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Clothes Pins.

Probably very few realize the extent of the manufacture of clothes pins, and the amount of capital employed in the business. Their manufacture is mostly confined to New England, and the State of Maine produces its share of the commodity.

According to the Bangor *Industrial Journal*, one of the most complete and extensive clothes pin factories is located at Vanceboro, Me. From the same source the process of manufacturing the pins, as carried on at the Vanceboro Wooden Ware Company's factory, is given.

The wood used is mainly white birch and beech. The logs are cut and hauled to the shores of the lake or the streams emptying into it, whence they are floated down to the mill. As fast as required they are hauled into the mill by a windlass and chain worked by steam power, and sawed into lengths of 16 or 22 inches—the former to be made into pins, and the latter into boards for the boxes required in packing. The 16-inch lengths are next sawed into boards of the requisite thickness by a shingle machine, then into strips of the proper size by a gang of 12 circular saws, and finally into 5-inch lengths by a gang of 3 saws.

The logs have now been cut up into blocks about five inches long and three-fourths of an inch square. Falling, as they leave the saws, on an elevator belt, they are carried into an upper story, and returning to the first floor are deposited in troughs, whence they are fed to the turning lathes, of which there are several—each being capable of turning 80 pins per minute. They are then passed to the slotting machines, in which a peculiar arrangement of knives inserted in a circular saw gives the slot the proper flange, after which they are automatically carried by elevator belts to the drying bins on the second floor, where they are subjected to a high temperature, generated by steam pipes, until thoroughly seasoned. There are several of these bins, the largest of which has a capacity of 100 boxes, 72,000 pins, and the smaller ones 50.

The pins are now ready for polishing and packing. The polishing is accomplished by means of perforated cylinders or drums, each capable of holding forty bushels, in which the pins are placed and kept constantly revolving until they become as smooth as if polished by hand with the finest sand paper. A few minutes before this process is completed, a small amount of tallow is thrown in the drums with the pins, after which a few more revolutions gives them a beautiful glossy appearance. These polishing drums are suspended directly over the packing counter on the first floor of the mill, and being thus immediately beneath the ceiling of the floor above, are readily filled through scuttles from the drying bins on the second floor, and as easily emptied upon the counter below, where they are sorted into first and second grades, and packed in boxes of five gross each. The sorting and packing are done by girls. Two hundred and fifty boxes are packed per day.

The market for clothes pins is not confined to any special locality, but is found nearly all over the world. Ten thousand boxes have been shipped to Melbourne, Australia, within the past four months. Ten firms in London carry a stock of ten thousand boxes each, and two firms in Boston carry a like amount. One thousand boxes constitute a load.

A Famous Yacht Builder.

The death of Capt. Robert Fish, at Pamrapo, N. J., January 17, deprives the country of one of the best known and successful of our later yacht builders. The victories won by many of his yachts made his name familiar to yachtsmen on both sides of the Atlantic. He was born in this city nearly seventy years ago. In 1850 he removed to Pamrapo, to establish the yard at which so many fast vessels have been built. Among his greatest successes were the reconstruction of the famous keel schooner Sappho, the Meteor, the Challenger, the Enchantress, the Wanderer, and the Vixen. Capt. Fish was a superior sailing master, as well as a remarkably successful designer and builder of fast yachts.

TAYLOR MANUFACTURING CO.'S PATENT SAW MILL.

We present an engraving of a circular saw mill with top saw, lately introduced by the Taylor Manufacturing Company, Chambersburg, Pa., removed from Westminster, Md., January 1st. This mill is made with the same careful excellence that distinguishes all the productions of the above establishment. The machine is very strong, and by its use the heaviest lumber can readily be handled under any power that may be applied to run it.

The set works are exceedingly simple and quickly operated. Very little time is required in dogging the log, and there is always a certainty of sawing true lumber. The set works can at all times be readily kept in adjustment and in perfect line with the saw. Owing to the construction of the log beam, it does not matter whether the track settles or is thrown out of line by the frost. If six feet of track before the saw is true, lumber will be sawed true. The simple mode of dogging the log at one end, and allowing the gauge roller to hold the log to the log beam, saves an enormous amount of time, preventing the springing of the log. This mill is arranged to set to a fraction of an inch, making lumber of any desired thickness. In this mode of dogging, a man is required to ride on the carriage, and it is claimed that in this way the man on the carriage can, as soon as the log is returned past the saw, instantly set the log to the roller and effect a great saving in time over other methods where the sawyer operates the set works from the ground.

This mill, with twenty-four feet of carriage, has two log beam blocks and one dogging block, making three blocks for twenty-four feet of carriage, the usual number being only two. The additional block gives great stiffness to the beam, and by the use of two intermediate supports between the blocks there is ample support under the log at any point of the carriage, and any length of timber can be sawed without changing the head blocks. The carriage to this mill is heavy and well stayed, and is placed on heavy axles, 2¼ inches in diameter, extending across carriage and run-

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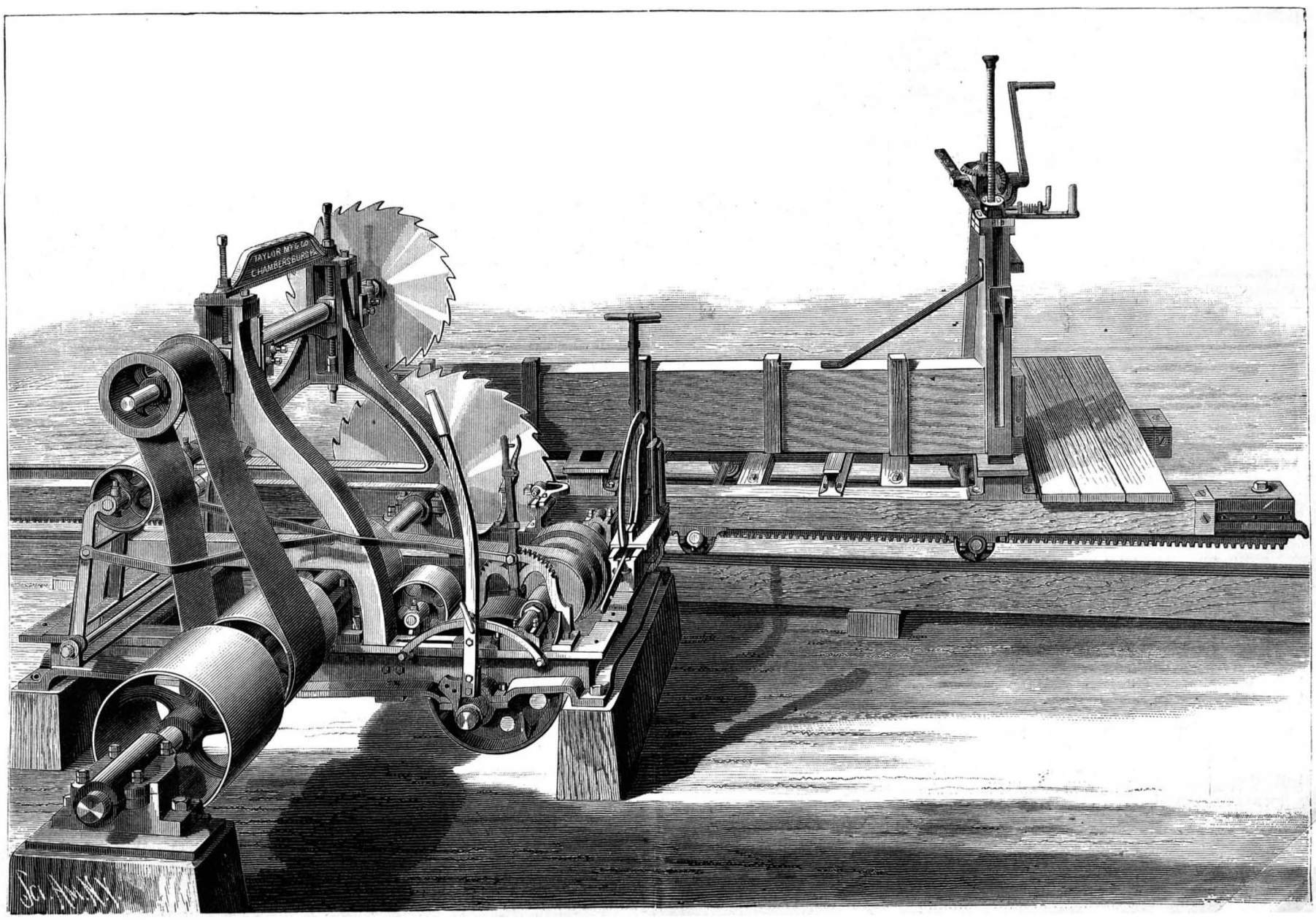

SAW MILL WITH TOP SAW.—MADE BY THE TAYLOR MANUFACTURING COMPANY, CHAMBERSBURG, PA.

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NEW YORK, SATURDAY, FEBRUARY 3, 1883.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 370,

For the Week ending February 3, 1883.

Price 10 cents For sale by all newsdealers

AN AMERICAN ASTRONOMICAL SOCIETY.

For many years the science of astronomy has been cultivated in this country with no small measure of energy and success. American astronomers, professional and amateur, have won by their intelligent labors and brilliant discoveries an honorable rank in the scientific world. We have some of the most favorably situated and powerfully equipped observatories in the world, and are building bigger ones. And yet, until lately, there has been in this country no specific organization devoted to astronomy, such as abound in Europe, particularly in Great Britain.

While we have no great observatory in New York, there are here and in this vicinity several private observatories better known, perhaps, abroad than at home. There are many isolated observers, some of world-wide reputation; and the popular interest taken in courses of astronomical lectures—like the admirable series now being given by Professor Young—shows that there is no lack of material here for the nucleus of an American Astronomical Society which shall be worthy of the name. It is gratifying to record a promising beginning in this direction. On Monday evening, Jan. 22, a number of gentlemen interested in the study of astronomy met at the residence of Mr. S. V. White in Brooklyn for the purpose of organizing an astronomical society, to consist of professional and amateur astronomers, teachers, and others interested in the study. Mr. White, who owns the largest and finest refracting telescope of any private observer in America, was elected President of the society; Mr. William T. Gregg, Vice-President; and Mr. G. P. Serviss, Secretary. The intention is to make the society broadly American in scope and membership. There is a good field for it, and properly conducted it cannot fail to become one of our most honorable and useful institutions.

A CURE FOR SEASICKNESS AT LAST.

In our report of the proceedings of the New York Academy of Sciences mention is made of a paper read by the Rev. Mr. Thwing describing a new and peculiar method of curing seasickness, which the author has tried with success in several instances.

He approaches the sufferer unawares from behind, places his hand upon the patient's head, and speaks in an assuring tone of voice. This puts the passenger into a trance, his sickness is ended, he is supremely happy. The doctor then pronounces the words "all right," which instantly restores the sick man to sense and health, enabling him thereafter to enjoy full meals of victuals without let or hinderance. The paper was listened to with profound interest by the members present, was discussed, and will be duly published in the printed proceedings of the Academy. If we were owners of a popular steamship line, our first business would be to negotiate with the author to take the chaplaincy of our best boat. One thousand dollars a trip would be nothing for the services of such a man.

We have heretofore heard of advantages claimed to arise from preaching and the laying on of hands; but this, we believe, is the first example of the practical application of the system to seasick passengers on board of Atlantic steamers.

THE ADIRONDACK WILDERNESS.

The need of saving the woodlands of the Adirondack wilderness, out of which flow the Hudson River and other streams of great commercial, manufacturing and sanitary value to the State, has long been recognized by observing and thoughtful citizens. The outer and more accessible portions of the original forest region have long been stripped of their timber, and vast areas of little use for agriculture have thus been made treeless and barren. So long as the forests of Maine and Michigan and other wooded regions in the North and West were able to supply timber at a less cost for transportation to market, the remaining Adirondack forests were practically protected from the inroads of lumbermen. That protection they are rapidly losing: and quite recently vast tracts of heavily wooded lands in that region have passed into the hands of timber cutters.

There is no question that the general clearing of the Adirondack region of its protecting forests would produce effects of the most disastrous character to the valleys of the streams flowing therefrom: effects like those which, during the past few months, have brought death and desolation to so many European river valleys. The rainfall of the Adirondack region is great; the drainage slopes steep; and without the controlling and restraining influence of the existing swamps and forests about their sources, the rivers which drain this northern wilderness would show only great and sudden alternations of flooded and empty channels, destructive at once to the agriculture of their valleys, to the manufacturing interests which cluster along their banks, and to the commerce of the Hudson, the channel of which has already been seriously obstructed by the detritus washed in from unprotected hill slopes and other spaces stripped of their original forests.

It is gratifying to note that the State Legislature, or rather the Senate, has taken ground against the further invasion of the Adirondack forests, at least for that part of the region under State control; and it is much to be hoped that the Assembly will do as well. Senator Frederick Lansing's bill, forbidding the sale of 660,000 acres owned by the State in the Adirondack region, was passed by a vote of 24 to 5, January 23. It is a good indication of increasing public appreciation of the need of preserving the wooded character of that part of the State. The timber there, if cut at all, should be cut only under rigid control, and with the most careful provisions for immediate rewooding of the cleared ground.

THE STARLIT SKY IN FEBRUARY.

If, facing the south, we raise our eyes to the starry heavens at nine o'clock on the 11th of February, we cannot fail to see on the meridian a very brilliant star, intensely white, with a sapphire tinge. It is Sirius, the leader of the host of heaven, a glorious object, far exceeding our sun in size and splendor. It is the leading brilliant in Canis Major, and, though classed as a star of the first magnitude, gives four times as much light as any other star visible in our latitude. It would be natural to infer that this star is nearer to us than its companions. Such is not the case. Several smaller stars are nearer to us than the brilliant orb that holds a place in the heavens at a distance of at least a million times our distance from the sun.

It is so far away that light is twelve years in spanning the distance. The flashing light that now comes from the star is twelve years old, and if it were this night blotted from the sky, it would continue to shine there for twelve years to come. Its dimensions have been approximately measured, and it is found to be a magnificent sun, at least two hundred times as large as our sun. Inequalities in its motion were long observed, and were attributed to the attraction of a companion. But no one succeeded in detecting the disturbing element until 1862, when the son of Mr. Alvan Clark, the famous telescope maker, in testing a powerful new instrument, turned it upon Sirius, and beheld a tiny point near the star that proved to be the long looked for companion. Sirius belongs to the highest order of stars, known as white stars. Its color has changed, for Seneca describes it as ruddier than Mars, and Ptolemy classes it with Antares. It has been seen with the naked eye in broad sunshine, and it is brilliant enough to cast a shadow.

Taking Sirius for a starting point, we will explore some of the leading stars and constellations in the vicinity. Northwest of Sirius, and an hour past the meridian, is the finest constellation in the heavens, the superb Orion. Its outlines are easily traced: an elongated parallelogram of four bright stars, a row of three stars in the center, and an oblique row running from the central band form the framework. The poetic imagination of the Greeks surrounded and interwove with this starry framework the giant stature and majestic proportions of Orion, the mighty hunter, brandishing a club in his right hand, and holding in his left a lion's skin for a shield. Betelguese and Bellatrix, the two upper stars of the parallelogram, shine brightly on his shoulders; Rigel and Saiph, the two lower ones, sparkle on his left foot and right knee. The three stars in the center form his belt, and the oblique stars mark his glittering sword. So striking are the outlines of this constellation, that when it has once been traced, it can never be forgotten. Not only does it take the lead for its exceeding beauty, but it is equally noteworthy for the telescopic interest attached to it and for the number and richness of its astronomical curiosities.

Orion is visible all over the habitable world, for the center is midway between the poles of the heavens and directly over the equator. The three stars in the belt measure three degrees in width, and may thus serve as a measuring rod for computing the distance of the stars. This constellation contains the most famous nebula in the heavens, and it is visible to the naked eye. Around the central star in the Sword clusters a hazy cloud-speck. When a powerful telescope is turned upon it, a wondrous transformation takes place—the Great Nebula of Orion springs into existence. The cloudy patch becomes a huge monster, with open mouth and branching horns. Within the open mouth a trapezium of stars is revealed, while spiral forms of ghost-like indistinctness fill in the field of vision. Telescope and spectroscope have exhausted their powers in seeking to solve the mysterious formation of this wonder of the skies.

Eighty stars may be counted in Orion visible to the naked eye, while nearly two thousand are revealed in the telescope. Many of them are double, triple, and multiple stars, the components developing every contrasted color of the rainbow, and bearing witness to the inconceivable richness and profusion of creative Power that not only produces systems ruled by a single sun, but mingles with them other systems, where two, three, four, and even more suns revolve about each other in circuits that take thousands of years to complete.

If now we turn our eyes to a point in the sky 26 degrees northeast of Sirius, and about the same distance east of Betelguese, a bright red star will appear. It is Procyon, the leading brilliant in Canis Minor. It shows to skillful observers similar evidence of disturbance to that of Sirius. It is hoped that some of the great telescopes now being constructed will reveal in like manner the companion of Procyon. It will help to impress the relative position of Sirius, Betelguese, and Procyon on the memory to note that they form a large equilateral triangle.

Looking 23 degrees north of Procyon, two bright stars, 4° 30′ apart, may be seen. They are Castor and Pollux, twin stars in the constellation Gemini. The upper and brighter of the two is Castor, of the first magnitude. It is the most beautiful double star in the northern heavens. A telescope of moderate power will separate it into two stars of nearly equal magnitude—one a brilliant white, the other white tinged with green. Castor and Pollux, as well as Procyon, are on the meridian about an hour after Sirius, while Orion has passed the meridian an hour earlier, and is descending on the westward track.

Turning our eyes northwest of Orion, we behold two clusters in Taurus. One of them is the Pleiades, with six stars

visible to ordinary eyes, ten or twelve to observers gifted with exceptional visual power, and two hundred in the telescope. The other cluster is the Hyades, containing five stars so situated as to form the letter V. The bright red star on the left at the top of the letter is Aldebaran. The brilliant star scintillating low down in the north is Vega in the Lyre, and northwest of the Twins is the superb white star, Capella in Auriga.

We have thus given a bare outline of some of the principal stars and constellations that grace the sky about 9 o'clock on the 11th of February. We have drawn the picture for 9 o'clock. At an earlier hour in the evening observers will find the stars less advanced on their stately march over the celestial track. Observers at a later hour will find the grand procession farther toward the west, while new stars will take their places in the east. The same is true for different portions of the month. Before the 11th, Sirius will not reach the meridian until after 9 o'clock. After the 11th, he will have passed it. The stars rise and set—excepting those around the pole that are always above the horizon—four minutes earlier every night, because the earth advances in her orbit round the sun a space equal in distance to that time. But the heavens present the same picture whenever the same season returns. The February sky of 1884 will repeat that of 1883.

The stars, as we look at them, seem as fixed and unchangeable as the vast vault in which they shine. In reality, they are in a condition of ceaseless commotion. Some are moving toward, others are receding from us. Sirius is receding from us at the rate of twenty-two miles a second, Betelguese at the same rate, and Castor is receding twenty-five miles a second. Vega is approaching with the tremendous velocity of fifty miles a second, and Pollux at the rate of forty-nine miles a second. These stars are at such an immense distance that the motion will not be apparent for many centuries, but in the progress of ages a change must occur. The receding stars will diminish, the approaching ones increase in brightness. The present configuration of the stars will be broken up, Orion will be transformed, Sirius will pale in luster, Castor and Pollux will separate, and Vega will shine with a superb brilliancy that will perhaps entitle her to a higher rank than Sirius now holds.

Staid and serene as the stars appear, the picture is never monotonous, never the same for two nights in succession. The planets give an ever changing element to the scene. Jupiter is now wandering high in the north, grandly posed for observation; Saturn shines with paling luster in the region near the Pleiades and Aldebaran; Venus holds her state as harbinger of the sun and sky; Mercury may be seen in the morning sky at the close of the month. The moon moves eastward in her course, and the ghost-like shadow of the great comet of 1882, speeding its way south of the glowing Sirius, harmlessly recedes to parts unknown.

Something new may always be hoped for, to give excitement to the celestial outlook. Comets may at any time enliven the scene with their fantastic and shadowy presence, meteors may flame across the sky and dissolve in trailing robes of silvery light, the aurora may raise its flaming banners in the northern heavens, a variable star may blaze forth into sudden brilliancy, a bright star may fade into invisibility, and new asteroids may be added to the system. It is not impossible that some clear-eyed observer may discern an intra-Mercurial planet in transit over the sun, or discover an ultra-Neptunian planet in the region that is being searched with that end in view.

Some of these events may occur within the boundaries of the present month. At least, there will be beauty and variety enough under any conditions to increase the knowledge, widen the sphere, and add to the enjoyment of every lover of the stars.

Adulteration of Aniline Colors.

BY FRIEDRICH EHRLICH.

The high price of the aniline dyes has unfortunately induced many persons that deal in them to attempt their adulteration. It is not, as may be supposed, the manufacturers that are reponsible for the adulterations, but single dealers, who weaken and dilute their wares in various ways, and by different manipulations, so as to make larger profits.

As long as aniline colors were sold in liquid form it was very convenient for the adulterators, for then the analysis was still more difficult and many intentional impurities could not be detected at all.

Now they find their labors much increased, for the aniline dyes are sold only in crystals, and hence adulterations are more easily detected. In some cases it is accomplished by interrupting the crystallization and mixing in foreign substances, then evaporating the mixture, and grinding when dry. But this can only be done in case of such dyes as the public are accustomed to purchase in powder. For other dyes, like fuchsine, other means of deception must be employed.

The principal substances used to adulterate aniline colors are sugar, starch, Glauber's salt, oxide of tin, and sulphate of magnesia, but dextrine plays the most important part. The last named is a favorite article with all kinds of adulterators, nor has it been passed over unnoticed by dishonest aniline dealers. We may say that the greater part of all the dextrine made is used for deception in various articles, and that only the smaller part finds use in stiffening cotton fabrics, imparting to them a stiffness they would not otherwise possess.

