SCIENTIFIC AMERICAN

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

Vol. XXXIII.—No. 19. [NEW SERIES.] | NEW YORK, NOVEMBER 6, 1875. | $3.20 per Annum. [POSTAGE PREPAID.]

A POWERFUL CRANE.

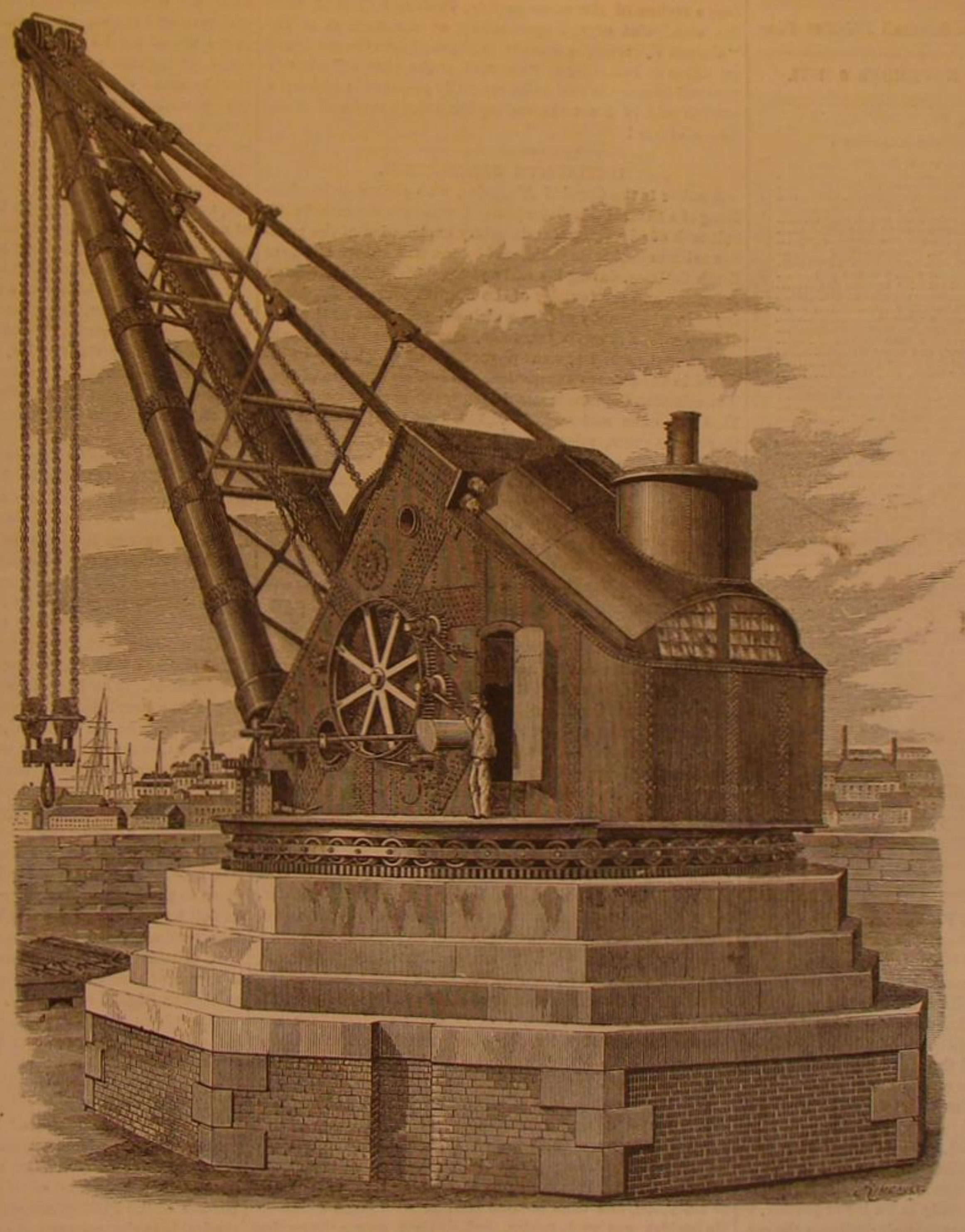
Messrs. James Taylor & Co., of Birkenhead, England, have recently constructed and erected five large cranes, one of which was sent to Australia, the others being established, one at Greenock, two at Glasgow, and one at Dundee. Our engraving represents the last-named machine. It is nominally a 70 tun crane, but the test load is 90 tuns, and the makers have no fear of putting 100 tuns on it It has already carried 80 tuns, lifting that load with only two thirds of the allowed pressure of steam, and lowering on the brake with a nicety that would enable the most delicate adjustment of its load, in case of its being used in erecting marine engines, to be made with confidence.

The crane will deposit its load a clear distance of 40 feet from the face of the quay wall, or 56 feet from the center of the pedestal of masonry on which it is fixed. The head of the jib is 60 feet in perpendicular hight from the coping of the pedestal.

The main features of construction are in the arrangement, by which the center post gives way to a central pin, only subject to direct upward tension, the whole crane acting as a lever to raise it vertically. The fulcrum is the ring of 60 rollers running on the cast iron and steel roller race on the top of the stonework, eight or nine of which at a time take the thrust at the foot of the jib, and constantly change as the crane revolves; and the resistance is the weight of the masonry secured by six massive radiating holding-down bolts by which the central pin is anchored.

The hoisting, says *Engineering*, from whose pages we select the engraving, is effected by two barrels, winding simultaneously the two ends of the chain, which lead from the barrels to pulleys on the jib head, thence drop to and rise again from the gin block, the middle or loop of the chain being on a fixed compensating pulley hung fast close below the jib head. The gin block weighs 4 tuns. The winding barrels are grooved right and left, by which an even distribution of strains on the crane framing is secured. There are three speeds of lift, besides a separate crab with a single chain for light lift up to 10 tuns. The hoisting engines are a pair of vertical direct acting engines with cylinders 10 inches diameter and 16 inches stroke.

The revolving is effected by a pair of smaller independent horizontal engines. The boiler is a vertical one, very large in proportion to the work to be performed, and is fed by an injector. All the valves and levers are easily within reach of one engine or crane driver. Wrought iron predominates in the structure, and is obviously the best material for the framing, the jib, the center pin, and all such important parts of the machine.



TAYLOR & CO.'S STEAM CRANE.

New Deodorizer.

A working man named Wilkes, residing at Bloxwich, England, has patented an intercepting process which does away with the necessity for sewers—so far as refuse matter is concerned—altogether. The vital principle of Wilkes's patent consists in effectually dividing the liquid matter from the solid. This is gained by the division of the receiving pan into two parts. The next point arrived at is the effectual deodorizing of both liquid and solid. Liquid matter is allowed to flow into a receptacle filled with a powder. This powder so effectually absorbs the moisture and kills any effluvium that, notwithstanding the fact that the receptacle examined had been in use for some months, no offensive odor of any kind whatever was discernible, even under the most critical testing. Solid matter is received into a receptacle which may either be made in the form of a movable pan or a fixed chamber, to be emptied periodically. On the solid matter the powder is sprinkled either mechanically, as in the case of Moule's earth closets, or by hand. In either case, no odor whatever can be detected. When the receptacles are full, they can be emptied either by day or by night, for there is no unpleasant smell perceptible. The refuse matter is taken away, and laid in heaps to dry. After this, it is pulverized, and can be sold as a most valuable manure at as high a rate as $26 per tun. The manure itself, when ready for transport, has the appearance of fine cement, and it is also devoid of odor. With reference to the powder spoken of, it is simply the result of calcining the contents of vegetable refuse and ashpits. It is much more effective than dry earth, and costs a mere trifle. The patent also embraces a very ingenious method of dealing with slops taken from the house, whether greasy water, soapsuds, or whatever they may be. The great feature, in short, throughout the system, is to obviate the necessity for anything in the shape of sewers. The apparatus for disposing of slops consists of a very simple set of filters, the water in its passage percolating through two small tanks filled with the powder, and exuding at the end so pure as to allow of its being used for scouring purposes. Whatever alkaline, greasy, or solid particles of any kind there may be are left behind amongst the powder in the tanks. The tanks in their turn are emptied, and a valuable manure secured.—*Birmingham News.*

Sewer Gas Dangers.

It is rarely that so striking an instance of the dangers of sewer gas as that reported by Dr. Trask, of Astoria, N. Y., in a recent number of the *Medical Record*, is brought to public notice. This physician states that a lady patient, shortly after confinement, was attacked with severe symptoms of fever and acute peritonitis. On the same day her son became sick with a severe continued fever, a week after a servant was taken with a similar malady, and so on through the members of a family of ten persons, only two of whom were excepted. After investigating every possible source of the epidemic, the doctor became convinced that it was due to the escape of mephitic gases from the mains of the house, and a long search finally brought to light an imperfect joint, which allowed the noxious emanations to pass up between the plastering and wall of the parlor. The family shortly afterward removed to another house, and here the health of all the members greatly improved; but on the other hand, the lady again became a sufferer with a chronic ailment. Another search, after she had undergone a tedious convalescence, proved that her illness was due to the same cause as before, this time produced by the choking up by ice of a soil pipe adjacent to her apartment. The medical aspects of the cases are peculiar, though not intelligible to the general reader. The report will, however, serve a good purpose if it suggests to people the overhauling of their drain pipes at once. During the winter, when pipes are easily blocked by frost, joints are liable to break or loosen and gases to escape, so that the present is the time to see that the entire house system is in perfect condition.

Molasses Manure.

We learn from *La Sucrerie Indigène* that, in consequence of the low price of beet molasses, attempts are being made in France to introduce it in the place of manure. It is used either in a liquid form, diluted with seven parts of water, or as a powder; and just at this moment it is cheaper than ordinary manure, while it contains all its essential elements in equal abundance. As soon, however, as the cold weather comes on, the molasses will again be required for cattle-feeding purposes, and will probably rise to a price at which it would be useless for manure.

