employed as fertilizers. Sugar, spirits, and potash have heretofore been the chief products manufactured from beets. But Mr. Vincent has now succeeded in realizing from the refuse that remains after the beet molasses distillation, a combustible gaseous body, which is easily condensed into liquid form, and is called chloride of methyl.

This liquid, obtained as stated from beets, is used in the preparation of some of the aniline colors; but it is now found to be especially valuable as a refrigerating agent. By its rapid evaporation a temperature of -55° C., or 67° F. below zero, may be maintained, which is far below the freezing point of mercury. Prof. Huxley says that by this means mercury (which freezes at 39° F. below zero) may be frozen by the pound. For the manufacture of ice this new beet root product promises to become of much importance.

MAGNETIC MOTORS.

Is there an available source of energy in magnetism? There are very many inventors who believe that there is, and every year many attempts are made to produce economical magnetic motors. A short comparison between the force of magnetism and other natural forces will answer our question.

An iron steamship plies between New York and Liverpool; it is more or less a magnet under the influence of the earth. Yet the helmsman does not allow for the attraction of the north or south poles of the earth upon this magnetic matter. This attraction is immensely inferior, even if the steamship were made of steel and been magnetized to saturation, to the drift of the tides, or even to the effect of the gentlest breeze. The force of gravitation, however, sinks the heavy vessel deep in the water, and is ready to draw it with all on board to the very bottom of the ocean. While the force of magnetism decreases or remains constant when the masses of the attracting magnetic bodies are increased, the attracting force of gravity steadily increases with the masses of the two bodies, between which this attraction acts.

It is sometimes proposed to utilize the magnetism of the earth in magnetic motors by supplying any waste in the energy of a permanent magnet from the store in the earth. Let us see how much this force of the earth's magnetism is in comparison with the force of gravity, which is our universal measuring force, so to speak. Suspend in a vertical position from one end a cylindrical bar of iron which is about one foot in length. It should be hung by a very short wire or thread from its north pole. Hang beside it a brass rod of the same dimensions, and provide it with the same length of suspension. Then set the two rods to swinging, and count the number of swings which each makes in a given number of seconds. It will be found that the two rods will accomplish very nearly the same number of swings in the same time. The rods will differ very little in weight, and their moments of inertia will be very nearly alike. The vertical force of the earth's magnetism, therefore, must be small in comparison with the force of gravitation; for the iron bar is acted upon by both gravity and the earth's magnetism, and yet it vibrates at nearly the same rate as the brass bar. An iron bar, such as we have used in the above experiments, will be rendered feebly magnetic by the earth's magnetism, and could hold a light cambric needle at its extremity; but nothing more. This is the force from the earth which we can count upon to renew the magnetism of steel when it has been deprived of it.

It has been said that it is possible to lower the energy of a magnet by vibrating an armature composed of a thin plate of iron in front of the magnet. An experiment will speedily

convince those who have no theoretical convictions upon the subject that it is not possible to do this. Having measured in any way the lifting effect of a magnet or its action upon a compass needle placed at a fixed distance, cause a thin plate of iron to vibrate by any automatic arrangement very rapidly in front of the magnet; and after some time has elapsed examine the strength of the magnet: it will be found as strong as before. The rate of vibration can be carried as high as 3,000 vibrations per minute, and still the magnet will be unaffected. If one endeavors to use the magnetic energy of the earth as a source of motive power, disappointment will surely result; for the earth's magnetism is too feeble to do an appreciable amount of work. Moreover the energy stored up in permanent magnets is feeble, compared with that of other forces. A horseshoe permanent magnet, the strongest that can be made, will not lift 200 pounds; and the lifting force does not increase with the size of the magnet, except to a very limited degree. Very strong electric magnets, however, can be made. Prof. Henry succeeded in lifting 640 pounds by one that he constructed. It might be supposed that there is no limit to the amount that an electro-magnet can lift; for we can increase the strength of the current which circulates about the iron to a very great amount. There is a limit, however, to the amount of magnetism which can be imparted to soft iron. This limit has been placed at a lifting power of 354 pounds to the square inch.

Let us now inquire into the expense of producing this effect. One pound of coal yields 7,200 thermal units; one pound of zinc yields 1,200 thermal units. One pound of zinc costs ten times as much as a pound of coal. It will be seen, therefore, that any magnetic motor will be sixty times as expensive as a steam motor of the same horse power; for we have no better agent for producing electricity in batteries than zinc. The inventors of magnetic motors should therefore turn their attention to the discovery of a cheaper source of electricity than zinc. The modern dynamo-electric machine affords another source of magnetism. This machine, however, requires a powerful steam engine to run it, and its useful effect is necessarily less than that of the steam motor which is employed to generate the current of electricity. If the useful effect of such a machine for producing electric currents was greater than the work of the steam motor, we should have perpetual motion.

Let us now turn our attention to other agents which we can use as sources of power. A pound of water converted into steam occupies about 1,250 times its former volume at the ordinary pressure of the atmosphere. This would give over 18,000 pounds pressure on the square inch, if the water when converted into steam was not allowed to expand. Liquid carbonic acid at 86° C. in assuming the gaseous form exerts over 1,000 pounds on the square inch. The explosion of gunpowder can exert pressures from 5,000 to 20,000 pounds on the square inch, and the explosive force of nitro-glycerine has not even been estimated with any precision, so tremendous is the energy developed. It can readily be seen that a motor which is driven by the expansion of steam, by the explosion of gas and common air, or by the explosion of gunpowder or nitro-glycerine affords with the feeblest of these agencies work which far surpasses what the most sanguine inventor of magnetic motors can even dream of.

Electro-magnetism is a swift and nimble servitor ready to convey ideas from mind to mind around the world in an instant. The attempt to yoke Pegasus to a plow and to make him perform the work of oxen has often been delineated by artists. We remember to have seen a series of cartoons which represented the mournful attempt. There was the delicate, highly-strung steed beside the sturdy beasts whose true province was to drag the heavy weight, and the various stages of the agony of Pegasus were vividly depicted. The cartoons could have been called "Electricity in Harness," and would equally well have illustrated the attempts of the inventors of magnetic motors.

UNDERGROUND TELEGRAPH WIRES.

In a late issue of the SCIENTIFIC AMERICAN notice was taken of the difficulties experienced in England in the use of telegraph wires underground. Notwithstanding the apparent success of the system in Germany, the electrician of the British telegraphs pronounced decidedly against underground wires as less efficient, less durable, and much more costly than the ordinary system. The system of insulating underground wires patented by Mr. David Brooks, of Philadelphia, is said to be open to none of the usual objections, being at once cheap, durable, and efficient. This plan is substantially as follows: The wires are wrapped in cotton and bundled together in a tight netting, to the number of 50 or less, then inclosed in a pipe and laid in the ground. Insulation is effected by oil which is poured into the pipe after it is laid, and the pipe is kept full by having the source of supply in an elevated vessel. A mile of line was thus laid about two years ago in West Philadelphia, with complete success. A line across the Schuylkill, in 35 feet of water, has been in operation since April, 1877, with increasing insulation. It is said that a line on this system will be laid between New York and Philadelphia this summer, and that the system will soon be generally adopted in this city. The exclusive right to construct telegraph lines in the United States under Mr. Brooks' patent was purchased a short time since by General Stager, of Chicago, one of the vice-presidents of the Western Union Telegraph Company, and president of the Western Electric Manufacturing Company. The purchase was made, however, for General Stager's personal benefit, and not on account of the Western Union Telegraph Company, as first reported.

LOCALIZING TELEPHONE CALLS.

The district telephone companies employ various kinds of alarms by which attention can be called to messages about to be sent. Vibrating reeds and magneto-call bells of many patterns are found to be most efficient devices. A summons, however, sent to one house will necessarily be heard in all the houses or offices on the same circuit. In some localities this has been found to be very objectionable. There are many theoretical ways in which a call can be localized, so to speak. The most obvious way is to employ a set of reeds or tuning forks which will only respond to definite notes. At the sending office the proper reed or other vibrating means is set in action, and the reed or tuning fork at one station responds only. There are, however, certain practical difficulties in the use of this method: it is comparatively costly and requires accurate adjustment. Niemoller, in a late article in Wiedemann's *Annalen der Physik und Chemie*, describes a simple method of setting a wire in vibration, which might be also turned to account in localizing calls on telephone circuits.

A steel wire stretched between two points is provided with a platinum point at its middle; this point dips into a vessel containing mercury. A current of electricity is passed over the half length of the wire, and a magnet placed above the middle point of the half length through which the current passes serves to maintain the vibration of the wire. The application of this simple interrupter to telephone circuits is obvious. At the sending office a wire could be stretched with definite weights over a long channel of mercury, and the length of the wire could be readily altered by simple bridges. In each office or station wires could be stretched on suitable sounding boards, provided with electro-magnets placed above their quarter lengths, and tuned to respond to the note of the wire at the central office. Only the wire which is of the proper length and tension would respond to the same length and tension of the wire at the central office. The wires could vibrate between bells or could strike when their amplitude of swing was at its greatest upon some sounding substance. This method also requires careful adjustment, but it is much cheaper than any system of reeds.

MOLECULAR CHEMISTRY.—NO. II.

The discovery that bodies combine in constant definite proportions by weight was followed by one of almost equal importance. At the beginning of the present century, Gay Lussac and Alexander von Humboldt found that one part by measure (one volume) of oxygen combines with exactly two parts by measure (two volumes) of hydrogen, and that the water so formed occupies two volumes when it is measured in a state of vapor. After numerous experiments, Gay Lussac announced that all gases and vapors combine in definite proportions by volume, and also that the combining volumes have simple numerical relations to each other as well as to the volume of the resulting compound, the latter being compared while in a state of vapor.

While the 100 grains of water in our last paper contained eight times as much oxygen as hydrogen by weight, this hydrogen takes up twice as much room as the oxygen. Still, we are not able to answer the question, How many atoms of each does it take to make the smallest possible quantity of water? At the first glance it would seem as though we needed to know either the number of atoms contained in a given volume, say a cubic inch, or else their size, and information on these points appears to be no more accessible than on the number or the size of the atoms contained in a given weight. Nevertheless the problem was most beautifully solved by the Italian physicist, Avogadro.

Reasoning on the remarkable fact that all gases undergo very nearly the same diminution of volume, when subjected to the same pressure, or to the same degree of cold, Avogadro concluded that this could be accounted for most simply by supposing that all gases have their particles separated by equal spaces, or, what is the same thing, that equal volumes contain the same number of particles.

Armed with this important deduction, we may now return to the study of the composition of water and reason as follows: The hydrogen in water occupies twice the space of the oxygen; therefore it contains twice as many particles, or in other words, water contains two particles of hydrogen for every particle of oxygen, and we may write H_2O as a formula representing its composition by weight and measure. The combining weight of H being taken as unity, that of oxygen will be 2×8 , or more accurately, 15.960; for the O in H_2O was found to weigh eight times as much as two volumes of H, consequently it weighs sixteen times as much as one volume.

As equal volumes of different gases contain the same number of particles, the weights of these particles must be the same as the densities of the gases, when hydrogen is taken as the unit both of weight and volume. This follows directly from the definition that density is the amount of matter contained in a given space. The densities of a very great number of gases, as well as of vapors, have been determined by independent methods with the utmost care, and the correctness of Avogadro's deduction has been again and again corroborated.

Whenever, therefore, an element forms either gaseous combinations or such as may be reduced to a state of vapor, we have two trustworthy means of determining its atomic weight: we can ascertain the percentage composition by chemical analysis, and we can determine the density of the gas or vapor into whose composition it enters.

The atomic weights of elements that do not form gaseous

combinations are ascertained from the results of chemical analyses, aided by two important laws, which need only be briefly stated here, as they are not essential to our chain of reasoning. The first, discovered by Dulong and Petit, is that all atoms have the same specific heat, a conclusion deduced from the fact that the products of the specific heats of the elements by their atomic weights differ very little from the number 6.4. The second law is that of Mitscherlich, that the crystalline form of substances furnishes an indication of their atomic structure. When two bodies are isomorphous, that is, when they have crystals of the same form, their composition may be expressed by analogous formulas. The latter law is true within certain limits only.

Let us now test our formula for the composition of water by the discovery of Gay Lussac, stated at the beginning of this paper. Suppose, for convenience of illustration, that the unit volume of hydrogen contains one thousand particles; then an equal volume of oxygen must contain one thousand particles, and so must one of water, vapor, or of any other gaseous substance. But two volumes of hydrogen containing two thousand particles combine with one volume of oxygen containing one thousand particles to form two volumes of water vapor containing two thousand particles, which is equivalent to saying that two particles of water vapor consist of two atoms of hydrogen plus one atom of oxygen. Now, what does one particle of water vapor consist of? We cannot divide by 2, or else we shall obtain a half atom, which is impossible. The only way out of the difficulty is to conclude that the particles of hydrogen and oxygen are all double, i. e., that they consist of an undetermined but even number of atoms. Then we shall see that two volumes of hydrogen containing two thousand H₂, combine with one volume of oxygen containing one thousand O₂, to form two volumes of water vapor containing two thousand H₂O.

The combination of two atoms of hydrogen among themselves is called a molecule of hydrogen, that of two atoms of oxygen among themselves a molecule of oxygen, and the union of two molecules of hydrogen with one molecule of oxygen forms a molecule of water. To resume, one volume of water vapor occupies two volumes, consists of three double atoms, and weighs 17.960 times as much as one volume (= one double atom) of hydrogen.

Our standard of comparison for molecules is the hydrogen molecule H₂, whose density is 1, and whose molecular weight is 2. Hence we must multiply the densities of other gases by 2 to obtain molecular weights comparable to that of hydrogen. For example:

The density of arsenic vapor is about 150.2 times that of hydrogen. Its molecular weight is therefore 2×150.2 , or 300.4. A study of its compounds shows that this molecule is composed of AS₄, or of 4 atoms each weighing $\frac{300.4}{4} = 75.1$. The correctness of this atomic weight may be tested as follows, by the law of Dulong and Petit: The specific heat of arsenic .0814 multiplied by 75 = 6.113, which is sufficiently near the average.

The density of chlorine is about 35.25 times that of hydrogen. Its molecule then weighs 2×35.25 , or 70.5. A comparison of the analyses of its compounds shows this molecule to be composed of Cl₂, or of two atoms, each weighing 35.368.

The density of mercury vapor is about 100 times that of hydrogen; its molecule is, therefore, about 200 times as heavy as that of hydrogen. A comparative study of its compounds indicates that this molecule contains but a single atom; or, speaking more accurately, half as many atoms as the hydrogen molecule. This view satisfies the law of Dulong and Petit; for $200 \times .03332$, the specific heat of mercury = 6.66.

A similar study of ozone assigns to it a molecule composed of three atoms of oxygen, O₃.

On the supposition that the hydrogen molecule contains only two atoms—the lowest even number—the other elements have molecules consisting of one, two, three, and four atoms. It is evidently of no consequence to our reasoning whether the hydrogen molecule contains two atoms or a multiple of two, because all our other molecular weights, being only ratios, are affected proportionally.

We are now prepared to begin the study of the relative sizes of the molecules of simple and compound bodies.

We have found that a given volume of oxygen contains as many particles as an equal volume of hydrogen, and that these particles weigh 16 times as much; therefore each particle of oxygen weighs 16 times as much as each particle of hydrogen. If these particles occupied the whole space, that is, if there were no interstices, we could conclude that the particles of oxygen and the particles of hydrogen are equally large.

As we have not, however, any means of knowing the real or absolute size of these particles, we shall be obliged, at the outset of our investigations, to define a molecular volume, or the volume of a molecule, as the cubical space of which, at a given moment, it occupies the center—a definition that involves no hypothesis. There is no difficulty in conceiving a given volume as divided up into equal cubes, each containing a molecule.

C. F. K.

THE Fall River (Mass.) News relates the following as a fact: Two men were conversing about the anticipated strike the other day, when one of them, a mule spinner, remarked that he had been in 26 strikes during his lifetime. "Well," said the other, "did you ever make anything by it?" "Not once," was the reply; "lost every time."

GALLY'S AUTOPHONE.

[Continued from first page.]

turning the lettered portion at right angles, as shown in the engraving, accomplishes the same result as pushing in an ordinary stop.

The sheet or strip of music is marked at its head with the number of button stops which should be turned on before starting the mechanism. These stops, although turned on, are operative only when perforations in the edges of the sheet occur which indicate their action. Wherever these punctures do occur, even for a note or a part of a note, or an entire passage, the effect of the stop is produced. Thus far it will be seen that the effect of the stops is limited to the set expression indicated by the punctures of the sheet. The variety which may be given in the expression to accord with the judgment or taste of the performer differing from that represented in the music strip, is produced in the following manner: By the use of the finger keys, *a*, *b*, Fig. 4, the performer renders inoperative at will any of the stops represented in the sheet, and substitutes others at pleasure. The key is double-acting, arranged to be depressed at either end. Depressed at *b* renders inoperative the stop that would otherwise come into action. Any stop that is turned off and not to come into action is thrown into action for the time desired by the pressure of the key at *a*. If the performer does not wish to use any of the stops indicated in the music strip, all the button stops are turned off before commencing the piece, and by pressing on the different keys at *a*, any variety of expression is given. These keys are very sensitive, requiring only a slight touch, but they perfectly and instantaneously control the stops of the instrument.

For example, a single note which for the best effect is to be begun softly, and would on an ordinary instrument be increased by the swell only, is in this instrument increased not only by the swell, but by an accumulation of stops commencing, if necessary, with only a single stop, and ending, if desirable, with an accumulation of ten.