The frequent use of starch gum (dextrine) for adulterating dye stuffs, especially logwood extracts, is due in part to its cheapness and in part to its indifference to colors, the beauty of which is not affected by it, and by its solubility in water, so that it escapes observation in dyeing and printing.

The only means we have to protect ourselves against this fraud is more care in examining the dye before purchasing. It would not be in place here to enter into a full description of the chemical analysis, so we pass over the scientific tests and mention the methods which do not require any special skill nor the use of costly apparatus.

Besides the scientific examination of dyes for their purity, of course only one other way remains of forming a judgment as to their quality, and that is the practical estimation of their value by comparison of the colors produced. Before undertaking these time consuming experiments, it is well to obtain an approximate idea of the object in question, which is best gained by studying the substances used for adulterating the different dyes.

We pass over the details given by the author on these points, as they are to be found in the ordinary text books, and pass next to an excellent recommendation of the author, which applies quite as well to other goods, drugs, spices, medicines, and even food, namely, to purchase only from houses of known reputation, and not to be misled by lower prices, and induced to buy from irresponsible or unknown firms.

Another Important Telephone Decision.

The long litigation between the Bell Telephone Company and the Dolbear Telephone Company came to an end in the Circuit Court, at Boston, January 24, victory resting with the former. In his decision Judge Gray held:

That Mr. Bell was the first inventor who successfully used the electric current for the transmission of articulate sound. The differences of Dolbear's and Bell's plans are not such as to warrant the former to claim an invention of the entire system. The essence of Bell's invention consists not merely in the form of apparatus which he uses, but in the general process, or method, of which that apparatus is the embodiment. Notwithstanding the distinct difference claimed by the Dolbear receiver, they avail themselves of Mr. Bell's discovery that undulatory vibrations of electricity can intelligently and accurately transmit articulate speech, as well as of the process which Bell invented and by which he reduced his discovery to practical use. They also copy the mode and apparatus by which he creates and transmits the undulatory electrical vibrations corresponding to those of the air. And in the plate charged with electricity, which they have substituted for the magnetic coil in the receiver, the charge constantly varies in accordance with the principle which Mr. Bell discovered, and by means of the undulating current caused by the process and in the mode which he invented and patented. The defendants have therefore infringed on Bell's patent by using his general process or method, and should be restrained by injunction from continuing to do so.

Societies for the Promotion of Thrift.

One of the notable features of Pennsylvania industrial life is the great development of societies for securing to workmen, from their individual savings, comfortable homes of their own. The lead in this useful movement was naturally taken by Philadelphia, which now has about three hundred and fifty building and loan associations, with an aggregate paid up capital of nineteen or twenty million of dollars. In other manufacturing towns of the State are nearly half as many more associations, with a proportional amount of accumulated property.

These facts have been compiled by the Philadelphia *Ledger* from the State Auditor-General's report of corporations paying taxes on capital stock. Fully ninety per cent of the thirty million dollars forming the aggregate capital stock of these associations, it appears, has been lent to members, and is composed not merely of the savings of thrifty people, but savings devoted at once to the material improvement and development of cities, towns, and villages, increasing the tax value of real estate and providing the people with comfortable homes.

Touching a proposition to exempt from taxation the capital stock of societies of this sort, the *Ledger* justly says that the thrift that produces such a grand total of savings, and that at once puts the savings into property that is of itself already taxed as such, is certainly deserving of such encouragement from the Commonwealth as would arise from exemption from other taxation for State purposes, especially at a time when the revenues arising from such taxation are not needed.

Following the lead of Philadelphia in the development of these commendable associations, are Pittsburg and Allegheny, which have together fifty-eight societies; Reading has eight; York, sixteen; Erie, five; and there are nearly two hundred other societies scattered throughout the State. All the busy smaller places in the State, such as Chester, Altoona, Pottsville, McKeesport, Williamsport, Easton, Allentown, Bethlehem, Wilkesbarre, Scranton, and Phœnixville are down in list. The centers of productive toil are also the centers of activity in building society work. They are the working people, indeed, who are the mainstay of these co-operative saving societies. A glance down the list of Philadelphia societies, printed in the *Ledger*, will illustrate this. Many of the societies have merely fanciful or other meaningless names, but some are named for great industrial works, occupations, or employers, that indicate to one acquainted with the subject the origin and chief membership of the societies. The Art Workers, Artisans, Carpet and Hosiery, Disston, *Ledger*, Lumbermen's, Pequa (Pequa Mills), Tradesmen's, Wood and Iron Workers, Willimantic, are all names for societies that originated from the business callings or associations of the original members. The names are interesting from another standpoint. The list shows that the thrifty Germans have adopted building societies as a most practicable means of securing their savings. The number of societies with German names is noteworthy, as is also the number with the names of Catholic churches, indicating their origin among the congregations of the churches whose names they have assumed.

Importation of Adulterated and Spoiled Teas.

The House Committee of Ways and Means reported favorably, January 23, a bill prohibiting the importation of teas adulterated.

This prohibits the importation of teas adulterated with spurious leaf or with exhausted leaves, or containing chemicals or other deleterious substances making them unfit for use. All tea imported is to be examined, and if it is found to come within the prohibitions of the act, the importer or consignee must give bond to export it within six months. In case of failure to do this, the collector must cause the tea to be destroyed. The the term "exhausted" is defined to include any tea which has been deprived of its proper strength by steeping, infusion, etc. This provision is intended to exclude teas that have been once used and then manipulated to be sold again.

This decision of the committee was materially influenced by a statement made by Mr. J. R. Davies, who has been for many years in the tea trade. Mr. Davies exhibited samples of worthless and adulterated teas which had been put upon the New York market, "teas" which had sold elsewhere from 4 to 8½ cents a pound. The enactment of a law in England prohibiting the importation of all adulterated teas, including all tea whose chemical properties are injurious to health, has had the defect to divert an immense quantity of these teas to the American market. In 1881 over 44,000 packages were forbidden entry into England and were exported, part of them coming to this country. Such importations should be stopped at the custom house or destroyed, as is done in England.

George M. Beard.

Dr. George Miller Beard of this city died of pleuro-pneumonia Jan. 23, at the comparatively early age of forty-three years. At the beginning of his practice he gave much attention to the use of electricity in the treatment of disease, and was throughout his busy life an untiring writer upon that and kindred subjects. The treatment of nervous troubles led him to pay especial attention to the relations of mind and body, particularly in those aberrant manifestations of mind shown in trances, delusions, obscure nervous diseases, mind readings so called and the like His studies of the conditions affecting the value of human testimony are suggestive and in many instances highly valuable. Had he been able to make proper allowance for the influence of his own intense personal character in determining his judgment, there would have been less occasion to doubt the correctness of his conclusions. One of his last utterances gives a key to the investigating and recording spirit which ruled his life. Almost with his last breath he said: "I wish it were possible for me to record for the sake of science the thoughts of a dying man. This final battle that I am going through with would be interesting."

Edward H. Knight, LL.D.

Edward H. Knight, the accomplished writer on mechanics and kindred subjects, and author of "Knight's American Mechanical Dictionary," died at his home at Bellefontaine, Ohio, Jan. 21. Mr. Knight was a valued contributor to the SCIENTIFIC AMERICAN, and was formerly connected with our branch office in Washington. He was one of the United States Commissioners to the Paris Universal Exposition, and in 1878 was decorated with the order of the Legion of Honor at Paris.

The First Comet of 1883.

Mr. W. L. Burton, second officer of the steamship City of Savannah, reports the discovery of a comet at two o'clock of the morning of January 12. The ship was on the way from this city to Savannah, and about 25 miles southwest of Cape Lookout. The position of the comet is indefinitely described as "southeast of Orion." The supposed comet, faintly visible by the naked eye, was observed the same evening as early as nine o'clock, the ship being in the river below Savannah.

The Floods in Europe.

A dispatch from the Imperial German Foreign Office at Berlin to the German Consul at Boston states that through the inundations last autumn 20,000 houses, 130,000 persons, and 150,000 acres of land and property have suffered damage in Prussia alone, and the damage by the December floods has been nearly as great. In the Bayrische Rheinplatz 1,000 houses were swept away and 12,000 persons rendered homeless. Hessen and other districts along the rivers suffered the same calamity.

The floods in Austria, Italy, and other parts of Europe were quite as disastrous as those of Prussia.

TAYLOR MANUFACTURING CO.'S PATENT SAW MILL.

(*Continued from first page.*)

ning in self-oiling boxes, and carrying heavy 8-inch wheels or rollers, which run on continuous T-rails. The extensions on each end of the carriage, which are 8 feet long in this size mill, are so arranged that they cannot spring out of gear, thus preventing stripping the feed pinion, and also allowing the sawing of lumber eight feet longer than the carriage. This is very convenient for backing the carriage to receive the log. It is an improvement that any one familiar with saw mills will appreciate. (See Fig. 3, page 259, vol. xlvii., SCI. AM.)

The log beam is moved by a lever with a simple ratchet arrangement for moving elbows of head blocks, or, as shown in cut, by crank wheel. The advantage of the crank wheel over lever is that no motion is lost, and that the log beam recedes continuously or goes forward, as is desired, is rapid, and easily handled. The gauge roller is a simple and ingenious device recently patented, and is so constructed that all wear or lost motion is provided for, and can be set to saw a thirty-second full, or a thirty-second scant, if desired. By it the log is pressed against the log beam, and as the carriage moves up to the saw, the log passing between the gauge roller and beam, it will be seen that lumber must be sawed true. By this mode of holding the log at the end next to the saw no dogging is required, the dog at the rear end being the only one necessary to hold the log to its place. We are informed that this gauge roller can easily be applied to other mills if desired.

The frame of this mill is very heavy, and is made in girder style, and so arranged as to set the carriage on either the right or left hand of the saw frame; the feed is a friction feed, with face 7 inches in width; feed belt is also wide, carrying a 5-inch belt. The main mandrel is made long (9 feet), so as to use the drive pulley on the outside of frame. It is of the best hammered steel, 3½ inches in diameter, and runs in three adjustable bearings, each 12 inches in width. The frame is made to take a saw up to 72 inches in diameter. The top frame is made very stiff and heavy with adjustments, by which the top saw can be lined to suit the bottom saw. It carries a saw up to 36 inches. It has an adjustable belt tightener to drive top saw when desired, and can be used while the machinery is running. This mill, with 48 feet of carriage, one dogging block, and four log beam blocks, weighs 12,000 pounds.

The company manufacture four smaller size mills—Nos. 2, 3, 4, and 5. Nos. 3. 4, and 5 mills have no top saw. Their No. 5 Plantation saw mill was illustrated in the SCIENTIFIC AMERICAN of December 16, 1882. This company also build cut-off stationary engines of various styles, from 12 to 250 horse power; also dry steam portable engines, from 8 to 40 horse power; and vertical engines, from 5 to 10 horse power.

For further particulars address Taylor Manufacturing Company, Chambersburg, Pa.

Weak Electric Currents.

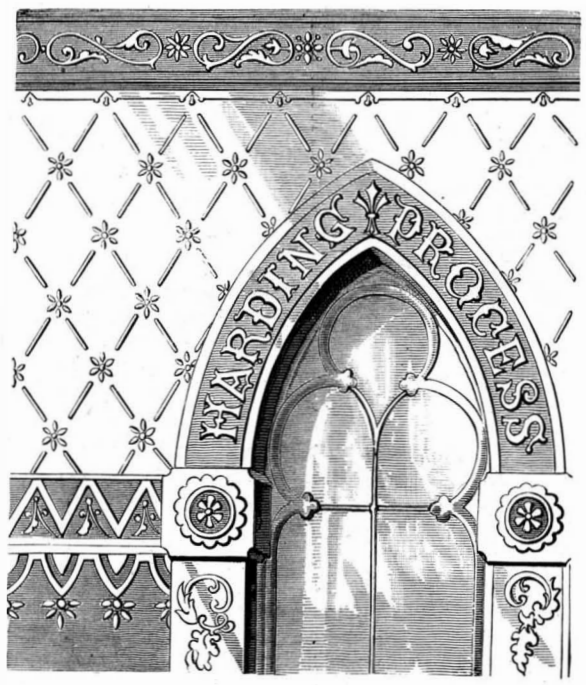
Dr. Hertz lately described and exhibited before the Physical Society, Berlin, an apparatus he had constructed for demonstration of such weak electric currents as change their direction very often, several thousand times in a second. He called attention to the defects of the electro-dynamometers previously employed for the purpose, and showed that the electric heat effect could most fitly be used in this case. The new dynamometer consists of an extremely thin horizontally stretched silver wire, the extension of which by heat, produced by the alternating currents, is observed. To this end the wire is, at its middle, wound round a vertical cylinder of steel capable of rotation about its axis, by turning of which the wire is stretched. Each extension of the wire through electric heating turns the cylinder the opposite way to this torsion, and its rotation is observed by means of a mirror and telescope. This dynamometer, as Herr Hertz showed, is only applicable when the currents are weak, and the current reversals are very frequent; that is, precisely in cases where other measuring instruments fail.

An Enormous Tumor.

A recent number of the *Medical Record* contains engravings from photographs of a woman who was afflicted with a tumor weighing eighty pounds. It was attached to the abdomen, and the picture shows the patient in a sitting posture, holding in her arms and on her knees a large bundle, which formed her undesirable appendage. After much entreaty from the poor woman that an operation for her relief might be tried, the surgeons of the Cincinnati Hospital finally consented; and Dr. N. P. Dandridge performed the hazardous work with great skill, being assisted by Dr. E. W. Walker and the hospital staff, in the presence of the medical class and a large number of neighboring physicians But the shock to the patient was very profound, and her inherent strength not sufficient. She survived a week after the operation. This was a subcutaneous fatty tumor, one of the largest ever known. It was 35 inches long and 67½ inches in greatest diameter—nearly as large as a barrel of flour.

THE HARDING PROCESS OF EMBOSSING ON WALLS.

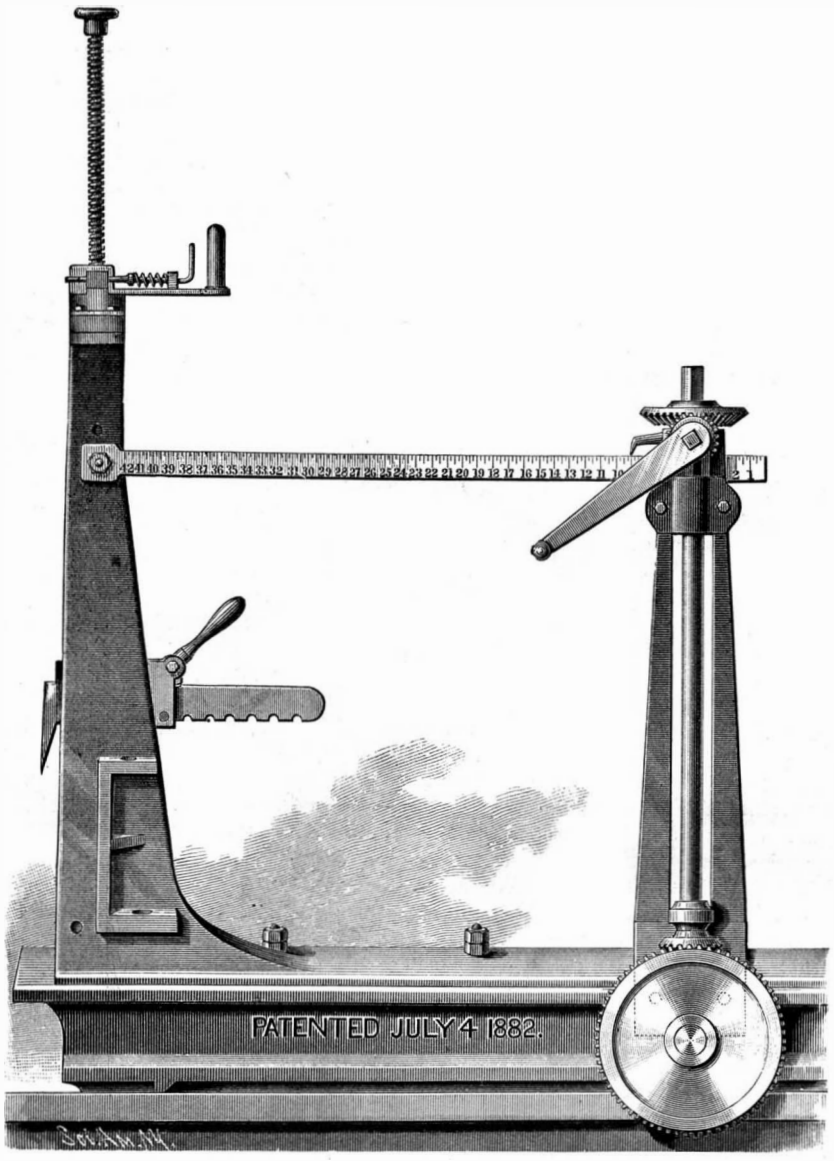
The number of house owners able to decorate their dwellings with mural carvings is few compared with those who are able to appreciate such home adornments and would be glad to have them. In this, as in many other instances,



THE HARDING PROCESS OF EMBOSSING ON WALLS.

popular taste has run ahead of the capacity of the average purse to buy. Accordingly, the invention of means by which genuine artistic effects in raised figures can be produced cheaply, almost mechanically, yet allowing the utmost freedom of choice or individuality in design, finds a numerous public ready to welcome it.

The new process of mural decoration, illustrated in the cut, is as simple as it is admirable in its effects. The designs, which may be varied unlimitedly to express the taste or fancy or purpose of the occupant of the apartments to be decorated, are drawn upon suitable material and cut into stencils. The plastic substance to form the raised figures is applied to the wall through the openings of the stencil, the thickness of the stencil material determining the height of the figures. By laying one stencil over another, any details of the figures may be raised to any height desired. The figures are thus part of the solid wall, at once relieving its dead flatness and furnishing an admirable foundation for color effects. Most beautiful results can be arrived at by artistic manipulation. The great advantage of this process over moulding or stamping lies partly in the low relief of the ornaments and in their applicability to old as well as new walls, without the aid of glue or paste to hold them in place (thus obviating decomposition in presence of damp and making it one of the healthiest decorations), but more to the circumstance that the freest expression of individual invention and preference may be enjoyed without adding to the cost of the work. Any plastic material may be used, and applied to curved as well as flat surfaces. Specimens of this work are exhibited at Caryl Coleman's art rooms, 821 Broadway, New York city. The inventor is Mr. J. H. Harding, Milwaukee, Wis.



HEAD BLOCK.—TAYLOR MANUFACTURING CO.'S SAW MILL.

Supreme Court Decisions.—The Clough Gas Burners.

Among the patent cases recently decided by the United States Supreme Court are two between Theodore Clough and the Gilbert & Baker Manufacturing Company. The first was a suit brought by Clough against the manufacturing company for infringement of his patent upon an improved gas burner. The claims of the Clough patent were sustained, and the decree of the lower court reversed. The second suit was brought by the Gilbert & Baker Manufacturing Company against Clough for alleged infringement of a patent on improvements in gas burners granted to John P. Baker, July 26, 1870.

The court held that while the Baker patent covered new, useful, and patentable modifications, it yet clearly infringed the claims of letters patent granted to Theodore Clough, July 26, 1870. Both opinions were by Justice Blatchford.

Preparation of Spongy Tin.

Tin precipitated from its salts by means of zinc is chiefly employed in making silver paper and printing textiles. It ought to be very light, of a bright gray color, and cover well like white lead. The following process for making a preparation having all these properties is described by C. Puscher in *Kunst und Gewerbe*:

Dissolve one part of tin salt in 400 parts of water acidified with hydrochloric acid. A rod of zinc is put in this solution and the precipitated tin, most of which floats on the surface, is carefully collected on a sieve without pressing, washed with water, and dried by warming. The tin sponge thus obtained can be readily pulverized in a mortar with water, and floated on a hair sieve without acquiring a metallic luster. After triturating well with starch paste it is ready for use in making silver paper, or in printing textiles. The small quantity of tin sponge that remains on the sieve is dissolved in a mixture of equal parts of water and hydrochloric acid, and used to mix with the next solution of tin salt instead of acid. The same liquid can be used from ten to thirteen times in making tin sponge by repeated additions of tin salt. The zinc chloride thus accumulated can be concentrated by evaporation, and used in soldering or in cleaning iron ware that is to be tinned.

Instead of using it as above, the tin sponge can be dried and ground to a fine gray powder and employed as an efficient and economical means of tinning all other metals except lead. For this purpose the tin powder is rubbed up into a paste with a hot saturated solution of sal ammoniac, and the metal to be tinned is painted with it. This is repeated according to the amount of tin it is desired to deposit on it, after which it is heated over a spirit lamp or a Bunsen burner. The tinning is effected in about one minute; it is only necessary now to wash the article and polish it with chalk to give it a good polish. This process can also be used to mend spots that have been formed on tinned articles, or to make white drawings on other metals.

If the spongy tin is mixed with 5 to 10 per cent of reduced antimony and 5 per cent of powdered sal ammoniac and a little water, the paste can be applied as before, and produces a still whiter and harder coating of Britannia metal.

Reduced antimony is obtained as a black powder by dipping a rod of zinc into a solution containing equal parts of antimonic chloride and water, to which, however, enough hydrochloric acid is added to dissolve the white precipitate first formed. The black precipitated antimony is collected on a filter, well washed with water, and then dried.

The spongy tin above described is sold in Germany, says our informant, at five marks per kilogramme, which is about 57 cents per pound.

AN international exhibition will be opened in Calcutta next December, and will close on February 29, 1884.

IRON SHUTTER.

Iron shutters are an excellent protection to buildings against fire from adjoining buildings; but on account of the difficulty experienced in opening such shutters from the outside in case of fire, they have been generally condemned.

The engraving shows an improved iron shutter that can be readily opened from the outside, and at the same time more easily operated from the inside than the usual hinged shutters.