WHILE tunneling into the side of Mount McLellan, Colorado, recently, the explorers came upon ground solidly frozen ninety feet from the surface. The question is how the frost got in, as there was no crevice through which it could enter.

IRON may be cemented in wood by dropping in the recess prepared in the latter a small quantity of a strong solution of sal ammoniac. This causes the iron to rust, rendering it very difficult to extract

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included $3 20

One copy, six months, postage included 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included $27 00

Over ten copies, same rate each, postage included 2 70

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VOLUME XXXIII., No. 19. [New Series.] *Thirtieth Year.*

NEW YORK, SATURDAY, NOVEMBER 6, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE GOAL OF EVOLUTION.

"Her 'prentice han' she tried on man,
And then she made the lassies, O!"

So the gallant Burns sang of mother Nature, intending to compliment the lasses. Had he lived till this more scientific age, he might have stayed his hand, or else have had the lasses fashioned first. The handiwork of Nature seems to have lost care or cunning toward the last.

In the details of the skeletons of the other animals, says Professor Cleland (in his address as Vice-President of the Department of Anatomy and Physiology at the late meeting of the British Science Association), one sees the greatest precision of form; but there are various exceptions to this neatness of finish in the skeleton of man. Witness the variations of the breast bone, which, especially in its lower portion, is never shapely, as it is in the lower animals; witness the coccygeal vertebra, which are the most irregular structures imaginable; even in the sacrum and the rest of the vertebral column, the amount of variation finds no parallel in other animals. In the skull, except in some of the lower forms of humanity, the *dorsum sellæ* is a ragged, warty, deformed, and irregular structure, never exhibiting the elegance and finish seen in our poorer relations. The curvature of the skull and the shortening of its base, which have gradually increased in the ascending series of forms, have reached a degree which cannot be exceeded; and the nasal cavity "is so elongated vertically that, in the higher races, Nature seems scarcely able to bridge the gap from the cribriform plate to the palate, and produces such a set of unsymmetrical and rugged performances as is quite peculiar to man." Other examples of similar conditions, he tells us, will occur to every student of human anatomy.

Thus it would appear that man, the highest product of evolution, is physically the least perfectly finished. His bony framework is more open to variation than that of the lower types of the animal world. This fact would seem to indicate a certain newness of character, as though Nature had not yet had time to settle down to stereotyped forms of human detail. To some it might also hint of possibilities of further development, perhaps of the evolution of human or superhuman, yet animal, types which may surpass the present human as that does the antecedent brute. Professor Cleland, on the contrary, sees in them curious indications rather of the "formative force nearing the end of its journey." Animal life, he thinks, has reached its preordained climax in humanity, and that the future progress of evolution is to be traced from man, not to other animal forms yet to appear, but through his physical (*qy.* psychical?) nature into the land of the unseen.

The reasons for this sudden spring into ether do not clearly appear, the only hint of a physical basis for it lying in the observation that the variations of structure which have been noted are principally to be found in the head, the part of the body most closely connected with the development and expression of the mental character.

Just here we may note a singular circumstance in connection with the present stage of discussion in regard to the possibilities of human progress, individually and collectively considered. Last year, from the standpoint of matter, Professor Tyndall traced the line of individual evolution into the infinite azure, where personal identity is lost; and half mankind were set by the ears in consequence. This year, before a section of the same society, Professor Cleland, from the standpoint of the speculations of the authors of the "Unseen Universe," argues from physical data the continued evolution of humanity in "the land of the unseen," wherein personal identity is said to be eternally preserved: and not a word is said of his transcending the strict domain of scientific inference!

INSTINCTIVE CALCULATION.

A writer in the *Cornhill Magazine*, who claims to be something of a natural calculator himself, attempts the rather difficult task of advancing a satisfactory explanation of the peculiar arithmetical feats performed by the well known engineer Zerah Colburn, during his early youth. Mr. Colburn was an American and the founder of the English journal, *Engineering*. In a biography of him which we published at the time of his death, five or six years ago, we mentioned his remarkable mental precocity, some phenomena of which may be recalled in the present connection. When eight years of age, it is said that Colburn instantly answered such questions as: Find the cube root of 268,336,125, how many seconds are there in 48 years, raise 8 to the sixteenth power, and others of similar difficulty, which even the most expert of mathematicians would have been unable to solve by any mere mental process. In looking for parallel cases of children with like abilities, we find three others, something regarding each of which it is well to note before passing to the consideration of the possibility of an explanation.

In 1839, Vito Mangiamele, a Sicilian boy eleven years of age, was examined by Arago and several other eminent members of the French Academy of Sciences. To him, questions equally knotty with the above were given, and these together with such posers as: "What number complies with the following propositions: that if its cube be added to five times its square, and then forty-two times the number and the number forty be subtracted from the result, the number is equal to zero." To this the boy gave the correct answer, (five) just as the questioner had repeated the sentence for the second time. An earlier case is that of Jedediah Buxton, a child almost totally uneducated. Of him it is related that if he heard a sermon or other speech he instinctively counted the words; if a period of time were mentioned in his hearing, he computed the seconds; or if he walked over a piece of ground his mind was busily employed in calculating the number of inches. He solved mentally such a problem as: How many cubical eighths of an inch are there in a quadrangular mass which measures 231,145,789 yards long, 5,642,732 yards wide, and 54,965 yards thick? And besides, he possessed the curious faculty of being able to suspend his calculations at any point, turn to other subjects for any length of time, and yet resume his mental work at the proper place. Like Mangiamele, he could give no account of how he accomplished his task.

The last instance is that of George Parker Bidder, who subsequently became a noted English civil engineer. His gift lay more in a natural taste for figures than through the instinctive calculating power which Colburn, Mangiamele, and Buxton possessed. He accustomed himself to count up to 1,000,000, and thus became familiar with large numbers. He besides was an inventor, and devised new arithmetical processes. From all accounts it would seem that, his was an acquired power, aided of course by natural genius, and this view finds further corroboration from the fact that in after life, Bidder retained his abilities, while the other three individuals lost theirs. In 1856 he gave an account of how his operations were worked, which goes still further to show them to be the results of acquired skill, more especially as neither Colburn, Buxton, or Mangiamele were ever able to give any explanation whatever of their mental processes. Bidder, therefore, is hardly to be considered in conjunction with them.

To return now to the *Cornhill Magazine* writer and his theory, the latter is essentially that the calculator does not regard the numbers set before him as abstractions, but rather as definite groups of concrete objects, as, for example, dots. The mental process required then to multiply 24 by 3 is to picture 24 as two columns of dots of ten each, and one column of four. To multiply by three, the imperfect columns are imagined as brought together, making one column of ten, and two over. The one is added to six columns pictured at the same time, making seven columns of ten, and one of two, that is, 72. We need not explain the supposed method of division, as it is essentially similar; for we believe the objection will at once occur to the reader that this plan cannot answer for dealing with great numbers, as it can in no wise be conceived that any mind can form a perfect picture of millions multiplied or divided by millions. It is very possible for the mind to be trained so as to conceive detail to an astonishing degree; and imagination, in conjunction with memory, in some people will reproduce scenes with every feature intact, of which only the most salient characteristics would remain fixed in the average mind. Robert Houdin, the French conjurer, could walk quickly past a shop window once, and then name every article in it, and the size, color, and position of each. This was purely acquired, though Houdin had the ability to make the acquirement in the beginning. Every artist who produces a design draws upon the same faculties; so do skilled chess players, who are able to play a dozen or more games at once; so do musicians, who can hear a harmony or melody by looking at the printed score. All of these instances we should class with Bidder, but not with Colburn or the other two mentioned.

What Turner was in color and Mozart in music, we believe Colburn and his peers to have been as regards numbers. Turner's perception of gradation of color—not mere light and shade, but color—was instinctive, purely inborn. He felt color, not outlines or form; and no one, before or since, in that respect has ever approached him. Mozart felt music; at the age of six he could compose difficult harmonies; he could distinguish accurately and instantly announce variations in sound equal to one sixty-fourth of a tone. Now no one pretends to explain Turner's coloring or Mozart's music from a mental standpoint, for the simple reason that there is no explanation. Both artists were born with wonderful gifts, gifts as inexplicable to their possessors as they are to the average man; and there the matter rests. Colburn, Buxton, and the Sicilian boy had a like sensation of the relations of numbers. They went through a kind of calculating process, probably as instinctively as Turner handled a brush to place his colors, or Mozart moved his fingers to grasp the chords of the harpsichord or organ. This mental operation, we believe, however, was unconscious cerebration; and the same genius or instinct, or whatever term by which we may agree to designate the faculty, which rendered it unnatural for Turner to make inharmonious contrasts, or Mozart to strike discords, prevented Colburn and the others from false calculation, and caused them to feel, as it were, the relations of numbers.

PINEAPPLE AND BANANA FIBERS.

It is from the fiber of the pineapple that the natives of the Philippines weave the celebrated web *nipis de piña*, considered by experts the finest in the world.

In his travels in that promising but badly managed Spanish colony—all Spanish colonies are badly managed, for that matter—the German traveller Jagor had the good fortune to witness the process by which the fiber is prepared.

When plants are intended for the growth of fiber, the fruit is not allowed to ripen, the leaves thereby taking on a larger development. The fiber is separated by hand. A leaf is placed on a board on the ground, with hollow side upwards. Sitting at one end of the board, a woman holds the leaf firmly with her toes and scrapes its outer surface with a potsherd, using the rounded edge of the rim.

The scraping reduces the leaf to rags, disclosing a layer of coarse fiber running lengthwise of the leaf. This is dextrously lifted up and drawn away in a compact strip: after which the operator scrapes again until a second fine layer is laid bare. Then turning the leaf round, she scrapes its back down to the layer of fine fiber, which she quickly draws to its full length away from the back of the leaf. The fiber is then washed, dried in the sun, combed, and sorted. It is from material thus crudely prepared that the *nipis de piña* is woven, of such exquisite fineness that robes of it are valued as high as $1,500, at Manilla.