Although the time in which the music is written is, by the mechanical motion, strictly adhered to, nevertheless, to avoid mechanical appearance in the rendering of the music and to divest it of every feature that might be in the least objectionable, or that in any way might fail to realize the most perfect conception of the artist, the instrument is provided with an ingenious mechanical device, by means of which the time may be instantly changed, accelerated, or retarded through any passage, note, or part of a note, or a "hold" made on a note, at the will of the performer, especially adapting the invention for rendering accompaniment for singing. The first key to the left of the receptacle for the sheet (see figure) operates a mechanism for retarding the movement of the sheet for retarding the time of a passage, producing a "hold" or a perfect rest, which is not indicated in the arrangement punctured in the strip. The degree and duration of the retard is controlled by the degree of pressure applied to the key. A positive hold on the key produces a "hold" on the tone. A positive hold between the notes produces a "rest," the length of time the key is thus held.

To repeat a passage or part of a passage not arranged in the sheet to be repeated as ordinarily performed, and to enable the operator to repeat any part at will, once or successively, without limitation, the key just described, in connection with the draw-knob at the right of the receptacle, recalls for repetition any desired part of the music-strip; the return being instantly made to prearranged limits, only so much of the strip being drawn as is desirable. The convenience of this device in singing, or in playing dance-music, will be seen at once, as comparatively short strips answer the purpose as well or even better than very long ones, besides lessening their cost.

The instrument may be arranged for any number of octaves; the music strip, however, need not necessarily be increased beyond the width already mentioned.

The autophone is not only adapted to organ music, but is equally well adapted to the piano. The "expression" produced upon the organ by the operation of the stops, in connection with the music sheet, is produced in a similar way upon the piano, the soft and loud pedals not only being acted upon on the music sheet, but the variety of touch required for the best effects is fully attained. This invention, as applied to the piano, as with the organ, is not limited to the set expression prepared in the music sheet, but allows of as great variety in the personal expression of the artist.

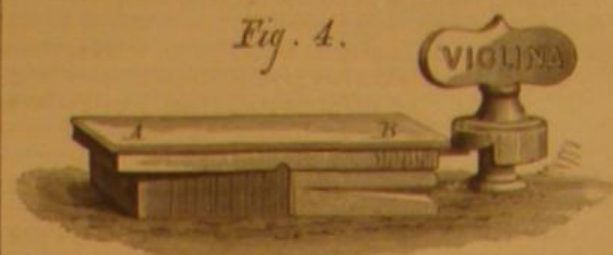
The autophone seems destined to prove invaluable in its application to orchestrons; the small, cheap music sheet accomplishing all, and even more, than the very expensive barrels of such instruments. The addition of variety in expression which this invention will impart to orchestrons, and which they have not heretofore possessed, will, it is claimed, increase their value.

The narrowness of the sheet, and the fact that it is not necessarily thick and cumbersome, but is light and cheap, are important qualifications. This music, we are informed, will be sold as cheaply as ordinary sheet music. It is made by machinery specially adapted to the purpose, and the perforations being so small, leaves it very strong and durable.

The autophone is adapted to instruments having a key board that may at pleasure be used for manual performing, as shown in Fig. 1; or it may form a part of an instrument not having finger keys, for use by those who are not musicians, and who do not desire the addition of the ordinary key board to the instrument. It is also made as an at-

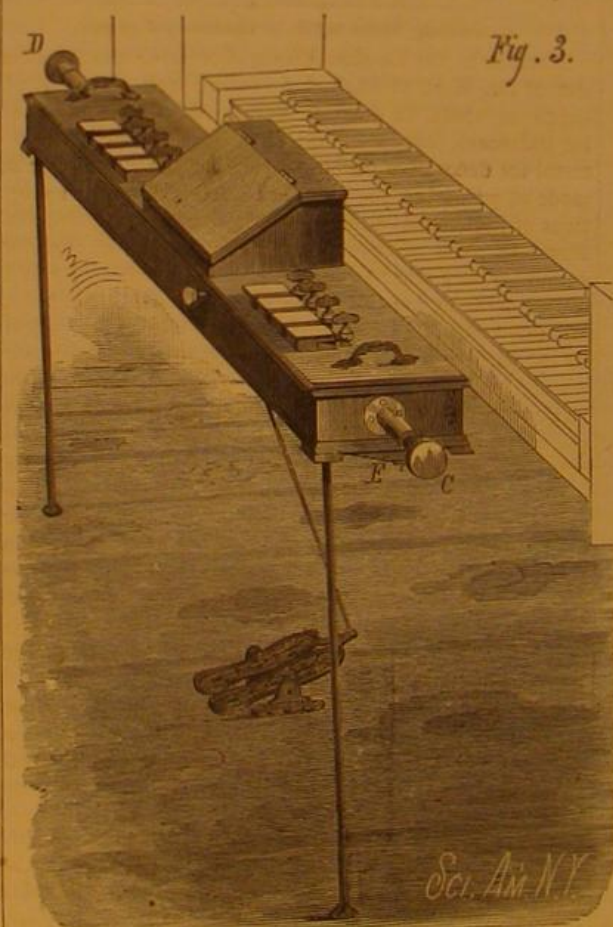
tachment to perform upon organs or pianos already in use, and may be readily placed upon or removed from the instrument.

The invention is represented in this form in Fig. 3, in which the ordinary key board of an instrument is shown, the attachment being moved toward it to be placed over the keys. If the instrument be a wind instrument, as an organ, the connecting rod, shown as attached to the foot pedals, is connected to the ordinary pedals of the organ, the pedals shown being used when the attachment is employed to perform upon a piano.



C D represent padded binding screws, which take hold of the uprights of the instrument at each end of the key board, to hold the attachment firmly in position. A line of strikers, corresponding with and striking upon the keys, are operated by mechanism similar to that already mentioned. Connections are also made from the attachments with the ordinary stops and "expression" devices of the instrument, and are operated by the punctures of the sheet or other finger stop keys, as heretofore explained. One of the strikers is shown at E projecting under the attachment. The rod supports shown are movable. In the form shown the attachment is light and portable, and may be easily carried by hand. When not desirable to have this portable a case is provided supported by casters.

Using the language of the inventor, the autophone is constructed on purely scientific principles, is as simple as it is wonderful, requires no adjustment, and is always ready for action. Its mechanism is so perfect and its operation so free, that it is not liable to get out of order, and, with ordinary care, will last for an indefinite period. It is, in all es-



sentia respects, unlike anything heretofore invented, either in structure, action, or musical results.

Professor Gally is better known to the public as the inventor and manufacturer of the Universal printing press. Further information regarding the autophone may be obtained by application to the inventor at his office, No. 9 Spruce Street, New York City.

The Electric Light in a Fish Market.

In the celebrated Billingsgate Fish Market in London, the electric light proved a complete failure, for the unexpected reason that it was too good. Business at Billingsgate begins at 3 o'clock in the morning, most of the bargains being struck by gaslight. When the searching electric candle was turned on, its brilliant whiteness literally showed the fish in such a new light that the trade was demoralized outright. Soles that would have fetched a shilling a pair by gaslight looked dear at sixpence, while turbot fresh from the sea looked a week old. The result was a general outcry. The copious and ornate dialect of the locality was enriched by a number of notable additions during the few days of the new light; and for fear of a revolt among the "bummies," as the fish salesmen are called, the corporation was obliged to restore the familiar yellow gas lights.

Captain W. H. Swift.

By the death of Captain W. H. Swift, America has lost one of the pioneers of American engineering. While still a cadet of the United States Military Academy his service began with Major Long's expedition to the Rocky Mountains, 1818-21. During the next ten years he was employed on the early surveys for the Chesapeake and Ohio and (proposed) Florida canal, the Ithaca and Oswego and Catskill and Oswego railroads; and in 1831 in surveys for the Boston and Providence, Providence, Norwich and Worcester, and Providence and Stonington railroads. Appointed 1832 brevet captain and "assistant topographical engineer" (as the captains were then officially styled), he was among the pioneers in our coast survey work; being employed for the next ten years on the geodetic survey of the Atlantic coast. From 1836 to 1849 he was the resident and constructing engineer of the Massachusetts Western Railroad (now incorporated in the Boston and Albany). As an officer of topographical engineers, he, with ex-Governor John Davis of Massachusetts, was employed in making an examination of the Illinois and Michigan Canal, the completion of which had in 1841 been suspended for want of funds, resulting in his becoming one of three trustees into whose hands the work was committed and remained until its completion in 1848.

The work with which Captain Swift's name has been most intimately associated is the first Minot's Ledge Lighthouse, off the town of Cohasset, Mass. The erection of this iron skeleton tower—the first of its kind—was a work of great originality as well as difficulty. Resigning from the army in 1849, Captain Swift was president (1849-51) of the Philadelphia, Wilmington and Baltimore Railroad; of the Massachusetts Western Railroad (1851-4); continuing president of the board of trustees of the canal named till 1871; president of the Hannibal and St. Joseph Railroad since 1856. For the last fifteen years of his life he made his home in this city.

The Gold Medals Won at Paris.

The gold medals awarded to the United States exhibitors at the Paris Exhibition have been received and distributed by Commissioner-General McCormick. The medals weigh three ounces each. Each medal bears the name of the exhibitor to whom it was awarded, and is accompanied by a diploma with the signatures of the Ministers of Agriculture and Commerce and the French Commissioner-General, designating the group and class in which the award was made. The medals are one hundred and six in number. There are twenty-three "diplomas of honor," which are considered equal to gold medals, and were chiefly given for exhibits made by the government or by public institutions. The Commissioner-General has not yet been advised when the silver and bronze medals will reach this country.

American Made Telescopes.

The perfection of workmanship attained by American opticians in making telescopes and microscopes has often won high praise from scientific men both at home and abroad. In 1861 European astronomers may be said to have had their eyes opened by Clark's discovery of a minute companion to the brilliant Sirius, with the eighteen inch object glass made for the Chicago Observatory. The monster telescopes of Herschel and Lord Rosse, and the great achromatics in the chief European observatories, had given no hint of this star's existence, although there were mathematical reasons for believing that Sirius had a companion. Since its discovery this delicate star has been seen with comparatively small telescopes, and now Mr. Jay Harcourt, of Wappinger's Falls, announces to Admiral Rogers that one fine night in April he saw the companion of Sirius with a Byrne telescope of only four and a half inches aperture. Several other persons saw the star, and they certify to the correctness of the observation. The maker here alluded to is John Byrne, of New York city.

The London International Agricultural Show.

The International Agricultural Show, to open June 1, promises to be very successful. Six hundred and fifty-one exhibitors of implements and machinery have applied for space, some two hundred and fifty more than at Bristol last year. The sheds for these exhibits would form a line three miles long, if all the space asked for were conceded. An additional mile of sheds will be required for machinery in motion. A correspondent writes that American manufacturers are among the foremost applicants outside of England, and adds:

"There is some uncomfortable foreboding here as to the issue of certain firms with whom your makers of mowers and reapers especially come into competition; nevertheless a vigorous effort is being made in the hope that the English firms will be able to show a better front in London than in Paris."

The report of the National Cotton Exchange shows that the cotton movement by rail routes this season is the largest ever known. There has been an increase of 186,651 bales in the direct shipments by rail from producers to Northern mills. The receipts of cotton at all United States ports for the year ending April 30, were 4,283,641, against 4,183,552 last year. These figures give gratifying evidence that the importance of this great staple to the industries of the country is to be still further increased.

PROF. RILEY, Entomologist of the Department of Agriculture, has resigned.

THE DONNADIEU RECIPROCATING PUMP.

This pump, which is represented in the accompanying engravings, works in exactly the reverse manner to that of ordinary pumps, the piston being fixed and the barrel movable. From this arrangement result several important advantages, namely, the suppression of the connecting rod and stuffing box, simple and easy erection, and greatly diminished friction.

In ordinary pumps with movable piston, friction is chiefly due to the packing of the piston in the barrel and of the piston rod in the stuffing box, and the working of the rod in its guides, to which must be added that of the water in the rising main. The usual cupped leather, forced against the interior of the barrel by the whole pressure of the water while being impelled upward, is in this pump superseded by

the same time forms the pump rod, transmitting the reciprocal motion to the barrel. This combined rod and delivery pipe is guided by stays working on pins at each joint of the pipe. The delivery may take place through a spout inserted in the top of the hollow rod itself, or the hollow rod may be connected to a fixed delivery pipe by a flexible joint, while in large pumps this joint is rigid, working in a cylinder provided with a stuffing box.

It will thus be seen that the friction of the rods in their stuffing boxes, as it exists in ordinary pumps, is entirely suppressed, and that the friction of the guides is greatly diminished, since it is reduced to the simple and very slight oscillation of a pin in its bearing. There is also no friction in the rising main, because the water, instead of being forced by the piston up the delivery pipe, is merely raised with the rod and at the same speed. A still greater saving of friction, and consequently of power, is effected by the adoption of the double pump, as shown by Fig. 2; for the mass in motion may be so perfectly balanced as to reduce resistance to a minimum, and afford a very high delivery in proportion to the power employed. This is due, not merely to the great diminution of friction and the facility for balancing the parts in motion, but also to the position of the valves, which are in the direct line of the action; they occasion no change of direction to the water, which therefore rises naturally. This application of the pump is suitable for great depths, as in mines.

The single Donnadiu pump may be applied with advantage to removing the debris and keeping the drill cool in boring operations, as the water is delivered in the very center of the boring, and the pump works equally well above or under water.

Another advantage which should not be lost sight of is the ease with which the pump is got at for inspection, there being no bolt to unscrew and no joints to break. By merely taking out three pins without the aid of any tool, the piston and the two valves are freely exposed.

Coating Iron with Iridescent Copper.

A writer in the *London Mining Journal* thinks the invention of Dr. Weil, of Paris, for coating iron and steel with copper or nickel in such a manner that the surfaces shall be iridescent, opens a large field for the employment of metal for decorative purposes. He has found that the best mode of preparing the metalizing bath and the best proportions of ingredients are indicated in the following directions: First, 35 parts of crystallized sulphate, or an equivalent amount of any other salt of copper, are precipitated as hydrated oxide by means of caustic soda or some other suitable alkaline base; this oxide of copper is to be added to a solution of 150 parts of Rochelle salt, and dissolved in 1,000 parts of water; to this 60 parts of best caustic soda, containing about 70 per cent NaO, is to be added, when a clear solution of copper will be formed. Other alkaline tartrates may be substituted for the Rochelle salt above mentioned, or even tartaric acid may be employed, but in the case of tartaric acid or acid tartrates a small additional quantity of caustic alkali must be added, sufficient to saturate the tartaric acid or acid tartrate. Oxide of copper may also be employed precipitated by means of hypochlorite, but in all cases the proportions between the copper and the tartaric acid should be maintained as above, and it is advantageous not to increase to any notable extent the proportion of the caustic soda.

The great advantage of the present process as compared with that proposed by the same inventor a few years ago, is that he now substitutes a Gramme machine for the alkaline bath before used. The object to be coppered is to be cleaned with a scratch brush in an alkaline-organic bath, and attached to the cathode, and immersed in the coppering bath, and treated with the usual precautions, when it will become rapidly coated with an adherent film of metallic copper. As the bath gradually loses its copper, oxide of copper as above prepared should be added to maintain it in a condition of activity, but the quantity of copper introduced should never exceed that above prescribed as compared with the quantity of tartaric acid the bath may contain. If the quantity of copper notably exceeds this proportion certain metallic irisations are produced on the surface of the object. These effects may be employed for ornamental and artistic purposes. According to the time of the immersion, the strength of the current, and the proportion of copper to the tartaric acid, these iridescences may be produced of different shades and tints, which may be varied or intermingled by shielding certain parts of the object by an impermeable coating of paraffine or varnish, while the iridescent effect is being produced on the parts left exposed. All colors, from that of brass to bronze, scarlet, blue, and green, may be thus produced at will.

If it be desired to deposit nickel, the only modification of the above process requisite is the substitution of precipitated oxide of nickel for the oxide of copper, produced by precipitation as above mentioned. In the above process it will be observed that the introduction of sulphuric acid into the bath is avoided, at least except in such insignificant quantities as may still adhere to the precipitated metallic oxides. Now, I think it will occur to most of your readers that the amount of ornamentation that could be produced with metal work treated by the above process would justify a large outlay for

providing the necessary plant. The ornamental iron castings made both in Great Britain and France are really beautiful in form and design, and by the judicious coloration of them with combinations of iridescent brass and scarlet, brass and blue, or brass and green, would produce effects which would insure their general adoption.

Clothing in its Relation to Health.