The shutters are of ordinary construction, made of two thicknesses of sheet iron, with a space between that may be filled with a non-conductor of heat, if desired. They rest and move upon a crossbar or track of steel, attached at its ends to the wall of the building. The ends of the bar are slotted, and enter loosely through the slotted castings that are attached to the wall. On the bolts and within the slots of the bar are eccentrics, by which the bar is clamped to the castings. This construction allows the bar to expand from the heat without springing, which might prevent the free working of the shutters. The object of the eccentric is to allow adjustment of the shutters if the wall settles or the shutters work too closely to the window sill. The outer end of the bolt is formed square to receive a wrench for the adjustment of the eccentric, and this square end is usually covered by a hollow washer.

The supporting bar passes between the two sides of each shutter, and through an iron box or casing that is fitted within the shutter. This casing, which is held in place by crossbolts, contains sheaves that are grooved, and roll on the supporting bar.

The shutters are made with their inner edges rabbeted to lap one upon the other, and the supporting bar is provided with a central pin, to prevent each shutter from passing beyond the center. The shutters are also provided with small handles both upon the inside and outside, for convenience in opening and closing them.

The advantages of shutters applied in this manner are as follows: They can be readily opened from the outside of the building in case of fire or otherwise, no fastenings being used, none being required. They can be opened from the inside with perfect ease and safety, even in high winds. The shutters may be applied to either the inside or the outside of the window. They are free to expand in case of fire without preventing their easy operation. They can be closed entirely or partly, as desired, in order to admit more or less light. They are safe in time of storm, cannot become loose or be blown down, and they may be applied to either new or old buildings.

Fig. 1 shows the manner of applying the shutter to a building. Fig. 2 is a detail view of the end support of the bar, and Fig. 3 is a section through the same.

This invention has been patented by Mr. Newman A. Foss, of Gold Run, Montana Ter.

IMPROVED COTTON PLANTER.

A machine capable of planting cotton seed or corn and distributing a fertilizer at the same time is shown in the engraving. While this machine is small, compact, and simple, it is very efficient, doing with one horse and one man the work usually requiring four horses and six men. It is in use by many of the prominent planters in the South, giving great satisfaction.

In this machine a narrow frame of wood rests on the axle, supported at its center in a single truck wheel. Thills are attached to the frame at the front end, drawing and supporting the machine. There are handles at the rear end, by which to guide and control the machine. Near the front is a crossbar arranged in bearings so as to oscillate, and projecting considerably beyond the frame on each side, and carrying the plows for opening the furrows.

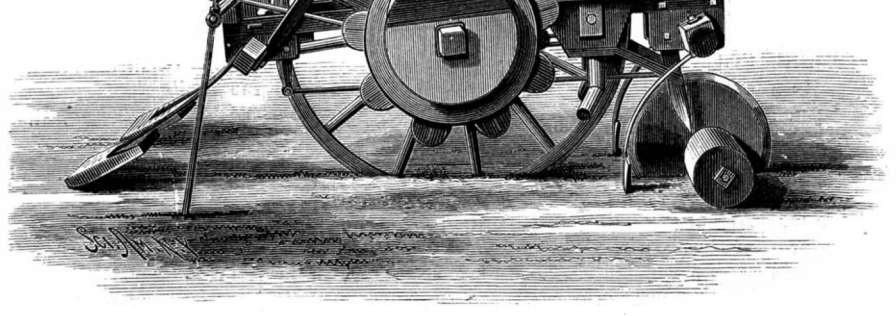
The crossbar is connected by an arm and rod with a shifting lever at the rear of the frame, by which the plows may be swung up or down to regulate their height from the ground. A ratchet bar holds the plows as required. Behind the plows are the guano hoppers, supported on iron rods adjustable toward or from the frame. Vertical slides in the hoppers rise up and carry the fertilizer down to discharge below, the slides being pushed down by tappets on the seed-dropping wheels, and they are forced up by a spring.

The seed-dropping drums are hollow sheet metal cases mounted on the projections of the main shaft. Near the periphery the sides converge for a short distance, and in the periphery are large openings as far apart as the required distance between the droppings.

Behind the seed-dropping wheels are suspended the covering scrapers from a crossbar, to drag along the ridges turned up by the plows and scrape back the earth into the furrows. They are notched or grooved in the front and under sides for facilitating the gathering of the earth into the furrows. They are also adjustable along the crossbar, and they are raised or lowered by a hand lever.

The plows and the scrapers do not extend so low as the bottom of the truck wheel, because they are to act on the ridges, while the wheel runs in the hollow between them; and the dropping wheels do not extend as low as the plows and scrapers because they are not required to touch the ground at all. On the contrary, they are kept above it to prevent the discharge holes of the pockets from being clogged by the earth. They will not be clogged by the seed because their shape is such that all the seed will fall out into the space below as soon as they rise high enough, so as to completely clear each discharge at every revolution of the wheel.

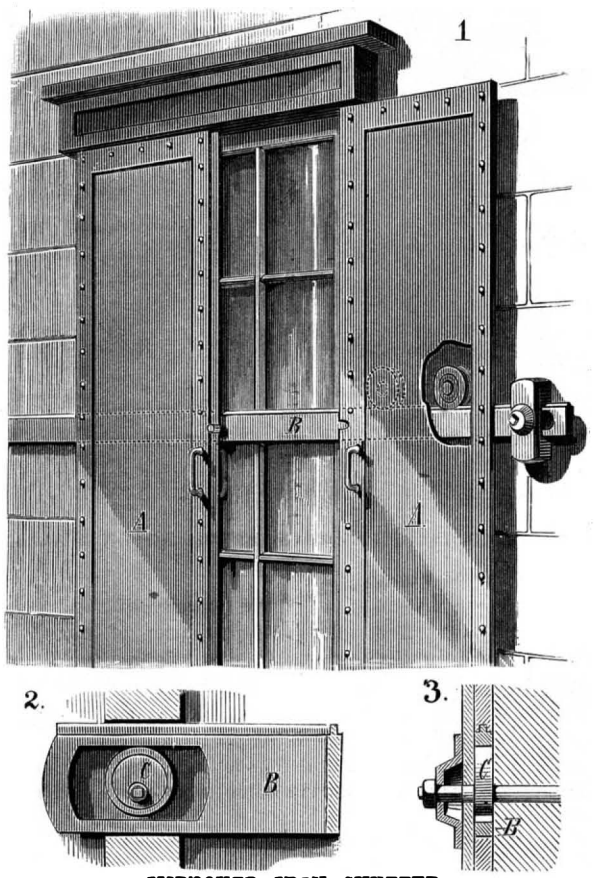
The relative arrangement of the guano-droppers and the seed-droppers is such that the seed and the guano will be dropped together. A great economy of labor will be effected by the use of this machine, which combines eight separate and special machines in one, requiring only one horse or mule and one attendant. This invention has been patented by Mr. George Paterson, of Waynesborough, Ga.



PATERSON'S COTTON PLANTER.

McAdam Roads.

John Loudon McAdam, according to his own account, came to Scotland from America in 1783, when the Scotch



IMPROVED IRON SHUTTER.

Turnpike Acts had been about twenty years in operation and roads were still being made everywhere. He got appointed a Commissioner of Roads, and afterward removed to Bristol, where he obtained a similar post and was made a magistrate. Gifted with a mania on the subject, he began about 1794 to travel over the country at his own cost; and these labors he continued from Inverness to the Land's End for six-and-twenty years, apparently to search for a well made road.

McAdam's plan of road making differed as much from the old way which he found in operation as a bridge does from a ford. Instead of going deep for a "bottoming," he worked solely on the top. Instead of producing a peaked, roof-like mass of rough, soft rubbish, he got a flat, smooth, and solid surface. In lieu of a road four feet and a half through, he made one of at most ten inches in thickness; and for rocks and bowlders he substituted stone broken small. His leading principle was that a road ought to be considered as an artificial flooring, so strong and even as to let the heaviest vehicle pass over it without impediment. Then people began to hear with wonder of roads thirty and forty feet wide rising only three inches in the center, and he propounded the extraordinary heresy that a better and more lasting road could be made over the naked surface of a morass than over solid rock. Another of his easy first principles was that the native soil was more resistant when dry than when wet, and that, as in reality it had to carry not alone the traffic but the road also, it ought to be kept in a condition of the greatest resistance; that the best way of keeping it dry was to put over it a covering impervious to rain—the road, in fact; and that the thickness of this covering was to be regulated solely in relation to its imperviousness, and not at all as to its bearing of weights, to which the native soil was quite equal. Instead of digging a trench, therefore, to do away with the surface of the native soil, he carefully respected it, and raised his road sufficiently above it to let the water run off. Impermeability he obtained by the practical discovery that stones broken small and shaken and pressed together, as by the traffic on a road, rapidly settled down face to face and angle to angle, and made as close a mass as a wall. Mankind in general now believe that this last is all that McAdam invented: the rest is forgotten. That important fraction of his discoveries is what has given to us the verb *to macadamize* ("To pave a road with small broken stones."—Skeat), and to the French their nouns *macadam* ("Nom d'un pavage inventé par un Anglais."—Littré), *macadamisage*, and the verb *macadamiser*. If a man is knocked down by an omnibus in the middle of the boulevard, a Parisian bystander will nowadays say: "Je l'ai vu tomber sur le macadam."

Surprise followed surprise. Roads which were mere layers of broken stone, six, four, and even as little as three inches in thickness, passed through the worst winters without breaking up, while, as the coachman used to say, they "ran true; the wheel ran hard upon them, it ran upon the nail." Commissioners could not believe their eyes when they saw new roads made for much less than it had cost them yearly to repair their old ones. When an old road was given into McAdam's charge, he often made a new one of it for £88 a mile, while round London the cost of annual repairs had been £470 a mile. For he knew that the roads—such had been the ignorant waste—generally contained materials enough for their use for several years if properly applied. Unless the road was hopeless, he went to work in a practical, cheap way; first cutting off the "gridiron" of ruts in the center "to a level with the bottom of the furrows," then "picking" the road up to a depth of four inches, removing all the chalk, clay, or mud, breaking the large stones small, and simply putting them back again, and one of his directions to his workmen was that "nothing is to be laid on the clean stone on pretence of binding." But too often the road was so bad, as at Egham, that it had to be removed to its foundations.

For the repairs of his roads, when once made, he always chose wet weather, and "loosened the hardened surface with a pick" before putting on the fresh broken stone: things familiar enough to us now, but paradoxes then to all the confraternities of the roads. In this way he had the greatest success with the freestone near Bath, and on a road out of Bristol toward Old Down, where everybody had always said a good road never would be made with the materials available. This impossible road of eleven miles, which the Postmaster-General, as a last resource, was about to indict, he perfected in two months, in 1816, for £55 a mile. Indeed, as to materials, they were to some extent a matter of indifference to him, provided they were stones, and stones only. Flint (Essex and Sussex), he said, made an excellent road, if only broken properly small; limestone (Wilts, Somerset, and Gloucester) consolidates soonest of all, but is not the most lasting; the pebbles of Shropshire and Staffordshire were also good, and the beach pebbles of Essex, Kent, and Sussex were some of the best materials in the kingdom; but the whinstone or granite of the north and of Scotland he pronounced the most durable.

Even in the breaking of stones McAdam made a revolution. He saw that able-bodied men standing up with heavy hammers wasted the greater portion of their strength. He made his stone-breakers sit, so that all the force of the blows took direct effect on the stone; and the result was that he found small hammers did the work perfectly well, and thus was enabled to confine it to old men past hard labor, women, and boys, which reduced the cost of the broken stone by one-half. The size to which the stone should be broken he determined in a practical way by the area of contact of an ordinary wheel with a smooth road. This he found to be about an inch lengthwise, and therefore he laid it down that "a stone which exceeds an inch in any of its dimensions is mischievous," that is to say, that the wheel in pressing on one end of it tends to lift the other end out of the road. In practice he found it simplest to fix a weight of six ounces, and his surveyors carried about scales to test the largest stones in each heap. He would allow no large stones even for the foundation of his roads, for he found they constantly worked upward by the pressure and vibration of the traffic. The whole road was small broken stone, even over swampy ground.—*St. James's Gazette.*

The Manufacture of Milk Sugar.

It is reported that the manufacture of milk sugar has been begun by newly invented processes at an Ohio cheese factory. Hitherto the $100,000 worth of milk sugar used in this country in compounding medicines has been imported from Europe, mainly Switzerland, Germany, and France. It is to be hoped that the new industry will prove successful and applicable at least to all our large cheese factories. At present this element of milk is in large measure wasted.

NEW YORK ACADEMY OF SCIENCES.

At the regular meeting of the Academy, held in their rooms, No. 6 West 31st street, on Monday evening, January 21, Rev. E. P. Thwing read a paper on "Treatment of Seasickness by the Trance State." The speaker described his experiments, made on many different passengers during his frequent trips across the ocean and the English channel. In most cases he was able to put the sufferer into a trance without the use of "passes" or looking him directly in the eye. The usual method pursued was to approach the persons from behind, place his hands on their head and press gently on the temporal region, uttering a few commonplace words in an assuring tone. In one case, that of a Welshman who could not understand English, pantomime was employed. Persons of different ages and of both sexes were experimented upon. After being in the trance state for a few minutes they were recalled by the words "all right," or something similar, when the sickness was found to have disappeared, and the appetite at once restored. The writer had recently employed this trance state instead of anæsthetics where minor but painful surgical operations had to be performed. Three or four such cases were then described by Dr. Jarvis, who had performed the operations, and one of the patients was present. It was expected that Dr. Beard would also be present, but a sudden illness, which has since proved fatal, prevented his attendance. Dr. Newberry, president of the Academy, mentioned having witnessed similar cases of mesmeric anæsthesia some twenty-five years ago.

The second paper of the evening was entitled "Notes on the Botany, Geology, and Resources of Southern Texas and Chihuahua," by Professor J. S. Newberry. The speaker, who had just returned from a month's absence, during which he visited the region described, gave a very interesting account of what he saw. The Professor brought home with him a specimen of the *sotold*, a large and succulent kind of cactus used by the natives in making an alcoholic drink not unlike the pulke distilled by the Mexicans. In the arid plains naught but prickly vegetation is found, while in other places the *agave* or century plant abounds, and the tall stalks of these may be seen at a considerable distance.

The lecture was illustrated by a series of lantern views, and the exhibition of interesting and curious specimens.

On Monday, February 19, Professor A. R. Leeds will lecture on "Health Foods, Invalid Foods, and Infant Foods," at the same place.

Earthquakes and Pagodas.

A notable instance of the Japanese understanding of the conditions under which they exist, says a recent traveler in Japan, occurs in the manner of giving security to pagodas. Pagodas are often of great height, yet many have existed for seven hundred years, and have withstood successfully the many vibrations of the ground, which must have inevitably achieved their overthrow had they been erections of stone or brick. When he first ascended a pagoda, he was struck with the amount of timber employed in its construction, and could not help feeling that the material wasted was even absurdly excessive. But what offended his feelings most was the presence of an enormous log of wood in the center of the structure, which ascended from its base to its apex. At the top this mass of timber was nearly two feet in diameter, and lower down a log equally large was bolted to each of the four sides of this central mass. He adds:

"I was so surprised with this waste of timber that I called the attention of my good friend Sakata to the matter; and especially denounced the use of the center block. To my astonishment, he told me that the structure must be strong to support the vast central mass. In my ignorance I replied that the central part was not supported by the sides, but upon reaching the top I found this monstrous central mass suspended, like the clapper of a bell; and when I had descended I could, by lying on the ground, see that there was an inch of space intervening between it and the earth which formed the floor of the pagoda. The pagoda is to a Buddhist temple what a spire is to a Christian church; and by its clever construction it is enabled to retain its vertical position even during the continuance of earthquake shocks, for by the swinging of this vast pendulum the center of gravity is kept within the base. I now understood the reason for that lavish use of timber which I had so rashly pronounced to be useless; and I see that there is a method in Japanese construction which is worthy of high appreciation. In the absence of any other instance, the employment of this scientific method of keeping the pagoda upright shows how carefully the Japanese have thought out the requirements to be met."

A Train in a Sandstorm.

The Southern overland train which should have reached this city on Monday afternoon only arrived at 8:10 last night, having been delayed at Sumner by a terrific sandstorm that raged through the Mojave Desert and spread out over a portion of the surrounding country. The storm began in the early morning, and when the train reach Sumner, in Kern County, had become a regular simoom. The wind swept across the sandy wastes with such violence that the train swayed and rocked under the violence of the blasts, and seemed ready to plunge from the track. The moon had become overcast in the early part of the night, and the journey was continued in a darkness that rapidly increased until the day began in Stygian gloom. The passengers, who had been aroused from their sleep by the fierce assaults of the wind and the dashing of the sand against the windows of the train, looked anxiously for the appearance of the sun, but no gleam of light relieved the forbidding darkness of the east. Night maintained her sway, and the blackness of the heavens grew intense with the morning, until the strong head light of the locomotive almost failed to pierce it. The small portion of the desert which was exposed by the engine's lights only served to discourage the travelers. The track was lost under the billows of sand that were being tossed across the rails by the angry storm. The desert moved like a sea, and when the waves of sand struck the shivering sides of the train they scattered like spray and filled the air with a dust which made free breathing impossible.

The travelers' fears of being stopped by a sand drift were soon realized. After leaving Sumner, which is 314 miles from San Francisco, the train moved cautiously for 10 miles through the shifting waste and then stopped with a crash. The alarmed passengers hardly dared to face the driving storm to learn the cause of the unpleasant halt. The few intrepid persons who ventured into the blinding simoom found that their express train had run into a freight train which had stopped in an impassable sand drift. The slow rate at which the express was moving enabled the engineer to stop the train in time to prevent a serious accident, and the collision was only sufficient to cast the locomotive from the track. The passenger cars remained on the rails. It was then ten o'clock, so slowly had the express train proceeded through the blinding storm after leaving Sumner. The darkness of the night had only increased, and nothing was visible except within the focus of the train's lights. For five weary hours the passengers were compelled to remain on the detached train while relief was being obtained from Sumner. Assistance having arrived, the track was cleared of sand sufficiently to enable a relief engine to pull the express train back to Sumner, where the passengers found slim accommodation until the storm blew over. Toward five o'clock in the afternoon the darkness began to disappear, but the simoom maintained its vigor until nightfall. Yesterday morning the unfortunate passengers proceeded on their journey, the remainder of which was made without sensational incident, as gangs of Chinese had been at work all night and had cleared the track of the accumulated sand drift.—*San Francisco Examiner, Wednesday, January 3.*

The Ventilation of Churches.

The *Christian Weekly* publishes a very effective, though not strictly grammatical or scientific, appeal to the sexton for a better ventilation of the churches. We quote some of the lines:

. . . . . "O Sexton!
You shet 500 men women and children
Speshily the latter, up in a tite place,
Sum has bad breths, none of em aint too sweet,
Sum is fevery, sum is scroflus, sum has bad teeth
And sum haint none, and sum aint over clean;
But evry one of em breathes in and out and out and in
Say 50 times a minnet, or 1 million and a half breths an hour:
Now how long will a cherch full of are last at that rate?
I ask you; say fifteen minnets, and then what's to be did?

. . . . . "I put it to your konshens,
Are is the same to us as milk to babies,
Or water is to fish, or pendlums to clox,
Or roots and airbs unto an Injun doctor,
Or little pills unto an omepath,
Or Boize to gurls. Are is for us to brethe.
What signifies who preaches ef I cant brethe?
Whats Pol? What Pollus to sinners who are ded?
Ded for want of breth?"

Hibernation of the Cotton Worm.*

I have already shown in previous remarks before the association that there were various theories held by competent men, both entomologists and planters, as to the hibernation of this *Aletia* (the common cotton worm of the South), some believing that it hibernated in the chrysalis state, some that it survived in the moth state, while still others contended that it did not hibernate at all in the United States. I have always contended that the moth survives within the limits of the United States, and in this paper the fact of its hibernation, principally under the shelter of rank wire grass, is established from observations and experiments made during the past winter and spring. The moth has been taken at Archer, Fla., during every winter month until the early part of March, when it began to disappear, but not until eggs were found deposited. The first brood of worms was found of all sizes during the latter part of the same month on rattoon cotton, while chrysalides and fresh moths were obtained during the early part of April.

The fact thus established has this important practical bearing:

"Whereas, upon the theory of animal invasion from some exotic country, there was no incentive to winter or spring work looking to the destruction of the moths, there is now every incentive to such action as will destroy it either by attracting it during mild winter weather by sweets, or by burning the grasses in which it shelters. It should also be a warning to cotton growers to abandon the slovenly method of cultivation which leaves the old cotton-stalks standing either until the next crop is planted, or long after that event; for many planters have the habit of planting the seed in a furrow between the old row of stalks. The most careful recent researches all tend to confirm the belief that gossypium is the only plant upon which the worm can feed, so that, in the light of the facts presented, there is all the greater incentive to that mode of culture which will prevent the growth of rattoon cotton, since it is very questionable whether the moth would survive long enough to perpetuate itself upon newly sown cotton, except for the intervention of rattoon cotton."

* Abstract of a paper read at the Montreal meeting of the Am. Ass. Adv. Sc., by Dr. C. V. Riley.

Treatment of Heart Disease.

There seems to be in this city, and perhaps it is equally noticeable in other communities, a growing complaint of heart affections, and the *Medical and Surgical Reporter* had an article recently on this subject, in which rest is recommended as the best remedy for some kinds of heart troubles.

By this, says the editor, we mean not positive, but comparative rest; neither do we refer to inflammatory affections of the heart, wherein, from the very gravity of the disease, confinement to bed and consequent rest become necessarily assured. We are thinking of those cases of heart exhaustion, so to speak, of individuals whose general health and tonicity is much run down, from overwork or abuse, and in whom the heart shares in this general vitiation. Possibly the organ is not in itself diseased; its organic integrity may be perfect, but its muscular walls may be flabby and weak, ready to yield, or, more properly, unable to resist any great strain. If, when in this condition, the man resorts to any violent muscular exercise, or subjects himself to the influence of violent physical emotions, this weak heart may become mechanically distended, in its efforts to perform the extra labor demanded of it. Or it may be that dilatation has already taken place to some extent; then does it become important to allow the organ time for the development of the beneficent hypertrophy that will do so much to preserve its integrity. By rest we mean to advise your patients who are threatened with or already have dilatation of the heart to do everything slowly, to perform every act of life deliberately, and to avoid, as far as possible, all occasions calculated to excite the passions or emotions. We must ever remember what a delicate machine the heart is, and how easily it can become deranged, and realizing this, must consider how much more care this organ requires when it is already diseased. We must, under such circumstances, walk slowly, think slowly, eat slowly—in a word, do everything slowly. It is not well, and we do not recommend the carrying of this advice to the verge of laziness; but what we do mean is, that while it is well for all (either sound or diseased) to avoid hurry, it is ten times more important, ay, absolutely imperative, for the man with a weak or diseased heart.