The pineapple fiber is also exceedingly strong: a cable 2¼ inches in circumference has been known to endure a test strain of over 6,000 pounds.

Another noted fiber, Manilla hemp, takes its name from the chief city of the Philippines. It is not hemp, however, but the fiber of a species of banana, which does not differ greatly from the edible banana, and is probably a variety of the same species. Thus far, according to Jagor, the serviceable fiber has been exclusively obtained from the southern portion of the Philippines, all attempts to make its culvation profitable in the western and northern provinces having failed. A species of banana grows in great luxuriance in Western Java, but it has not been utilized as a fiber plant to any great extent. Great efforts have been made in the Celebes to cultivate this fiber, but Bickmore repeats that it has been abandoned in favor of coffee, which is found to be far more profitable. For domestic purposes, the banana fiber—known to commerce also as *abacá*—is made use of in many tropical countries, and in time will doubtless be largely supplied; but for the present the supply comes, as already stated from the Philippines.

The plant thrives best on the shaded forest-covered slopes of volcanic mountains, such as abound in Albay and Camarines: on level ground not so well, and on marshy land not at all. The plant requires, on an average, three years to produce its fiber in a proper condition. For the first crop only one stalk is cut from each bunch: later on, the new branches grow so quickly that they can be cut every two months. In full growth the yield is 30 cwt. to the acre, whereas from an acre of flax not more than 4 cwt. is obtained. After the plantation is once established, the plants flourish without any care or attention, the only trouble being to collect the fiber. One plant may yield as much as two pounds of fiber, but the average is not more than a pound: on indifferent soil much less.

Several grades of fiber are derived from different parts of the leaf stalk, the edges yielding the finest. The fiber, which lies next the surface, is stripped off by hand in broad bands, and then softened by being drawn backwards and forwards between a broad bladed knife and a block of wood. One worker cuts up the stalks, strips off the leaves, and attends to the supply: the second, frequently a boy, spreads out the strips of fiber; the third draws them under the knife. The coarse fiber is called *bandala*; the finer, *lupis*. The former is chiefly used for ships' rigging; the latter is employed in weaving. The three finer grades of lupis are further softened before weaving by being pounded in a rice mortar. Generally the first or finest sort is worked as woof with the second as warp, and the third as warp with the second as woof. The fabrics so woven are nearly as fine as the *nipis de piña*. For purity, flexibility, and color, the finest of these banana stuffs are said to compare with cambric as cardboard does to tissue paper. According to Jagor the finest stuffs require so great an amount of dexterity, patience, and time in their preparation, and are consequently so expensive, that they cannot compete with the cheap machine-made goods of Europe. Their fine warm yellowish color also is objected to by European women accustomed to linen and muslin strongly blued in the washing. By the rich half castes, however, who understand the real goodness of their qualities, they are highly appreciated. In the regions where abacá is cultivated, the entire dress of both sexes is made of coarse banana cloth called guinára. For foreign markets, still coarser and stronger fabrics are prepared, such as crinoline and stiff muslin, used by dress makers.

It is as an article for exportation, however, that the fiber is of the most importance commercially. In 1871 over 600,000 cwt. were exported, nearly three fourths coming to this country. It is very largely used in the manufacture of paper.

THE ORIGIN OF MOUNTAINS.

Mountains have been explained by two widely different suppositions. One is that they are due to sediments deposited under water from the erosion of a wasting continent, which by upheaval have become mountains. The other is that they are due to uplifts, as the result of lateral pressure caused by shrinkage of the earth's interior. For the last fifteen years or more, these conflicting views have each been held by geologists of undisputed authority; and "when doctors disagree, who shall decide?" is the old question which remains still unanswered. This uncertainty in all moral reasoning, when we have to balance probabilities, is a great source of discomfort to the youthful student; and in perhaps no department of human inquiry is this more true than in the field of Science, for what is highly probable today may be shown in the light of advancing Science to be highly improbable tomorrow. And in reply to the oft-repeated question of the young student: "What is the use of learning as truth today what may be rejected as error tomorrow?" it may be said that all the successive theories of advancing Science are stepping stones which may eventually lead to the undoubted truth. We see use in taking the first faltering and ill-advised steps in any avocation, though we soon reject these for others more conducive to the end desired.

Without attempting a decision, we propose in this article only to state some of the main points in the arguments *pro* and *con*, and leave all to decide for themselves as to which is the more reasonable.

We would naturally conclude that, if mountains are due to lateral pressure, they would be formed by the uplifts or elevations of the earth's crust. But this is seldom the fact, for several reasons. According to Professor Dana, many if not all mountains have their origin in the bending down of the crust. As the crust subsided, the trough was kept full of water, which continually deposited sediment. This deposition about kept pace with the rate of subsidence. In this manner, many of our mountain ranges were, in the earlier ages, taking the initiatory steps in the process of mountain making. As the crust subsided and was covered to a great depth with an accumulation of eroded material, it would be weakened by the earth's internal heat. An addition of several thousand feet of sediment to the surface would bring a given degree of heat so many thousand feet nearer the surface. This would often be sufficient to soften or melt the sustaining crust, which would then yield before the lateral and vertical pressure combined, and cause the crusts on the sides of the trough to fold over and approach each other above it, thus crushing the sedimentary beds into a narrower space, with the necessary result of elevating the crushed and folded strata in the middle.

The Appalachian chain illustrates the fact that one mountain system may be formed by several successive depressions, accompanied with the deposition of eroded material. Professor Hall attributes the cause of mountain making to sedimentary accumulations, which, by their weight, are sufficient to cause a depression in the crust. Thus, by the addition of 40,000 feet of sediment, the crust would sink the same number of feet. Then, by a subsequent elevation of the crust, the accumulated strata would be raised into a mountain, independent of lateral pressure. He just reverses the idea of Dana, by making the subsidence a consequence of sedimentary accumulations, instead of the accumulations a consequence of subsidence. To this Dana objects, because "the earth's crust would have to yield like a film of rubber to have sunk a foot for every added foot of accumulation over its surface, and mountains would have had no standing place."

Another reason why the elevations due to lateral pressure do not produce the high mountains appears in the fact that, when a series of strata is sharply bent upwards—forming an anticlinal—the outer strata are fractured and strained apart, while the strata which are bent downwards—forming a synclinal—present to the surface a firm and compact mass. This can be clearly shown by making a sudden bend in a walking stick. The fibers of the outer curve will be torn asunder, leaving a splintered and ragged surface, while on the inner curve they will become unusually dense and firm. The fractured edges of the anticlinal curve are in a favorable condition to be worn away by water, while the compact surface of the synclinals, though forming the valleys, where the greatest amount of running water would act upon it, suffers but little erosion. The consequence is that the elevated strata are worn away even below the level of the original valleys, and the latter become the elevations. This can be proved by noticing that the strata visible on the sides of most valleys and hills are not parallel to the sides, but are nearly at right angles to them.

The mountains formed by depressions of the crust were far more common in the early history of sedimentary deposit, for the crust was then comparatively thin, and hence more yielding to lateral pressure. But after the crust became thickened beneath by the cooling of the earth, and more rigid by the accumulation of strata above and by previous plication and solidification, the mountains formed were largely due to uplifts of very wide extent carrying the stratified deposits with them. Our Rocky Mountain system was formed by these uplifts in the tertiary age, and it is probable that coral island subsidences in the Pacific Ocean accompanied the continental elevations.

The adherents to the accumulation theory—among whom are Hall and Hunt on this continent, and Scrope and Lyell in Europe—have noticed that, in mountainous districts, the elevations are less than the aggregate thickness of the strata, while in non-mountainous sections the hights correspond to the thickness of the strata. If the latter were equally true in mountainous districts, the Appalachian Mountains would attain a hight of forty thousand feet. Mr. Hall holds that these barriers are due to original deposition of materials, and not to any subsequent forces breaking up or disturbing the strata of which it is composed; and that upheavals and contortions of strata are only accidental and local. In this view he is sustained by Montlosier and Jukes. He also claims that the direction of mountain elevations is determined by accumulations along the sides of oceanic currents or shore lines. Dana, on the other hand, considers the northeast and northwest trends of most of the mountain and shore lines on the globe to be the result of cleavage in the earth's crust, and to indicate lines of weakest cohesion, like cleavage planes in crystals.

The accumulation theory supposes that, after a vast amount of material has been deposited in successive strata under water, a great continental upheaval brings the whole mass high and dry above the water line; and the present mountains are the stratified deposits which have escaped denudation by the action of frosts and floods. We have good illustrations of this process of erosion in the Missouri River valley, where the elevated land is being constantly washed away, forming deep ravines and abrupt ridges, and is carried into the muddy Missouri, and deposited in the deltas at the mouth of the Mississippi, thus adding constantly to the territory of Louisiana. As Egypt is said to be a gift of the Nile, so Louisiana is a gift of the Missouri. The effects of erosion, on a small scale, can be seen on the sides of deep railroad cuts, where miniature mountains and valleys are formed by the washing of water as it runs down their slopes.

Professor Le Conte opines that these opposing theories result from the loose use of the word mountain. He treats the whole subject under the two heads of mountain formation and mountain sculpture, and claims that the true mountain chain, or the convex plateau which constitutes it, is due only to foldings of the crust, and that those elevations which are left by the erosive action of water are not mountains, but simply sculptured continental elevations.