Approximately, the human body when clothed resembles a steam jacketed pipe; the clothing forms the outer covering, between which and the body there is a layer of steam and heat, and which are constantly ascending. The place where this current of hot air and steam passes out into the atmosphere is the narrow ring between the neck and the shirt collar. This opening plays, therefore, an important

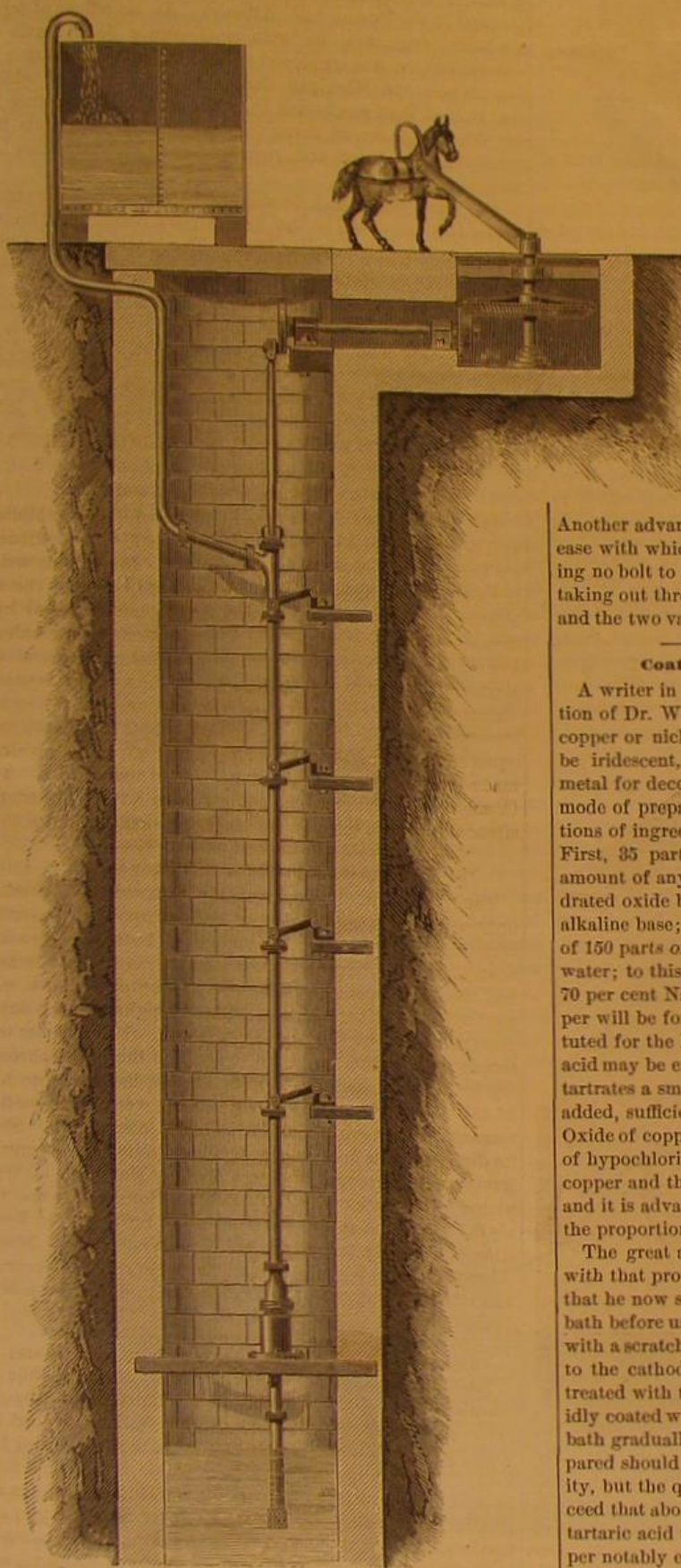


Fig. 1.—THE DONNADIEU PUMP.

superposed segments of leather, breaking joint with one another, clamped between washers, and pressed uniformly against the inside of the barrel by an internal spring. With this packing the influence of the pressure of water while being forced upward is nil, so that one great contingent in the total amount of friction is suppressed.

Fig. 1 of the accompanying engravings shows the single barrel form of this pump, as applied to wells and arranged for being worked by a horse gear. The piston, fastened to the crossbearer, consists of a hollow rod serving for the suction, which is fitted with the packing above described, and contains in the center a clack valve opening upward. The movable barrel terminates at its upper extremity in a cap, which forms a box for the delivery valve, also opening upward. Both these valves are on the center line of the pump, so that no change of direction is given to the water. The cap is in communication with the rising main, which at

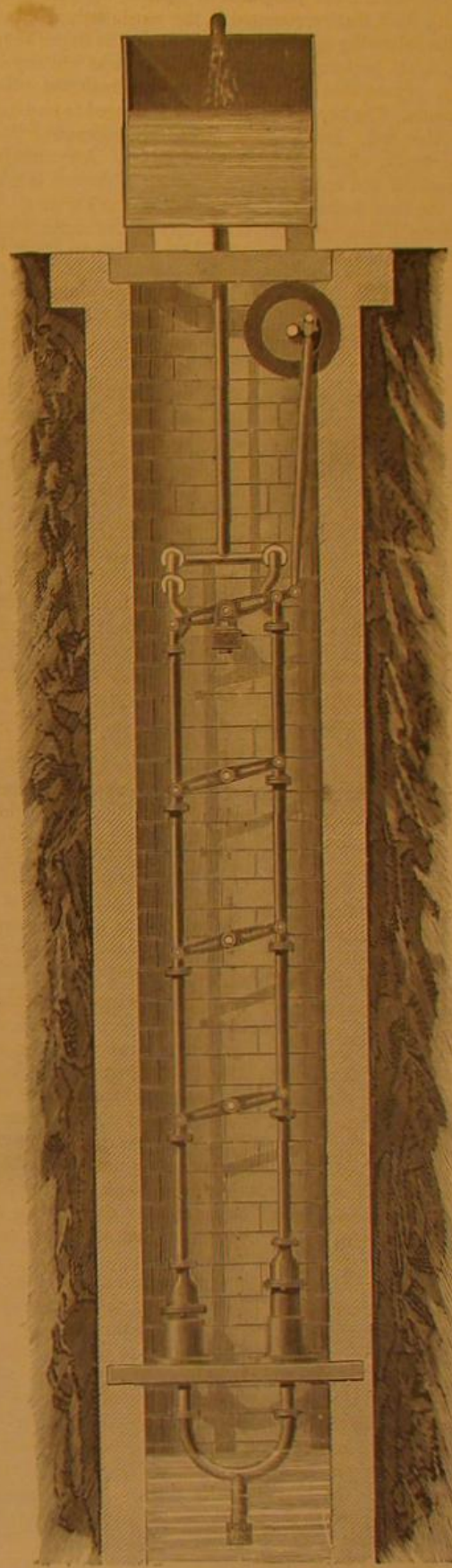


Fig. 2.—THE DONNADIEU PUMP.

part in the maintenance of the temperature of the human body. If it is enlarged, the heat and steam escape more quickly, and the skin is soon cooled; if, on the contrary, it is wholly or partially closed, by being closely buttoned or by a muffler, then the loss of heat is stopped, and the temperature of the skin raised. Thus there is nothing more injudicious than the constant wearing of a muffler or the thick neckerchief of our forefathers, because it impedes the evaporation of the matter which ought to pass out of the skin; though, for the same reason, it is of great value in case of a cold.

While the dampness of the atmosphere affects the evaporation through the lungs as well as the skin, clothing, by night as well as by day, regulates that of the latter. All covering which impedes this evaporation acts injuriously. Though no material is quite faultless in this respect, there is still a great difference in their structure. The less they are

impervious the more they are to be avoided. India rubber stands at the bottom of the list, for it does not admit of the passage of any water; leather comes next; less objectionable, but still repellent, is close linen, as an instance of which we may mention the blue linen blouses worn by the Belgians and Dutch, and also the French, over their other garments as a kind of waterproof. Cotton has a great advantage over the foregoing, as it is, to a certain extent, porous; but the best of all percolators is a woolen material. Thus a flannel shirt is more healthy than a cotton one, and a blanket a far better covering for the night than a linen sheet.

The action of the skin depends also upon the circulation of the blood under its surface, and the latter is promoted by outward friction; a material which induces the latter is therefore also more healthy, and rougher underclothing, such as woolen or coarse cotton, are preferable to the enervating finer linen or silk.

Another point to be observed is the keeping of the skin warm, because warmth keeps the pores open, while cold contracts and closes them; and here again woolen clothing stands first.

Thus it is proved that in point of porousness, friction, and warmth, woolen clothing is to be preferred to all others.

But not only the material of the clothing is of importance, but also its cut. In warm climates, where clothing is more a luxury than a necessity, the loosest garments are the best; but in those latitudes where a certain amount of warmth has to be obtained by clothing the garments must be worn more closely fitting. We have before likened the human body to a steam jacketed pipe, where this steam is constantly in an ascendant motion; the faster this circulation takes place, the more is the skin cooled; it follows, therefore, that the most regular and constant evaporation is maintained by closely fitting garments, and the soldier's uniform is therefore the healthiest of all.

We need not here enlarge upon the very extended use of flannel underclothing, especially as shirts, which has come in vogue since cotton clothing rose to such exorbitant prices during the American war, and which, once appreciated, has not been abandoned since. This has also led to the production of a great many textile fabrics containing more or less wool mixed with cotton or other fibers, in order to counteract the shrinkage of the latter and make the fabrics more adapted for washing, one of the products being the vigogne yarn, to which we have lately drawn attention.—*Textile Manufacturer.*

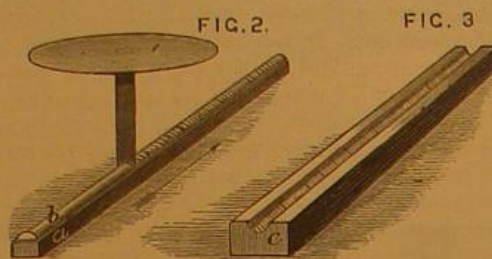
A SIXPENNY PHONOGRAPH.

When a great scientific discovery or invention is announced to the world, such, for example, as the telephone of Professor Graham Bell, the microphone of Professor Hughes, or the phonograph of Mr. Edison, it is pretty certain in a short time to be followed first by spurious and unauthorized imitations, which, if the invention be protected, are nothing more or less than direct infringements of the patent, and after that by highly interesting modifications of the apparatus either for the extension of the principle, developing further physical facts, or to analyze those already discovered; or else for the reduction of the instrument to its simplest possible form, so as to place in the hands of the teacher as well as in those of the million a scientific toy which can illustrate and render familiar the principle which lies at the base of the more important and typical apparatus.

The sixpenny phonograph, which is represented in Fig. 1, consists, first, of a hollow cone of pasteboard, about one inch and a half in diameter, whose apex is connected to the center of a similar sized pasteboard disk by means of a lead wire about sixteen inches long; and, second, of a small board or tablet, on which is fixed one or a larger number of short lengths of lead wire, each of which bears upon its upper surface a phonographic embossed record corresponding to a certain word or sentence, by which it was originally produced. The method is as follows: The upper surface of a rectangular prism of glass, or other hard and rigid material, is thickly coated with stearine wax, which is then scraped into a convex form, as shown in the diagram, Fig. 2, in which *a* represents the glass bar and *b* the convex coating of stearine. This bar is then fixed into a simple phonographic instrument, which, by means of a screw or other mechanical contrivance, traverses it at a suitable speed below a diaphragm. This diaphragm is rigidly held around its circumference by an annular framework (not shown in the diagram), and is in every respect exactly similar to the diaphragm of an ordinary phonograph. To the center of this diaphragm is attached a thin flat plate, whose lower end is cut out to a concave curve to fit the convex surface of the stearine, *b*. When all is properly adjusted, and the temperature is so arranged as to give to the stearine surface the

proper degree of hardness to insure the best results, the handle of the instrument is turned, and at the same time words are spoken against the diaphragm, which immediately set up in it vibrations, which are communicated to the plate or style. While this is moving up and down, following the vibrations of the diaphragm caused by the voice, the stearine coating of the bar, *a b*, is steadily drawn in the direction of the arrow below the vibrating bar, receiving from it a phonogram similar to that produced on the tinfoil of an ordinary phonograph.

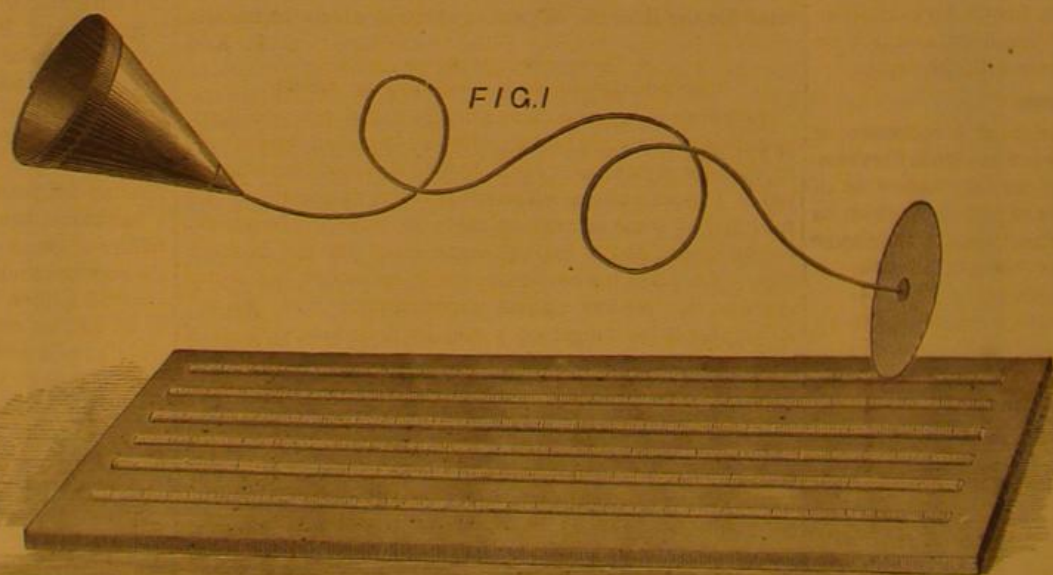
The stearine bar is then coated with a fine surface of plum-bago, so as to give to it an electrically conducting surface, and it is then electro-plated with copper by the ordinary process. Out of the copper coating so formed the stearine is removed, and a rigid backing of lead or other metal having been run over the outside convex surface of the copper,



A SIXPENNY PHONOGRAPH.

a firm copper lined matrix or mould is formed, the whole presenting the appearance shown in Fig. 3, and consisting of a rectangular block having along the center of one of its sides a semi-cylindrical groove, *c*, of copper, which bears upon its surface certain raised striations corresponding to the depressions which were made by the diaphragm on the surface of the stearine. Into this groove is laid a piece of lead wire of about three or four millimeters in diameter, and the two being put into a press and squeezed together, the surface of the lead wire receives a permanent impression, which is an exact reproduction of the original impression made upon the stearine bar. From one copper matrix a very large number of lead impressions may be made, and we are told that the whole process can be gone through, and lead wires, each containing the record of a short sentence, can be made and sold with a profit for one halfpenny each.

We have had an opportunity of testing this simple little instrument, and the words come out of it with remarkable distinctness, though of course with but feeble power; and among the following words, all of which we have heard it utter, some were unmistakably clear: "Mon cher ami," "Louis Quatorze," "Victor Hugo," "La République," "Octavie," "Bonjour," "Lambrigt," "Misérable," and "Miracle," and it is a curious fact that while in the phonograph the words "Phonograph," and "How do you do?"



A SIXPENNY PHONOGRAPH.

come out with exceptional distinctness, so in this instrument the words "Bonjour," and the name of the inventor, "Lambrigt," are the clearest of those we have heard.

It is only fair to Mr. Edison, the inventor of the phonograph itself, to point out that the plan of producing a phonogram on a stearine surface, and afterwards reproducing it in copper by the process of electrolysis, was suggested by him long ago, but we do not understand that M. Lambrigt claims any novelty for that portion of the invention, but more especially for having produced a little instrument at the cost of a few pence, which can demonstrate the action of the phonograph and illustrate some of the most beautiful phenomena connected with the science of acoustics.

The sixpenny phonograph described as above in *Engineering*, is a novel affair, but we doubt if it is, after all, as simple and effective as one described and illustrated in our columns some eight months since. Page 118, Vol. 29.

Compressed Air for Blasting in Mines.

At a meeting held at Manchester, England, recently, Mr. Joseph Dickinson, H. M. Chief Inspector of Mines, in the chair, a paper "On the Advantages of Compressed Air at High Pressure (8,000 lb. and upward to the square inch) as compared with Blasting by means of Gunpowder or other Explosives," was read by Mr. W. E. Garforth, of Dukinfield. After referring to the various efforts which had been made to dispense with gunpowder for blasting in mines, Mr. Garforth stated that a machine had been invented by Messrs. Garforth, of Dukinfield, for bursting down coal by means of compressed air. The machine was portable, of small dimensions, so as to be suitable even for small mines, and could be worked by two men, and by it air had been compressed to 946 atmospheres, or 14,200 lb. per square inch. The compressed air was conveyed through wrought iron pipes to a cast iron cartridge 12 inches long, placed in a hole drilled in the coal, and the cartridge, when its known breaking strain was reached, burst and broke down the coal.

A machine had recently been made by Messrs. Garforth which was capable of giving 2,000 lb. pressure to the square inch, and by permission of Messrs. Morland, of Hollinwood, a trial was made at the Bower Colliery in the presence of some of the members of the Geological Society under the following conditions: The coal known as the Bower Mine was 5 feet thick and very hard. It was undercut to the depth of 4 feet 6 inches, and by a drilling machine a hole was cut 39½ inches in depth and 7 feet from the cut end of the coal. The cartridge, 11¼ inches long, 3 3-16 inch diameter, and 9-16 inch thick, was put into this hole and stemmed tight. The pipes and machine were then attached, and at 9,553 lb. pressure per square inch, the coal was broken down, the quantity being estimated at between 5 and 6 tons.

After describing the great difficulties which had been experienced in perfecting the machine and the cartridges, Mr. Garforth proceeded to lay before the members his ideas of how this great power, obtained by means of compressed air, could be utilized. He would first state that among other points which had been proved by the experiments which had been made were: (a) that 14,200 lb. pressure per square inch could be obtained; (b) that a pressure of 9,550 lb. per square inch was sufficient to break down the coal in a hard mine like that of Bower Colliery; and (c) that the pressure when obtained could be kept for hours both in the machine, pipes, and cartridges. In the suggestions which he was about to make he felt convinced that a machine to meet the requirements of deep mining should be such as not to require too much manual labor, owing to the high temperature experienced in deep and extensive workings.