Improvement in Submarine Mining.

Mr. William L. Saunders, civil engineer, engaged with the Ingersoll Rock Drill Company, has made a notable improvement in the plant used in removing reefs and other obstructions to commerce. He surrounds the drill commonly used in submarine mining by a tube which, for deep water working, may be made in sections telescoping with each other. Inside this tube runs an independent pipe, through which a stream of water may be discharged upon the bottom of the drill hole to remove the material broken down by the bit. The lower section of the inclosing tube carries an ejection pipe through which the debris is conveyed by the discharging water, thus keeping the hole clear and greatly facilitating the progress of the drill. When the drill is withdrawn for any purpose, the inclosing tube maintains the connection of the drill hole with the water surface, so that the hole can be quickly found again, for further drilling or for charging and tamping, without the aid of a diver. It also prevents the filling up of the hole by material washed in by currents between the times of drilling and charging, and makes it possible to insert the charge and perform all the accompanying operations from the surface of the water.

Those who understand the difficulties attending the prosecution of mining under water will appreciate the convenience and economy of working wholly from the surface, and the advantage of this simple means of preserving the integrity of the drill hole, both through the water and through any mud, sand, or gravel that may overlie the rock to be removed.

Large Pearls.

The *Pacific*, of Mazatlan (Mexico), has the following: The largest pearl in the world has been found recently in Lower California (Mexico) by one of the fishers (or divers) belonging to the firm of Gonzalez & Ruffo, merchants at La Paz (L. C.). The pearl is of the dimension of a lemon, weighing 75 carats, and measures one inch in length and three-fourths of an inch in width. It took the fisher who opened the shell several minutes to extract the pearl. There is no doubt that the coast of Lower California is very rich. The largest pearl known before was also found on that coast, in Loreto (L. C.), in the time of the Jesuits, and adorned the crown of the Queen of Spain.

Alum Water as a Fire Extinguisher.

It has been found by M. I. B Dumas that water saturated with alum is remarkably efficient in extinguishing fires. This property is supposed to be due to the coating it gives to objects wet with it, which prevents contact with the oxygen of the air, and thus retards combustion. It is reported that, as an experiment, French firemen are to be quite extensively supplied with instruments for throwing such solutions of alum.

Some New Lecture Experiments.

Prof. A. W. Hofmann, of Berlin, has recently described in the *Berichte* of the German Chemical Society a number of new and instructive experiments for the lecture table. Some of these require peculiar forms of apparatus not easily obtainable in this country, and need illustrations to render them intelligible; we therefore present only such of them as can be easily performed in an ordinary laboratory.

INCREASE OF WEIGHT BY COMBUSTION.

This can, of course, be rendered visible to a large audience in several ways. Prof. Hofmann has been accustomed to suspend a small magnet from one end of a balance, after drawing it through fine iron filings. The magnet and its load are carefully balanced, and the iron set on fire, when the increased weight will be made evident. In his recent paper, above referred to, he says that the experiment is much more elegant when magnesium wire is used. To prevent the escape of the fine particles of oxide, he burns the wire in a two-liter flask, the magnesium spiral being fastened to a copper rod that passes through the cork.

The magnesium is ignited just above the mouth of the flask, and the cork quickly inserted. The weight of magnesium wire used must not exceed 0·5 gramme, nor be less than 0·3 gramme. It is well to put some sand in the flask, so that the pieces of glowing wire which drop off will not touch the glass. Of course, some magnesia goes off in the air while setting it on fire, and is lost; but the subsequent increase of weight is only the more striking.

The experiment can also be performed in a tightly closed space. For this purpose the two-liter flask is fitted with a tight cork bearing a gas manometer, and a glass tube with stop cock. Two thick copper wires also pass through the cork; the magnesium wire is fastened to one; the other ends in a fine platinum wire, which touches the lower end of the magnesium spiral. By passing through it a current from four to six cells of a Bunsen battery, the platinum is heated red hot and ignites the magnesium, which burns very quietly, although at first there is a heavy pressure within, owing to the high temperature produced. For this reason it is well not to use too much of the magnesium, the above limits being preserved. The increase of weight is first perceptible when, after cooling, the stop cock is opened to restore the equilibrium.

A still more instructive experiment consists in burning phosphorus in a closed quantity of air. The conditions are much more favorable with phosphorus than with magnesium, since the latter gains only two-thirds of its weight on burning, the former four-thirds, or twice as much. It is likewise performed in a two-liter flask with perforated cork. In the cork is a manometer, as before, a glass tube with a stop cock and bent at right angles, a copper wire ending in a spoon (deflagrating spoon), and a glass tube that can be closed at the upper end with a cork, while the lower (open) end is just above the spoon. Some dry oxide of iron or sand is put in the flask, a little asbestos is put on the spoon, and a piece of phosphorus weighing half a gramme laid on this, just under the open end of the glass tube. The phosphorus is ignited by dropping a short piece of hot copper wire through the tube. Instead of the spoon, a little porcelain crucible may be suspended from the lower end of the open glass tube by means of copper wire.

The wire that is heated and dropped in must, of course, be weighed with the flask; the small cork is removed for an instant from the open tube and the wire dropped in. The combustion takes place quietly and slowly, but a slight increase of pressure is noticed at first. The sides of the vessel are covered with the phosphoric anhydride. When cold, no change of weight is noticed until the stop cock is opened. By attaching a little reed to this tube, like that on a child's whistle, the entrance of the air becomes audible at some distance. A considerable increase of weight is then observed, which may amount to 0·4 or 0·5 gramme.

If a current of electricity is employed to ignite the phosphorus, the platinum wire forms an easily fusible compound with the phosphorus, and is destroyed.

BURNING OXYGEN IN HYDROGEN.

A simple method of exhibiting this phenomenon was first described by Prof. Hofmann in 1870, in which a current of oxygen was introduced into a vessel of hydrogen from beneath. In the present article the experiment is so modified as to bring in the oxygen at the top. A glass bulb of 500 or 600 c. c. capacity, and having a tube below as well as above, is filled by a rapid current of gas from below and then ignited at the top. A double bored cork, that fits the upper tubulus or neck, is fitted with a long and a short tube; the former is bent like the letter J at the lower end, and both are bent at right angles and in opposite directions above the cork. If a current of oxygen is passed through the former while the cork is inserted into the tubulus, through the burning hydrogen, a flame will appear at the jet on the short end of the J, where the combustion really takes place. The cork must be pressed in quickly, so as to extinguish the hydrogen flame. The excess of the latter escapes through the shorter bent tube.

SPECIFIC GRAVITY OF STEAM.

Water in the form of gas, or true vapor, is but nine times as heavy as hydrogen, or about two-thirds as heavy as atmospheric air. Prof. Hofmann shows that it is lighter than air, as follows: A wide glass tube has two short pieces of tubing soldered on it a few inches apart, but on opposite sides, thus ⊤⊥. This tube is placed horizontally with one short tube projecting upward, the other downward, and then connected by means of a bent tube with a flask in which water is boiling. The large tube and the short branch which is turned upward are corked, so that the steam can only escape downward. On opening the horizontal tube, steam at once begins to escape there, and then on taking the cork from the upward branch it prefers to escape there. Were it of the same specific gravity as air it would prefer the horizontal exit, were it heavier it would go downward, but as it prefers to ascend, this proves that it is lighter than the air.

RELATIVE VOLUMES OCCUPIED BY WATER IN THE LIQUID AND GASEOUS STATES.

A glass bulb having a capacity of about 300 c. c. and having fine exit tubes on both ends (one of them provided with a stop cock) is suspended over a vessel of mercury. A rapid current of steam is passed through the apparatus for five or six minutes, or until every trace of air is expelled when the stop cock is closed; the bulb is lowered until the open tube dips in the mercury. The mercury begins to rise as the steam condenses, and fills the bulb, the condensed water occupying only a small part of the tube just below the stop cock.

MAXIMUM DENSITY OF WATER.

This can be shown by means of a glass float, if just enough platinum wire be wound about it to make it heavy enough to just float in water at 4° C., and sink in that which is either colder or warmer. As this requires careful readjustment every time it is used, Professor Hofmann prefers the following modification of the apparatus:

A glass tube 15 cm. (6 inches) long and 2 cm. (·08 inch) wide is nearly filled with distilled water, and in it is placed any object made of colored glass which will just float in water at 4° C., and sink in that at any other temperature. As soon as this is properly adjusted, he seals the upper end of the tube above the water, and in this form it is always ready. This apparatus, called a "maximum density tube," is put in a tall glass jar of ice water, and by the side of it a thermometer. Of course the colored float sinks, but on allowing a stream of water of the ordinary temperature to flow through the jar from bottom to top, a point will be reached when the float will rise to the top of the tube. Of course this will not take place until the water outside is warmer than 4°, usually about 7° or 8° C.

CARBON DIOXIDE CONTAINS ITS OWN VOLUME OF OXYGEN.

This is shown by burning a bit of prepared carbon in a flask of pure oxygen provided with a mercury pressure gauge. The apparatus resembles that for burning phosphorus, already described. The carbon is made by mixing lampblack and a little gum water to a paste, and forming rods of it by pressing through a glass tube. These rods are first dried at 100° C., then ignited in a current of carbon dioxide. After burning the carbon and cooling, no diminution of volume is noticed.

Duties of Railway Corporations.

During the freight handlers' strike in this city, last summer, the movement of freight was seriously obstructed, much to the inconvenience and loss of shippers. Attorney-General Russell was appealed to for aid, and suits were brought by him for a mandamus to compel the railroads doing business in this city to receive and deliver with due diligence all freight offered for transportation. A hearing was had before Justice Haight, who sustained the objections of the railway companies' counsel and denied the Attorney-General's application.

An appeal was made, resulting in a notable decision of the general term of the Supreme Court, rendered January 17, reversing the decision of Justice Haight. The general term was composed of Justices Davis, Daniels, and Brady, and the opinion was written by Justice Brady.

That portion of the opinion relating to the duties of railway corporations as common carriers is of the highest possible interest and importance, since it settles the question whether the people of the State can invoke the power of the courts to compel the railway companies to perform their most useful public functions.

Speaking of the nature of railway corporations, the objects for which they are created, the powers conferred, and the duties imposed upon them by the laws of their creation and of the State, Justice Davis said:

"As bodies corporate, their ownership may be, and usually is, altogether private, belonging to the holders of their capital stock, and their managements may be vested in such officers and agents as the stockholders and directors under the provisions of the law may appoint. In this sense they are to be regarded as trading or private corporations, having in view the profit or advantage of the corporators. But these conditions are in no just sense in conflict with their obligations and duties to the public. The objects of their creation are from their very nature largely different from those of ordinary private and trading corporations. Railroads are in every essential quality public highways created for public use, but permitted to be owned, controlled, and managed by private persons. But for this quality the railroads of the respondent could not lawfully exist. Their construction depended upon the exercise of the right of eminent domain, which belongs to the State in its corporate capacity alone, and cannot be conferred except upon a 'public use.' The State has no power to grant the right of eminent domain to any corporation or person for other than a public use. Every attempt to go beyond that is void by the Constitution, and although the legislature may determine what is a necessary public use, it cannot by any sort of enactment divest of that character any portion of the right of eminent domain which it may confer. This characteristic of 'public use' is in no sense lost or diminished by the fact that the use of the railroad by the corporation which constructs or owns it must from its nature be exclusive. That incident grows out of the method of use, which does not admit of any enjoyment in common by the public. The general and popular use of a railroad as a highway is therefore handed over exclusively to corporate management and control, because that is for the best and manifest advantage of the public. The progress of science and skill has shown that highways may be created for public use of such form and kind that the best and most advantageous enjoyment by the public can only be secured through the ownership, management, and control of corporate bodies created for that purpose, and the people of the State are not restricted from availing themselves of the best modes for the carriage of their persons and property."

After showing how under the general railroad act every railway corporation, by accepting the trust imposed upon it, becomes an agency of the State to perform public functions, and citing a number of decisions in which it had been held that railroads could be compelled by mandamus to perform certain express and implied obligations arising from their charters, the court described the duty of carrying freight and passengers as the ultimate ratio of railway companies' existence, the great and sole public good, for the attainment and accomplishment of which all the other powers and duties are given or imposed; and declared it strangely illogical to assert that the State, through the courts, may compel the performance of every step necessary to bring a corporation into a condition of readiness to do the very thing it is created to do, but it is then powerless to compel the doing of the thing itself.

Touching the excuse of the railway companies that their freight handlers had refused to work for 17 cents an hour, demanding 20 cents, and that the unskilled men who were employed to do the work were incompetent, and so caused the neglect and refusal complained of, Justice Davis held substantially that while both parties had the legal right to differ as to the proper amount of pay for the work to be done, the railways did not have the right to hold to their decision to the injury of the public. "If the consequences of doing so were an inability to exercise their corporate franchises, to the great injury of the public, they cannot be heard to assert that such consequence must be shouldered and borne by an innocent public who neither directly nor indirectly participated in their causes."

In other words, the railway corporations cannot refuse or neglect to perform their public duties, upon any controversy with their employes over the expense of doing them. "The duties imposed must be discharged at whatever cost. They cannot be laid down or abandoned or suspended without the legally expressed consent of the State. The trusts are active, potential, and imperative, and must be executed until lawfully surrendered; otherwise a public highway of great utility is closed or obstructed without any process recognized by law. This is something no public officer charged with the same trusts and duties in regard to other public highways can do without subjecting himself to mandamus or indictment."

Opossum Hunting in Australia.

Prof. H N. Moseley, in his "Challenger Notes," speaks of a visit he made to the domain of Sir William McArthur, at Camden Park, forty miles from Sydney, New South Wales, and gives his experience in hunting the opossum. He says:

The park is 10,000 acres in extent. Here I went out on several occasions to shoot opossums by moonlight. The opossums are out feeding on the trees at night, or are out on the ground, and rush up the trees on the approach of danger. They are very difficult to see by one not accustomed to the work, but those who habitually shoot them discover them with astonishing ease.

In order to find the animals, one places himself so as to get successive portions of the tree between his eye and the moonlight, and thus searching the tree over, at last he catches sight of a dark mass crouching on a branch, and usually sees the ears pricked up as the animal watches the danger. This is called "mooning" the opossums.

Then, with a gun in one's hand, one fully realizes for the first time the meaning of the saying, "'Possum up a gum tree." The unfortunate beast has the toughness of his skin alone to trust to. "Bang!" and down it comes with a heavy thud on the ground, falling head first, tail outstretched; or it clings with claws or tail, or both, to the branches, swaying about wounded, and requires a second shot. It must come down at last, unless, indeed, the tree be so high that it is out of shot, or it manages to nip a small branch with its prehensile tail, in which case it sometimes contrives to hang up even when dead and remain out of reach.

Nearly all the female opossums which I shot had a single young one in the pouch. The young seemed to be attached with equal frequency to the right or left teat.

I shot the animals in the hopes of obtaining young in the earlier stage, but found none such.

Among stockmen, and even some well educated people, in Australia there is a conviction that the young kangaroo grows out as a sort of bud on the teat of the mother within the pouch.

We killed about twenty opossums in a couple of hours on each occasion on which I went out.

CARRIER FOR COAL, HAY, ETC.

The engravings show an improvement in carriers and track for handling hay, grain, coal, ensilage, and other materials requiring elevation and transportation. As will be seen by examining the engravings, there is a new departure in the construction in both the carriers and track, differing materially from the principle generally employed in similar devices.

The most serious objection made to the use of the ordinary carrier being that when the fork or bucket is elevated to the carrier, the motion is so suddenly arrested that it produces a shock which would scatter a large portion of its load back and tend to break or derange the carrier.

To overcome this objection, this carrier is provided with a toggle joint for a locking device, which requires little force to raise it when struck by the traveling pulley with its load. After it is raised and the retaining hook released, the motion is not arrested, the pulley and load can continue to rise for a short distance higher, while the carrier and its load is started, moving along the track. When the momentum is overcome by gravity, the pulley with its load settles into the balanced hook under the carriage, where it is securely held till the carrier is returned to the fixed catch (bolted to track), which, by pressing the upper portion of the hook forward, draws the lower or hooked end out from the eye on the traveling pulley, and allows the toggle to drop down and securely brace the hook, the upper portion of which is engaged by the notch in the fixed catch. The shock is so slight that the driver of the horse used in elevating and conveying cannot tell when the carrier has unlocked and started along the track with its load. Another important feature in these conveyers is a sliding catch, which is used where it is necessary to change the points of elevation; as, for instance, in taking ensilage from silos, only one section of a silo is uncovered at a time, beginning at one end and removing a section of four feet in width, and when this is taken out another section of cover and weight is removed. When it is necessary to change the point in the track where the carrier shall be locked fast, the sliding catch obviates the necessity of climbing up to the track each time it is necessary to make the change. An illustration of this device is seen with the carrier on curved track in Fig. 3. It can be used with either carrier; one is a lever, to the upper end of which is attached a cord, which, passing through a pulley at front end of track, is brought down and made fast at some convenient point below.

To change the catch, all that is necessary is to loosen the cord below, then by taking hold of the draught rope near the traveling pulley, draw carrier and catch to the point where wanted, when the cord is again made fast, and the catch is securely clamped at that point to the rails of track.

Two styles of these carriers are manufactured, one for straight (Figs. 1 and 2), the other for curved tracks (Fig. 3). In the curved track carriers, the axles are pivoted at their centers, and are free to move on the bolts which secure them to the frame of the carrier, with which they are connected by a reach jointed at the center, at which point is attached a guide which moves between the rails of the track and controls the axles, so that they move freely along the track, be it straight or curved.

The draught rope is kept in line with the track by pulleys fastened to the inner rail along the curves. It is claimed that this carrier will run freely along a track curved to a circle, or one which is partly straight, with curves at various points, and reversed with respect to each other. The track principally used with these carriers is put up with iron hangers, which are fastened by wrought loops passing through the hole at top of the hangers, and spiked to rafters or beams, the rails resting on a shoulder cast at the bottom of the hanger, and bolted to keep them in place. The track is narrow gauge, there being only three inches space between the rails. The carriers will run as free, or nearly so, as on a rod, and can be supported as often as deemed necessary. The track cannot be strained out of shape, as it will swing and allow the carrier to keep in line with the point from which the load is being elevated. The buckets for handling grain, coal, and ensilage are shown closed in Fig. 3 and open in Fig. 1.

The supporting bar, 1, is attached to the halves of the bucket by chains at such points that the bucket, when empty, will keep closed by its own gravity; but when loaded, the sides and bottom inclining tend to force it open; and when unlocked, by raising the lever, 2, by pulling on the trip rope, 3, the bucket being so nearly balanced, it is forced open to the extreme point of the levers, when it is held by the notch at the end of the levers engaging in the lug attached to the bucket. When empty, by again pulling on the trip rope, the bucket will close from its own gravity.

It is simple in construction, no shock when being unloaded, and it does not scatter its load. For further particulars the inventor, Mr. J. A. Cross, of Fultonville, N. Y., may be addressed.

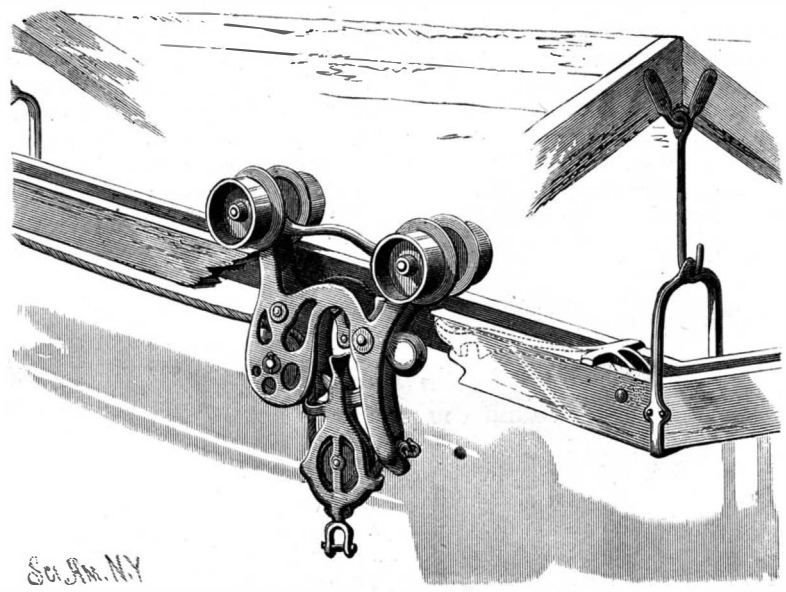


Fig. 2.—CARRIER WITH FIXED HOOK.

Fig. 1.—CROSS' CARRIER, WITH STRAIGHT TRACK.

THE *Leipziger Tagblatt* shows that in the last ten years the exports of German rails have increased 300 per cent.