The effect of shrinkage and of erosion can be fairly seen on a small scale by the following artificial contrivance: Take a well filled bladder or toy rubber balloon, and cover it completely with several successive coatings of tallow, glue, plaster of Paris, or other substances that will harden after they have been put on in a plastic state. These will represent the stratified crust. Then by withdrawing some of the air from the bladder, which will answer to contraction of the nucleus, the crust will become rigid, furrowed, and fractured by lateral pressure, like the crust of the earth. Now by allowing a well regulated stream of water to flow over the surface of this, we can see many of the phenomena of erosion, like those apparent on the earth's surface.

Sir Charles Wheatstone.

This distinguished inventor died in Paris, France, on the 20th of October last. He was born at Gloucester, England, in 1802, and in early youth was engaged in the manufacture of musical instruments. With the object of improving upon these, he was led to study the laws of sound; and thus imbibing a strong taste for physical science, he proceeded to the investigation of the phenomena of optics and subsequently of electricity, on the velocity of which he published papers in 1834, detailing many very striking and new experiments. In the same year he was appointed Professor of Experimental Philosophy at King's College, London.

Previous to this time William Fothergill Cooke, in Heidelberg, Germany, had completed his first telegraphic invention, based on the electrometer form, had followed it with two mechanical telegraphs, and soon after came to England to introduce the telegraph system on railroads. His efforts at first pointing towards success were, however, nullified by a pneumatic signal apparatus, to which the railway people gave preference; but instead of being disheartened by his failure, the inventor began new experiments, regarding which he sought the advice of Faraday. The latter referred him to Wheatstone, and then, in 1837, began that partnership which has sent the names of the two inventors to posterity, indissolubly linked. It was Wheatstone's great learning, combined with Cooke's inventive genius, that evolved the succeeding discoveries in the telegraph. "Mr. Cooke," says Brunel, "is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the electric telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches have already prepared the public to receive it as a project capable of practical application."

Invention now rapidly followed invention: the first was a discharger and secondary circuit to be applied to Cooke's original alarm; then combinations of all the various improvements; then a new mechanical telegraph, Wheatstone's work; then another telegraph, having a revolving index hand on a fixed dial, a new device of Cooke's; besides others, all devices of remarkable ingenuity, and the subjects of several patents in England. On the 12th of June, 1837, the inventors received their first English patents, and on the same date obtained an American patent on the electro-magnetic telegraph. This, however, was of no benefit to them, as the apparatus was never practically employed in this country, Professor Morse's instrument, as is well known, being the chief one in use from 1844 to 1846.

Wheatstone was a Fellow of the Royal Society, and twice received the medal of that association for his discoveries. Both himself and his co-laborer Cooke received the honor of knighthood in recognition of their public services.

SCIENTIFIC AND PRACTICAL INFORMATION.

POPPY RED FOR ARTIFICIAL FLOWERS.

Thin cotton tissues are brushed over with a mixture of corallin lake ground up with water and thickened with gum, 75 grains of calcined magnesia per quart being added before use.

NEW PERFUME.

The local committee in Tahiti have sent to Paris the odoriferous bark of a yet undetermined plant, known over the Society and Pamotons islands by the name of *marie*. It can be advantageously employed in the preparation of the perfume known as new-mown hay.

SOLIDIFIED MILK.

A sample of condensed milk, weighing about 1 cwt., has been exhibited at the rooms of the Society of Arts, London, and an interesting experiment made thereon. This mammoth piece of solidified fluid was prepared by Hooker's process. It had been exposed to the action of the air for four years and three months, yet its quality was still so excellent that in a few minutes it was resolved, by churning, into good fresh butter. The trial was only one of a series made at the International Exhibition, South Kensington, and elsewhere. In each case the same satisfactory results were obtained.

QUADRUPLEX TELEGRAPHY IN INDIA.

It will interest our readers, says the *Indian Daily News*, to learn that quadruplex telegraphy—that is, the art of sending four messages, two in each direction, simultaneously, by means of one wire—has this week been accomplished on the Madras Railway Telegraph. The system which Mr. Winter, the telegraph engineer, invented in March last, proved perfectly successful on eighty miles of line, and its extension to lines of greater length is simply a question of additional condensers and battery power. The principle of sending two messages simultaneously in the same direction, on which this quadruple system depends, was successfully worked between Salem and Madras on April 16, but unfortunately other duties prevented Mr. Winter's carrying out the duplexing of this principle until the last few days.

THE WESTON LOCOMOTIVE.

A new engine, built by the Baldwin Locomotive Works of Philadelphia, has been put on the Boston and Albany Railroad for trial. A saving of fuel of generally over 30 per cent is claimed. This is effected by means of a peculiar firebox. In most locomotives, the long flues or pipes connecting the furnace with the smoke stack are directly opposite the door, and much of the fine coal is caught by the draft as soon as thrown into the furnace, and comes out of the smoke stack in the form of dust and sparks. With this boiler, however, the invention of a man named Weston, a firebrick arch over most of the furnace keeps down much of the fine stuff, and what does escape has to pursue a zigzag course through a consuming box—where the particles are stopped, and even the smoke is consumed—in front of which are the flues, only six feet long instead of a dozen, as in an ordinary engine. This much for economy of fuel; and to provide still more for comfort, the smoke stack contains an arrangement by which what few sparks do get that far are carried off to the ground by pipes running beneath the engine. The locomotive is higher than most, and is extremely well proportioned. This is rather a small one, having a cylinder 16 inches in diameter, with a stroke of 22 inches, and driving wheels five feet in diameter. H. B. Klinger, who has it in charge, has been running it on the western end of the road, and comparing its work with that of the company's engines, with an average saving of 46 per cent in fuel.

CASTING LARGE STEEL INGOTS FOR HEAVY ORDNANCE.

THE BESSEMER STEEL PROCESS.—EMPTYING A CONVERTER

THE SHEFFIELD STEEL MANUFACTURES.

Most of our workers in iron are familiar with the name of Thomas Firth & Sons, of Sheffield, England, whose tool steel bears such a high reputation in this country. Mr. Mark Firth, the head of the firm, is this year Mayor of Sheffield, and has signalized his term of office by presenting the people with a magnificent park, paying the whole expenses (over $500,000) from his own pocket. The park was recently opened, with great rejoicing, by the Prince and Princess of Wales, who took an opportunity of inspecting several of the most remarkable of the steel works of the very grimy and very prosperous city.

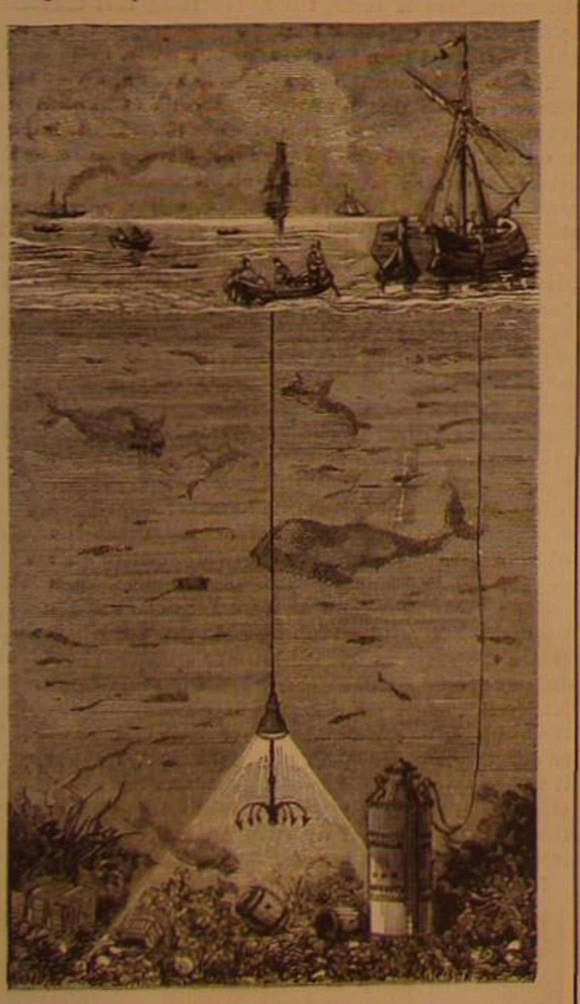
Our first engraving represents a scene in Messrs. Firth's works. An ingot for making the interior tube of an eighty tun gun is being cast, the gun, as we have already explained, consisting of a tube of fine steel surmounted by welded coils of wrought iron. The steel is melted in crucibles, which are brought to the founding pit on wheeled trucks, as shown in our engraving. By this means, ingots of nearly any weight and of the highest purity can be readily cast; and they are then forged into shape by immense steam hammers. We have frequently spoken of the large hammer, erected at Woolwich for welding the iron coils on these large cannon. This implement cost about $250,000, and the falling portion weighs 40 tuns, its force being increased by the use of steam to give it additional velocity. Messrs. Firth have recently erected a similar hammer in their works at Sheffield. But the greatest of all is being built at Krupp's works at Essen, where $1,000,000 is being expended in building the largest hammer yet conceived, even in this age of Cyclopean wonders.

It is found that tubes for ordnance must be of pure steel, but softness of the metal is a requisite, a hard metal being too brittle to sustain the concussion of the large charges of powder used in these guns. The milder steel is tenacious, and has been proved to be almost indestructible by wear.

The Bessemer steel process is very largely carried on in Sheffield, the works of Sir John Brown & Co., Vickers & Co., and many others being largely in this manufacture. The second engraving on the opposite page represents the emptying of a Bessemer converter of its charge, after the metal has been brought to the required condition by the injection of the air blast. The proportion of carbon present in the metal is ascertained by the spectroscope, the moment for stopping the blast being ascertained by the use of that instrument with marvelous nicety.

DIVING BELL AND GRAPNEL.