What he proposed was to use a vessel or small receiver, made so very strong that the bursting point would be six or seven times the required pressure, proved beyond doubt to be perfectly safe in transit, also of such a capacity as would allow highly compressed air to expand into the pipes and cartridges without reducing the pressure below the known bursting point of the cartridge. The air compressing machine necessary to fill this receiver with highly compressed air might be fixed on the surface, or, if preferred, at the bottom of the shaft, and worked by steam in the ordinary way. These portable receivers should then be charged with air to the required pressure, sent into the various working places, attached by means of a valve and pipes to the cartridges with the coal, and then by simply opening the valve the air in the receiver would rush into the cartridge and explode it, the operations requiring little or no manual labor. Of course, it would be understood that the receiver could be placed at a sufficient distance away to obviate the use of pipes; the receiver could be placed near, and the valve opened by other means.

If the expansion of the air were found to be such as to make the receiver too large, a small hydraulic pump might be connected to it, and by forcing water through the valve opening upward, the water would thus occupy the place of the air, and by this means any pressure which had been lost through expansion could be recovered, or, if necessary, increased to more than the original pressure. As water was, comparatively speaking, incompressible, the time taken to effect this operation would not be long nor the labor very great. In the same way that machines were improved upon the original idea, so he felt convinced that in a short time this great force of ten, fifteen, or twenty thousand pounds pressure per square inch would be so utilized that they would be able to put into the hands of the miner a power that, when gunpowder and other explosives were prohibited, would enable him to get the coal with the same facilities as now, without the risks from blown out shots, explosions, or the production of deleterious gases.

It might appear strange to old miners when it was proposed to place a small machine in the hands of the workmen, but

certainly not more strange than it did to engineers when men chipped and worked by hand what was now done by planing, riveting, or other machines. When they considered the great restrictions at present placed upon the use of gunpowder and other explosives in mines, and that every day the coal to be got lay at a greater depth, and the difficulties of getting increased more than *pro rata* with the depth, he thought there could be little doubt that in a few years the government would entirely prohibit the use of explosives in mines. He now proposed to compare the two systems of breaking down coal—by gunpowder and that by compressed air at 8,000 lb. pressure per square inch or upward. The undermining of the coal would in both cases be about the same, also the time taken to drill the hole, provided the machine drill was used. If the arrangement of the receiver as proposed in the foregoing remarks, with or without hydraulic pump, were carried out, then the time taken to fire the gunpowder or burst the cartridge by compressed air would be about the same. In stemming the hole there would be a gain in favor of gunpowder of about ten minutes, but at the same time it would be at greater risk. If instead of the portable receiver a machine had to compress the air to the required pressure, there would be a gain of about thirty minutes in favor of gunpowder; but, as they were aware, when a shot had been exploded by gunpowder the working place was filled with smoke for a quarter, half, and in some cases three quarters of an hour, so that the gain in time was more than counterbalanced.

Compressed air, however, possessed advantages over gunpowder which could not be too highly estimated, above all as regarded safety. He thought there was no one connected with mining but would admit that the time had now arrived when some power ought to be found to supply the place of gunpowder when it was prohibited, to enable us to produce coal as economically then as now. Should gunpowder and other explosives be prohibited, what was the best means to supply their place? He thought for the reasons he had named in the foregoing paper that compressed air would stand foremost, especially for its safety. Although monetary considerations might, to a certain extent, weigh with people, no one could deny for a moment, after seeing the lavish expenditure made by colliery proprietors for the safety of their men, that safety was the main consideration with both mine owners and the managers.—*Colliery Guardian*.

THE NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences was held Monday evening, May 12, Prof. Newberry in the chair.

COPPER AND SILVER IN MAINE.

At the request of the president, Dr. Hamlin, the author of a very interesting book on tourmalines, gave an account of the new mineralogical discoveries in Maine. Until very recently it was not known that either copper or silver existed in Maine. A copper belt, some two miles long and from 200 to 400 feet wide, has now been discovered about the middle of the southern part of Maine, directly on the coast; but it is impossible as yet to present any trustworthy information in regard to the richness of the deposit.

Some twenty miles to the northeast of this copper belt silver has been found in flakes, masses, and filaments, specimens of which have found their way to Boston for exhibition. A shaft has been sunk some hundred feet deep, and it is reported that the ore increases in richness with the depth.

GEOLOGICAL NOTES.

Dr. Newberry announced the receipt of a collection of fossils from Moosehead Lake, and also of one from Fort Bennett, Dakota, which latter appeared to the finders as of vegetable origin, resembling a species of nuts, but which on examination proved to consist of saurians' teeth, having some resemblance to the teeth of crocodiles, but not being as yet sufficiently investigated for identification.

Further geological investigation of the north shore of Long Island confirms the conclusion previously arrived at, that the micaceous sandstone found there in the glacial drift, and containing impressions of dicotyledonous leaves, belongs to the cretaceous period. Its source has not as yet been ascertained.

The paper of the evening was by Dr. Albert R. Leeds, of the Stevens Institute of Technology, on the presence of peroxide of hydrogen in the atmosphere.

PEROXIDE OF HYDROGEN IN THE ATMOSPHERE.

The existence of hydrogen peroxide in the atmosphere has been doubted by many investigators. The reason of this is to be found in the difficulty of ascertaining its presence, seeing that several other substances, such as ozone, nitrous acid, and nitric acid, give almost identical reactions. Numerous tests have been devised to distinguish these substances, but nearly all are liable to objections. A solution of iodide of potassium and starch is colored blue by ozone as well as by the peroxide. The addition of sulphate of iron, or of litmus, has been recommended, but the results have been questioned. Struve proposed a solution of oxide of lead in caustic potash, with the addition of a few drops of basic acetate of lead, in which the peroxide of hydrogen produces a precipitate of binoxide of lead. A freshly prepared solution of guaiacum that has not been exposed to the light, and to which a watery infusion of malt has been added, first turns pink and then blue by the action of the peroxide, and forms a test of such delicacy that one part in ten millions can easily be detected. Yet this test is also affected by ozone. The investigations in progress at the Institute seem to indicate, however, that ozone acts upon it much more slowly than per-

oxide of hydrogen does. The same remarks apply to the test of A. Levy, of Paris, who uses arsenious acid and arsenite of sodium, which are converted into arsenic acid and sodium arsenate by the action of ozone.

Reasoning from the analogy of the recombination of nitrate of ammonia from nitrous oxide and water, our distinguished chemist, Sterry Hunt, threw out the ingenious suggestion that the nitrates in the atmosphere might be due to the combination of atmospheric nitrogen with evaporating water. Later, Schönbein, the discoverer of ozone, came to the same conclusion from different premises, and actually found nitrites in the air wherever water was evaporated. Böhlig, however, demonstrated that in these experiments the proper precautions had been neglected, and that the nitrites found pre-existed in every case in the atmosphere. When the air was previously purified from every trace of nitrites none could be detected in the results of the experiments. This was a fortunate fact, for if nitrites were formed by mere evaporation of water in the air, atmospheric tests would be of no value, as we could never determine to what agency our reactions were due. In another sense, however, it was unfortunate, as it deprived us of a very plausible explanation of nitrification in the atmosphere, on which plant life is in a great measure dependent.

The most extensive investigations of the presence of hydrogen peroxide are those of Schoene, of Moscow, who examined all the snow, hail, rain, and sleet that fell in Moscow for one year, beginning July 1, 1874, and ending June 30, 1875. He found peroxide present in 208 out of 215 specimens of hail and rain, and in 86 out of 172 specimens of snow and sleet. The average amount was 0.17 c.c. in 1,000 cubic meters of air. His method was to add his sample to a weak solution of iodide of potassium and starch, and to compare the coloration with that produced by standard peroxide solutions of different strength. He found among other interesting results that the equatorial winds were much richer in peroxide of hydrogen than the polar winds. Houzeau, of Paris, was unable to find any peroxide in the atmosphere of that city, and it is suggested that it may be absent in some localities. Prof. Leeds found none in Hoboken, although his processes are so delicate as to enable him to detect minute quantities like the following: 100,000,000 parts of air were found in one analysis to contain 16 parts of ammonia, 10 parts of nitrous acid, and 17 parts of nitric acid, equivalent to 15 parts of nitrite and 20 of nitrate of ammonia.

The influence of these substances may be of the utmost importance in relation to health and disease, as well as to vegetable life and growth. But the investigations made in reference to their determination, both qualitative and quantitative, will be of limited utility so long as any doubt is possible as to the reliability of the tests employed. When the New Jersey Board of Health desired Dr. Leeds to furnish them with trustworthy ozonometers to be used in systematic observations throughout the State, he was obliged to reply that there were none he could recommend.

INDUCED MAGNETISM.

Mr. Wolcott then exhibited an experiment to show that a wire, magnetized at its middle point by contact with the pole of a magnet, had the same polarity at both ends. Prof. Seeley then made some remarks on induced magnetism, which were discussed by Mr. Warner, and the Academy adjourned.

C. F. K.

HYPOSULPHITE AS A THERAPEUTIC AGENT.

Anthony's Bulletin contains a communication from a correspondent proclaiming the rare virtues of hyposulphite of soda as cure for erysipelas. Medical men are familiar with the use of hyposulphite as a somewhat active aperient, and it is regarded by some as very valuable in removing impurities of the blood; but it has not come much into use in medicine. We place the new claim for it on record, but would caution our readers against experimenting with disease. Erysipelas is too dangerous a malady to be tampered with, and should be placed under the treatment of a competent medical man. We subjoin the communication in question:

"I take pleasure in communicating the needed information concerning the virtues of hyposulphite of soda in erysipelas. Of course, when erysipelas proceeds from a wound, it is more delicate to manage, and requires the best surgical skill; but when it is of the milder form, on the outside skin in the face or any other part of the body, proceed as follows: Take of hyposulphite of soda any quantity, and make a saturated solution in a bottle of any convenient size—six, eight, or ten ounces. If the individual is a strong, hearty man, and the disease has a good start, give your patient one tablespoonful every hour for twelve hours; then decrease the dose, as the benefits become manifest, say once in three hours. It may cause diarrhea; but never mind, it will destroy any febrile symptoms. Twenty-four hours is generally sufficient to produce a decided change for the better, unless it has six or seven days' start, in which case it will take longer. The results are generally so wonderful that I have never known the remedy to fail. With an old person you may substitute a teaspoonful for tablespoonful, and once every two hours. You may put this down: that the sooner you can get a good quality of the soda solution into the body, the sooner the trouble will be over. Now, for an outward application: use equal parts of the soda solution and glycerine; saturate cotton flannel with the above, and lay on the part affected. Eat simple food—avoid all exciting food and drink; farinaceous diet is absolutely necessary. If you can bathe the part affected with the above solution, do so; then lay on the saturated cotton.

"Hypo is equally as efficacious in any poisons from insects or vegetables; old wounds in sores are soon healed by washing the parts in a solution of soda. It is also good in typhoid fever, carefully administered.

"Now, if a person has a form of erysipelas that is not so decided, but (say) chronic, let him take a teaspoonful every night of the solution, and the disease will be entirely removed, if kept up for a month. The disease seldom or never attacks a person the second time when eradicated by the soda treatment.

"If any other information is needed, I shall be very much pleased to communicate, for I consider the foregoing has saved my life, and it has cured fifty persons in succession without fail right under my own supervision."

RECENT MECHANICAL INVENTIONS.

An improved apparatus for automatically measuring and discharging grain has been patented by Mr. Robert H. Edmiston, of Loveland, Col. It is particularly intended for use in connection with thrashing machines to measure the grain as it is delivered from the thrasher.

Mr. Daniel D. McIntyre, of Sterling, Neb., has invented an improved washing machine, consisting of a semi-cylindrical suds box, having a slotted bottom, and having a pump barrel for creating a circulation of the suds, as the semi-cylindrical rubber is operated by means of a hand lever.

An improved press for compressing cotton and other similar materials has been patented by Mr. W. J. Butts, of Willow Green, N. C. It consists in a horizontal box mounted on wheels, and drawn forward by a screw, the ribbed bed at the end of the box being drawn forward by a screw toward a fixed ribbed platen, so as to compress cotton contained in the box.

Messrs. F. E. Cross and R. G. Speirs, of Waterbury, Conn., have patented an improved machine for straightening and cutting wire. It is arranged to work automatically, and it consists in an arrangement of clamps and a stopping device in connection with cutting mechanism, which cannot be described without an engraving.

An improved grain troller has been patented by Mr. David Waugh, of Willsburg, W. Va. It consists in a notched rotating disk arranged in the grain tube. It is contrived so that the grain that passes through the notch as the disk revolves is counted as toll.

An improvement in machines for dressing millstones has been patented by Mr. David L. Ellis, of Homer City, Pa. It consists in the combination of an adjustable slide provided with a rubber block or strip and set screw, and a peculiar arrangement of frame and feed screw.

Messrs. S. S. Black, of Fredericton, N. B., and Charles A. Black, of Chicago, Ill., have invented an improved machine for trimming the sole edges of boots and shoes. It consists in a combination of ingenious devices, whereby the sole is quickly and neatly trimmed.

Large Farming a Precarious Business.

The following figures are given by a San Francisco correspondent of a Philadelphia paper, as evidence that farming on a gigantic scale is profitable neither to the country nor to the farmer. He says: "The largest wheat producer in California, or in the world, is Dr. H. J. Glenn. He was formerly from Monroe County, Missouri. He is a man of great enterprise and energy. His rancho lies in Colusa county, and comprises 60,000 acres, nearly all arable land. He has this year 45,000 acres in wheat, which, at a low calculation, will produce 900,000 bushels. His wheat will sell for 85 cents per bushel, or \$765,000. Dr. Glenn has been farming ten years, and one would suppose he ought to have a handsome sum to his credit in bank; but what with a failure of crops—which occurs two years in every five—and the enormous interest he pays on his loans, he is said to owe a round million of dollars. Last year his credit was bad, as he had no crop. Now, with his splendid crop in prospect he will probably get out. The Dalrimples of St. Paul, who, ten years ago, were the largest farmers of wheat in Minnesota, raising as much as 40,000 bushels in a single year, went to the wall. Another large wheat raiser is D. M. Reavis, whose land lies on the borders of Colusa and Butte counties. He is also from Monroe county, Missouri, and has an unpretending little estate of 15,000 acres, 13,000 of which are in wheat, which he thinks will average this year 30 bushels, or 390,000 bushels. He also is hard pressed, and I am told is paying 9 per cent on a couple of hundred thousand dollars of borrowed money. If farmers raising half a million to a million bushels of wheat cannot get out of debt, it might be well to inquire what is the use of having so much land? The truth is that from the frequent failure of crops in California and the waste that attends on large operations of that kind, farming on a gigantic scale in this portion of the Pacific coast must be considered a failure. North of this, in Oregon and Washington Territories, there is no failure of the harvest; farming operations are carried on on a smaller scale, and consequently the farmers, while not rolling in wealth, are all well to do."

Rapid Communication.

A merchant, sitting in his office in South St., New York, recently received an answer to his dispatch sent to Shanghai, six hours previously. Thirty thousand miles in six hours is good time, even for the telegraph. The charge to Shanghai is \$2.80 per word; to Yokohama, \$3.05; but the code, or cipher, is so well systematized by certain mercantile houses, that a single word serves for a dozen when transcribed.

The Electric Light.

Mr. W. H. Preece, the eminent electrician, recently delivered, at the Albert Hall, London, a lecture on the Exhibition of Electric Lighting Apparatus. The Prince of Wales, the Duke of Edinburgh, and a large assembly of ladies and gentlemen were present. The Werdermann light was one of the first shown, and while it lasted, was both bright and steady. Much attention was also excited by the light produced by iridium rendered incandescent by electricity, and much satisfaction was expressed at its extreme brightness, purity, and steadiness. The Lontin light also made a brilliant show, and the Rapiéff was greatly admired on account of its steadiness. Then came the turn of the so-called "candles," constructed on the systems of Jablochkoff and Wilde. The former of these, ranged round the upper corridor, for an instant shone brightly, but afterward gave evidence of capriciousness. On the other hand, the Wilde lamps, from their being close together instead of distributed over a wide circuit, or from some other cause, burned very steadily and well. Mr. Preece then introduced the audience to the "holophote," a powerful lamp for "illuminating the depths of the sea," about to be introduced into the ports at Spithead, with a view to testing their value in detecting the advance of an enemy's torpedo. He next referred to the advantage of the "arc" over the "incandescent" system in economy of power, and the strength of the incandescent lamps in their great steadiness and durability. The Wallace-Farmer lamp was then tried, and with very satisfactory results; and the eyes of the audience were next directed upward toward the great Siemens light, or rather chandelier, hanging from the inside of the dome, and which made a noise far less agreeable to the ears than the light was to the eyes.

Mr. Preece dwelt upon the many short-comings of the electric light as at present produced—the noise, the flickering, the deep shadows, and the whiteness of a light which sets all calculations based upon the warm yellow of gaslight at a defiance. On the other hand may be set the absence of smoke and the purification instead of poisoning of the air in large buildings.

A NEW STEAM HAMMER.

The accompanying engraving illustrates an application of Mr. Wadsworth's steam controlling valve to a steam hammer having a rotating anvil, the valve and the anvil block being both under control of the same lever.

The valve, being substantially the same as that described in connection with the steering apparatus patented by the same inventor, and illustrated on page 191 of current volume of the SCIENTIFIC AMERICAN, will not be described in detail in this connection. It is perhaps enough to state that it is capable of perfectly controlling the admission of steam to opposite ends of the cylinder, so that a blow of any desired strength may be given.