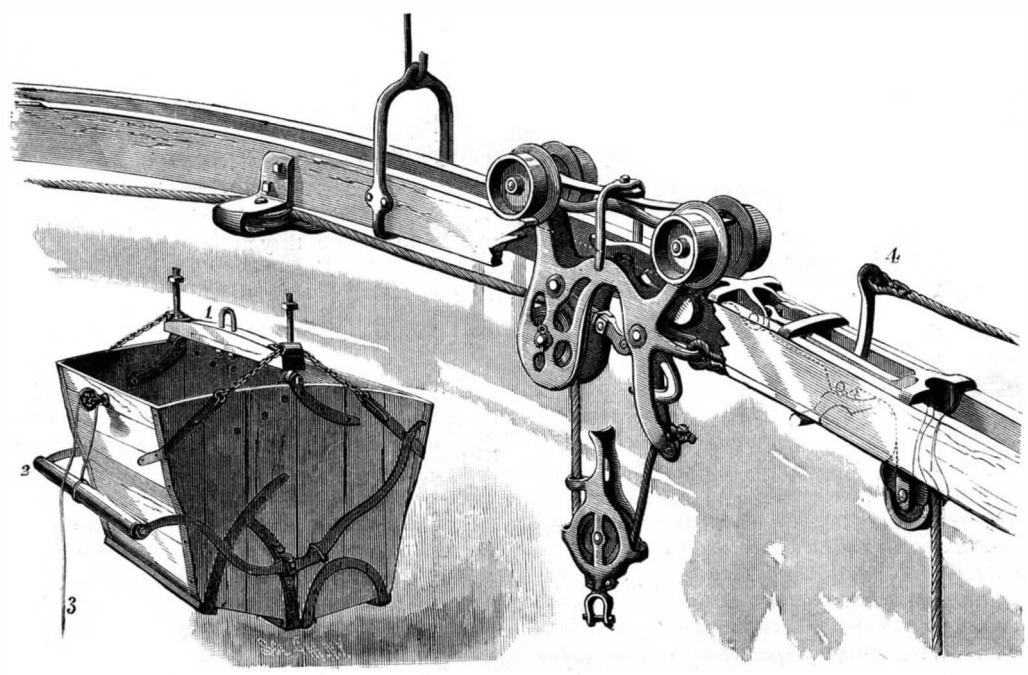


Fig. 3.—CROSS' CARRIER, WITH CURVED TRACK.

The Microscope in Testing Timber.

A paper was recently read before the Franklin Institute, Philadelphia, on the use of the microscope in testing timber, and it was decided that if the microscope condemns the sample, further delay in testing is not worth the while. The larger the specimens requiring to be tested, the greater will be the gain the microscope will effect in avoiding the cost of further proof or the risk of using without such proof. Samples and micro-photographs were exhibited of bridge timbers which had proved faulty, but which a preliminary examination with the microscope would have promptly thrown out. The timber from which these poor specimens were taken was a fragment from a railway bridge wrecked in 1879. The timber was so excessively poor that, on mounting a specimen on the plate of the microscope, its weak and porous nature was at once apparent. The annular rings appeared about three times as far apart as they would be in good wood of similar kind. The medullary rays were few in number and short in length, while in good wood, on the contrary, they are of considerable length and so numerous that tangential sections present the appearance of a series of tubes seen endwise, or a number of parallel chains. After once seeing and comparing samples of good and bad wood, it is easy to recognize the difference with a pocket magnifying glass. The trunks and limbs of exogenous trees, as is well known, are built up of concentric rings or layers of woody fiber, which are held together by radial plates acting like treenails in a boat's side. The rings, representing successive years' growths, are composed of tubes, the interstices of which are filled with cellulose.

The slower the growth of the tree, the thinner these yearly rings, and the denser and harder the wood—other things being equal. Not only is the closeness of texture an indication of the hardness and strength of the timber, but the size, frequency, and distribution of the radial plates which bind the annular layers together may be taken as a very close illustration or sign of the character of the wood and its ability to resist strains, especially a breaking stress. The micro-photographs of good and bad timber show that in the strong kinds the concentric layers are close in texture and narrow in width, and the radial plates numerous, wide, long, and stout, while in poor stuff the opposite characteristics prevail. The practical application consists in having such enlarged photographic sections, longitudinal and transverse, of standard pieces of timber, bearing a certain known maximum or minimum strain, and rejecting any piece which the assisted eye detects to have fewer rings per inch of tree diameter, fewer fibers, or fewer radial plates per square inch of section, or to use such pieces with a greater factor of safety. The advantage of the method is that it allows every stick in a bridge or structure to be tested before use.—*Northwestern Lumberman.*

California Vineyards.

Late accounts from California notice the great increase in the size of the vineyards there. A plantation of 200 acres used to be considered a large vineyard; now vineyards of 500 and 600 acres are not uncommon, and one of 1,500 acres was recently planted near Los Angeles. It is expected that in three years or so California will possess vineyards of 5,000 or 6,000 acres in extent. The total number of acres at present devoted to vine culture is estimated at about 100,000, all of which will be bearing in about four years' time, and producing about forty or fifty million gallons annually. New wines at present fetch from 20 to 25 cents per gallon for dry wines, either red or white. Sweet wine is dearer, ranging from 55 to 75 cents per gallon. Though next year's prospects are good, last year's prices for grapes are not likely to be maintained, as the cellars of San Francisco are said to be full.

RECENT advices from Japan report that the intention of the Japanese Colonization Department is to adopt the American system of railroad building in the extension of the railroad system in the northern part of the Empire. This decision is attributed to the economical and satisfactory working of the railroad from Sapparo to the sea coast in Yesso. This road was built by Col. J. A. Crawford.

NEW POSTAL COIN SCALE.

This ingenious scale, recently patented, is so fully shown in the accompanying cut that a description is hardly necessary. A letter scale is a necessity to every business man, and the coin attachment adds but a trifle to the cost, and is of equal advantage to all who handle coin, especially as it gives the three tests that the counterfeiter finds it impossible to overcome—weight, diameter, and thickness.

Full information may be obtained of the special agents, Messrs. Geo. F. June & Co., 267 Broadway, New York, who have an advertisement in this issue, to which attention is directed.

American Steamboats Sweep the World.

There is apparently a large and extended market for American flat river steamers on the shallow navigable rivers of Europe and Asia. In China they have already effected almost a revolution in the water carrying trade of that empire, and we hear that there is a brisk demand for them already on the Volga. The plan adopted in that case by the American builders is to take out the machinery with them, and to build the steamers of timber on the spot. This plan produces a steamer much cheaper than the iron river steamers exported from England, which have been in use there for some time. Not only is their success due to that cause, but more especially owing to the fact that the American built boats only require a draught of four feet, while most of the English steamers require nine. Even a draught of five feet bars the navigation through a great portion of the river, and the speed of the wooden American boats is said to be better than that of any of their iron competitors. The light draught of the American boats has opened up a navigable length of some 2,000 to 2,300 miles on the Volga, which will probably induce considerable further orders for the other large rivers of Russia. There should be an equally good market for such steamers on the rivers of the Argentine Republic, which are very wide, but for the most part shallow. We understand, however, that there is a strong prejudice against them, owing to their liability to catch fire—the first two which were run on the Plate having been destroyed by fire. We do not see why America should have a monopoly of such flat bottomed river steamers, and we recommend this to the attention of English ship builders, though as a nation we are said to be the last to suit our goods to customers' requirements.—*Marine Engineer.*

A NEW AND INTERESTING ELECTRICAL MACHINE.

We find in a recent number of *Engineering* the following description and illustration of a new electrical machine designed by Mr. James Wimshurst, of the Board of Trade, and which possesses several points of superiority over the Holz machine, while at the same time it can be constructed for but a fraction of the cost.

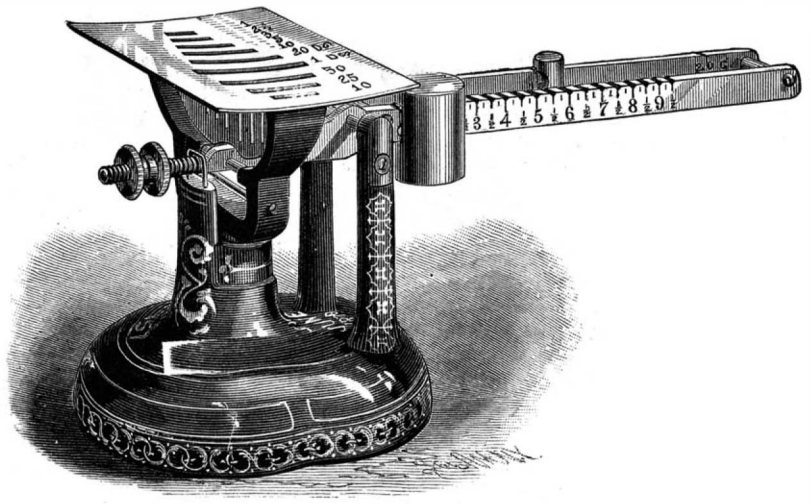
This new machine consists of two circular disks of ordinary window glass, 14½ inches in diameter, mounted upon a fixed horizontal spindle in such a way as to be rotated in opposite directions at a distance apart of not more than one-eighth of an inch. Each disk is attached to the end of a hollow boss of wood, or of ebonite, upon which is turned a small pulley. This is driven by a cord or belt from a larger pulley, of which there are two attached to a spindle below the machine, and which is rotated by a winch handle, the difference in the direction of rotation being obtained by the crossing of one of the belts.

Both disks are well varnished, and attached by cement to the outer surface of each are twelve radial sector shaped plates of thin brass disposed around the disks at equal angular distances apart.

The two sectors, situated on the same diameter of each disk, are twice in each revolution momentarily placed in metallic connection with one another by a pair of fine wire brushes attached to the ends of a curved rod, supported at the middle of its length by one of the projecting ends of the fixed spindle upon which the disks rotate, the brass sector-shaped plates just grazing the tips of the brushes as they pass them.

The position of the two pairs of brushes with respect to the fixed collecting combs, and to one another, is variable, as each pair is capable of being rotated on the spindle through a certain angular distance; and there is, as in the case of the collecting commutator brushes of dynamo electric apparatus, one position of maximum efficiency. This position in the machine we are now describing appears to be when the brushes touch the disks on diameters situated about 45 deg. from the collecting combs, and 90 deg. from one another. To make this clear, let us suppose the twelve sector shaped plates to be numbered round like the hours of a clock, from I. to XII., then opposite plates, such as XII. and VI, X. and IV., VIII. and II, if on the front disk, would be momentarily connected together when passing the diameter, joining a point midway between X. and XI., and IV. and V., on a clock face; and, if on the back disk, they would be connected when passing between I. and II., and VII. and VIII.

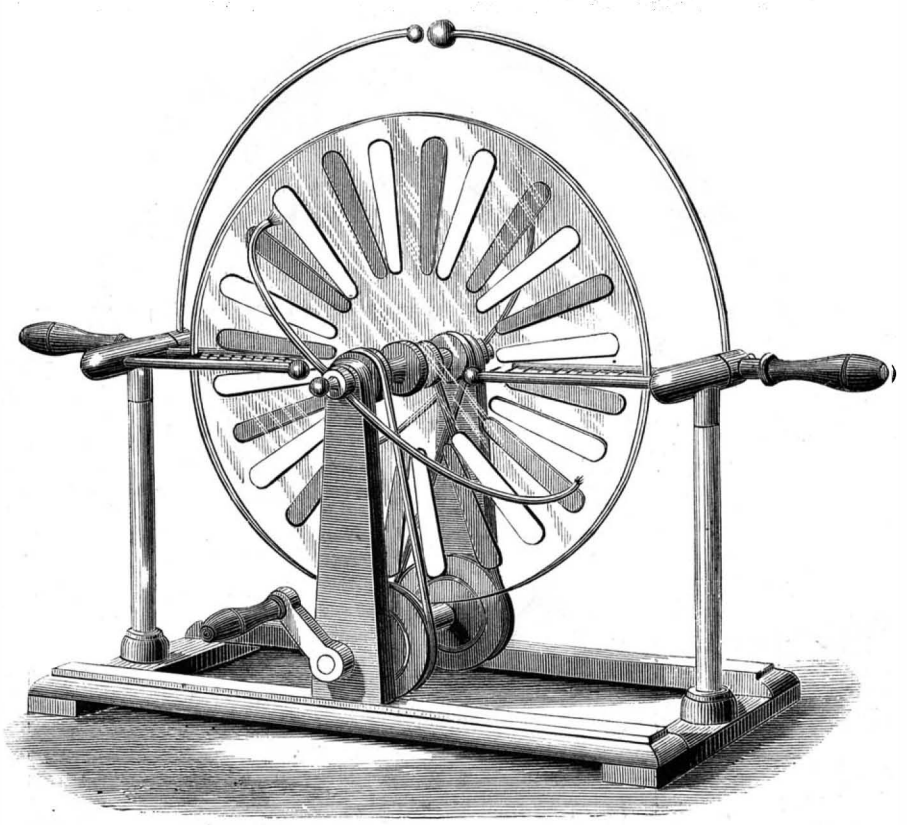
The fixed conductors consist of two forks furnished with collecting combs directed toward one another and toward the two disks which rotate between them, the position of the two forks, which are supported on ebonite pillars, being along the horizontal diameter of the disks. To these collecting combs are attached the terminal electrodes, whose distance apart can be varied by the two projecting ebonite handles shown in the illustration.



NEW POSTAL COIN SCALE.

The presence of these collecting combs appears to play no part in the action of the apparatus except to convey the electric charge to what may be termed the external circuit; for the inductive action of the machine is quite as rapid and as powerful when both collectors are removed, and nothing is left but the two rotating disks and their respective contact or neutralizing brushes, the whole apparatus bristling with electricity, and if viewed in the dark presents a most beautiful appearance, being literally bathed with luminous brush discharges.

It is one peculiarity of this interesting machine that it is only with the greatest difficulty that the polarity of its electrodes can be reversed, and in this respect it has a very decided advantage over most of the induction machines. It is difficult to account satisfactorily for the exceptionally high efficiency of the apparatus.



WIMSHURST'S NEW ELECTRICAL MACHINE.

With a machine of the size we have described, and which is shown in the illustration, there is produced under ordinary atmospheric conditions a powerful spark discharge between the electrodes when they are separated by a distance of 4¼ inches, a pint size Leyden jar being in connection with each electrode; and these 4¼ inch discharges take place in regular succession at every two and a half turns of the handle. This remarkable efficiency may be partly due to the duplex action of the apparatus, both plates being active and contributing electricity to the collecting combs, the sector-shaped plates of brass acting as *inductors* when in their position of lowest efficiency as *carriers*, and as *carriers* when in the positions at which their inductive effect is at a minimum, and *vice versa;* and as it follows from the construction of the instrument that the inductors of the one disk are at the position of highest efficiency, when those of the other are at their lowest, and *vice versa*, and as this applies with equal force to the sectors when considered as carriers, it also follows that the charging of the electrodes, and, therefore, the discharge between them, is by mutual compensation maintained constant. The machine is, moreover, perfectly self-exciting, requiring neither friction nor the spark from any outside electric exciter to start it, and this is one of the most remarkable features of the apparatus, for under ordinary conditions the machine is working at its full power after the second or the third revolution of the handle.

We are inclined to think that this initial charge is obtained not so much, as in Sir William Thomson's replenisher, from a minute difference of electrical potential between two parts of the apparatus—for the insulation is hardly perfect enough to allow so minute a difference to be so enormously increased in so short a time—but rather from the frictional influence of the air, and that chiefly between the plates—that is to say, on the surfaces opposite to those to which the sectors are attached. Within this narrow space the air friction must be far greater than on the outside surface, on account of the two disks rotating in opposite directions. Whether, however, the initial charge be derived from air friction or not, its generation is a point of very great interest, and this is especially conspicuous in the remarkable experiment to which we have referred, in which both conductors are removed, and the most brilliant electrical effects are produced when the apparatus consists simply of two disks rotating in opposite directions, with no fixed conductors except the light conducting brushes.

From the above description and illustration it will be apparent that the apparatus can be constructed for a few shillings, and thus a very useful and highly instructive generator of static electricity is, by Mr. Wimshurst's latest invention, placed within the reach of all. Having constructed several machines himself, Mr. Wimshurst is of the opinion that manufacturers could construct and sell them with a reasonable profit for something not much more than seventeen shillings apiece. If such a result can be obtained, Mr. Wimshurst will, besides having won the gratitude of the scientific world for having made a valuable contribution to the science of electricity, deserve the thanks of teachers and students for placing in their hands a much-needed instrument for the induction and production of electricity.

Why Men Cannot Fly.

The New York *Sun* wisely concludes that this century is likely to be forever memorable for its mechanical and engineering triumphs. It is distinguished from all the centuries which have preceded it as the age of steam and electricity, of rapid transportation for human beings and their products, and for bringing all the world in instant communication, one part with another.

Other eras may have surpassed us in literature and art. Some of our metaphysical science may not be so wonderful to the future as it seems to us; but our mechanical and engineering development has been so far beyond anything of the same sort in the past, even taking many centuries together, that this century is separated from the eighteenth by the broadest gulf in the history of human progress from era to era.

Yet, with all our mechanical triumphs and our engineering achievements, the *Sun* thinks that we are no further advanced in one respect than men were one hundred years ago, or a thousand years ago, except to some slight extent for military purposes. Ballooning has made no progress, and is still nothing more than an amusement of no practical value. We do not seem to be any nearer flying than men were at the beginning of the Christian era.

Our modern engineers have not yet constructed a practicable flying machine; nay, they have not yet so much as taken the first step in that direction.

The London *Engineer*, which has lately discussed flying machines in a scientific way, comes to the conclusion that there is no combination of wings or arrangements of any kind which will enable a man to fly with his own strength. He lacks muscular power to practice the accomplishment in which the birds are so proficient. And even if machines are devised to compensate for that lack of power and endurance, they will not be successful unless they shall be so constructed that each pound of the machine will develop as much energy as each pound of a bird. "Not till then," says this engineering critic, can flight for man be achieved.

Because birds fly, that is no reason why man should do

the same thing, even if he is able to fit to himself wings as well adapted to his body as the wings of the bird are to its physical construction. Already "the wings of many model flying machines act just as do those of the rook and other birds" whose movements are slow enough for us to observe just how they fly. For there is a great difference among birds as to the rapidity of their flight, and not only that, but also as to the grace with which they do it. They have various styles of moving through the air, some graceful and others comparatively clumsy, just as the walk of a courtly woman differs from that of a Sioux squaw. "We have no doubt," says our London contemporary, "that if men could once fly, we should soon have as many styles developed as there are men."

We have said that the reason men do not fly is not merely because they lack wings, but also because they are not strong enough. There is no bird of flight which weighs as much as even a very light man, but there are many birds which are far stronger than men. The limit of weight beyond which the air cannot be utilized for bird flight is somewhere about thirty pounds. Nature does not produce heavier birds, and doubtless for the reason that the air is not the proper home for animals weighing more. "The conditions under which species are developed," says the *Engineer*, "are such that everything goes as far as it can go in size and speed." The roc of Eastern story it pronounces a "mechanically impossible creature."

The albatross is the largest bird in existence, and one of the heaviest. There are heavier birds with limited powers of flying, but the maximum weight of any natural flying machine which can fly well does not exceed 30 pounds, according to the *Engineer;* and the weight of the albatross seldom, if ever, exceed 28 pounds, or one-sixth that of a powerful man. But the albatross can keep its wings, 13 feet long from tip to tip, in motion for a whole day, while the strongest man would be exhausted, if he had to keep beating the air with them, in half an hour. And to fly he would need far heavier wings to be kept in motion.

After a mathematical calculation, the *Engineer* comes to the conclusion that the albatross possesses as much muscular energy as a man, and far more endurance, with which to propel the 28 pounds of its body. "We have in the bird," it adds, "a machine burning concentrated fuel in a large grate at a tremendous rate, and developing a very large power in a small space. There is no engine in existence, certainly no steam engine and boiler combined, which, weight for weight, gives out anything like the mechanical power exhibited by the albatross."

The conclusion arrived at by both of our contemporaries is that man will have to give up the hope of competing with the birds in flying.

Expiration of Artificial Alizarine Patents.

Scarcely fifteen years have elapsed since Graebe and Liebermann discovered the constitution of alizarine and then made it synthetically. In that short space of time German energy and genius have succeeded not merely in putting on the market an artificial product that would compete with the natural article, they have done far more; the natural product has been driven to the rear, and for a long time has completely disappeared, we may say, from the market. The importance of this revolution as an example of national and political economy is far reaching. On the one hand a large extent of land that has been devoted to the cultivation of madder, is now available for better uses, while on the other hand a material hitherto useless has suddenly attained a high value and become the source of a profitable and flourishing industry. What advantages Germany, in particular, has derived from this change are too well known to need any detailed description.

Being protected by patents, its manufacture was retained in the hands of a limited number, but these few exhibited unusual industry and great skill in overcoming the technical difficulties which made it questionable whether artificial alizarine would ever conquer its way into trade. Their restless and genial activity has secured for them a lasting and honorable name in the history of the great chemical industries. Now, as the expiration of the patent is approaching, it is probable that those already engaged in its manufacture will seek for means of combating the fresh competition, so as to be able to consign it to its grave before it is fairly born. They have had a conference in Frankfort-on-the-Main, the result of which was a close compact, an agreement upon a common price, and the issuing of a circular to be mentioned later.

In England alizarine is of the greatest importance; half of all the alizarine produced is consumed there; part of it in Glasgow, the center of the Turkey red dyeing, part of it in Manchester, the head center of calico printing. It is natural that the large manufacturing chemists of England are watching most attentively the expiration of the patent on alizarine, and that they will strive with all the power and tenacity which characterize an Englishman to manufacture for themselves an article, the raw material for which is sent over to Germany, in order that it may be returned, in great part, in the shape of a dye stuff.

This threatening competition and the danger that it involves to German industries did not escape the united alizarine manufacturers, who decided, as the best means of meeting it, to send out the above mentioned circular to all the calico printers and dyers in England. It contained the following proposition: The consumers agree to take all the alizarine used by the mup to the end of 1884 from these manufacturers, at present prices. The manufacturers offer a rebate of 5 per cent for 1883, and one of 10 per cent for 1884, to be paid at the end of the contract. The final clause states that in case the manufacturers lower their prices between the beginning and end of the contract, the buyer shall receive the benefit of this reduction. The buyer also pledges himself to buy only for his own use, and not to sell or transfer it, and indirectly it is understood that the producers will not sell to any that do not enter into this agreement.