We have already described M. Toselli's grapnel for raising heavy and valuable articles from the bed of the sea; and we now publish an engraving showing some recent improvements and new uses for this very ingenious apparatus. A diving bell, constructed of iron and bronze and weighing 3½ tuns, is used; it is about 4 feet in diameter and 14 feet in hight. The diver enters at the top, the lid on the dome being raised for the purpose, and the upper part is wholly out of the water when the bell floats, which gives an easy entrance to and exit from the apparatus, the bell not needing to be suspended by a crane. When the diver has entered the



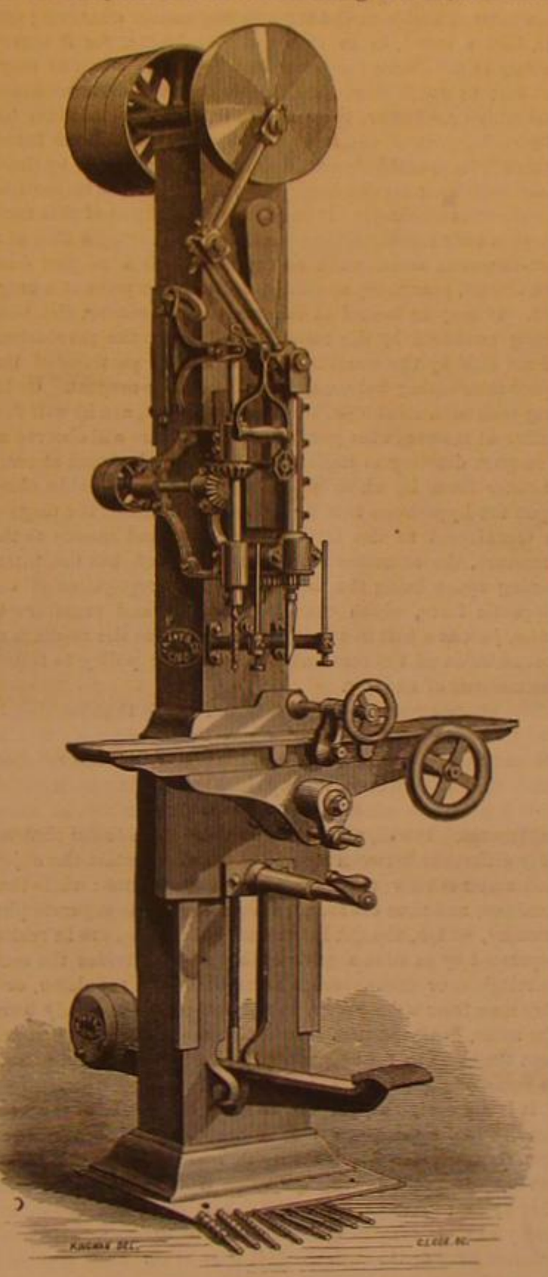
bell and closed the lid, he descends by allowing the water to enter the lower part of the cylinder, and he can come to the surface by ejecting the water by means of a pump placed inside the bell. Thus no rope or tackle is used, and the only necessary connection between the bell and the attendant boat is a telegraphic wire, shown in our engraving

At a distance of 5 feet from the bottom of the bell are placed bullseye glasses, guaranteed to resist a pressure of 60 atmospheres, equivalent to over 300 fathoms of water. At a depth of over 55 fathoms, the darkness is such that artificial light is necessary, both for taking observations and for directing the operations of the grapnel, which is provided with a submarine lamp. The bell is made double, the space between the circular walls being a magazine for fresh air; and two men can remain all day in the bell without further supply from above. Ample arrangements are made for absorbing the products of respiration.

The whole system seems to be complete and efficient, and in employment for coral, pearl, and sponge fishing, as well as for wrecking and salvage purposes, it will probably be found very valuable

J. A. FAY & CO.'S MORTISING AND BORING MACHINE.

The operation of mortising is one which has, to a large extent, engaged the attention of producers of woodworking machinery, and the numerous difficult problems in connection therewith have been solved only by actual experiment. Of the various systems in use for mortising in wood, the verti-



cally reciprocated chisel has obtained a preference. Other systems, such as rotating tools of various designs, are in use for special purposes where the same results could not be produced, or the stuff be conveniently handled, with the reciprocating mortising machine.

The class of work for which a machine of the abovementioned nature is wanted has a governing influence upon its construction. In one case the bed may have a vertical adjustment to receive the thrust of the chisel, which has a fixed distance to travel without any variation in its terminal points; and in another the bed may be in a fixed position, and the chisel be brought down from its highest position, where it has no reciprocating motion, to the depth of the mortise and full length of the stroke. An excellent example of the latter method, or variable stroke mortiser, is given in the accompanying illustration of a mortising and boring machine for agricultural, wagon, and cabinet work, recently brought out by the well known wood tool builders, J. A. Fay & Co., of Cincinnati, Ohio, who call it their No. 3½ mortising and boring machine.

This machine has for its support a cast iron column of strong section and substantial base. The driving shaft, carrying the pulleys and crank wheel, is placed at the top of the column, and revolves in self-oiling bearings with heavily bolted caps to receive the impact produced by the chisel blow. The treadle is connected by a rod to a short crank on the back end of the shaft to which the radial arm in front is keyed This radial arm is connected with the central joint of the intersecting rods which connect the chisel stock with the pin in the crank wheel. By depressing the treadle, the radial arm is thrown out, which draws the central joint nearly into the vertical line drawn through the center of the driving shaft, and this produces the full stroke of the chisel with all the variations from a stationary position. There is attached to the short crank on the radial arm shaft a frictional slide, which receives the force of the stroke of the chisel, thus entirely relieving the foot of the operator from its effects.

The attached boring apparatus is set to the center line of the chisel, and will bore to the full depth of the mortise. It is driven from a pulley on the shaft at the top of the column, and has tight and loose pulleys so that it can be stopped while the chisel is operating. The bed is of a compound character; the timber can be moved upon it the length of the mortise, or the bed can be moved with the timber clamped on it, by means of a rack and pinion and hand wheel in front. There are stops for holding down the stuff, and necessary arrangements for adjusting to different sized mortises. The bed can be adjusted to any desired angle and mortises with the same facility as to a right angle.

An important feature in this machine is the positive automatic reverser for the chisel, which is operated simultaneously with the raising of the chisel from the mortise. This being done at the end of the mortise, the chisel is thereby placed in position for finishing.

Further particulars can be obtained by addressing the manufacturers, J. A. Fay & Co., Cincinnati, Ohio.

THE PSYCHO MYSTERY.

We make the following extract from a letter to a gentleman in Boston, from Mr. J. A. Clarke, one of the inventors of the curious automaton Psycho, which of late has attracted much attention in London. Some time ago we mentioned this subject and noted the apparent discovery of the trick by an American gentleman, who suggested that the figure was worked by an air blast through the hollow glass pedestal. This suspicion was confirmed by one of the exhibitors declining to close the aperture previous to the operation of the automaton. It now appears that this test is freely permitted, so that the mystery of how the figure works remains as great as ever. We leave the (of course *ex parte*) statement of Mr. Clarke to the consideration of our readers without further comment, only reserving to ourselves the opinion that a solution to the puzzle certainly exists, and that that solution will be forthcoming should Messrs. Maskelyne and Cooke see fit to submit their trick, on this side of the Atlantic, to the crucial test of proverbial Yankee 'cuteness.

"Several years ago," says the writer, in substance, "it occurred to me that there was a good opening for a conjuring invention which should be really original and should baffle the profession as well as the public. After very many designs, I finally adopted the principle now embodied in Psycho, and I believe it is a completely new application. I made a rough model of the mode of working, and by accident was brought into communication with Mr. J. Neville Maskelyne. Mr. Maskelyne, possessing extraordinary ability in designing and constructing mechanical subtleties, has marvelously worked out my ideas; and Psycho is so much the fruit of mutual contrivance that all the parts may be said to be the

joint invention of us both. We designed an isolated figure, perfectly removed from any possible connection with anything or anybody outside, with no communication (mechanical, electrical, magnetic, pneumatic, hydraulic, or otherwise) conceivable from the stage, back, sides, roof, or elsewhere, yet controlled by our influence, so that the figure moves when and in whatever manner desired."

To show diversity of effects, we make the figure calculate numbers and play whist. But it is adapted for many other things that we may choose to set it to; and it works precisely as if there were a person inside, and yet there is nothing beyond the mechanism. The audacious part of the invention is that a maker of automata, or other person, is allowed to see and feel all the inside of the figure, so as to satisfy all senses that there are no spaces concealed by optical arrangement or otherwise. The chief difficulty was in demonstrating to the public that the automaton is really insulated from all connection with the stage or with the performer: and it is sometimes exhibited in one way and sometimes in another. It is placed upon a hollow glass cylinder 24 inches in hight, as shown in the engraving, or upon the carpet or upon a loose wooden stand, with legs to keep the automaton from the floor. Another way is that the glass cylinder is set loose upon a small wooden stool that is set loose upon another wooden stand, and the legs of the latter are set loose on glass pianoforte insulators.

The audience are at liberty to go upon the stage and handle and examine all the parts as much as they please, and anybody may remain close to it while it is in operation, and see and feel that no threads, or wires, or any other things connect any parts of the apparatus with the outside.

I should say that a single pillar, instead of a solid glass pillar or two glass pillars, was adopted, because a former invention worked by one piece of glass sliding or revolving inside another, while the appearance was that of a single solid piece; and to suspend Psycho by cords would suggest electricity.

Thus it will be seen that the arrangement precludes the theory of a Mr. Coffin, from America, who published an explanation representing that air is forced into or down out of the glass. If it were, how could it produce the great number of movements which Psycho performs? Besides, it will act just as well in any private room as on a public stage. It does not require any contrivance under or behind a stage which cannot be worked in a private room.

The figure sits upon a small box; the latter is much larger than it need have been, for we did not know how much space the mechanical movements would require. Were another box to be made it would be much more compact.

Psycho has worked twice a day (half an hour each time) since the middle of January last, and nothing has ever got out of order beyond the wearing of a few of the cords by which the counterpoise weights are suspended over a pulley.