The value of this valve as applied to the working of a steam hammer lies in the facility with which the ponderous machine may be controlled, and the exemption from the possibility of accidents, such as the striking of the piston on the cylinder head, in case of the moving of the anvil from below the hammer, the valve being so contrived as to admit steam at the proper point in the stroke to cushion the piston.

The lever, A, of the controlling valve is moved through the medium of the rod, B, bill crank lever, C, and rod, D, by the lever, E, which is fulcrumed in a ball and socket joint, and is capable of universal motion. The lower end of this lever extends through two slotted and pivoted sectors below the floor, which are arranged at right angles to each other, and are connected one with the controlling valve, and the other with the mechanism by which the anvil is turned. This construction admits of controlling all of the movements of the machine by a single lever. Moving the lever to the right or left effects the steam supply, and moving it forward or backward sets in operation the mechanism which turns the anvil. The anvil, as will be observed, is made convex on one of its sides; it has also a rounded corner and a square corner, all of which are found very convenient in forging irregular work.

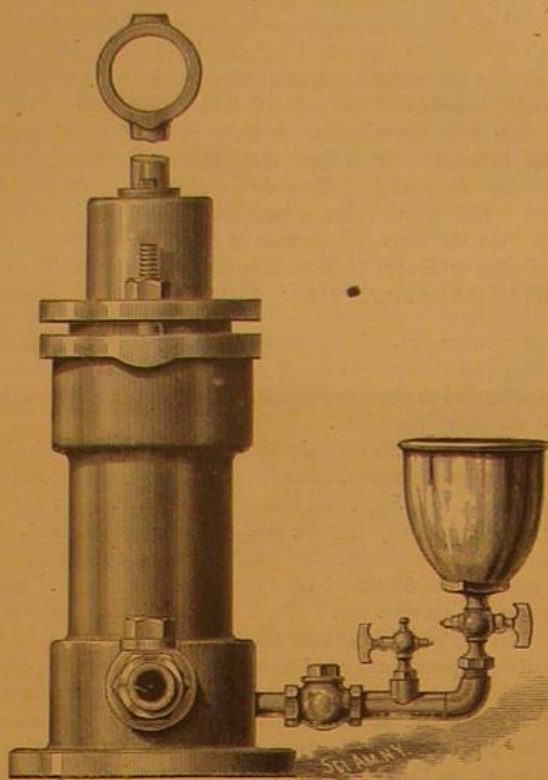
Although this machine is intended for bending ships' ribs and performing other similar operations, the details of some of the parts by which this kind of work is done are omitted for the sake of giving a clearer idea of the other parts.

The ingenious valve used in this hammer seems as well adapted to one of its applications as another, performing its functions easily and with precision, whether used in the steering apparatus previously described or in the hammer shown

in the engraving. Further particulars relating to this invention may be obtained by addressing Mr. Herbert Wadsworth, Merchants' Bank Building, 28 State street, Boston.

ATTACHMENT FOR BOILER FEED PUMPS.

The accompanying engraving shows an improved attachment for boiler feed pumps, for introducing into the boiler

**CLEGG'S FEED PUMP ATTACHMENT.**

along with the feed water any liquid for preventing or removing incrustation or scale, or to prevent foaming. It consists in a short pipe screwed into the lower end of the pump, having at its outer extremity a cup for containing the liquid to be introduced into the boiler. Between the cup and the pump there is a check valve in the pipe, also a stop cock for closing the communication between the cup and pump. Out-

side of the check valve there is a small air cock, which may be used to admit small quantities of air to the pump to act as an air cushion to the plunger to obviate pounding and the consequent wear and tear of the pump.

This invention was recently patented by Mr. Benjamin Clegg, of 526 Richmond street, Philadelphia, Pa., from whom further information may be obtained.

RECENT AMERICAN PATENTS.

An improved waste valve, which is applicable to either wooden or iron pumps, has been patented by Mr. Perry A. Peer, of Comstock, Mich. It consists of a pivoted cover arranged to slide over an aperture in a base plate that is secured to the pump.

Mr. Edwin A. Benson, of Detroit, Mich., has patented an improvement in hydrants, which provides for removing, replacing, repairing, renewing, or otherwise manipulating the ground faucet or valve of a hydrant without removing or digging around the box which contains it.

An improvement in car brakes has been patented by Mr. Nathan Webb, of Sacramento, Cal. The object of the invention is to provide a simple car-connecting brake clamp that can be used as a supplement to any other brake connecting clamp.

A hand car, adapted for running upon a track and dumping its load, and which may be used for loading wood or coal upon locomotive tenders, and for other similar purposes, has been patented by Mr. Stephen Johnson, of Huntsville, Texas.

An improved steam rock drill, in which the valve is shifted by the piston before it has completed its stroke, so that the piston will be cushioned, has been patented by Mr. Thomas J. Murphy, of New York city.

An improved weather strip, patented by Mr. Lawrence Scully, of Meridian, Miss., consists in a strip of rubber fitted to a groove in the bottom of the door, so that both of the edges of the strip project below the door and act as fenders against wind and rain.

Mr. William J. Orr, of Rock Hill, S. C., has patented an improved dust-excluding and car-ventilating window, which consists of a series of vertical parallel pivoted transparent slats between which the air passes freely, and which may be so adjusted that when the train is in motion a draught will remove the air from the car.

An improvement in the class of burners used for burning gasoline, naphtha, etc., has been patented by Mr. William H. Russell, of Sedalia, Mo. It consists in a burner tube having a cup near its upper end, a base piece at its lower end, and a hollow wire wound around the upper end of the burner and concealed in the cup with its ends extending to the base piece, one communicating with the supply pipe and the other with a chamber leading to the burner.

An improvement in passenger registers for cars, omnibuses, etc., has been patented by Mr. S. B. Crane, of Davenport, Iowa. The seat or foot rest is made movable so that when a passenger sits the device closes an electrical circuit which is connected with a recording device.

An improved spark arrester patented by Mr. Allan Talbott, of Richmond, Va., is intended for arresting sparks as they issue from the furnaces of steam boilers, and preventing them from passing into the open air. It consists in a number of inverted hollow truncated cones placed at the bottom and top of the smoke stack.

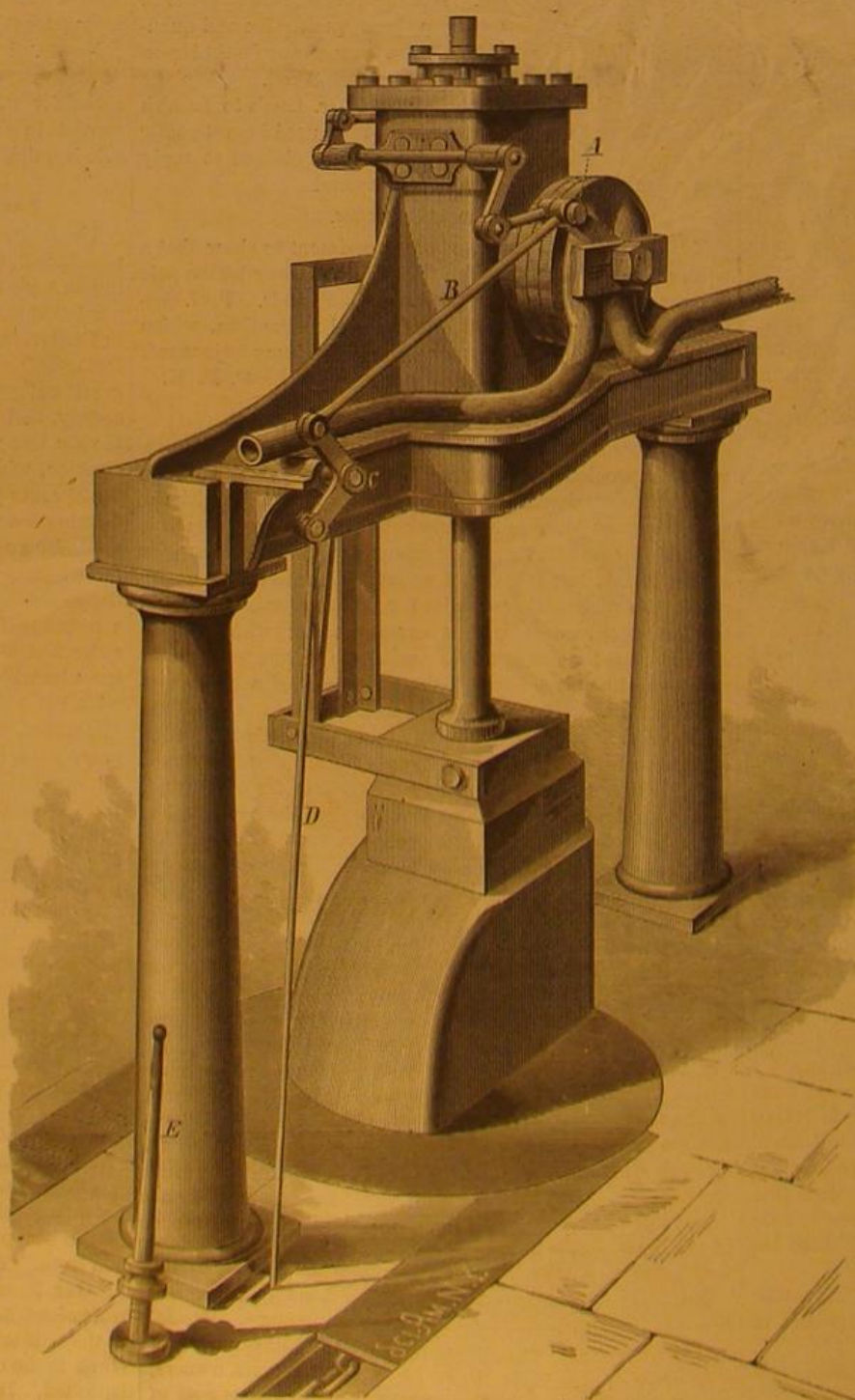
Mr. Martin Rabenau, of Baltimore, Md., has patented an improved apparatus for treating leaf tobacco for developing its flavor, increasing its burning qualities, and darkening its color.

Mr. Thomas H. Locher, of Alburtis, Pa., has patented a chair having a frame made entirely of band iron. The object of the invention is to produce a chair having the greatest strength and rigidity with the employment of a small amount of material.

An improved heat regulator for incubation has been patented by Mr. Frederick Meyer, of Doylestown, Pa. It consists in a lever carrying a tube with reservoirs at each end containing ether and mercury; when the heat expands the ether the mercury is forced to one end of the lever, causing it to tilt and operate the damper.

An improved pole attachment for vehicles has been patented by Mr. James L. Dykes, of Demopolis, Ala. The object of this invention is to furnish combined thills and tongue which may be readily adjusted as thills or tongue.

Mr. George W. Williams, of San Diego, Cal., has patented a simple and efficient trap for catching animals. It consists of a toothed ring secured to one end of a bent spring, the other end of the spring being provided with teeth and held down by a tripping device.

**WADSWORTH'S STEAM HAMMER.**

TERRESTRIAL GASTEROPODS.

Next to the insects no class of animals presents such a variety of families and species as the mollusks. While the majority of them inhabit the sea, a limited number abide in sweet water, and a few only live on dry land. These all belong to the order of Gasteropoda, and differ from the majority of other mollusks by being supplied with well developed pulmonary organs, enabling them to breathe atmospheric air. They may be divided into two groups—snails and slugs—the former of which are provided with a helical shell, while the latter are entirely naked shell, possessing instead of a shell only a calcareous deposit under the shield forming the fore part of the back. As the anatomical structure of both groups is identical we may describe them jointly. From the head protrude two pairs of tentacles, which have the form of the finger of a glove, and may be retracted and projected. The posterior pair carry the small black globular eyes. The tentacles are very sensitive to the touch and the eyesight is apparently very poor; the animal depends on its feelers, principally, for guidance. The mouth is located in the center of a thick muscular mass; in the upper lip lies embedded a crescent-shaped grooved plate, forming the upper jaw. Directly below and opposite to this is placed the tongue, which carries on its upper surface a disk lined with numerous transverse rows of teeth. In eating the snail grasps its food between the upper jaw and tongue, and rubs it to a smooth paste between the friction plates. By the peculiar motion of the tongue the paste is conducted into the oesophagus and stomach. On both sides of the tongue are situated the salivary glands, connected with the mouth by separate ducts. Behind the stomach is found a voluminous liver. This is traversed by the intestine, which turns, after leaving it, and leads to the anus located in the neighborhood of the branchial opening. Into the same opening are also emptied the secretions of the kidney, which is situated near the heart.

Two minute glands near the entrance of the oesophagus are the only organs that might be considered organs of hearing.

Respiration takes place through the branchial aperture, from which the air is conducted to the lung, a cavity nearly filled with a porous, spongy mass, from which numerous minute veins lead to the heart. The latter has two chambers, and by its pulsations sends forth the purified blood coming from the lung on its journey through the body, from which it returns again to the lung. The foot, or rather the ventricular plate bearing that name, is formed of powerful muscles, which propel the animal by alternate contractions and expansions.

Among the principal conditions necessary for gasteropodal life on dry land are moisture and warmth. If deprived of moisture by being, for instance, placed in a pasteboard box in a dry room, most snails will die soon. Instances are, however, on record in which snails have been kept, apparently dead, for months and even years, and revived again by the application of a little warm water. It is, therefore, natural that snails prefer moist spots, shady places under shrubs, trees, stones, etc. Many prefer to creep below the layer of leaves and moss covering the ground in forests, and some even live between the bark and wood of trees.

The most common family is that of *Helix*, of which alone nearly 5,000 species are known. They all have shells which have either the familiar form of the garden snail or are a little more elongated. The shells are generally wound from right to left, that is, when the mouth of the shell is placed to the right of the observer, the umbilicus turned toward the latter, the whorls will be seen to pass down from right to left toward the end. The whorls may either come into contact in the center and form a spindle, or may remain separated, forming a hollow shell. In some of these the umbilicus is closed, in some open.

The shell consists of about 5 per cent of animal matter, 90 per cent of carbonate of lime, and about 5 per cent of other mineral substances.

In our engraving are illustrated two of the commonest snails indigenous in Europe. The smaller ones are *Helix aspersa*, the common garden snail. It varies greatly in color and form, but is usually of a bright yellow color with brown

bands, or numerous irregular stripes. About forty different varieties are known. The larger snail is *Helix pomatia*, or the edible snail, which is very common throughout this country and Europe.

Some snails hibernate regularly. *Helix pomatia* either works its way into the ground or seeks refuge in a natural cavity, and proceeds at once to close the entrance of its shell by a cover formed of material similar to that of the shell. The cover, although not firmly attached to the shell, fits almost air-tight into it. In this state the snail remains throughout the winter, until the warm air of spring and the increased moisture of the soil call it into life again.

In extremely dry weather, or on cool days, snails which do not hibernate retire into their shells; remaining for a while near the entrance, the salivary glands secrete a viscid mucus, which soon forms a partition, closing the shell entirely. As the exterior surface is exposed to the air, the viscid mass dries and forms a thin membrane, which is kept elastic by the moisture exhaled from the snail. As respira-

In Switzerland, Bavaria, Württemberg, and Austria, snail culture at one time attained considerable importance. They were raised in numerous gardens; at Ulm alone over ten millions were annually raised, and shipped partially to Austria. Although this industry has now nearly disappeared, snails are still eaten in large quantities in Austria. They are collected in the fall and kept between layers of oats for use. The snails most esteemed in those countries are *H. pomatia*, *aspersa*, and *hortensis*.

Snails are of great importance as an article of food and commerce in Italy, where numerous kinds are consumed in large quantities. The principal seat of the snail trade is Palermo, but all larger cities have numerous establishments dealing in them, and in some places snail growing and snail hunting form distinct trades. Snails are extremely cheap, and this accounts for their enormous consumption. In the "flying" street kitchens a plate of snail soup can be had for one or two soldi, and this, together with a handful of macaroni and a slice of watermelon, forms the daily repast of the average Italian lazzarone.

To the second group of terrestrial gasteropods, *Limacidae*, belong our common slugs. They have no shell, but a calcareous deposit of more or less firmness in the shield covering the neck may be regarded as the rudiment of the shell. Anatomically the slug corresponds to the shelled snail, except that the entrails, which in snails are contained in a bag extending into the interior portion of the shell, are, in the slugs, contained in the main body, which is ordinarily covered by the mantle.

Slugs are divided into two sub-families—*Arion* and *Limax*. *Arion rufus*, as a representative of the former, is very common throughout Europe, about five inches long and of variable color, generally black or reddish-brown. Similar in appearance and size is *Limax ater*, or road slug of Europe; it is generally black or dark-brown, and very common. This species is represented in the engraving.

Angora Goats Turned to Profit.

The San Francisco correspondent of the Baltimore *Sun* reports a more hopeful prospect for those who have invested so largely in the raising of Angora goats on the Pacific coast. Hitherto these animals have not been profitable owing to the lack of a market for mohair. He says:

The owners of some thousands of these goats, before abandoning the enterprise, concluded to try some way to utilize them. They established experimental works in San José, the beautiful garden city, fifty miles south of San Francisco. After much experiment and vexatious discouragement they have now a flourishing factory, with fifty hands, over one half women. "The Angora Robe and Glove Company" have founded a new and very profitable industry. They have a large tannery, and they have created an unlimited demand for goat skins, till now of no paying value. Their goods, like the woolen fabrics of the coast, challenge comparison with like goods in any part of the world. We have a vast domain of mountain land, with evergreen shrubbery for goat pasture and a climate that is their paradise. What we sadly

want is diversified agriculture and manufacturing industry. There is scarcely anything combining these qualities that we cannot raise on this coast, and the crowning success we record will doubtless encourage others in other directions.