The combination made a great blunder when they put forth this proposition, and the English manufacturers were not slow to profit by this mistake. The newspapers immediately pointed out what a restraint would be laid on the consumer by entering into such a contract, that it would be equivalent to lengthening the patent, and also how greatly the buyer would injure himself by thus closing the market, as he could not take advantage of the freedom of competition. In addition to all this, statistics were published to show how much alizarine was used, and how much Germany had made out of its manufacture, and that England, which furnished the anthracene and consumed the alizarine, was permitting immense sums of money to flow into the pockets of foreigners.

The Turkey red dyers held a series of meetings and resolved not to accept the proposition of the manufacturers, but rather to limit their own production than to place themselves under this restraint; and in fact a part of them, it is said, did stop work for a short time. The agitation promises to bear the desired fruit. An English stock company has been formed with a capital of £200,000, for making alizarine on a large scale, and the works of Burt, Boulton & Hagewood, in London, have been purchased for that purpose.

In the mean time the circular of the German combination has been withdrawn, and their two great precautions have accomplished nothing beyond hastening a catastrophe that might not otherwise have occurred for several years.—*Chemiker Zeitung.*

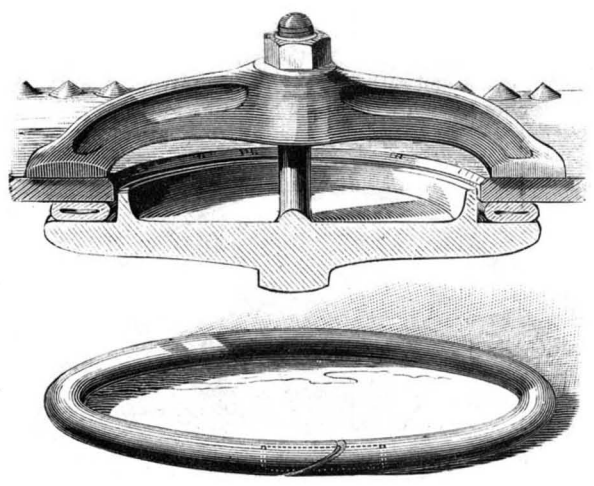
When will capitalists ever venture on the manufacture of alizarine in America?

Manhole Packing.

To the Editor of the Scientific American:

It may be of interest to parties having charge of steam boilers, some who, no doubt at one time or another have been troubled with leaky manholes, to know that the very best packing for the same is a piece of ordinary rubber tubing of an internal diameter of about three-eighths of an inch, cut and joined together.

Both ends of the tubing are cut on a long bevel, the ends



being held together by simply putting into them a roll of common draughting paper, the spring of the paper being sufficient to keep the adjustment until it is in place. Leaky manheads are common, blowouts often occur, nd that means delay and pecuniary loss. The roughest surfaced manhead will be made tight by this method, and the cost does not exceed that of plaiting a gasket. To protect the iron from the effect of sulphur contained in the rubber, coat the tube with "black lead."

A. D. TYTLER.

San Antonio, Texas.

How to Dry Plants.

Mr. Leo H. Grindon, whose name is well known in scientific circles, gives the following practical hints on this subject in a recent article in the *Field Naturalist:*

"The very ancient adage, that if a thing be worth doing at all it is worth doing well, applies to the preservation of plants for the herbarium as much as to any great and important work or business. Specimens that are no better than fragments of brown stick, or that seem effigies of plants cut out of thin brown paper, the flowers shriveled and shrunk so as to be no longer intelligible, the leaves crumpled and doubled up, everything confused and mashed together, such as one may see sometimes in collections, are altogether undeserving of the name. Nothing that is not dried in the best manner possible, its colors and configuration preserved as perfectly as the nature of the plant will admit, ought never to be allowed a permanent place in the herbarium; the bad may be tolerated a while, in default of better, but the further a specimen is from vivid and pleasing resemblance to the living thing, the speedier should be the endeavor to supersede it. Specimens from abroad that cannot be superseded of course we do not speak of. In the plants within reach, none but admirable representatives of their best features while alive should be considered worthy of a place. Plants dry very variously. Some require not a moment's trouble; others demand patience. Now and then the case is hopeless, and we are constrained to fall back upon the pencil, and prefer drawings, colored ones if possible. Grasses and their allies, most kinds of ferns, plants that resemble heather, everlastings, the mature leaves of shrubs and trees, call for only the minimum. Those which try the patience, and can be managed only after considerable experience with easy ones, are such as may be illustrated by citation of the hyacinth. To secure the best results, obtain a half a dozen pieces of stout millboard cut to about 18 inches by 12 inches. Then gather together a hundred old newspapers, and fold them neat and square to about the dimensions of the mill boards. Four or five yards of common white cotton wadding, a score of sheets of tissue paper and as many of blotting paper, all cut to the same size, complete the apparatus. One of the boards serves for the foundation; on this only a newspaper, then a piece of wadding, and upon this place the specimen intended to be dried. The cotton being soft and retentive, every portion can be laid in a proper and natural way, including the petals of the flowers. A newspaper above, two or three if the specimens have thick stems, and so on, till all shall be deposited in the way of the first. If the specimens are sticky, or hairy, or of a kind that the wadding seems likely to adhere to, then, before depositing them on it, introduce a half sheet of the tissue paper. A heavy weight must be put on the top of all, sufficient to embed the specimens in the wadding; then leave the whole to rest for twenty-four hours. All the papers must then be changed, dry ones being put in their place; and if the plant seems to throw off a very considerable amount of moisture, such as will render the wadding quite damp, change the wadding also. A second and even a third change is desirable at the end of two or three days or a week; and when this is made introduce the blotting paper, pressing again till everything is perfectly flat, and the specimens are absolutely dry.

"Such is the simple process by which the writer of these lines has succeeded in the art of preserving the colors and forms, not only of robust and tractable plants, but of the most delicate and very many of the obdurate. Every petal, every leaflet, retains the form it had in life, and nine specimens out of ten keep their colors excellently. To insure the keeping of color, it is well, if time can be spared, to change the blotting paper many times, and to dry it thoroughly before the fire, but this need not be done until after the third day from the beginning."

English Locomotives.

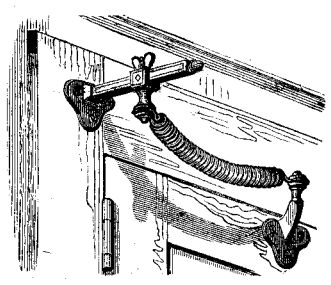
The express passenger engine, having 18 inch cylinders and four coupled 7 foot driving wheels, with four wheeled bogie in front under the smoke box, designed by Mr. S. W. Johnson for the traffic of the Midland Railway, is supported on a wheel base of 21½ feet in length. The engine weighs about 42 tons in working order, and with tender, including coal and water, about 68 tons. The average load taken by engines of this class is fourteen carriages, at the time bill speed of fifty miles an hour, over gradients of from 1 in 120 to 1 in 130, with a consumption of 28 pounds of Derbyshire coal per mile run. The engine can take, as a maximum load, seventeen carriages between Manchester and Derby, either way, over ruling gradients of 1 in 90 and 1 in 100 for ten miles, at a speed, up the banks, of thirty-five miles per hour; and on a level, or on falling gradients, at fifty miles per hour. The curves on the Manchester line are very frequent, and vary from eleven chains to forty chains of radius. The carriages weigh, with passengers, 11 tons each, making a train of the gross weight of 187 tons. The express passenger engines on the Great Northern Railway, designed by Mr. Patrick Stirling, having 18 inch cylinders, and 8 foot single driving wheels, weigh, in working order, about 38 tons, of which about 16 or 17 tons weight is upon the driving wheels. They work the express trains between King's Cross and York. Engines of this class take trains of from sixteen to twenty-two carriages. On one occasion a length of fifteen miles was run in twelve minutes with sixteen carriages of from 10 to 12 tons each. These engines can take a gross load, including the engine and tender, of about 350 tons, on a level, at a speed of forty-five miles per hour, with a steam pressure in the boiler of 140 pounds per square inch.

In his recent inaugural address as president of the Institution of Engineers and Shipbuilders in Scotland, Mr. J. Reid gave some interesting notes on locomotives. The first engines of the old Garnkirk and Glasgow Railway, which was opened about the year 1829, weighed from 8 to 9 tons. They had 11 inch cylinders, and wheels of cast iron 4 feet in diameter, with a working pressure in the boiler of 50 pounds per square inch. The Garnkirk engine used to take a train of three carriages, weighing 7 tons gross, at an average speed of sixteen miles per hour, between Glasgow and Gartsherrie. When the old line, eight miles in length, merged in the Caledonian Railway, now comprising a system of about 870 miles, the power of the engines was greatly increased, and at this day there are express passenger engines working over the same ground having 17 inch and 18 inch cylinders, and wheels of 7 feet and 8 feet in diameter, and weighing, in working order, from 35 to 45 tons. These engines take a gross load of 90 tons at a speed of from forty to fifty miles per hour, burning about 23 pounds of coal per mile run.

RECENT INVENTIONS.

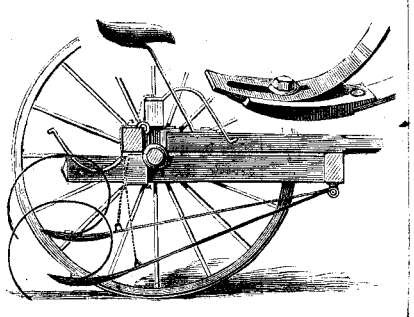
Double-acting Door Spring.

This invention consists of a spiral or other spring, a stud to be applied to the side of the door facing the direction in which the door moves when opening, and a stud carried by an arm or bar applied to the jamb of the door, the spring being fitted to turn freely at its ends on the two studs which act as pivots, and is so arranged that it is bent in direction of its length when opening or closing the door. This device will close the door, blind, or gate to which it is applied, and will hold it either closed or open. It is easily applied, and its power may be readily regulated to suit the door to which it is applied. While it is very efficient, it is the same time so even and light in its bearings that it is hardly noticeable; in fact, it suspends its power when the door is opened at a little more than right angles, but when the door passes this position (or center point) the spring carries it gently round and holds it open against the wall. However desirable it is to have doors shut, it is very often equally desirable to have them held open, hence a brick, poker, a chair, or a hook, is used to accomplish what this spring does. This spring has many advantages in its application to window blinds and shutters. It prevents all rattling and slamming, and holds them open, closed, or on the bow. Wherever hinged doors, shutters, or gates are used, this spring can be applied to advantage. This useful invention has recently been patented by Mr. W. S. Barlow, of Paterson, N. J.



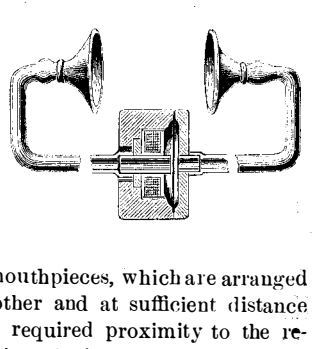
New Spring-toothed Sulky Harrow.

This spring-toothed sulky harrow is provided with curved spring teeth attached adjustably to shoes that slide upon the ground, and are attached to draw-bars hinged to the carriage frame. With the draw-bars are connected chains attached to bars pivoted eccentrically to the carriage, and provided with levers for raising and lowering the teeth. The teeth are bent into nearly circular form, and are attached at their upper ends to the shoe by one or more bolts. The tooth is slotted or has two or more holes formed through it to receive bolts, so that the tooth can be readily adjusted to work deeper or shallower in the ground, as the work to be done may require. The upper side of the shoe is recessed to receive the tooth as shown in the detail view. The lower side of the shoe rests and slides upon the ground when the harrow is at work. The forward end of the shoe is secured to the rear end of a draw-bar, the forward end of which is hinged to the front bar of the frame, so that the harrow tooth will move up and down readily. The teeth will yield and rise, should they strike an obstruction, and readily pass over, and the teeth conform to an uneven surface, so that all parts of the ground are properly cultivated. When desired, a grain box can be attached to the forward part of the frame, and the machine used as a broadcast seeder. This simple and effective harrow has been patented by Mr. Stephen O. Hickok, Hillsdale, Mich. (Box 175.)



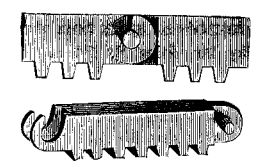
Receiving Telephone.

The device shown in the engraving is designed so that the entire volume of sound on one side of the diaphragm is delivered into one ear, and the entire volume of sound on the other side thereof is delivered into the other ear. The bobbin is placed on a tubular soft iron core, which is tapped into one end of a magnet, and also passes through the casing and is screwed into one of the rigid sound-conducting tubes. The other conducting tube is attached to a short tube, which is aligned with the tubular core and passes through the opposite side of the casing. At the inner end of the core is placed the diaphragm. The outer ends of the sound conducting tubes are curved upward and inward, and provided with mouthpieces, which are arranged opposite and facing each other and at sufficient distance apart to bring them into the required proximity to the respective right and left ears when the instrument is properly adjusted for the purpose of receiving a message. The tube, being rigid, will always retain the form and relation shown in the drawings. The instrument is used in connection with a battery transmitter—for instance, Blake's or Edison's. With this improvement the entire sound is utilized, so that a message that might be indistinct or faintly audible with the ordinary form of single tube receiver becomes clear and loud when received through this improved instrument. This invention has been patented by Mr. George F. Dailey, of 304 East Eighth Street, Leadville, Col.



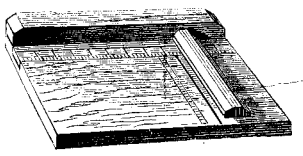
Cog Link for Chains.

This is an endless chain for transmitting power in machinery of different kinds and for various purposes, including traction engines, in which a spur wheel on the engine shaft is connected by a cogged chain with a spur wheel on the shaft of the driving wheel of the engine. It is also applicable to reapers, self-binders, and various agricultural and other machines. It consists in a cog link for such chains made with a slotted hook-shaped jaw at one of its ends, and a tenon at its opposite end provided with a transverse joint-pin or pin-like projections for engagement with the slotted hook-shaped jaw of a similar adjacent link. In this way is made a stout and durable chain, having the necessary flexibility at its joints, and which, while admitting of being readily put together, or taken apart, will be free from disengagement of its links when in use or working. This invention has been patented by Mr. Jacob S. Aydelott, of Xenia, Ind. (Lock box 21.)



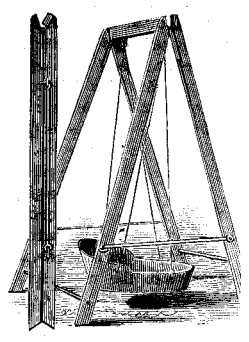
Glass Cutting Frame.

This device consists of a base plate of wood, metal, or other material, with a cleat along one edge having an arm or tongue projecting from it at right angles, near one end and a little above the bed plate, so that the glass plates may be placed under it and cut off squarely by a tool drawing along the tongue for a gauge; and a scale of lineal measure is arranged in the bed plate along the cleat, and also along the tongue, by which to measure the glass for cutting, the scales being seen through the glass when laid on the base plate. This useful invention has been patented by Mr. Wm. R. Rodman, of New Burnside, Ill.



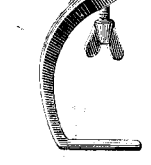
Novel Swing.

This is an improved swing, which can be erected or taken down very quickly and easily, and which is especially adapted for the nursery. Two oblong frames are hinged to each other at their upper ends in such a manner that they can be folded against each other. One frame is provided at its upper end with a cross bar, to the lower edge of which two loops or eyes are secured for receiving the snap hooks attached to the upper ends of the ropes which hold the basket. The upper ends of the side bars of the frame are provided with notches, into which the end parts of the cross-bar pass when the swing frames are erected. A brace hook rod is pivoted to each side bar of the frame, and when the frames are erected the hook ends of these rods are passed into loops or eyes on the side bars of the frame. When the swing frames are folded, the hook ends of the brace rods are passed into loops or eyes on the side bars of the frame as shown in one of the views. This invention has been patented by Mr. Charles W. Young, of Dartmouth, Nova Scotia, Can.



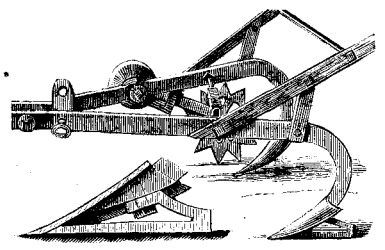
Hand Turning Tool.

The engraving shows a new hand tool for turning rods, pivots, or pintles without the use of a lathe. A hooked arm is made integral with or attached to one end of a bar or handle which is curved and bent, so as to adapt it to be used in reaching pivots or pintles on cross-heads or on other like objects which cannot be reached with a straight handle. The cutter bit is contained in a recess in the inner edge of the upper part of the hook, and the rod or pivot is pressed against it by a pressure block, adapted to slide between the shanks of the hook and pressed against the pivot or rod by a set screw passing through the curved handle. A bit having a serrated edge something like a screw cutting die is used to turn off the rod in its rough state. It is, however, provided with a plane surface which leaves the rod tolerably smooth. Another bit is then used, which turns down the surface of the rod or pivot true and smooth. The inventor makes one form of turning tool with a straight shank. By turning this tool around the object to be turned, rods, pintles, pivots, wrist pins, and like parts of machinery can be turned true and smooth very easily and rapidly. This implement is very compact, can easily be stored in a locomotive tool box or engine room, and turns a rod or pivot as well as an expensive and cumbersome lathe. This invention has been patented by Messrs. J. A. Plummer, Jr., and T. Gainford. Address J. A. Plummer, Jr., Newark, Cal.



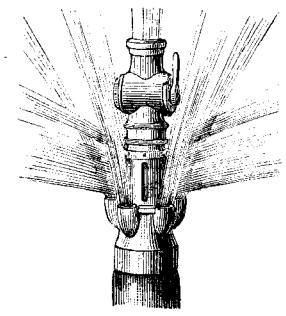
Double Shovel Plow.

We give an engraving of a double shovel plow of very simple construction recently patented by Mr. Charles Kenner, of St. Mary's, Mo. The plow beams are made of different lengths, and are connected together at the forward end by a bolt which also passes through the clevis, which is of improved form. The rear ends of the beams are curved downward and carry the shovels. A screw threaded rod is used to adjust the distance of the shovels apart. The shovel is provided with a shoe underneath, as shown in the small sectional view. To the outer side of the plow beam next the row of plants being cultivated is secured by a clutch an arm carrying a rotating fender, which is adjustable up and down, and rotates in contact with the ground. This fender will allow nothing but fine soil to pass to and around the plants. This improved shovel plow insures a thorough and even cultivation of the soil, and is easily handled and managed.



Improved Fire Hose Nozzle.

The engraving shows a new fire hose nozzle, which can be adjusted to deliver the water as a single jet, a spray, forward and sidewise, or all at the same time, and can also be used to signal to the engineer. A tube, which is preferably made tapering, is provided with a series of longitudinal openings or slots, and surrounded by a sleeve which fits closely on the tube, but is adapted to turn on it. The sleeve is held in place by a ring surrounding the tube above the upper end of the sleeve, and secured to the main tube. The sleeve is provided with as many upwardly and slightly divergent short tubular projections as there are openings, the lower or inner openings of which consist of slots of about the same size and shape as the slots in the main tube. Above the tubular projections the main tube is provided with a series of longitudinal slots, and at that part is surrounded by a sleeve provided with a series of longitudinal slots of the same size. On the upper end of the main tube a nozzle is screwed, which holds the outer sleeve in place. This nozzle is provided with a plug which can be turned by means of a key. The outer end of the nozzle is screw threaded, and a cap with a large or small opening can be screwed on it. When the plug is open and the main tube and the two sleeves are so adjusted that their slots do not coincide, all the water will pass through the nozzle, and will be delivered in a single stream or jet. If the tube and the lower sleeve are so adjusted that their slots coincide, some of the water will be delivered as spray or in small jets through the tubular projections, and part of the water will be delivered through the nozzle as a single stream or jet, and if the other sleeve is so adjusted that the slots coincide with the slots in the main tube, part of the water will also issue through them from the tube laterally. If the plug at the end of the tube is closed, and the slots of the tube and the sleeves coincide, all the water will be delivered as spray or in fine jets through the tubular projection and the slots. In this manner the nozzle can be adjusted by the fireman to deliver the water just as he thinks proper. If the plug is open and the sleeves are so adjusted that the slots of the tube and sleeves only partly coincide—that is, if very narrow openings are formed—the water will be delivered as a single stream and a very fine spray, which keeps the smoke from the fireman and permits him to approach very close to the fire. By turning the sleeves but slightly, the nozzle can be adjusted to deliver a very large quantity of water. One of the advantages of this improved nozzle is that it can be used for signaling to the engineer. If the nozzle is suddenly adjusted to deliver a large quantity of water, the pressure at the engine immediately decreases; and the reverse occurs if the water is partially or entirely shut off at the nozzle; the pressure rises correspondingly at the engine, and the indications or pressure is shown at the present gauge. This invention has been patented by Mr. Matthew Ward, South St. Louis, Mo.



A FEW years ago a wide field was open for young men in telegraph offices throughout the country. Now young women take their places as operators to a great extent, and the young men have to seek other avenues of employment. Mining and electrical engineering present a wide scope for capable young men, and there would seem to be a growing demand for skilled talent in either department.

ENGINEERING INVENTIONS.

A novel globe valve has been patented by Mr. George Reimann, of Quincy, Ill. The invention consists of a globe valve which is steam and air tight, and which also has a capacity for the renewal of those special parts which are exposed to wear without the renewal of the remaining parts, and it consists mainly in the combination of the various parts with each other, whereby the valve in its entirety possesses marked advantages over those commonly in use.

An improved indicator for hydraulic elevators has been patented by Messrs. Carl Schon and Calvin S. Brown, of Toledo, O. The invention consists of a roller to bear against and run along the elevator post or guide way, and of recording mechanism which is operated by the roller, arranged in a case attached to the elevator carriage, and operated when the carriage ascends, to show the number of feet the piston is moved by the water pressure, thus recording the number of gallons of water used.