As at present exhibited, the performance is as follows: The audience names two numbers, and Psycho multiplies them together and shows the answer (one figure at a time) by opening a little door in a small box and sliding the figure in front by a movement of its left hand. The audience give it a sum in division, and it shows the answer in the same manner. Then three persons go on the stage, inspect Psycho and the apparatus, and, sitting at a side table, play a game of whist. The thirteen cards for Psycho are placed, upright and singly, in a quadrant rack over the range of the figure's right hand. The arm has a radial motion horizontally to find any card wanted, and Psycho lifts the card and holds it up in view of the audience. It lifts the card up repeatedly, or keeps it up, at command of any person among the audience. The figure then covers the card to be played. Mr. Maskelyne then takes the card to the table, and calls out the names of the cards as the player plays them; and sometimes he retires from the figure and card table, to show that Psycho goes on with the game independently of the conductor. After the game, it tells, by movements of its arm, the state of the game and the number of tricks in its favor. Psycho shakes hands with the players, and answers questions by ringing a bell. It also takes part in some usual card tricks.

An infinite number of effects may be produced, but the above are sufficient to show in general what Psycho does."

He closes his letter by saying: "I hope this general description will enable my friends in America to understand and appreciate some of the merits of the automaton card player."

Correspondence.

The Electric Force and Magnetism.

To the Editor of the Scientific American:

On pages 229 and 260 of the current volume of the Scientific American, I observe that two of your readers take some exceptions to certain of my assertions in respect of terrestrial magnetism and the electric force. I cannot do better, in continuing the discussion of these interesting subjects, than reply in explanation and further elucidation.

There is every reason to believe that magnetism, so to speak, is a crystallization of the electric current.* This expression may at first glance strike the reader as somewhat singular; but after ten years of almost constant practical experiment in this branch of the science, I am unable to advance any more expressive or significant proposition than is compassed by this phrase. Electricity and magnetism are, as we know, interconvertible, and the great difficulty with electricians is to draw between them a distinguishing line; for, paradoxical though it may seem, while one is the other, there is so marked a dissimilarity that we cannot reasonably overlook the difference. With all deference to those who believe that my statement "that the earth is not a great magnet, but that the phenomena of the magnetic needle are due to the electric earth currents which flow at right angles to the earth's axis" is contradictory, because the earth, being surrounded by such currents, is as much a magnet as the magnetic needle, I see no reason why the statement should be qualified. For these reasons, susceptible of easy proof:

That if the earth were a great magnet, the phenomena of the magnetic needle would not exist.

That even those scientists who accept the magnetic theory are forced to acknowledge that a very complex system of magnets indeed, in the earth's interior, instead of the earth being a great magnet, is necessary to account for the phenomena of the magnetic needle. (In a discussion of magnetism, we should obviously confine ourselves within distinguishing lines, otherwise we might confound the attraction of gravitation with magnetism. We have no right to formulate a generality, but should individualize details and branches.)

That it is impossible for the earth to be magnetized (I use the word in its distinctive sense) by the electric earth currents encircling it. The utmost that can be urged is that those portions of the earth's surface which are traversed by the electric currents are magnetic; but even this would be an erroneous hypothesis, for it is in the atomic action or condition alone that magnetism exists and is, and this atomic action is transferable to and through any matter whatever; and air, like a metal, is in this sense magnetic, for it serves merely as the conductor or medium for propagation of magnetism; to which conductor the magnetic force is confined, and which conductor, the same thus being the medium for the propagation of the force, obeys the action of the force, which is inseparable from the conductor, bound to it by those links which render the magnetic or electric force impossible without the conductor. If one desire illustration of this fact, he need only repeat the experiment of revolving a disk of a non-magnetic metal, such as copper, which a magnet does not attract, practically speaking, between the poles of a magnet. It may be heated in this manner to redness, the heat being produced by the resistance offered to the revolutions of the disk by the condition of the atomic particles of the space intervening between the poles of the magnet. Or he may seek for a solution of the magnetic effect, and he will find sufficient answer in the phenomenon which he will observe of a magnet drawing to itself a magnetic metal placed at some distance from it, which phenomenon is explainable alone upon the hypothesis that the atomic condition of the magnet is transferred to the intervening space and thence to the armature, the armature only being attracted, but the intervening space being the medium for the propagation of the magnetic force, which causes the magnet and armature to unite, just as a belt in a machine shop acts as the medium of transmission of the force which causes one pulley to follow the motions of another.

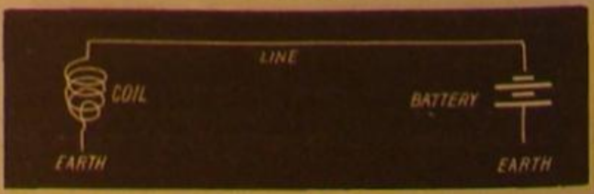
The electric force or the magnetic force is thus nothing in itself; it cannot exist without a so-called conductor; and as all substances are more or less conductors, we have clear proof that the electric force, which is nothing in itself, is merely a certain condition of the atomic particles of those substances. It will, upon close inspection, be found that the only difference between me and those who sustain the objection under review relates to a question of terms: while they combine, and thus confound, I have sought to separate phenomena, which, though intrinsically the same, are in reality separated by as wide a gulf as that which divides the sects in religion, or distinguishes attraction from repulsion, or a live man from a dead man, in the latter case the body being the same, dead or alive. To define the differences and present the same in terms plain and forcible is a purpose soon to be accomplished.

It is my design at present to reply especially to the communication upon page 260, in which your correspondent frankly confesses his inability to realize the circumstances set forth in the following quotation from a past communication by me: "When one pulls a bell cord, and instantaneously a bell is rung in a distant room by the molecular transmission over or through the bell wire of the force applied at the cord, does not one realize that he is as veritably, as wonderfully, and by a similar molecular motion transmitting it by applying a battery to a telegraph wire, and thus setting the atomic particles in motion?" Your correspondent acknowledges that in the case of the bell cord one can easily realize the disturbance of the atomic particles from ocular demonstration, but he adds: "In the case of the telegraph, he sees no motion, either where the force is applied or where it is taken off, even when the force so applied is very powerful." If I could have your correspondent on my premises for an hour, I am confident I could clear his mind of doubts by a few practical exhibitions; but as I shall probably never have that pleasure, I am constrained to resort to the example of argument and the logic of stated facts.

In the first place, he assuredly would not deny the verity of a proposition upon the ground that it is incapable of ocular demonstration. By so doing, he would deny the confirmed theories of the propagation of light, sound, and heat; for, taking an example, one can never have ocular demonstration that so many million light waves are necessary to produce a certain color, and so many another color, or that so many waves or vibrations of matter are necessary to produce a certain sound. Now I am enabled positively to assert that the propagation of the electric force is by molecular action, that the electric force is a certain active condition of the atomic particles of matter, for, unlike your correspondent, I have had ocular demonstration of this molecular action. It was not my design to allude to experiments I am now conducting until such time as I should be able to lay a mass of absolutely convincing facts before your readers, and I cannot even now enter into a statement which not only requires careful preparation, but would be premature, in view of the incompleteness of detail which would result from a presentation previous to such time as that in which the necessary instruments can be prepared for observation and accurate measurements be taken. I could not undertake the task at present without injustice and risk to myself; but I can promise that a series of interesting and novel facts shall be forthcoming within the next two months which will for ever set at rest all conflicting theories in respect of the electric force. But leaving out of the question these new developments, I trust that I can satisfy your correspondent by other proof. He says: "The wire terminates in a coil, and inside of this coil, entirely separated from it, is a bar of metal, and entirely separated from this is the bell lever. Now it is difficult to conceive how the mere molecular disturbance of the wire causes a like disturbance in the bar, which again causes the same in the bell lever or armature. If the motion were transmitted directly to the bell lever by a material connection, as in the first case (the case of the bell wire and bell cord), then there would be no difficulty in understanding this application of the theory." It should be well known that magnetism is the result of induction, for it is a well settled fact, thus: that a current of electricity moving in the vicinity of a magnetic metal extends to that metal "tubes" (convenient term) of electric force which magnetize the metal. This fact is so well established that discussion is out of the question, and it is apparent that this can only be the case upon the hypothesis that the intervening space or substance partakes of the nature of the electric action of the conductor, by which means a transfer of force is effected; for it must be borne in mind that no substance whatever is a non-conductor of the electric force, the conductivity simply differing in degree in different substances. For this very reason a current of low tension, that is, a current which has not sufficient electro-motive force to leap a very short length of a poor conductor, such as wood or air, in preference to traversing a very long good conductor, will enable a telegraphic signal to be transmitted a proportionally greater distance than a current of greater electro-motive force, the maximum of which electro-motive force is secured in an induced current or in frictional electricity. Thus with a Grove or a carbon battery, the elements of which are of considerable proportions, a current may be transmitted from New York to Chicago, automatically, at the rate of twenty-five words per minute; but by reducing the size of the elements one half and doubling the number of elements, a speed of fifty or more words per minute may be obtained, because we have increased the electro-motive force of the current while decreasing its quantity, and the current has therefore greater tendency to leap the wire, that is to say, to follow a short poor conductor to the earth through wood, glass, or air, in preference to following a long good conductor for an immensely greater distance, thereby in great measure preventing that elongation of a signal, which is inimical to rapid transmission over a long circuit. But this merely illustrates the point, at which I wish to arrive, that any current of electricity whatever has its direct and inductive circuit, and that one pole only of a battery put to a wire will give a circuit, without regard to whether the other pole of the battery or the other end of the wire be connected to the earth, as can be demonstrated by sufficiently delicate instruments, markedly when the atmosphere is moist, the reason being that the atmosphere acts as a conductor from the other pole of the battery to the earth, and from the other end of the wire to the earth.