Plain Talk to Southern Idlers.

Under this heading, the *Mercury*, of Meriden, Miss., gives some very pointed advice to Southern women, and winds up with a little advice to Southern boys. We quote the letter, premising that from the best of our information and belief, the women of the South have been more prompt to throw off the old prejudice against honest labor than the young men have. The *Mercury* says:

"Our Southern boys must be bred to trades instead of professions, be taught to prefer the plow handle to whittling on the streets and sunning themselves in front of grog shops. Work is the only, open sesame, to the cave where wealth is deposited. Industry and frugality is the great need of the South, but these will not be seen until false pride disappears and self-help takes its place."



TERRESTRIAL GASTEROPODS.

tion does not entirely stop, there is necessarily going on a constant interchange of air and moisture, the former flowing in, the latter out. When the air becomes moist and warm, as on approach of rain, the air entering the shell carries back the moisture exhaled, the body of the animal, which was wrinkled up and retired to the innermost portion of the shell, swells gradually, until the diaphragm is torn, and the animal resumes its usual mode of life. The period through which this sleep extends varies greatly with exterior conditions.

As might be inferred from the low state of development of the eyes, light is only of secondary importance to the well being of snails; they seem to prefer shady, dark spots.

Snails are used as an article of food. Among the ancient Romans they were esteemed as a great delicacy. Special gardens were devoted to breeding them. Pliny relates of Fulvius Lippinus as one of the principal snail park owners, who is also said to be the discoverer of a delicious pate of grape juice, wheat flour, and other ingredients with which snails were served.

DRAINAGE.

The State Board of Health of Massachusetts has lately made public the following useful information:

Local boards of health are reminded that, at this time of the year particularly, special attention is required to secure cleanliness about dwellings and throughout towns.

No decaying matter should be allowed in cellars. On the contrary, they should be kept sweet and clean, and as much exposed to fresh air and sunlight as possible. They should also be made dry, by draining if necessary. It should be remembered that the air of houses is supplied largely from cellars; so that the common practice of storing all sorts of rubbish there should be condemned. If the air of the cellar is impure, it often gives rise to various ailments in the persons breathing it in the rooms above; and not seldom becomes one predisposing cause of such diseases as typhoid fever, diarrhea, dysentery, cholera infantum, diphtheria, scarlet fever, sore throats, and numberless conditions of ill health which cannot be described under any particular name. If the air in the cellar is damp, neuralgia, rheumatism, and affections of the lungs and other respiratory organs are very apt to follow.

The air supplied to furnaces should never be from cellars, but from the outside atmosphere, and, if possible, on the sunny side of the building. This is a very important matter in schools, where there would generally be no difficulty in following the best methods. The air supply should never be drawn from shady back yards, or the vicinity of privies, sink-spouts, etc.

If kept clean ashes may be used to advantage in filling up low spots of land, making paths, etc.

Garbage should never be allowed to accumulate; all that is not fed to fowls or animals on the place should be kept in tight receptacles, and carried away frequently. Pig-pens should not be permitted in thickly settled places.

There should be no soakage into the ground near wells or houses permitted from stables and barns. It will often be found economical to save all the manure, liquid and solid, by receiving it in water tight vessels, etc., or mixing it with loam, under cover, and frequently carting it away.

Chamber slops, and slopwater generally, should never be thrown on the ground near houses. They may be placed directly on the soil of gardens, etc., or pumped up from water-tight cesspools, or be used by distribution under the surface of the soil, in the manner described on p. 334 of the "Seventh Annual Report of the State Board of Health," and now introduced in the town of Lenox, Mass. The chamber slops alone can be easily disposed of by mixing them with ashes or loam, as at the Pittsfield Hospital, by the method shown on p. 87 of the "Ninth Annual Report of the State Board of Health." If the kitchen slops are discharged directly into a cesspool care should be taken that the pipes do not get clogged with grease.

Earth closets serve a good purpose, particularly for sick people and invalids, if carefully attended to, and if well dried loam be used for them in sufficient quantity; they are more easily managed if liquid refuse be kept out of them.

The ordinary privy should be abolished. It is dangerous on two grounds: 1st. It must be so far from the dwelling as to seriously expose children, particularly during bad weather. 2d. It corrupts the air, the soil, and consequently too often the wells. Instead of the common privy-vault, which is not safe even if cemented, it is best to use under the seat some receptacle which can be frequently removed and emptied. Galvanized iron tubs, barrels sawn through the middle, etc., answer the purpose very well. If kept thoroughly disinfected with dry earth or ashes, they can be near houses, connected by passageways, and will not corrupt the wells.

If water closets are used, and there are no sewers, the best disposal of the sewage is by the flush-tank, and irrigation under the surface of the soil, as described on p. 135 of the "Eighth Annual Report of the State Board of Health." If cesspools must be used, they should be tight, and often emptied by the odorless process, or else have their contents pumped out on the surface of the ground for fertilizing purposes, where that can be done without causing a nuisance. If the sewage is placed on the soil in the morning of a dry, clear day, when the sun is shining, and in places where it may be readily absorbed by the earth, the odors from it are the least offensive. In very loose soil, and remote from dwellings, ordinary loose walled cesspools may be used without danger for a short time; but even then the custom cannot be approved.

The evils arising from want of attention to the suggestions briefly given above are many, and undoubtedly much ill-health can be thus explained. Good water, from deep wells, is much better than rain water, which is soft, and does not contain the lime, etc., so beneficial to health. If the wells and springs are kept free from contamination, as they may be with some care, until houses and streets become placed closely together, the water furnished by them is of the very best quality. A few illustrations of the baneful effects, when contaminated, are given.

A clergyman living in one of our towns reports as follows:

"About a year ago my son, thirteen years old, was taken sick with diphtheria. It was quite a severe case, and was very obstinate, resisting, day after day, all treatment; medicines did not have their usual effect. By and by we thought of the water (which was found upon chemical examination to be polluted with organic matter like that found in drains and cesspools). We immediately stopped using the water, concluding that the impure water was the probable cause of

the boy's sickness, and the probable reason why the medicines would not work; for they had been mixed in this water, and he had used it for a gargle.

"With change of water, the sick boy at once began to mend, and was soon about the house again. This was the third case of diphtheria in our family within the space of some two years, and they were the only cases in the neighborhood, which led us to suspect something was wrong.

"I had myself been subject to a chronic irritation in my throat, often amounting to soreness and serious trouble, and also to frequent attacks of diarrhea, especially through the warm weather; but, for a year past, or since we ceased to use that water, I have had no trouble worth speaking of in either of these ways.

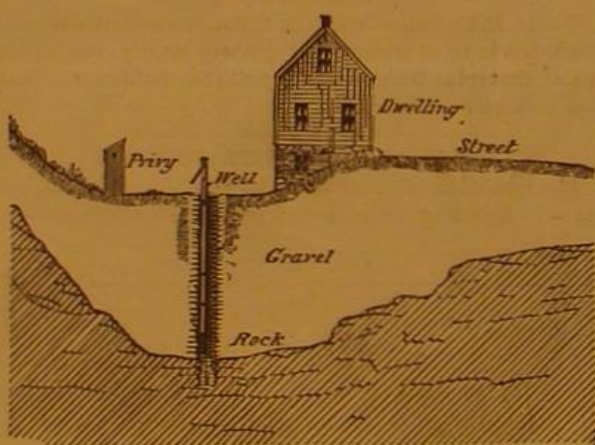
"The well is in the cellar, almost directly under the sink, 3 feet only to the right of it. The top of the well is 2½ feet from the cellar wall. The drain, originally of plank, was 16 feet long, so that the cesspool was within 17 or 18 feet of the well. But this was not the worst feature of the case. This plank drain, after a time, rotted away, so that the filthy water began to soak into the ground just outside the cellar wall, and within 6 or 8 feet of the well, and almost directly over it. The earth, when we removed it to lay a new tile drain, was good manure as deep down as we dug, and I know not how much deeper.

"The water looked clear, except just after heavy rains, and had no ill smell or ill taste about it. We now use cistern water and leave the well untouched."

This case shows what great danger to health may exist unsuspected, when the rules suggested above are not followed out. It is impossible to say that a well is safe at any ordinary distance from a source of constant pollution of the neighboring soil, like a privy, cesspool, barnyard, etc. Often the filth goes a long distance, sometimes not very far. There is always a risk; and, even if well marked sickness does not occur as narrated above, more obscure affections are probably not uncommon.

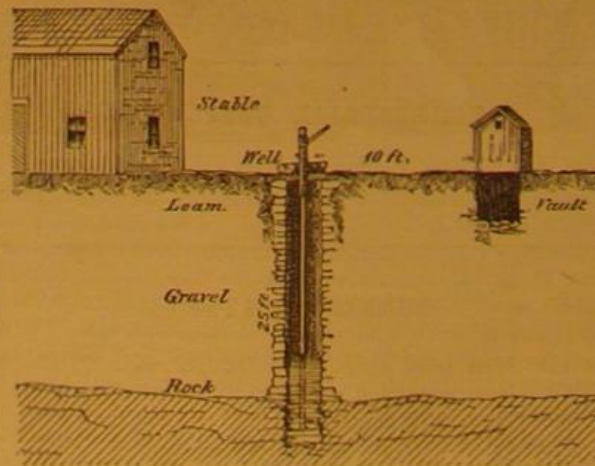
Dr. J. G. Pinkham, in his "Report on the Sanitary Condition of Lynn," published in the "Eighth Annual Report of the State Board of Health," reports the following two cases, the illustrations in which are most clear and convincing:

CASE No. 1.—The diagram explains the position of the well, and shows the certainty of its pollution. The soil and subsoil are loose; contamination occurs both by surface drainage and from soakage. Five cases of typhoid fever oc-



curred in 1875, in the family living in the house, and seven more, with one death, among other persons using the well water. This house became the center of infection for a whole neighborhood.

CASE No. 2.—The well is 25 feet in depth, a portion of it being dug into the rock. The vault is 10 feet distant on the same level. There is a cesspool in the garden below, and a stable on the left. The buildings and well are on a side hill. The premises are kept clean, and the water, which is clear and of good taste, has been used for many years. The occurrence of typhoid fever in the family led the physician in



attendance to suspect the water, which, upon chemical examination, proved to be very much contaminated. There were five cases of typhoid fever in the family, and several others, with one death, among neighboring persons using the water.

Where wells are not in use the corruption of the air from foul privies, and by the emanation from the soil of the pro-

ducts of decomposition of filth, becomes a prominent factor in the spread of such diseases as typhoid fever, dysentery, diarrhea, diphtheria, etc. In towns, sources of filth on some premises may be more injurious to the health or more offensive to neighbors than to the occupants of the place itself. Different people are differently susceptible to disease, too, so that the filthiest places are not always necessarily those where there is most sickness.

A marked illustration of disease due to polluted air, when the drinking water was pure, occurred in a school in this State, in 1864, where 51 out of 77 young ladies in the institution were attacked with typhoid fever, of whom 13 died; 3 servants also died of the fever. The vaults of the privies were shallow, filled to overflowing, and emitted a very offensive odor, which at times pervaded the whole building. The kitchen drain discharged its contents on the surface of the ground, and a few rods from the school there was a foul barnyard.

Where filth has accumulated, and it is necessary to use a disinfectant, or if for other reasons it is desirable to do so, earth, lime, or chloride of lime will serve a good purpose. If it is wanted in liquid form, it may be made by adding to a pailful of water three pounds of copperas (sulphate of iron), with a pint of Calvert's carbolic acid, one pound of chloride of lime, or one half pound of lime.

For use inside of houses, a solution of nitrate* of lead or chloride of zinc† (Burnett's disinfecting fluid) is recommended. Whitewashing in cellars, sheds, etc., is a most excellent means of purifying the air. Prevention of the accumulation of filth, however, is better than the use of disinfectants. "To chemically disinfect (in the true sense of that word) the filth of any neglected district, to follow the body and branchings of the filth with really effective chemical treatment, to thoroughly destroy or counteract it in muck-heaps and cesspools, and ashpits and sewers and drains, and where soaking into wells, and where exhaling into houses, cannot be proposed as physically possible; and the utmost which disinfection can do in this sense is apparently not likely to be more than in a certain class of cases to contribute something collateral and supplementary to efforts which mainly must be of the other sort" (prevention of filth).

Directions for soil pipes, drains, etc., will be issued in a succeeding circular. At present it need only be said that sewers are of the first importance where the water carriage system is generally used for removal of sewage. Where for any reason they cannot be introduced, the greatest consideration should be used before it is decided to introduce water-closets, if the result must be to drench the soil with filth and water by means of cesspools.

It is in the highest degree important that each town should have an independent board of health to devote their attention to these matters. It is desirable that at least two thirds of such a board should be composed of persons not otherwise connected with the town government, and that there should be at least one physician on the board.

Chloride of Magnesia in Gas Meters.

Owing to the difficulty and expense of obtaining a good dry meter wet meters are still largely in use, and the question of what shall the liquid be is an important one. Water is, perhaps, the worse possible filling; it freezes in winter and evaporates in summer. Alcohol is free from the former disadvantage; but not from the latter. Glycerine, the use of which was first proposed by Prof. H. Wurtz, is better than either. A solution of chloride of magnesium has also been tried and found to be excellent, when the gas is free from ammonia, which is, unfortunately, seldom the case, as the white spots on our argand chimneys tell us. Goebel has tried chloride of magnesium, and found that when there is only 0.3 gramme of ammonia in 100 cubic meters of gas serious results follow in a few months. A part of the salt is decomposed, forming sal ammoniac, which combines with a second portion of the former to form a double salt, magnesia being precipitated as white powder on the clockwork and wheels. The double salt subsequently decomposes, liberating hydrochloric acid. Chloride of magnesia is most effective in purifying gas from ammonia.

Amyl Nitrite in Ague.

Dr. W. E. Saunders, of Indore, India, regards the nitrite of amyl as the most powerful diaphoretic, and uses it in all cases of fever to produce sweating. In a report of several cases of ague treated with this drug, printed in the *Indian Medical Gazette*, he claims that in no instance did the amyl fail to remove the attack in about one-third the usual time, and in most cases the fever did not return. The drug may be mixed with an equal part of oil of coriander, to make it less volatile and to cover its odor, and administered as follows:

Four drops of the mixture or two of amyl are poured on a small piece of lint, which is given into the hands of the patient, and he is told to inhale it freely. He soon becomes flushed, and both his pulse and respiration are much accelerated; and when he feels warm all over, the inhalation is discontinued, as the symptoms continue to increase for some time afterward. A profuse perspiration now sets in, which speedily ends the attack; in some cases, however, the cold stage merely passes off without any hot or sweating stage.

* One part in one hundred of water. Cloth soaked in such a solution, and hung up in a foul air, quickly destroys bad odors.

† One part in two hundred of water for foul liquids, etc. This is used by order in the German navy for bilge water. Labarraque's disinfecting fluid (chlorinated soda), one part to four of water, may be used with soap in washing floors, etc.

May Meetings.

During the first week in May the American Medical Association, the National Board of Health, and the Sanitary Council of the Mississippi Valley, were in session at Atlanta, Ga. Their meetings were largely attended. The epidemic of yellow fever last year, and its possible outbreak during the coming summer, naturally gave great prominence to questions relating to quarantine methods and general sanitation. The Medical Association chose New York as the place of its next meeting in June, 1880. Dr. Lewis A. Sayre, of this city, was elected president. The National Board of Health will meet again in Nashville, Tenn., next October.

The annual session of the American Institute of Mining Engineers was begun in Pittsburg, Pa., May 13. Over one hundred prominent metallurgists were present at the first session. The closing session was set down for Friday, May 16.

The sixth annual convention of the National Millers' Association began in Chicago, May 13, six hundred members present. In his annual address, the president, George Bain, proposed that the association be organized as a corporation on a legal basis for the purpose of carrying on suits regarding patents; that an attorney be appointed to look to the interests of the association as against the encroachments of patentees; that the success attending their efforts against the impositions of the Cochrane patent should encourage them to wage uncompromising warfare against the Denchfield patentees, and that a better system and practice of grading and inspection should be adopted.

The annual meeting of the Silk Association of America was held in this city May 13. The secretary reported that while there had been no great failures in the silk industry during the year, there had been, on the other hand, no instance of remarkable prosperity. The prices of silk have steadily declined during the year from 20 to 30 per cent, and in February fell lower than at any time during 30 years. More silk was consumed in this country last year than in preceding years, the imports being 38 per cent over those of 1877, and there has been a large increase in the receipt of raw silk from Japan and China. European raw silks have been cheaper than the Asiatic product. With the decline in the value of the raw material, manufactured goods have become cheaper. The lowering of prices and the absence of tariff excitements have also enabled manufacturers to make costly experiments and improvements during the year. The general tendency in woven goods has been toward work of the higher grade. The mills have been fully employed, but great expense has been incurred in the improvement and alteration of machinery. A decided advance has been attained in the production of dress silks, and more of them are made, and of a higher class, than ever before. If they are kept up to the standard there is every prospect of their displacing the loaded silks of Europe in our market by supplying a better and cheaper article. Nearly all the weaving mills are producing broad goods. The number of paying members of the association has been doubled during the year, and includes among its members nearly every silk manufacturer in the country. The following officers were chosen for the coming year: President, Frank W. Cheney, Hartford, Conn.; Vice-Presidents, A. B. Strange, New York, William Ryle, New York, Robert Hamill, Paterson, N. J.; Treasurer, S. W. Clapp, New York; Secretary, William C. Wyckoff, New York.