An improvement in railroad switches has been patented by Mr. Martin A. Green, of Altoona, Pa. The invention consists of an arrangement whereby the switch rails carry the wheels over the main rails in such a manner that the main track rails remain solid and the point and frog are dispensed with; and it also consists of a switch contrived in a manner that a train running along the main line will automatically shift and pass the switch when running in one direction, in case the switch is open, and, also, so that a train running from the branch on to the main line will shift the switch automatically, in case it is set for the siding.

A novel drill frame, the object of which is to facilitate the drilling of holes in steam boilers for the attachment of machinery, has been patented by Messrs. David Clark and John Lee, of Hazleton, Pa. The invention consists in a drill frame constructed with a base having points or claws, and a standard provided with an adjustable arm, and an arbor placed at a point above the base. A chain is connected with the arbor at one end by a hook and at the other end by a swiveled screw and a claw hook, whereby the chain can be readily drawn taut to hold the drill frame securely in place.

A car coupling of improved construction has been patented by Mr. Franklin W. Kelly, of Vermontville, Mich. The invention consists in a U-shaped rod passed through the bottom of the drawhead into the cavity, on the crosspiece of which U-shaped rod an eye is loosely mounted, to which eye a lever is pivoted, which is also pivoted to the drawhead or a projection of the same, whereby the U-shaped rod will raise the link in the cavity in the drawhead by pulling this lever downward, by which means the coupling is greatly facilitated, and the great danger to life in the present systems avoided.

An improved escape door for railway cars, which can be opened to permit the exit of the passengers in case the car has caught fire or has been been overturned, and the usual outlets are not accessible, has been patented by Mr. Thomas E. Flint, of Middlebury, Vt. The invention consists in a car provided with openings in its bottom, which openings are closed by doors connected with slats resting on sliding bars in the car floor, the sliding bars being provided with racks engaging with pinions on a shaft below the car floor. When the shaft is rotated, the sliding bars, the seats, and the doors will be moved in the direction of the length of the car, leaving the openings in the car bottom uncovered to permit persons leaving the car through the same.

MECHANICAL INVENTIONS.

Mr. Horace L. Kingsley, of Racine, Wis., has patented a vehicle king bolt connection of peculiar device, the object of which invention is to reduce the cost of construction of that portion of a vehicle or carriage gear which is connected with the king bolt, as well as to increase its strength and durability.

A novel cotton cleaner, designed to remove the dust, trash, and dirt from cotton immediately after the cotton passes the brush, has been patented by Mr. John E. Engram, of Eufaula, Ala. The invention consists of the combination with a cotton gin flue having openings through its bottom, of deflecting wires secured within the flue, which act in such a way as to shake the cotton and loosen the dust therefrom, which latter then passes out of the flue through the openings in the bottom.

An improved converting motion, to be used when power and not speed is required, has been patented by Mr. Edward T. Alling, of Milledgeville, Ga. This invention consists of shafts upon which are keyed or fixed ratchet wheels having oppositely pointed teeth and meshing or gearing pinions, combined with drums sleeved loosely upon the shafts and surrounding the ratchets, and provided with spring pawls which engage the ratchets. The drums have also depending arms connected to a reciprocating rod.

A simple and convenient improvement in bed lounges is the subject of a patent recently granted to Mr. Philip Herbord, Jr., of Galion, O. The invention consists principally in a double jointed arrangement of the front portion of the lounge, which may be let down when in use as a bed. This front board rests on a couple of extension braces, which are folded out of sight when the article is used as a lounge, but are brought into use to support a mattress of sufficient width to accommodate two persons when used as a bed.

Mr. William W. Wythe, of Red Bank, N. J., has patented an improved hoisting gear, the object of the invention being to secure frictional adhesion of the rope to the drum or pulley of the hoisting mechanism, so that one end of the rope may be left to hang free without danger of the load descending by the slipping of the rope. To that end a friction pulley, arranged to press the rope into the groove of the pulley with more or less pressure in proportion to the load that is being raised, is combined with the hoisting gear and the desired results obtained.

A calendar clock of ingenious construction has been patented by Mr. Mathias L. Jacquemin, of Council Bluffs, Ia. The invention relates to improvements in perpetual calendars adapted to be operated by clock mechanism, or on a smaller scale by watches, or by any kind of time keeper, whereby an efficient and reliable calendar is provided for automatically making the weekly and monthly changes, for showing the names and numbers of the months, for making the changes for the different numbers of days in the months, and the leap year changes, and for showing the number of the quadrennial year.

An improvement upon that class of fire escapes which are formed of extensible parts, and supported upon wheels for convenience in transportation, has been patented by Mr. Richard Bentley, of Corning, Iowa. The invention consists in a hinged folding and extensible slideway attached to the forward end of the truck, which slideway is provided with an endless chain cable by which persons, goods, or furniture may be lowered to the ground in safety. The slideway is elevated by a system of pulleys and ropes, and is held in position by a stout support, so arranged as to hold the slideway in any desired inclination.

An invention relating to improvements in water sealed gas meters has been patented by Mr. Pedro Enrique Perez, of Valparaiso, Chili. These meters, as ordinarily constructed, if tipped out of level, will not register all of the gas that passes through them. This invention consists in providing such meters with valves that will cut off the flow of gas if the meter should be tipped out of level in any direction. To accomplish this, two valves are arranged horizontally and at right angles to each other, one being operated by a float, the other by a pendulum weight or plumb. The valves are by preference made double acting.

An improvement in gauge edgers, the object of which is to promote their efficiency and increase the convenience and simplify the construction and operation of gauge edgers and other sawing machines, has been patented to Clara A. White, of Eau Claire, Wis., executrix of Samuel White, deceased. This invention consists in devices which serve as brakes, and prevents the lumber from flying toward the front of the machine, also of the placing of feed rollers one or more in front, and two or more in the rear of the saws, by which the lumber is passed to the saw more evenly and with less danger of swerving than in the ordinary way.

An improved permutation lock has been patented by Mr. Wilbra W. Swett, of Springfield, Ill., capable of being operated by the sense of feeling instead of the sense of sight. The operation is substantially as follows: The knob handle, after having been turned to the right several times in order to bring the tumbler disks into the proper relation to each other, is moved to the base point—that is, in such manner as to bring the double groove of a disk in the lock into contact with the detent of the spring. Having found the base point by feeling the click as it snaps into the grooves, the grooves are counted in alternate directions until each tumbler in its turn, beginning with the inner one, is brought into the proper position for unlocking. The end of the locking bar being thus disengaged from the stop block, the bolt may be moved into the case to unlock the door. By a proper arrangement of the pins, any desired combination may be obtained in the manner well understood.

An improved extension fire escape has been patented by Mr. Philip Schuh, of Westchester, N. Y. The invention relates to an extension fire escape constructed with a carriage having the rear part of its frame movable and its forward part stationary, the said parts being connected by levers and connecting bars to allow the movable frame to be readily adjusted and controlled. To the movable part of the carriage frame on each side are swiveled two screws provided with a driving gearing, and carrying two pairs of nuts, to which are hinged the lower bars of a lazy tongs, so that the lazy tongs can be raised and lowered by turning the screws. With the lazy tongs and carriage frame are connected a flexible ladder and its reel, and a bail, pulley, rope, and reel, the said rope reel having a brake lever connected with it for controlling its movements. The carriage is also provided with dogs to engage with the ground and hold the carriage stationary while the machine is being used.

AGRICULTURAL INVENTIONS.

An improved harvesting machine has been patented by Mr. Edson L. Bracken, of Dawson, Ill. This invention consists of the combination and arrangement of a grain table, grain carrier, and a binding table with an ordinary or any special "rear cutting" mower in such manner, as to be readily attached at any time for the purpose of converting a mower into a harvesting and binding machine.

A novel sulky harrow of has been patented by Mr. Leroy M. Gillett, of Lyons, Kan. The invention consists of several novel features of construction, one of which is a device for shortening the axle and bringing the wheels nearer together when occasion requires; also, of an arrangement by which the harrow will be caused to work shallower or deeper as may be desired, and further of a pulley and lever combination, by which a portion of the harrow attachment may be raised to avoid contact with stumps, logs, stones, or other obstructions.

MISCELLANEOUS INVENTIONS.

Mr. Charles H. Scofield, of Utica, N. Y., has patented a new envelope for dry plates used in photography, which is to be used as a cover for the plates and as a plate holder in the camera, thus permitting the operator to dispense with the camera plate holding frames.

An improved tape line case has been patented by Mr. George Clark, of Brooklyn, N. Y. The invention consists in a tape line case made of sheet metal enameled on the inner and outer surfaces, the bearings for the spindle on which the tape line is wound being punched or pressed in these metal plates.

A combined music stool and pedal attachment is an ingenious invention recently patented by Mr. William E. Leighton, of West Pembroke, Me. It consists of a music stool having a supplementary pedal attachment for children, the attachment being adapted to be folded and shoved back into the base, or under the stool, when the stool is to be used by adults.

A novel corn popper has been patented by Mr. Jeremiah Wilkie, of Worthington, Ind. The invention consists of a tin, wire, or other receptacle for the corn, mounted upon a handle containing a trigger, spring, and connecting rod, all so arranged that the receptacle can be agitated by working the trigger with a finger of the hand holding the handle.

An improvement in the manufacture of shoes without side seams has been patented by Mr. John Haszinger, of Vicksburg, Miss. The invention consists of an upper having the tongue so formed as to provide edges for attaching tie-straps, the object being to provide a seamless shoe which is strongly supported at the instep and which is made at a minimum of cost.

An improved split bolt wedge has been patented by Mr. John P. Edmonds, of Jacksborough, Tenn. This invention relates to bolts which are partially split lengthwise at one of their ends, and have combined with them wedges, which, on the bolts being forced home, cause the split portions of the bolts to be expanded for the purpose of holding the bolts in their places.

A novel window screen has been patented by Mr. Henry Grimshaw, of Elroy, Wis. The invention consists in the combination with a frame carrying a wire netting screen, of an auxiliary frame, consisting of adjustable bars provided with transverse slots, and a series of corner plates provided with slots at right angles to each other, whereby provision is made for adjusting the screen to windows of different sizes.

An improved telegraph cable has been patented by Mr. Coroden J. Slafter, of Grand Junction, Mich. The invention consists in a fluted cylinder or bead having apertures and cleats, in combination with a telegraph cable consisting of wires, insulating beads, and coatings, the object of which is to provide for allowing ready access to the separate wires in a cable for repairs and connections.

Mr. Loring Wood, of Greenfield, Mass., has patented a useful improvement in wrenches. The invention consists in constructing an axle nut wrench with a movable bar in its handle, the end of which by means of a spring is forced out, and fitted into a notch made for it in the nut, whereby, when the nut has been loosened by the wrench, it is held in place and kept from falling to the ground by the gripping bar.

A novel paper trimming apparatus for use of paper hangers has been patented by Petter C. N. Pederson, of Neenah, Wis. The invention comprises, first, an improved knife consisting of a handle, a circular rotatable cutter, and a device attached to handle of knife for sharpening the edge of the cutter, and secondly, of a cutting board, and a straight edge which is adapted to be clamped to the latter, so as to confine the paper between them.

A novel improvement in signs has been patented by Mr. Romeo E. Ghezzi, of New York city. The invention consists in a sign having a base of sheet metal or other suitable material, on which is cemented a stencil of water proof paper or other flexible water proof material. The object of this invention is to produce a cheap stencil sign which shall be weather or water proof, and in which the design or lettering shall appear upon a suitable base.

Mr. Robert A. Carter, of Elizabeth, N. J., has obtained a patent for some improvements in spectacles and eye glasses. The invention relates to the construction of frameless spectacles and eye glasses, especially to that class in which a screw or bolt passes through the glass and through the arms of the clip. It consists especially in certain novel features of construction in the clips, and their attachment to the shank and to the nose piece, also in the catch which engages with the handle, and by which the glasses may be kept closed.

A new arrangement of sights for fire arms has been patented by Mr. Walter Cooper, of Bozeman, Montana Ter. The invention has for its object the production of a front sight of ordinary height and simple construction, that will require no special adjustment, yet will provide for dispensing with an elevated rear sight and allow of a stationary rear sight being used, and so that the rifleman may with a glance of the eye aim either for a short or a long range or point blank without moving the rifle from his shoulder.

An improvement in the manufacture of spoons and forks has been patented by Mr. Joseph Sheridan, of Jersey City, N. J. This invention consists in a novel method of and means for forming and cutting, with a shear cut, spoon, ladle, and fork blanks by one and the same operation, and whereby the barb, fin, or selvedge is removed at the same time, and the blank is delivered in the required bent form of the article to be produced, and so that it conforms to the shape of the curved die in which is it afterward struck up or embellished.

Mr. John G. Macfarlan, of Richmond, County of Surrey, England, has patented a process of and apparatus for the manufacture of ammonia and animal charcoal. The invention consists principally in a novel application of steam for the distillation of bones, etc. The process consists in making animal charcoal and treating the by-products thereof, by passing superheated steam through carbonaceous matter and then into the bone retorts, and subsequently mixing steam with the vapors and gases from the retorts.

A device for holding a horse's tail after it is plaited or folded up has been patented by Mr. Henry W. King, of Canaan, N. Y. Horse tail holders heretofore have been constructed in the form of a strap with two inwardly projecting tines or prongs that pass entirely around the tail; but in this invention flexible flaps are devised which involve no injury to the stump of the horse's tail, nor to his rump from the switching of his tail, and yet firmly hold the strap in place by a pinching action.

An improvement in ice machines, whereby the latent heat from the water introduced into the moulds is removed and a more rapid freezing of the water secured, has been patented by Mr. John T. Davis, of New York city. To this end the latent heat is extracted by a separate pump, and discharged into a chamber through which a stream of water is allowed to flow, in which chamber are the separate coils of pipe used for the different menstruums employed in the freezing operation.

A device for cleaning ash pans of locomotive engines by forcing water through them has been patented by Messrs. Alden D. Kilbom and William F. Smith, of Tucson, Arizona. Arranged within the front portion of the ash pan in proximity to its bottom and disposed crosswise of the pan, is a row of straight ejecting pipes of unequal length which force the water in a series of streams striking the bottom of the pan, one in advance of the other, whereby the ash and cinders are blown and washed away, and the pan thoroughly cleaned.

An invention providing a new and improved electrode for treating the uterus, and for bringing it to its normal condition, has been patented by Mr. Albert W. Tipton, of Jacksonville, Ill. The invention consists in an electrode formed of a tube made of a metal section and a hard rubber section placed parallel to each other, and united, to which tube a bell or cup is hinged, which is formed of a metal section and a hard rubber section united to each other. The tube is provided with devices for receiving an electrical conductor.

An invention providing an improved curtain holder which can easily be adjusted according to the length of the curtain roller or width of the window opening, has been patented by Mr. William J. Mullen, of New York city. The invention consists in a tube provided near the ends with clamping or binding screws, in the ends of which tube curved rods are held by the screws. These rods have loops at their extremities for receiving the pintles of the curtain roller, and have loops or eyes near the upper ends for hooks for suspending the curtain roller holder.

An ingenious construction of bridge for streams subject to high floods has been patented by Mr. Ebenezer B. Stephens, of Humboldt, Neb. It consists in so constructing the bridge that the floors may rise off their foundations and float on the surface of the water when the floods overflow the foundations, and at the same time may be crossed by means of aprons at the ends, arranged so as to connect at one end with the foundations at the road levels and with the bridge at the other end, and afford practicable ascent to and descent from the bridge while floating above the foundations.

A novel improvement in windmills has been patented by Mr. Randolph O. Robinson, of Glidden, Ia. The invention consists of a contrivance of the vanes of a wind wheel, whereby the wheel, being arranged on a horizontal shaft the bearings of which are stationary, will run in the same direction, whichever way the wind may blow, the use of a turn table and contrivances for enabling the shaft to shift with the wind being thus avoided. The invention likewise consists of an improved construction of the vanes of the wheel calculated to increase the efficiency of the surface acted upon by the wind.

A novel adjustable funnel holder for convenience in filling sacks, bags, and other packages of different sizes has been patented by Messrs. John R. Johnson, of Smyrna, and James S. Johnson, of Moorefield, O. The invention consists of a vertically slotted casing through the opening of which is passed one end of the funnel holder, the other end being attached to a sliding block which is capable of elevation and depression by means of a system of ropes and pulleys, and a crank, the latter being located on the outside of the casing. This apparatus may be made of small size to adapt it to the use of druggists, grocers, etc., and of large size for the use of farmers.

Messrs. Robert Pallett and Francis Mahedy, of New York city, have patented an improved fire escape. The invention consists in brief of a carriage upon which are raised four upright hollow telescopic hydraulic columns, upon the extremity of which is placed a platform which may be elevated or lowered at will by means of hydraulic pressure acting upon the extension sections of the columns. A flexible hose is attached to the upper extremity of the support, so that the water discharge may be directed as required. The platform is reached by a chain ladder situated in the center between the supports. The reservoir from which the hydraulic pressure is obtained for the columns is located in the center of the carriage under the columns, and may be filled by as many as four or five engines at a time.

A waterproof, fireproof, and frostproof roof or wall covering has been patented by Mr. Duncan McLean, of Wallacetown, Ontario, Can. The composition employed consists of the following ingredients: hydraulic cement, one barrel; clear sand, three barrels; salt, one-half bushel; hair and water in sufficient quantities to form a good mortar of medium stiffness. This mortar is spread to the thickness of about half an inch upon the roof, which is made rough by laths or narrow timber in order to hold the mortar. Then one or more coats of hot gas or coal tar are applied by means of a brush, and as much sand is spread on the tar as it will absorb. This sanded surface is rubbed down, and more coats of tar applied, and clear sand is spread on each coat of tar. When the coating is thoroughly dry and hard, it is rubbed with a suitable tool until it is smooth, hard, and glossy. Linseed oil is used in this last operation to give the coating a good finish.

Messrs. Thomas Rosevear and Richard Bryant, of Negaunee, Mich., have patented an improved apparatus for thawing giant powder. In mining and other operations requiring the use of giant powder and other high explosives, there is frequent loss of life and property from accidental explosions, resulting mainly from the shifts resorted to by miners to warm the powder to blast with. The object of this invention is, besides that of saving life and property, to provide a convenient and efficient apparatus by which the cartridges can be warmed and kept warm until ready for use. This invention consists of a receptacle adapted for receiving hot water, and provided on the interior with cartridge holders. At the same time there is no contact of the water with the cartridges, and no risk of deterioration by the oil being abstracted by the water. There is, further, no risk of accidental explosion, and no loss of time from the necessity of carrying the cartridges to a placed where they can be warmed.

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.

NEW BOOKS AND PUBLICATIONS.

ANATOMICAL TECHNOLOGY AS APPLIED TO THE DOMESTIC CAT. By Burt G. Wilder and Simon H. Gage. New York: A. S. Barnes & Co.

The authors have chosen the anatomy of the domestic cat as the basis for an introduction to human, veterinary, and comparative anatomy because of the convenient size of the animal, its small cost and ease of attainment, its physical characteristics, and its zoological position. They confine their attention mainly to special portions of the gross anatomy of the cat—particularly the brain and the abdominal viscera—for the reason that these parts best serve their purpose of teaching the methods of anatomical study, with so much of the fundamental facts of structure and function and anatomical terminology as will suffice to give the beginner a good start toward successful independent study, whether as working naturalist, medical practitioner, or veterinary surgeon. The work is thoroughly scientific in spirit and method, and has had the practical test of several years' use in the anatomical laboratory of Cornell University. The description of materials, operations, and modes of study are minute, clear, and practical, making the work usable and very helpful for students working alone, as well as for teaching technical anatomy in medical and veterinary schools.

CATALOGUE AND INDEX OF THE PUBLICATIONS OF THE SMITHSONIAN INSTITUTION—1846 TO 1882. By William J. Rhees. Washington: Smithsonian Institution.

Scientific students and teachers will not be slow to appreciate the value of this catalogue. It comprises not only a full descriptive list of the publications of the Institution (now nearly 500 in number), but also an alphabetical index (covering 200 octavo pages) of all the articles in the Smithsonian contributions, miscellaneous collections, annual reports, bulletins, and proceedings of the United States National Museum, and report of the Bureau of Ethnology. In addition, there is a convenient and valuable classified list (thirty pages) of separate publications of the Institution, arranged by subjects and authors.

A PRACTICAL TREATISE ON CAOUTCHOUC AND GUTTA-PERCHA. From the German of Raimund Hoffer, by William T. Brannt. Philadelphia: Henry Carey Baird & Co. $2.50.

An interesting account of the natural, industrial, and commercial history of these important gums; their sources, properties, and the manner of working them in the crude state; the fabrication of vulcanized and hard rubbers; caoutchouc and gutta-percha compositions; waterproof substances, elastic tissues, and other useful products. There are also chapters on the impurities and adulterations of the raw materials; the utilization of wastes in the various manufacturing processes; substitutes for gutta-percha and rubber, statistical data, etc. The work will be found an instructive and suggestive handbook for manufacturers, dealers, and inventors.

THE BUILDER'S GUIDE AND ESTIMATOR'S PRICE BOOK. By Fred. T. Hodgson. New York: Industrial Publication Company.

This handbook is intended chiefly to assist the builder and contractor in making estimates of the cost of work. It gives practical directions for making estimates; memoranda of items for estimates, and modes of calculating quantities and costs; schedules of approximate prices for materials and labor in each department of construction; rules for measuring artificers' work; elementary mechanics of architecture; weight and strength of various building materials; useful tables; glossary of technical terms; summary of lien laws of the various States, and other information of value as well to those who contemplate building as to those who are to do the work.

AN INTRODUCTION TO THE STUDY OF ORGANIC CHEMISTRY. By Adolph Pinner, Ph.D. From the Fifth German Edition, by Peter T. Austin, Ph.D., Rutgers College. New York: John Wiley & Sons.

An admirably straightforward and intelligible account of the structural development of the carbon compounds as found in nature or artificially produced in the chemist's laboratory. Professor A. W. Hofmann, of Berlin, whose class-room teaching the work substantially follows, had a genius for organizing chemical instruction; and in this text book the subject is developed with wonderful precision, coherence, and clearness. We do not know another text book in this usually bewildering science that can compare with it in usableness or for giving in small compass a comprehendable general view of the science.