The induced current has, as is well known, a very high tension, so high that it may reach a point at which it will not traverse a hundred feet of wire in preference to leaping to earth, and it is also well known that the magnetism which actuates the bell lever is the resultant of this induced current. The effect of induction should be understood precisely the same as we understand imparted heat. For instance, if we bring a heated body near another, the heat will be imparted from the one to the other. In precisely the same manner, when we bring an electrified body into proximity with another body, the latter partakes of the electrification of the former. By what means? Precisely as the cold body partakes of the heat of the warmer body, or the warm partakes of the cold of the colder body, by means of the intervening substance, to which the atomic conditions of the heat and the cold are imparted. Your correspondent will doubtless now realize that what is termed insulation or isolation, in respect of the electric force, is really no insulation or isolation at all, but a poorer connection, the inferiority of which may be compensated by the electro-motive force of the current. Therefore, contrary to what he supposes, it is not "difficult to conceive how the mere molecular disturbance of the wire causes a like disturbance in the bar, which again causes the same in the bell lever or armature;" it is only difficult to conceive how the case could be otherwise; and, as Mr. Marckley says, "if the motion were transmitted directly to the bell lever by a material connection, then there would be no difficulty in understanding this application of the theory," it will be apparent from the foregoing that there is the most direct material connection, the tubes of force extending from the coil to the bar, and from the magnetic bar to the armature, by means of the intervening substance, air or other.

Not only is this the fact, but the magnet and armature



may be dispensed with altogether, and your correspondent will be able to witness an ocular manifestation. Let him construct a circuit as shown in the engraving.

* Electric current, like electric potential, will some day be positively defined—"a convenient term."

Now as he closes the circuit at the battery, the coil will contract, that is, the various convolutions will draw together. It makes no difference of what kind of metal the coil be composed; and here we have an ocular demonstration, not safe to repudiate, although it clearly only demonstrates the divisible or indivisible fact, either that the current renders each convolution attractive, or that the current alters the atomic particles in a manner, or that both results are effected. These experiments may be varied in many ways.

But if more direct ocular demonstration be needed, the coil may be omitted; and it will be found that every time a current is transmitted over a wire, markedly an iron wire, it is increased in length and decreased in size by transverse contraction, showing that its volume undergoes no change. Note the similarity of this result to the effect upon an elastic substance stretched out; the volume is the same, but the form is changed, and we know that we have changed, by our stretching, the molecular structure.

The above was Joule's experiment. But I need not dwell at present upon the fact that the electric or magnetic force exists in and is a certain action of the atomic particles of matter, when it is so well known, and has been so prominently shown by Tyndall, that, when magnetization is suddenly effected by completing an electric circuit, an ear close to the bar hears a clink, and another clink is heard when the circuit is broken. The condition therefore continues without clinks corresponding to the electric force waves during the continuation of the circuit. Therefore, to give a single reason, I term the magnetic effect a crystallization of the electric current.

W. E. SAWYER.

New York city.

Life-Saving Devices.

To the Editor of the Scientific American:

I have lately read some articles in your esteemed journal on torpedo boats. Cannot such life destroying apparatus be converted into life-saving ones, by substituting (for the torpedo) lines, and other apparatus, and conveying them to the shipwrecked?

H. J. F.

The Education of the Mechanical Engineer.

We are indebted to Professor R. H. Thurston, of the Stevens Institute of Technology, for a copy of an address, entitled "The Mechanical Engineer: his Preparation and his Work," delivered before a recent graduating class of the above named college.

As a *resumé* of what a mechanical engineer ought to know, it is the best production we have ever met with, and we especially commend the extracts below given to all who contemplate devoting themselves to that great and useful calling. It is hardly necessary to remark that the speaker had particular reference to the Stevens Institute course, through which his audience of graduates had just passed. To these young men he talks as follows:

"You have been taught here, not only a course of pure mathematics, such as was formerly prized principally for the mental training which it gave, but you have been led to make useful applications to those problems of practical, every day life and work which, while no less valuable as intellectual gymnastics, give development to good common sense, and which assist to make the man as symmetrical as the gymnast and as skillful as the world's best workers. You have not only been given a set of useful tools, but you have been shown how to handle them. But the greatest value of these acquirements, as aiding you professionally, will be seen later in life, when, perhaps after years of hard work and of severe competition, you may have arrived at the hight of professional practice, and when you will begin to meet with those exceptional problems, difficult of solution by all, and soluble by very few. It is then that you will see most plainly the advantages of this early and extended preparation, and will learn that success in these exceptional cases may make you leading men in your profession. You will find multitudes doing ordinary work well; but between the leaders, success in competition is won by overcoming great and rare obstacles. Great fields of application lie before you in the new and yet undeveloped science of thermodynamics, and in its application to the theory of heat engines and to practical problems of inestimable importance. Those of your comrades who have preceded you have shown you where to look for them.

"In the laboratory you have pursued the study of chemistry. You will have frequent occasion to apply your knowledge of this science, and to put in practice that adroitness in manipulation which you have here acquired.

"Metallurgy offers you a score of attractive fields for its application and for study and most valuable research. You will be sometimes called upon to examine new materials processes, and industries in the course of professional practice. When this occurs, study the subject cautiously, critically, and thoroughly, deceiving neither yourself nor your client. That later science, physics or natural philosophy—I like the old name best—has been opened to you with all the completeness that these collections of delicate and wonder-working apparatus and the knowledge and skill of your accomplished preceptors could secure. The beautiful phenomena of optics have become familiar to you by frequent observation; and their occasional exhibition in this hall on a grander scale has assisted to impress upon you their characteristics. You have yourselves read, in a ray of light, the composition of a complex metallic alloy, and of the salts of every kind collected in the laboratory of our President, and you have, in the same curious way, seen the constitution determined of the sun and the farthest stars.

"The sciences of heat and of the chemico-physical phenomena of evaporation and combustion and of thermo-dynamics will find daily application in your work, which affords a field, not only for the use of that theoretical knowledge obtained from the text books, but for the exercise of all that familiarity with the laws and the facts of the sciences which is secured by actual manipulation and personal attention. They will demand such methods as you have practised in the physical laboratory, where you were not simply told how the thing was done, but were shown how to do it for yourself. The design and construction of heat engines, the study of special applications of thermotic principles, and sometimes their theoretical investigation, are now the occasional tasks of the engineer, and may, after a time, become yours. They are every day arising more frequently and assuming higher importance.

"The study of modern languages has pleasantly varied your course. You have been prepared to make your own all of those splendid treasures of scientific learning which have so long enriched the French, and all of the inestimably valuable literature of engineering of which German literature is now so prolific. In both languages, as in the English, you will find the periodical literature most immediately useful, as presenting you with the latest discoveries, the subjects of most direct importance, and the views of contemporary authorities.

"Your studies of history and of English literature have been by no means the least important part of this preparatory training. This branch of your education is not only necessary, as of frequent use, but it is a most satisfactory and thoroughly enjoyable portion of your knowledge. These studies, however, are by no means to be regarded as giving you purely ornamental accomplishments, or as furnishing only entertainment for hours of leisure. You will have daily occasion to apply them usefully. The power thus acquired of expressing thought, and of stating facts with elegance, precision, and conciseness, is an important element of an engineer's success. A report made to a client, worded carelessly, expressed in vague terms and with orthography not beyond criticism, sometimes casts a dark shade over the professional reputation of a really talented, experienced, and reliable man. A specification so drawn as to be capable of double interpretation may subject one or both of the parties to the contract to serious annoyance or to great loss of time and money.

"You have given a large part of your time, during these four years of study, to the acquirement of a knowledge of the principles of engineering and to the practice of the arts which are in daily application in the practice of the profession. You have, from the beginning of your course, studied the theory of the graphic art and the geometry of machinery. You have spent such an amount of time in the drawing room, copying well known plans, and designing new forms of mechanism, that you have become familiar with every principle of common application in graphic construction, and every detail of ordinary draftsman's work. You will find this skill, in sketching your plans, in making accurate drawings, and in reading the drawings of others, of daily use and of incalculable value to you. Without this power of comprehending plans existing only on paper, you would be absolutely crippled in your efforts to advance yourselves. Without the ability to sketch rapidly and draw readily and accurately, you would have the greatest difficulty in securing the prompt and thorough working of your own schemes. You have mastered the fundamental principles of applied mechanics and of mechanical construction, and have become acquainted with the nature and uses of the materials with which you are to work. You can, I presume, make a stronger lever of a built beam than could Archimedes. The water wheel, the mariner's compass, gunpowder and nitro-glycerin, the telegraph, the chronometer, the steam engine, the printing press, the spinning frame and the loom, and a thousand other inventions seem already perfected. Yet, some one, whether man of science or working mechanic or educated engineer, none can tell, will yet rival Fourneyron, and give us better turbines, will find a means of giving us safety in navigating iron ships, will excel Frodsham in making accurate timekeepers, will give us better printing presses, will supersede the spinning frame and the loom, and will earn a greater fame than Watt by giving us, in some new motor, a means of approaching that theoretical efficiency to which no heat engine has approximated.

"Who has greater reason to aspire to fame and fortune in these coming years of such noble competition than have you? The development of the natural resources of this broad land of ours will afford ample opportunity for the application of your knowledge and the practice of your art, and for the employment of every faculty, natural or acquired, that you may possess, and in whatever way your inclination may prompt, and to any extent that ambition may urge, and that your strength and endurance may permit. Take hold of the work which offers itself, never standing idle, waiting for something more perfectly satisfactory, and do the work as promptly and skillfully as possible, and you will ultimately find that no man need complain that opportunities do not present themselves. Your competitors possess the advantages of training in the rough school of the world, of a knowledge of men, of business methods, and of the rights and the wrongs of daily experience. They have had hard knocks and become callous, or have learned by dint of long practice, and by natural tact frequently, to evade them, and to push on without giving a thought to their scars. They will have the advantage of you at first, for these experiences are essential to early success. They may smile at your book knowledge, and may sometimes even deride your more precise methods and scientific ways; but—bide your time! Make yourselves masters of all the accomplishments, and seek to acquire all of the knowledge, of these rough and ready but untaught competitors, never refusing to give them a liberal reward from your own stores of information, should they ask it."