American Mutton.

We must be prepared to hear shortly that American sheep are subject to no end of hideous diseases, and that the use of American mutton is hazardous in the extreme. The exportation of sheep to England increases rapidly, and the profits of English breeders are seriously threatened. Something will have to be done; and we shall not be surprised if an epidemic of tape-worms, or something equally distressing, is soon reported among eaters of American mutton. It is not possible that American sheep can be wholly exempt from the numerous maladies to which all flesh is heir—when exported!

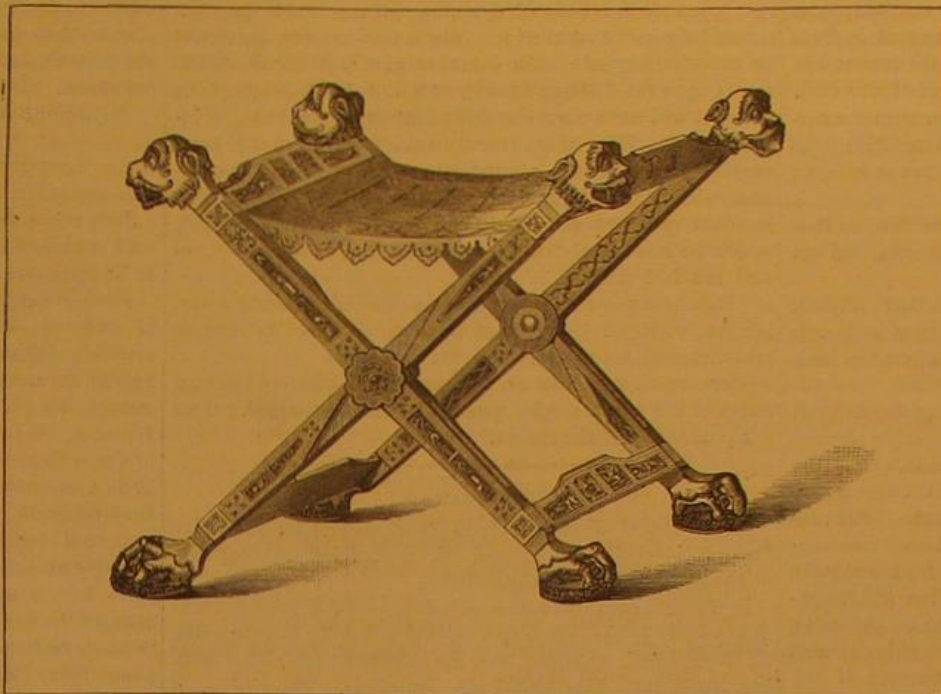
Quick Work with Wool.

The exploit of the English baronet, Sir Roger Throckmorton, has been bettered by an Austrian clothier. Sir

Roger wagered that between sunrise and sunset a coat could be made for him out of wool from the back of a sheep. Accordingly the sheep was sheared at dawn, the wool was dressed and dyed, woven into cloth, cut and made to fit before nightfall. An Austrian clothier has done all this in eleven hours, so that he really has outstripped the Berkshire baronet, who allowed himself from 4 A. M. to 9 P. M.

STOOL OF INLAID WOOD AND EMBROIDERED CLOTH.

The design shown in the accompanying engraving is by J. Androuet du Cerceau, who lived from 1515 to 1558. It contains grotesque masks and other fanciful decorations.

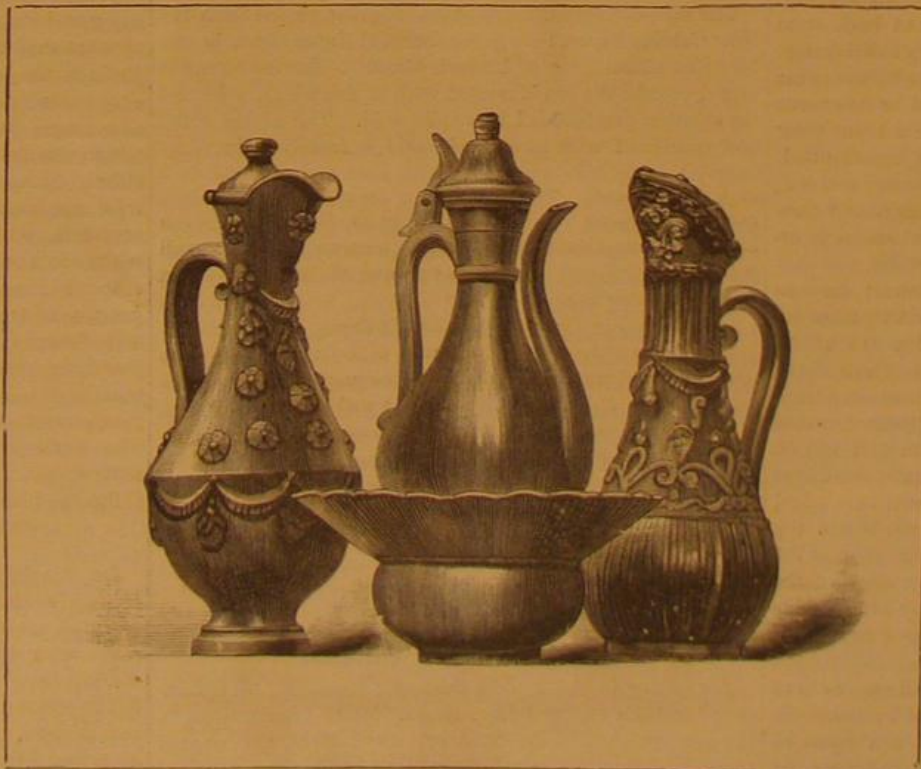
**STOOL AFTER AN ELEVENTH CENTURY PATTERN.**

Many choice works of this artist are known, his refined taste having a large share in the art embellishments of the Renaissance period.

BACON, in his instruction, tells us that the scientific student ought not to be as the ant, that gathers merely, nor as the spider, that spins from its own bowels; but rather as the bees, that both gathers and produces.

SPECIMENS OF TURKISH POTTERY.

The specimens of Turkish pottery shown in the engraving are of modern manufacture, but in strict resemblance

**TURKISH POTTERY.**

to the oldest ware produced at Gallipoli, near Constantinople. It is green and gold, and is almost identical with forms of pottery in common use in Persia and India.

The Oldest Mine Map.

Dr. Gurli, a German metallurgist, who has devoted much attention to the study of the history of mining and metallurgy, exhibited recently, before a German society, a copy of what appears to be the oldest map of a mine known. It is the plan of an Egyptian gold mine from the time of King Seti I., or about 1,400 B. C. The original, drawn on papyrus, is at the museum of Turin, Italy.

Some Aspects of Labor.

Reports coming in from all parts of the country indicate a greater demand for skilled labor than has existed for several years. And the redistribution of labor during the years of depression threatens in some instances to work no little temporary inconvenience to reviving industries. From New England, for example, there comes the curious report that several cotton mills find it impossible to go on for lack of hands. A large number of the more thrifty and forehanded cotton operatives left the East for the West when work failed in the mills, and now cannot be recalled, having taken up farming on their own lands, or engaged in some other occupation. This readiness of American workmen to leave one calling for another when occasion demands is one of the most encouraging features of our industrial classes, since it prevents any long continued distress among any class of operatives, when their special business fails, and equally prevents any protracted lack of labor in any field when a demand for it arises. The New England cotton mills will not have to wait long for hands if they can offer the average inducements in the way of wages, and if they cannot do that it is evident that there is no urgent demand for their products, in which case the world will not suffer from their suspension.

The demand for unskilled labor, even in this city where the glut of day laborers was supposed to be greatest not long since, is manifestly quite up to the supply. On this score a city daily remarks in a recent issue:

"It is commonly supposed that there are thousands of destitute and unemployed working men in New York who are anxious to get work at any wages which will support them. The steamship companies, it

seems, would be glad to find some hundreds of this presumed multitude. They have failed, although they required only unskilled labor and have offered at least the means of daily subsistence in return for it. How much of the apparent and undeniable destitution in this city is a real consequence of a real lack of employment, therefore, and how much proceeds from the habit of promiscuous almsgiving without inquiry and from the growth of a positively vagrant pauper class in this country, are questions worth looking into."

Touching the same general topic a well-informed Philadelphia paper says: "The iron and steel trade was one of the very first to succumb to the pressure of the times, but even that is now exhibiting more activity than at any previous period since 1873; other trades are doing even better, and the number of mills and works which remain shut down for sheer want of remunerative business are exceedingly few. That any should stop, however, for want of hands, is most remarkable, in view of some of the speeches that are occasionally made in Congress and out of it by the self-styled labor reformers. According to the statements of these gentlemen, there are at the present time in the neighborhood of a million industrious skilled workmen vainly seeking employment; but we are afraid that after deducting, say nine tenths of the number (as imaginary?) the other tenth is largely made up of the vicious tramps who vagabondize through the country to the terror of the agricultural population, and who would not work if they were ever so well paid for it. If work is wanted some of them can certainly find it among the mills of New England, which so greatly need operatives as to stop for want of them."

Existing and widely threatened strikes for higher wages still further testify to the increased demand for labor. How far these strikes will retard reviving industry and delay the better times coming for American labor remains to be seen. We are strongly inclined to believe that the good sense of the vast majority of our industrial classes will forbid their making haste thus to kill the industrial goose that is beginning to lay golden eggs, at the dictation of a misguided few who are determined to rule or ruin. Strikes are unprofitable at all times; at this stage of industrial revival they cannot be other than suicidal.

A SYSTEM of pneumatic tubes took the place of telegraph lines in Paris on May 1, for the transmission of messages from one part of the city to another. The charge is 50 centimes, or 10 cents, for open, and 75 centimes for sealed messages.

Girdling the Grape Vine.

The girdling of a grape vine has a very marked influence on the fruit: it causes it to grow much larger, to ripen sooner, and makes it of better flavor. Girdling consists in taking a rim of bark about one fourth or one sixth of an inch wide from the trunk or branches of the vine. Some recommend taking this rim of bark from the main stem, others from the side canes. As many may not understand the operation or the effect it has upon the vine, it may save the life of many a vine if we examine and see how it grows. A vine does not grow, as may appear at first sight, from the bottom upward, but from the top downward. The roots take from the soil what moisture the plant needs; also the mineral matter. This food cannot be used by the plant unless there is water in the soil to hold it in solution, as it must be in a liquid form to be taken up by the roots. This crude or undigested food or sap is carried to the leaves, not through the bark, but through the entire wood of the vine. When it reaches the leaves, it comes in contact with the carbon absorbed from the atmosphere by the leaves; here it is digested, and is now ready to be used by the vine in making new growth in what is called the cambium region, and is deposited in the form of cells just beneath the bark, so that all growth is made from the downward flowing sap, and not from the upward.

If a vine is girdled by taking away a rim of bark, a break is made, so that the sap as it descends cannot pass over this gap, and all growth must take place above where the bark has been removed. If the main trunk is girdled, that portion below the girdle must go without receiving any support from the rest of the vine until this wound can be healed over and complete circulation renewed. All this time the roots have furnished crude sap for the part of the vine above the girdle, and have received nothing in return. This cannot help weakening the roots, and if followed up it must entirely kill the vine. This gap may heal over (as it probably will if not done too late), when the circulation will be restored once more; but there has been a strain on the roots, and they must be somewhat exhausted. If only girdled once the vine may not be permanently injured; but if followed up it must be weakened, and the moment its vital forces begin to lag will disease of some form step in and hasten the work of destruction. If instead of girdling the main trunk a side shoot is taken (taking care to leave some untouched), the injury may not be enough to be felt by the roots, and the vine will not be injured to any extent. After a vine is girdled, the crude sap is taken up the same as before and is digested by the leaves. This prepared sap descends as far as the place where the rim of bark has been removed, and can go no farther. The result is, the branch is crowded with food that must be made use of, the fruit has more than the usual amount of nourishment supplied it, which causes it to develop faster, grow larger, and makes it of better flavor. If a single branch be tried, the effect of girdling can be distinctly seen; the cane girdled will show ripe fruit, while that on the remainder of the vine will hardly have begun coloring. I think the best results from girdling will be obtained if done in the following manner: As soon as the fruit is half grown, take a rim of bark from the side canes (leaving part ungirdled to supply nourishment to the roots, and to keep the vine in a healthy condition) near the main trunk. The rim of bark should not be over one fourth of an inch wide. This will make the fruit grow nearly as fast again as on canes that have not been girdled. The vine at this season is growing very vigorously, and will heal over the wound made by taking away this rim of bark in a short time. As soon as the natural circulation is restored, the fruit will seem to have stopped growing, and that on the rest of the vine will partly catch up with it; but if as soon as the circulation is restored another break is made by taking away another rim of bark, just above where the first one was taken, the fruit will ripen fully two or three weeks earlier than that on the rest of the vine. Last season I tried this method on a Concord vine. The first girdling caused the fruit to increase in size nearly as fast again as it did on the canes that had not been girdled. The wound healed over in a few weeks, and the berries seemed to come to a stand still. I removed another rim of bark just above where the first one was taken, and it was astonishing how quickly the berries began coloring. They were larger than those on canes not girdled, of better flavor, and ripened fully fifteen days sooner. If any one will take the pains to grow new canes each year to girdle the next, and cut away the canes girdled the year before as soon as they have produced one crop of fruit, I see no reason why girdling should not be practiced, and would even recommend it, as the fruit will ripen so much earlier that it will be in no danger of injury from early frosts, which in this latitude often destroy the crop. But do not girdle the main trunk, only the side branches, and grow new canes each year to girdle the next. If instead of this the main trunk is girdled, the vine will become weakened, and in a short time will be ruined.—J. W. C., in *Scientific Farmer*.

Cotton Mills for China.

The Berlin correspondent of the *London Morning Post* recently made the following statement in a communication to that journal: "The Chinese government has purchased machinery and engaged experienced engineers and spinners in Germany to go out to China and establish mills there. The government hopes by this means to make its country independent of Russian and English manufacturers, and to supply the home market with home produce. The mills are

to be constructed and worked on the European principle." "Is this statement correct?" it has been asked. We know that it is, for the design of the government of the Celestial Empire has been heard of in Lancashire, and negotiations have been opened here having the above object in view. Here, then, we have the prospect of another competitor of a formidable character springing up to confront us. Doubtless, also, the new industry will be founded, cherished, and developed under a system of protection as rigid and uncompromising as the government may deem it safe to inaugurate. The result of this experiment, presuming that it will be made, can hardly be predicted. We shall have to wait patiently, and observe if the ingrained conservatism of Chinese nature will permit at home such a startling innovation upon the methods of spinning and manufacturing, immemorially old, that are in vogue in the country, as would be the planting of cotton spinning and weaving establishments upon the English system. Should this, however, take place, it will need no prevision to safely affirm that the industry of the West in another thirty or forty years will have to stand face to face to a competitor whose formidable character will dwarf all previous ones into insignificance. The personal qualities of John Chinaman, as shown abroad, where he has latterly begun to appear more frequently, reveal the fact that he is patient, docile, sober, industrious, and possesses great power of adapting himself to and mastering the details of any new occupation to which he may be put. Should he, therefore, in his own home take kindly to western methods of labor, the industrial and commercial states of the world would speedily be revolutionized. This is a possibility of the future.

Noumeite.

At the recent World's Fair in Paris, noumeite—a massive form of garnierite or hydrated silicate of nickel and magnesia—was exhibited in large quantities.

In a recent number of *Dingler's Journal* Prof. Rudolph van Wagner states that the largest nickel works in France make all their nickel, its alloys, and the salts used for nickel plating, from this New Caledonia ore alone. The ore, as it reaches the factories, has the following average composition:

Oxide of nickel.....	18
Oxide of iron.....	7
Magnesia.....	15
Silica.....	38
Water.....	22
	100

It occurs in serpentine, and possesses a beautiful green color, similar to, but not easily mistaken for, malachite. Its color, together with its variegated and clouded appearance has led to selecting the finest specimens and polishing them for use as setting in breastpins, earrings, and other ornaments. It is more especially to these selected and polished specimens that the name of noumeite is applied. Being massive and dense it cannot equal the fibrous malachite with its beautiful satin luster, but may yet find extensive use along with lapis lazuli in mosaics and the like.

The methods employed in extracting the nickel from the New Caledonian ores are quite different from those in use for other nickel ores, and much simpler. In the so-called mixed process the ore is treated with hydrochloric acid and the solution precipitated by oxalic acid. The nickel being now combined with an organic acid is readily reduced by simply heating it in a crucible with lime and charcoal to a high temperature. The metal thus obtained contains 99.5 per cent of nickel. In the other method, known as the wet process, the ores are likewise treated with hydrochloric acid, the iron and alumina precipitated with carbonate of lime, and every trace of sulphuric acid removed with chloride of barium. The nickel is afterward precipitated as oxide by means of chloride of lime and lime water. The metal obtained by reducing this oxide is of excellent quality, and can be beaten out under the hammer, which is not the case with either the English granular or the German cubical nickel. Riche's analysis gave the following results:

	Ni in the wet way.	Ni in the mixed way.
Nickel.....	97.75	98.00
Silicon.....	0.54	0.50
Carbon.....	1.25	0.13
Manganese.....	0.36	1.63
	100.00	100.00

Chloral a Poison Antidote.

According to the *Lancet*, Professor Huseman, of Göttingen, has been engaged in a long series of observations on the antagonistic and antidotal actions of drugs, and, among these, investigations relating especially to chloral.