PICTURESQUE JOURNEYS IN AMERICA OF THE JUNIOR UNITED TOURISTS' CLUB. Edited by Rev. Edward T. Broomfield. New York: R. Worthington.

Under the guise of reports of papers and conversations of a young people's club of stay-at-home tourists, the editor has somewhat heavily supplied descriptive text for a considerable number of illustrations of American scenery. Many of the engravings are large and admirable wood cuts of views in California, Utah, the Yellowstone Park, the mountains of Pennsylvania, the Adirondacks, the White Hills, and along the Atlantic coast; a few are poor, and some have obviously been misplaced. Occasionally the editor betrays personal unfamiliarity with the regions described, and a lack of skill in developing the capabilities of his subject. But young folks are not so critical as their elders; the pictures are suggestive, if not always instructive; and the book as a whole is above the average of the class. It is well printed and handsomely bound.

GATELY'S UNIVERSAL EDUCATOR: AN EDUCATIONAL CYCLOPEDIA AND BUSINESS GUIDE. Edited by Chas. E. Beale and M. R. Gately. Boston: M. R. Gately. 8vo., 3 vols. in 1; pp. 361, 396, and 372.

The aim of this ambitious volume is to present under one cover the general principles and many of the practical applications of the educational and business sciences and the more general useful and ornamental arts. The first volume embraces vegetable and animal life, astronomy, geology, mineralogy, metallurgy, physical geography, human history, statistics, and law. Vol. ii.: Architecture, drawing, physics, and mechanics; chemistry, agriculture, physiology, medicine, hygiene, etc. Vol. iii.: Grammar, poetry, rhetoric, logic, elocution, phonography, penmanship, music, letter writing and bookkeeping, deportment, domestic economy, games, tailors' measures, milling, etc., etc. Fifteen contributors are named; none of them widely known as writers or teachers. Bearing in mind the fact that the most difficult thing in the world is to present the elements of any science or art in small compass, in plain and understandable English, with accuracy as to facts and sound judgment as regards the proportioning of parts, the value of this work will be indicated when we say that, with one or two exceptions, the contributors have shown anything but a comprehensive view and grasp of their subjects, and little skill in expressing what they have to say. In several instances the articles are the rawest sort of hack-work, by unskillful compilers who cannot write even tolerable English. In these days of cheap manuals by the most capable investigators and instructors, and of cheap encyclopedias as well, a work of this sort would have to be supremely good to succeed.

A DICTIONARY OF ELECTRICITY; OR, THE ELECTRICIAN'S HAND-BOOK OF REFERENCE. By Henry Greer, with additions by Wm. L. Allison. Published by New York Agent of College of Electrical Engineering. 12mo. $2.00.

Contains definitions of a large number of terms used in electrical science, descriptions and illustrations of the more important recent forms of electrical appliances, and other kindred matter of value as well to the general reader as to those directly interested in the invention, manufacture, or use of electrical apparatus and machinery. The book might be more comprehensive, and should be better printed for the price.

HISTORY OF THE PACIFIC STATES OF NORTH AMERICA. By Hubert Howe Bancroft. Vol. i., Central America. San Francisco: A. L. Bancroft & Co., 1882. 8vo; pp. lxxii–704.

Mr. Bancroft has developed a method of historical research and authorship as magnificent as the results are commendable. He pursues history as Mr Edison does invention, with a corps of trained assistants and a "plant" embracing everything attainable in print or in manuscript bearing upon the subject in hand. For example, the authorities quoted in the present volume fill nearly fifty closely printed octavo pages, and number something like twenty thousand entries, not a few of the names standing for collections of fifty or sixty volumes and more. This vast store of raw material forms a part of the historical library which Mr. Bancroft has collected for his great undertaking. The "History of Central America" takes up the history of the Pacific States where it was dropped on the completion of the author's "Native Races of the Pacific Coast." The first volume covers the period between 1501 and 1530, introduced by a rapid and brilliant survey of the European world, particularly Spain, at the beginning of the sixteenth century, and a chapter on Columbus and his discoveries. The author's theory of history writing is to tell the truth plainly and concisely. His style is direct and forceful, sometimes eloquent; and the matter of this volume is of necessity a record of some of the most exciting, adventurous, courageous, horrible, and damnable undertakings and proceedings that human history has place for. The "History of Central America" is to be followed by other volumes devoted to Mexico, the North Mexican States, New Mexico and Arizona, California, Nevada, Utah, the Northwest Coast, Oregon, Washington, Idaho and Montana, British Columbia, and Alaska. It is to be hoped that Mr. Bancroft's health and endurance may be adequate for the completion of the monumental task which has been so admirably begun.

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. If not then published, they may conclude that, for good reasons, the Editor declines 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.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) I. B. F. writes: Can you give me any information relating to aniline colors, how made, etc.? Have you any information in any of your SUPPLEMENTS? A. Consult SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 57 and 68.

(2) A. M. asks: Can you give me formulæ for making cotton, vegetable, and orange fertilizers? I have abundance of fish, salt marsh, muck, pine wood ashes, and charcoal. An orange fertilizer should have the following composition: ammonia, 3·25 per cent; available phosphoric acid, 3·50 per cent; potash, 14·50 per cent. Cotton fertilizer: ammonia, 2·50 per cent; available phosphoric acid, 7·50 per cent; potash, 4 per cent. The formula for the vegetable fertilizer varies with the kind of vegetable which is cultivated: Ammonia, 5 to 7 per cent; available phosphoric acid, 6 per cent; potash, 8 to 12 per cent. It will be necessary for our correspondent to have analyses made of his refuse materials, and then from the analytical data obtained calculate them to the above formulæ.

(3) N. T. R. asks: Which is best to use, iron or steel rivets in riveting two steel plates together? The plates are one-sixteenth inch thick, and the pressure is between the plates—that is, to spread them apart. A. Steel rivets are best, if they are sufficiently soft.

(4) H. L. S. writes: 1. We have a steam boiler, 42 inches by 12 feet, with thirty-four 3 inch flues. It furnishes steam to run a 10 inch by 15 inch engine, and concentrate the cane juice. We find it is too small to run our machinery to its full capacity during the sorghum season (about two months); the balance of the year we wish to run a feed mill to the capacity of the engine. Will it be the most economical in setting up, fixtures, and consumption of fuel, etc, to get another boiler of same size to build in with the one we have, or sell ours (for almost cost) and get one larger—50 inches by 14 feet, with fifty-two 3 inch flues? A. Sell and get a larger boiler. 2. Will it be better (in our business) to superheat the steam by running the flue back over the whole length of boiler before entering the chimney? A. No; there will be danger of injuring the top of boiler.

(5) W. O. asks: 1. Has aluminum the appearance of silver? I am informed it has, and will not tarnish as silver does. If so, can it be used as an alloy with gold? A. For a complete description and history of the metal aluminum we refer you to SCIENTIFIC AMERICAN SUPPLEMENT, No. 36. 2. Some students of the English language have disputed about the number of the letters of the alphabet, and their sound. Would it be possible to construct an instrument of the character of the telephone or phonograph that would analyze the sounds of the words, so as to get a correct alphabet? I was thinking of trying to construct such an instrument. I thought, as there were seven notes to music and seven primary colors in nature, we might find seven true vowels in language, and by getting the number of vibrations produced by the same per second, and dividing, might find the consonant filling the place in language, as the half note does in music. A. There are twenty-six letters in the English language, and, according to Corell, forty-one sounds, or according to Greene, forty. In order to ascertain about instruments used to analyze sound, it would be necessary to consult the literature of the subject. Both Helmholtz, of Berlin, and Koenig, of Paris, have described such instruments, but whether they will answer your purpose can only be decided by yourself. There are seven primary colors and seven notes in music.

(6) J. T. F. asks: 1. For the best way to polish fancy woods? A. Soft woods may be turned so smooth as to require no other polishing than that produced by holding it against a few fine turnings or shavings of the same wood while revolving. Mahogany, walnut, and some other woods may be polished by the use of a mixture as follows: Dissolve by heat so much beeswax in spirits of turpentine that the mixture, when cold, shall be of about the thickness of honey. This may be applied to furniture or to work running in the lathe by means of a piece of clean cloth, and as much as possible should be rubbed off by using a clean flannel or other cloth. Hard woods may be readily turned very smooth; fine glass paper will suffice to give them a very perfect surface; a little linseed oil may then be rubbed on, and a portion of the turnings of the wood to be polished may then be held against the article, while it turns rapidly around, which will in general give it a fine gloss. You may also try alcoholic shellac varnish, 2 parts; boiled linseed oil, 1 part; shake well before using. Apply a small quantity with a cloth, and rub vigorously until the polish is secured. 2. To make paper-hanger's paste? A. First heat water to boiling, then add flour with constant stirring. To prevent the formation of lumps the flour may be passed through a sieve, so as to insure its more equable distribution; agitation is continued until the heat has rendered the mass of the desired consistency, and, after a few moments' further boiling, it is ready for use. In order to increase its strength, powdered resin in the proportion of one sixth to one-fourth of the weight of the flour is added. To prevent its souring, oil of cloves, or few drops of carbolic acid is added.

(7) J. H. S. asks: Can I get as much power from an engine with a 3 foot flywheel and a 2 foot belt wheel, crank in center, by running belt direct from flywheel to mill as to run belt from pulley to line shaft and then to mill? The small pulley does not run the mill fast enough for direct connection. A. You can get as much power, if the engine runs at same speed, but the motion will not be so steady when belting from the flywheel as when belting from the pulley.

(8) R. R. L. writes: Some time last year you published, under the head of "Metallic Designs on Glass Reproduced by the Aid of Photography," a process for the same, and you mention as the principal article to be used "sensitive bitumen." What is it, and how is it sensitized? A. Sensitive bitumen is Assyrian asphalt dissolved in turpentine, ether, or oil of lavender. It is sensitive to light, and after exposure the parts which are not attacked by light may be dissolved out by oil of turpentine.

(9) G. H. T. asks how to soften putty that has become hard by exposure, so as to easily remove it from a sash. A. To soften putty, take 1 pound of pearl ash, 3 pounds of quick stone lime; slake the lime in water, then add the pearl ash, and make the whole about the consistency of paint. Apply it to both sides of the glass and let it remain for twelve hours, when the putty will be so softened that the glass may be taken out of the frame with the greatest facility.

(10) L. B. asks: What can I use that will render a paper butter or lard tray grease and brine proof, and at the same time be non-poisonous? A. Coat the paper tray with paraffine, or else cover the article with an ordinary varnish.

(11) H. C. inquires of what metal those bright red or blue caps are made which are on many of the French bottles of medicines, etc. It is very thin, and I should like to know how it is colored. A. The caps referred to are composed of tin mixed with more or less lead, then coated with more or less shellac varnish, colored with aniline dyes according to fancy.

(12) J. G. B. asks how to temper thin sheet steel, size 10 by 14 inches, and keep it straight. A. The saw-makers temper steel saws by dipping in oil edgewise to harden, then draw in hot oil bath and hammer to straighten. The hammering involves much experience, and is considered a high art among saw-makers. You can make a fair experiment in hammering by a trial upon a piece of sheet iron that is warped. Hardening sheet steel by pressure between cold plates of iron, but we do not know with what success.

(13) J. S. W. asks: 1. How to mend an ivory penstock which was broken square across? A. Ivory cement. Dissolve 1 part of isinglass and 2 of white glue in 30 of water; strain, and evaporate to 6 parts. Add one-thirtieth part of gum mastic, dissolved in one-half a part of alcohol; add 1 part of zinc white. When required for use, warm and shake up. 2. How is aniline prepared from coal tar? A. See SCIENTIFIC AMERICAN SUPPLEMENTS, 57 and 68. 3. Would a bullet from a rifle go through an ordinary book, one-half inch thick, bound in boards, placed at a distance of 200 yards? A. It depends upon the caliber of the gun, the amount of powder used, and the manner in which the book is supported. Under favorable conditions the bullet would pass through a book one-half inch thick.

(14) R. A. T. asks: 1. What is the difference between "draught pounds" and "avoirdupois pounds"? A. "Draught pounds," as we understand it, is the "pull" in pounds by the horse on the vehicle or load. Avoirdupois pounds are the ordinary pounds of commerce. 2. What is the difference between the distances the power is from the draught (in foot lengths)—*i. e.*, if a team of horses are hitched at a distance of 3 feet at one time and 5 feet at another from the draught, what is the difference of "draught pounds"? A. None. 3. What is meant by "draught pounds," and what by "foot pounds!" A. The meaning of the term "foot pounds" is the weight in pounds multiplied by the distance it is lifted in feet in one minute of time. The difference between "draught" and "foot" pounds is that the former takes no account of the movement of the load, and the latter does.

(15) C. E. A. writes: I notice in your issue for January 13, page 25, an article upon the formation of sulphuric acid and a method of absorbing the same by means of a zinc plate. Is the acid mentioned formed when gasoline is used? A. If the gas from gasoline is properly prepared and burned, it should not contain any sulphuric acid.

(16) W. H. D. asks: What is the per cent of potash in pine wood ashes? A. Red pine, 5·2 per cent potash; white pine, 15·8 per cent potash.

(17) J. W. F. asks: 1. What is the best book to buy for the use of analyses? A. Fresenius' "Manual of Quantitative Chemical Analyses." 2. Also, a book on fertilizers, how to manufacture, etc.? A. "On Artificial Manures, their Chemical Selection, and Scientific Application to Agriculture," by M. G. Ville, translated and edited by Wm. Crookes.

(18) M. T. S. asks: 1. At about what temperature would pure oxygen attack copper, producing combustion or fusion? Or would it so act at any temperature short of fusion? A. It would oegin at low red heat before fusion. 2. Please give best method of obtaining oxygen (absolute purity not essential) cheaply and rapidly. A. Consult SCIENTIFIC AMERICAN SUPPLEMENT, No. 313, p. 4994. The method is there given in full.

(19) A. B. asks: Can you tell me if there is any quick method of transferring the film and image of an albumen photograph on to glass, linen, etc.? A. There is no satisfactory method for transferring the film and image of an albumen photograph on to glass, linen, etc. The best method would be to photograph direct.

(20) B. C. M. asks: 1. How the non-erasible lines are put on slated paper? A. The lines are ruled with zinc, after which one coat of the silicate coating is put over the slate. 2. Would varnish prevent the fading of an outline taken by the gelatine transfer process? A. Use bleach shellac and alcohol as a varnish, as it will prevent fading.

(21) T. G. H. asks for a receipt for manufacturing the "hektograph," or gelatine pad, now much used in office and clerical work. It is imperfect and unsatisfactory in its present condition, and can, I think, be improved. A. The following is a composition by Lebacque:

Gelatine	100 parts.
Water	375 "
Glycerine	375 "
Kaolin	50 "

Also one by W. Wartha:

Gelatine	100 parts.
Dextrine	100 "
Glycerine	1,000 "
Barium sulphate	q. s.

(22) F. T. H. asks: 1. If ordinary school crayon is just chalk, or of what is it composed, and in about what proportions? A. Washed pipe clay and washed chalk, equal parts; mix them into a paste with sweet ale made hot, and with a chip or two of isinglass dissolved in it. 2. Are the crayons cut into shape, or are the materials made in solution and let settle into moulds? A. The paste is rolled out with a rolling pin, then cut into slips, and then rolled into cylinders by the aid of a little flat piece of wood, then cut to the length of three inches each, and placed in a slow oven or drying stove until hard.

(23) L. R. A. asks: 1 Where can I obtain directions for making a simple and efficient telephone transmitter, in which carbon is used? A. See SUPPLEMENTS, 250 and 163. 2. Please give the formula for computing the power of a celestial refracting telescope? Also, for determining the focal distance of a two-lens eyepiece? A. To compute the magnifying power of a telescope, divide the focal length of the object-glass in inches by the focal length of the eyepiece, or its equivalent in inches. The quotient is the magnifying power. To get the focal value of a Huyghens eyepiece, multiply together the focal lengths of the two lenses in inches, and this product by the distance from face to face of their plane sides, also in inches. Divide this product by the *sum* of the focal lengths of the two lenses in inches. The quotient will be the focal length of an equivalent lens in inches. To illustrate: Take two lenses, respectively 3 inches and 1 inch focus, distance apart, 2 inches. Then $\frac{3'' \times 1'' \times 2''}{3'' + 1''} = \frac{6''}{4''} = 1\frac{1}{2}''$, or the focus of an equivalent lens. Suppose that your object glass is 40 inches focus, then $\frac{40}{1\frac{1}{2}} = 26\frac{6}{10}$ magnifying power. A crude way practiced with small telescopes is to observe a distant and distinct object with one eye through the telescope and with the other eye direct, both eyes seeing the object at the same time. A little practice will enable one to approximate to the power. This is often done with terrestrial or erecting eyepieces which are sometimes a little complicated in the arrangement of the lenses. 3. In the secondary battery described on page 406 of vol. xliv., SCIENTIFIC AMERICAN, could the lead foil that covers the insides of tea chests be advantageously used as plates, or is it too thin? Canton flannel and blotting paper is soon destroyed by the sulphuric acid. What other cheap stuffs can be used instead? A. The foil would be too thin. Better cast your plates with holes in them, and fill the holes with the lead oxide. 4. I have an induction coil 8 inches long; wire core, seven-eighths inch in diameter. The primary coil consists of four layers No. 16 cotton-covered copper wire, and the secondary of 2⅔ pounds No. 32 cotton-covered wire. Even with a battery of four Bunsen cells only a mere trace of an induced current is perceptible. Please give me a clew to the fault. A. It is probable your insulation is imperfect. You cannot obtain results without the most careful insulation. Try doubling or trebling the quantity of fine wire. See SUPPLEMENT, 160.

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

J. P. G.—The mineral is a slate containing pyrites.—J. E. H.—The mineral is a carboniferous shale.

COMMUNICATIONS RECEIVED.

On Fire Escapes. By A. C. A.

On Flight. By F. P. H.

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(About eight words to a line.)

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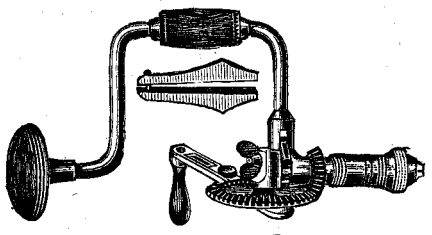

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This Bit Brace is made of steel, highly polished and heavily nickel plated, with a cocobola handle and lignumvitæ head. It has two sets of forged steel jaws, which will hold square and flat shank tools of all shapes and sizes, and round twist drills from 7-16 to 1-32 inch in diameter. The ratchet attachment enables the Brace to be used in places where there is not room to revolve the sweep.

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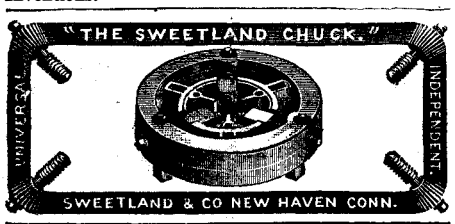

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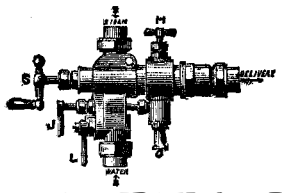

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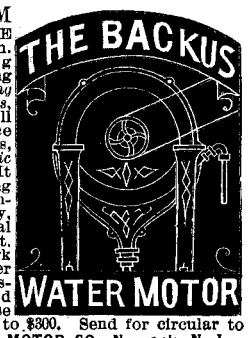

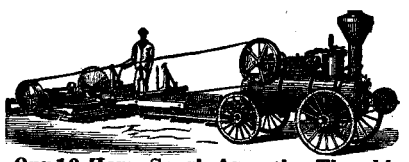

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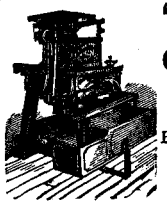

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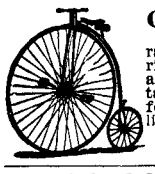

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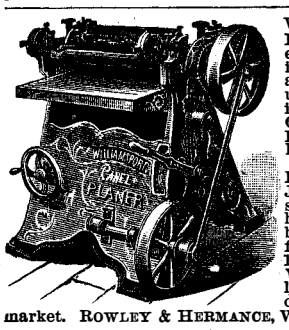

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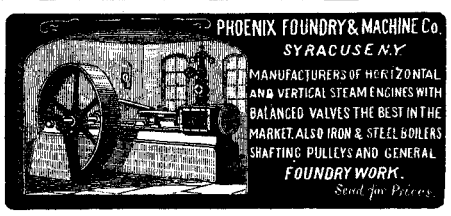

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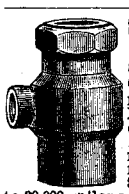

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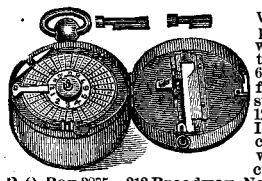

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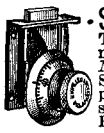

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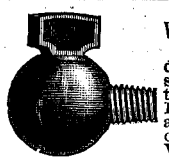

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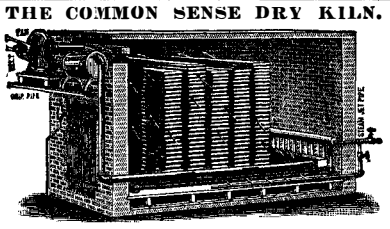

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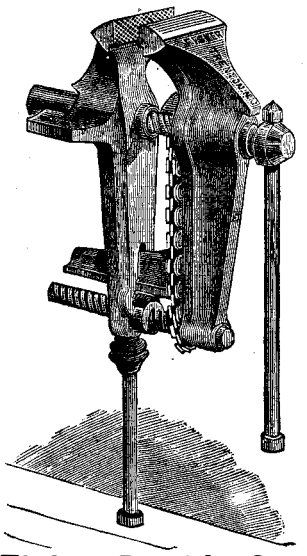

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