Chloral hydrate is known to act as an antidote to strychnine, lessening the spasm, and even preventing death. It has a similar action in the case of the mixture of strychnine bases sold under the name of brucin, and also against the opium alkaloid, thebaine, which simultaneously tetanizes and lessens sensibility. The spasms produced by chloride of ammonium diminish under the employment of non-fatal doses of chloral hydrate, and can indeed be completely stopped. Nevertheless death occurs, probably from the paralyzing effect of both substances on the respiratory center. The antidotal effect of chloral on the action of the poisons which cause convulsions by their action on the brain, is not the same for all these substances. The quantity of the poison which can be counteracted by the antidote appears to be considerably greater in the case of picrotoxin than in the case of codeia. Of the latter, indeed, the

fatal dose, and even a quantity half as much greater, can be rendered harmless, but twice the fatal dose cannot be counteracted, and is still fatal. Calabrin is counteracted by chloral hydrate in about the same degree as codeia. The symptoms produced in rabbits by poisoning with baryta are not materially altered by the action of chloral, which does not appear to prolong life. So, also, with carbolic acid; the spasms produced by it are not arrested by chloral, and the minimum dose fatal to rabbits still produces death. The combination of a fatal dose of carbolic acid with a non-fatal dose of chloral hydrate causes in rabbits a remarkable fall of temperature, which is not produced by the action of either of these alone. As a rule, when chloral antagonizes the action of these cerebral poisons, the respiration sinks in frequency much more than in the case of the analogous action of chloral on the tetanizing poison. The depression of temperature caused by the chloral is also independent of any peripheral loss of heat. The elevation of temperature due to division of the spinal cord is hindered by chloral hydrate.

ASA PACKER.

Judge Asa Packer, President of the Lehigh Valley Railroad Company and founder of the Lehigh University, died at Philadelphia Saturday, May 17. He was born in New London county, Conn., December 29, 1805, and at the age of seventeen, with no inheritance save a sound frame, an earnest purpose, and sterling character, set out to make his way in the world. He journeyed on foot to Susquehanna county, Pa., where he apprenticed himself to a carpenter. When master of his trade he married, and spent a number of years farming a piece of land owned by his wife's father. Tiring of that occupation, the young couple removed to Mauch Chunk, where Mr. Packer took command of a canal boat, and engaged in the business of transporting coal. In a couple of years he was able to build himself a boat and to enter into a profitable partnership with his brother. In 1840-43, he and his brother were building boats at Pottsville to carry coals to New York by the Schuylkill navigation system. Later, Mr. Packer took up the double enterprise of mining as well as transporting coal.

In 1852 he began the gigantic undertaking of building the Lehigh Valley Railroad, which was finished in 1855, and, with its branches, opened up the entire anthracite region of Pennsylvania. As Mr. Packer had foreseen, the railway at once gave an enormous impetus to the coal mining business, and developed other interests and industries proportionally, adding greatly to the prosperity and wealth of the State.

While carrying on these vast material undertakings Mr. Packer found time to carry on constantly the studies which he began in the evenings while learning his trade, and to render excellent service to his State and the nation in judicial and legislative capacity. His judicial title was acquired by service as county judge. In 1844 he was elected to the State Legislature, and in 1852 was sent to Congress, where he served two terms.

In his business career Mr. Packer acquired great wealth and used it most creditably. He gave munificently and steadily to charitable, religious, and educational objects, crowning his life-work by the establishment and liberal endowment of the Lehigh University, an institution designed with special reference to the needs of young men preparing to undertake the great mining, manufacturing, and other material interests of the country. In its course of studies the chief places are assigned to civil, mining, and mechanical engineering and other departments of practical and industrial science. To the endowment of this institution Mr. Packer gave in all upwards of \$2,000,000.

Mr. Packer's personal life was marked by exceptional gentleness, kindness, simplicity, and sincerity. He made many friends and retained them to the end. His entire career exemplified not only the highest type of success in personal and practical affairs, but paid the highest tribute to the institutions under which he lived, which made it possible for one, without wealth or family influence to begin with, to gain great wealth by honorable means, to benefit his age and country, and to leave behind him monuments that must make his life grandly productive through many generations.

Some years ago, at a meeting of eminent Pennsylvanians, Colonel J. W. Forney pronounced an eloquent tribute to Mr. Packer's life and character, worthy of recalling at this time. In it he said:

"Here is a character for youth and manhood to study. Here is a lesson to the one to move on in the path of improvement, and a stimulant to the other never to despair in the darkest hour of disaster and misfortune. We pick out Asa Packer as the miner picks out a piece of coal to show the value of the precious deposit from which it is taken; we pick him out to show what can be won by personal honesty, industry, and kindness to men; by courage in the midst of bad luck, by confidence in the midst of gloomy prophecy, by modesty in prosperity, and by princely generosity when fortune comes with both hands full to realize a just ambition. Mr. Packer's whole career exemplifies the truth that in the United States there is no distinction to which any young man may not aspire, and with energy, diligence, intelligence, and virtue attain. When he set out from Mystic, Conn., to make the journey to Pennsylvania on foot it is not probable that his entire worldly possessions amounted to \$20. These possessions are estimated at \$20,000,000, all of which has been accumulated, so far as known, without wronging a single individual."

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.

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.

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Cutters shaped entirely by machinery for cutting teeth of gear wheels. Pratt & Whitney Co., Hartford, Conn.

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A Draughtsman of many years' experience desires a situation; best of references. Address T. Y. Edwards, Brooklyn, E. D., N. Y.

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.

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

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.

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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.

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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.

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Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the Scientific American Export Edition. This paper has a very large foreign circulation.

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) J. A. B. asks: Can you tell us of a good hair wash to strengthen the hair and scalp, after such a dangerous disease as typhoid fever? A. See Professor Wilson's paper on treatment of the hair, Scientific American Supplement, No. 102.

(2) W. H. C. asks: 1. Does it take more battery power to ring an electric bell than to work a telegraph machine, and why, magnets of same resistance? A. No. 2. Why will an electric bell not work through a telephone, and vice versa? A. Because the introduction of either into the circuit increases the resistance beyond that which the battery is capable of overcoming.

(3) E. S. writes: 1. I have a lot of printed postal cards, and would like to wash the print off. How can it be done? A. We know of no practicable method. 2. Which is the most powerful known explosive, and how does it compare with powder? A. Probably the so-called chloride of nitrogen (described in most works on chemistry). For practical purposes, trinitrolycerine or Nobel's explosive gelatine—six to seven times as effective as common blasting powder. 3. What is the chemical composition of the saliva of rabid animals? A. Not determined, we believe. 4. Who invented the Gatling gun? A. Dr. R. J. Gatling, of Hartford, Conn. 5. With what kind of an instrument did the British give each other signals at long distances in the late Zulu war? A. With the heliograph.

(4) L. P. S. writes: I have several very rusty steel bits (for horses) which I wish to silver plate. I have a battery and every necessary for silver plating, but rust troubles me. How can I remove cheaply and quickly? Dip in warm muriatic acid for a moment and then scour with clean sand and water. Pickle in dilute sulphuric acid, rinse, and suspend in the plating bath without touching. 2. Also a large mirror which looks as if it was dusty, but it is on the inside. Please tell how to brighten it up. A. Resilvering will be necessary. See p. 1670, No. 105, Scientific American Supplement.

(5) C. L. asks (1) how stove cement is made? A. Moist iron filings with strong aqueous solution of ammoniac (ammonium chloride). A little sulphur is sometimes added, to make the cement harder quicker, but it is better without. 2. Which is the best two horse engine in market? A. We cannot undertake to decide between rival manufacturers. 3. What material would you use for cleaning white shirts made dirty through wear, and which resist washing and bleaching? A. Soak in a 10 per cent solution of chloride of lime (calcium hypochlorite), then in water containing about three per cent of sulphuric acid, and finally rinse well in cold water.

(6) F. C. F. wishes to know (1) the horse power of an engine, cylinder 6x14, 60 lbs. of steam, and making 120 revolutions per minute. A. See p. 267 (4), current volume. 2. What is the rule to find the area of a piston? A. Square the diameter and multiply by

0.7854. 3. What kind of paint is best to put on a tin roof that has been painted once with common paint, and water is used from the roof? A. A good asphaltum varnish answers very well.

(7) F. G. asks: Is there any truth in the assertion that anthracite coal loses its heating qualities after being exposed to the air for a length of time? A. No.

(8) V. & B. ask what to impregnate wood with to render it incombustible. A. The following is one of the best: commercial tungstate of soda, 1 lb.; phosphate of soda, 1/4 lb.; water, 2 gallons; dissolve. Apply boiling hot if possible.

(9) E. L. N. asks how to make a black printing ink, which shall be a heavy black, and of a bright color after printing. A. Small quantities of a superfine ink may be prepared as follows: Balsam of copaiba, 9 ounces; lampblack, 3 ounces; indigo and Prussian blue, 1/4 ounce; Indian red, 1/4 ounce; yellow turpentine soap, dry, 3 ounces; grind upon a marble slab with a wooden muller until a perfectly smooth ink is obtained.

(10) J. E. L. asks (1) whether he can make a paper canoe by covering a light, strong wooden frame work with a single piece of common-card board 1/4 inch thick and afterwards waterproofing the whole. A. Possibly; but we think it would not be serviceable. 2. What inexpensive substance can be used for the waterproofing? A. See answer to F. C. R. This page.

(11) F. C. R. writes: I am building a canvas boat, and would like to know what they use to waterproof canvas. A. The oil used is usually prepared by saturating the dry fabric with a varnish prepared about as follows: Bled linseed oil, 100 parts; wax, 15 parts; litharge, 3; oil of turpentine, q.s. The oil is heated so as to readily melt the wax, which, together with the litharge, is then thoroughly incorporated with it and the mixture thinned down sufficiently with turpentine.

(12) B. A. asks for the process for making chloride calcium. A. Dissolve marble dust, chalk, or lime, in hydrochloric (muriatic) acid, filter, concentrate the solution by heating it in an open porcelain lined pan, and collect the salt which separates on cooling. This should be strongly heated (with constant stirring) to fusion in a clean iron pan to expel the remaining water.

(13) C. L. D. asks: 1. Is there any means of melting India rubber and have it retain its original elastic property? Is there any means of applying it to wood and have it retain said property? A. No. Native gum caoutchouc (unvulcanized rubber) is soluble in bisulphide of carbon containing about six per cent of absolute alcohol. This solution on evaporating leaves the rubber in its original condition. 2. Is the slipping of belts affected by the distance the power stands from machine, and if so how? A. An increase in the length of a belt increases its weight between the pulleys; this of course increases the pressure and friction on the pulleys.

(14) B. F. S. asks: Can a photograph be taken on any other substance than glass or tin? Can a picture be thrown upon some kind of material that can be lithographed from, without the process of drawing? A. There are several carbon and chromated gelatin processes—such as that Woodbury—that accomplish this. You will find several of them described in the Scientific American and Supplement. Consult also Vogel's "Chemistry of Light and Photography."

(15) A. M. asks: 1. How can I make a good telephone, or where can I find descriptions? A. See the Scientific American Supplement, No. 102. 2. How can I keep copper ores from tarnishing without spoiling their general character, and if any lacquer is to be used, what is the best receipt? A. A thin coating of an alcoholic solution of bleached shellac will sometimes suffice.

(16) W. V. R. writes: I have a large pile of cinders, taken from a cupola after melting which contains a large per cent of iron. Can I, after cleaning or scouring, melt them without mixing with other iron? I have been told I could do so by using a flux of lime stone or oyster shells. This I do not understand. Can you inform me how to use the flux and in what proportions, etc., to charge the cupola, which is 22 inches diameter, in order to melt 1,500 or 2,000 lbs. of the scrap at a melt? A. The slag can be fused as suggested; but in order to determine the proportion of flux necessary the per cent of iron in the slag must be known. Unless the per cent of iron in the slag is very large it is very doubtful if it can be economically extracted.

(17) C. H. B. asks: 1. Is phosphorus very dangerous to handle? A. It may be handled with impunity under water—in the air it is inflamed by very slight friction at ordinary temperatures when dry. 2. Will it show light in the dark, and how far can it be seen? A. Exposed to the air and moisture it exhibits (through slow oxidation) a faint phosphorescent light. In utter darkness this light is faintly visible 100 yards distant; at much greater distances with difficulty or not at all. 3. What other substance that will show light without flame? A. You might substitute a small spiral of platinum wire heated to incandescence by the passage of an electric current.

(18) F. S. asks (1) if the year 1900 is a leap year. A. No, since it is not divided by 400. 2. Explain all about leap years. A. The earth makes the circuit of the sun in 365 days 5 hours and 48 minutes 46.02 seconds. This is called the solar year. The civil year is ordinarily 365 days, the excess (5h. 48m. 46.02s.) amounting in 4 years to very nearly a day. Accordingly each 4th year is given 366 days. But this counts a little too much, the excess amounting in a century to nearly a day. So, instead of calling the even hundred years leap years, they are made ordinary years of 365 days. This approximate correction involves an error of a little over one fourth of a day every century, which is nearly set right by counting each 400th year as a leap year. By these leap years and intercalated days (every 4th year except the hundreds not divisible by 400) the civil and solar years are closely reconciled, the object being to make the seasons permanently accord with the

calendar. By making a further correction of one day every 400th year, counting each 400th year as not a leap year—the error is so small that 21,600 years must elapse before it will amount to a full day.

(19) E. S. W. asks: 1. How can I rid a house of cockroaches? A. A mixture, composed of 1 part of powdered borax and 2 parts of powdered sugar sprinkled upon the floor where they frequent, will soon eradicate them. 2. How can I find the side of the greatest square contained in a given circle? A. (a) If you mean the square exactly equal in area to the circle, it cannot be done. The square root of the area of the circle will give the side of a square approximately equal to the circle. Or multiply half the diameter of the circle by 3.14159. (b) If you mean the greatest square that can be drawn within the given circle, draw two diameters at right angles to each other and connect by a straight line any two adjacent extremities of such diameter. The last line will be the side of the required square. Or, take the square root of twice the square of half the diameter. 3. What is cyanide potassium? A. Cyanide of potassium is a compound of cyanogen and potassium (KCy). It forms colorless cubic or octahedral crystals, deliquescent in the air, and exceedingly soluble in water. Its solution always has an alkaline reaction, and when exposed to the air exhales the odor of hydrocyanic (prussic) acid. The salt is anhydrous, and is nearly as poisonous as hydrocyanic acid itself.

(20) W. H. C. asks: 1. What quantity of soft iron wire should be used in the center of an induction coil 1/2 the size of that described in Supplement No. 160? A. Make the binder of wires about 1/4 inch in diameter. 2. Why is wire better than one iron rod? A. A bundle of wires acquires and loses magnetism more rapidly than a solid rod of the same diameter.

(21) J. S. asks: How are carbon points that are used in electric lights made? A. By mixing finely pulverized gas carbon with a little coking coal, and baking the mixture under pressure for several hours or days.

(22) A. D. asks: Will you be kind enough to inform me if there is any cure for premature gray hair? I am a young lady of 25 years, and my hair is rapidly turning gray. My hair is thick, and far below my waist in length, but it is losing its dark color. Is there anything that could be taken internally to supply the coloring matter and restore the scalp to a healthy condition? A. Consult Scientific American, vol. 38, page 283 (13). The hair can be restored to a jet black, but probably only by artificial means, which are decidedly injurious to health. See lecture "Hygiene of the Hair," Professor Erasmus Wilson, Scientific American Supplement No. 102.

(23) H. F. asks: Is there a book that contains all that is new relative to the telephone, microphone, phonograph, phonometer, etc.? A. Prescott's "Speaking Telephone, Electric Light, and other Novelties," contains much on these subjects. You will also find these instruments described in the Scientific American Supplement.

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

T. S. B.—It is spiegelstein (mirror iron), produced by smelting, in a blast furnace with charcoal, a spathic iron ore containing a large percentage of manganese—used in the Bessemer process of making steel.—W. W. S.—The supposed animated horse hair is a species of the genus gordius, frequently found in still water. Linnaeus calls it gordius aquaticus.—P. R.—It is magnetite enclosing granules of apatite or phosphate of lime.—G. L. R. A.—If the pots are to be used for melting fine glass, a clay containing less oxide of iron will be requisite.—B.—The sand contains enough iron to unfit it for fine glass.—J. M. H.—The gravel in large box consists chiefly of quartz mica, hornblende, and feldspar, derived from the disintegration of a syenitic granite. The sample in small box contains much graphite.—D. M.—A dolerite containing crystallized lime carbonate and iron sulphide—pyrite.—J. W. C.—Quartz containing ilmenite—titaniferous iron, and a trace of copper. The quartz is not aniferous.—W. J. R.—No. 1. Haytorite—a quartz pseudomorph after datholite. No. 2. It is composed chiefly of silica and aluminum silicate, with traces of lime phosphate and sulphate.—H. T.—It is galena (lead sulphide), a valuable ore of lead.

COMMUNICATIONS RECEIVED.

On Crank Shafts. By R. G.
On Electric Light Telegraph. By F. P.
On Curious Application of Fluorescence. By P. P.
On Silver Powder. By J. C. W.
The Grand Discovery of the Ages. By D.
On the Metric System. By J. G.
On Broosen's Comet. By T. J. L.
On Planets. By P. & J. S.

[OFFICIAL.]

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FOR WHICH

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

April 29, 1879.

AND EACH HEARING THAT DATE.

[Those marked (r) are reissued patents.]

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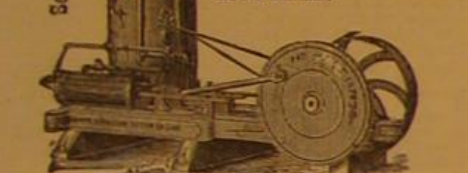
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