We shall publish some more extracts from this interesting address in our next issue.

The Relation of Food to Work.

Dr. Du Chaumont, in a recent lecture, said that up to a quite late date there was an absence of any satisfactory theory as to the relation of food to work, and it was supposed that bodily force was due to a chemical change in the muscles themselves, and that the nitrogenous matter in food repaired the waste. But the researches of Joule, Playfair, Frankland, and others, on the conservation of energy, have led to the conclusion that active force is produced chiefly by the potential energy stored up in the carboniferous food, and set free by oxidation. Hence it was seen that to credit the chemical changes in the muscles with the origination of force in the body was not more philosophical than to credit the force exerted by a steam engine to the wearing away of its wheels and pistons.

The lecturer then proceeded through a large number of elaborate circulations, based upon actual observation, for the purpose of showing the ordinary amount of productive work of which a man of average hight is capable, and its equivalent in foot tuns—a foot tun representing the amount of force required to raise one tun one foot high. It appears that the work done in walking three miles an hour is equal to about one tenth the work done by direct ascent. Three hundred foot tuns is a fair day's work for a man of average hight. This would be equivalent to walking fifteen miles in a little over five hours. A hard day's work would be equivalent to walking twenty-four miles in eight hours. Dr. Parkes mentions an extreme case, in which a man in a copper mill did as much as 723 foot tuns in a day, his average work being 443 foot tuns. The ordinary work of a military prisoner is 310 foot tuns. The velocity at which work was done, and the consequent resistance, greatly affect the quantity of potential energy required for its accomplishment. For the production of any amount of what may be termed productive work, a much larger amount of potential energy has to be expended. Professor Haughton, of Dublin, has calculated that, of the total potential energy produced in the body, 260 foot tuns are required for the action of the heart. Then the animal heat absorbs from 2,000 to 2,500 foot tuns, or more.

According to Helmholtz, about five times as much energy is used in the internal work of the body as is expended in ordinary productive work. In the case of severe work, the proportion of internal work to productive work is still greater. Supposing the work performed by a man to consist of walking, the most economical rate, both as regards the amount of food required to sustain it, and the amount of potential energy expended on the body itself, is about three miles an hour. Both above and below that speed there is a decrease in the amount of active work as compared with the non-productive energy. A man walking fifteen or sixteen miles a day, or doing an equivalent amount of work in another form, would require 23 ozs. of food, composed of albuminates 4·6 ozs., fat 3 ozs., starch 14·3 ozs., and salts 1·1. ozs. This would yield a potential energy of 4,430 foot tuns, and 300 foot tuns for productive work. A mere subsistence diet for a man at rest would be 15 ozs., but with this amount a man would lose weight. About 7,000 foot tuns a day of potential energy is about the greatest amount which is possible as a permanency. This would yield 600 foot tuns of productive work. These calculations apply only to men in health.

Magnetisation of Ilmenite (Titanic Ironstone).

Dr. T. L. Phipson says: "Some fine specimens of ilmenite having been sent to my laboratory from Norway, it seemed a good opportunity to investigate the magnetic properties of this mineral. The composition of that which served in my experiments was: Titanic acid, 24·60; protoxide of iron, 72·10; Fe S_2., 2·06; manganese, trace; silicic acid, 1·24. Total, 100.

Its specific gravity was 4·8, and it acted with tolerable energy upon the magnetic needle. From the inspection of this action, I concluded that it was possessed of a very considerable number of poles in close proximity to each other, so that scarcely two closely adjacent parts acted in the same manner upon the north pole of the needle; hence it was evidently built up by a mass of crystals. An elongated rectangular piece of this mineral was separated by a blow of the hammer; it measured $1\frac{1}{2}$ inches in length and was about $\frac{1}{2}$ inch broad. This was placed upon a table and submitted to magnetization by friction with good magnets for upwards of an hour. It was then found to have a pole at each extremity, which it certainly had not before, and was accordingly suspended to a piece of silk, and hung up in a quiet corner of the laboratory. It pointed constantly towards the north, and returned to that position when deviated. It continued to do so for some weeks; but one morning I found it pointing east-west, or nearly so; it had lost its acquired magnetism entirely, having retained it for rather more than a month.

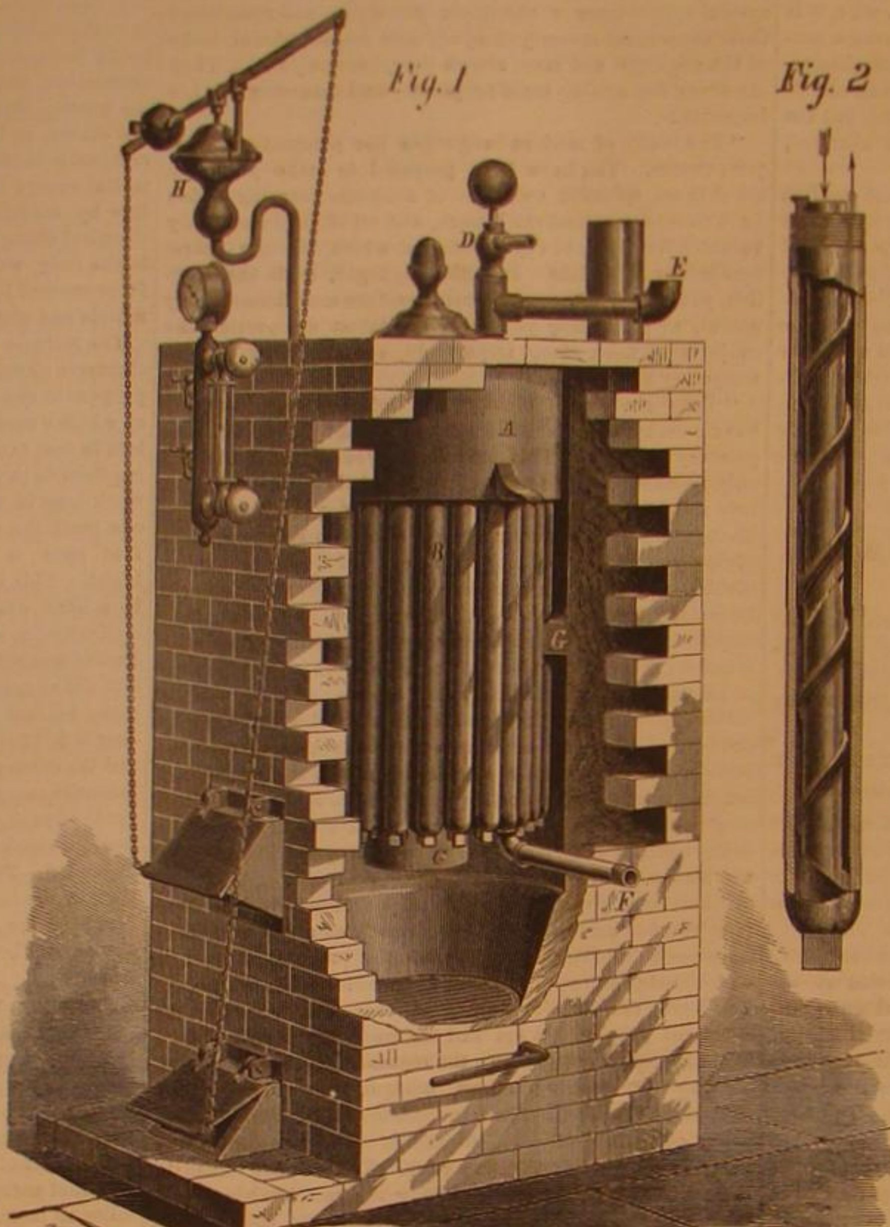
This loss occurred rather suddenly, and I believe that it coincided with a magnetic storm of some intensity which happened about the time. If these experiments could be continued by some who have more time to devote to them, they might lead to some interesting results. It is possible that some minerals that show action upon the needle might be made magnetic in the above manner."—*Chemical News.*

IMPROVED STEAM HEATER FOR DWELLINGS.

We illustrate in the accompanying engraving a new low pressure steam heating apparatus, for which is claimed the advantages of high efficiency, reduction of first cost, safety, and simplicity of management. It is, besides, self-regulating, and is so constructed that a constant circulation of the water in its steam-generating space is maintained.

The steam and water drum, A, surmounts an annular series of tubes, B. The latter are of peculiar construction inside, as shown in Fig. 2, to which we refer more particularly further on. Within the ring of tubes is the fuel magazine, C, which is fed from the top by removing the cover, so that a constant fire is maintained in the grate below. The magazine also serves as a deflector for the heat, directing it against the tubes. At D is a ball safety valve, placed so as to blow off at five pounds steam pressure, and at E is the delivery pipe for the steam, conducting the latter to the radiators in other apartments. Condensed water is returned to the boiler by the pipe, F, by which the feed water is also supplied. The smoke pipe is shown in the rear. The grate is of the shaking and dumping pattern, and can be easily removed without disarranging other portions of the heater. G is a deflector, the object of which is to prevent the heated gases taking a direct course to the smokepipe. It is made by setting one course of bricks close to the tubes.

The boiler is set in brickwork eight inches in thickness, the outer course being built up square, while the inner course is made circular to conform in shape to the firepot and boiler. A space is left between the bricks and the steam drum, which forms a flue to the stack. The apparatus shown at H is a fire regulator, so constructed and poised that, when the steam falls, the weighted arm of the lever is lowered and the ash pit door opened, thus admitting a draft under the grate. On the steam rising above the limit, the weight arm rises, opening the furnace door and so cooling the fire.



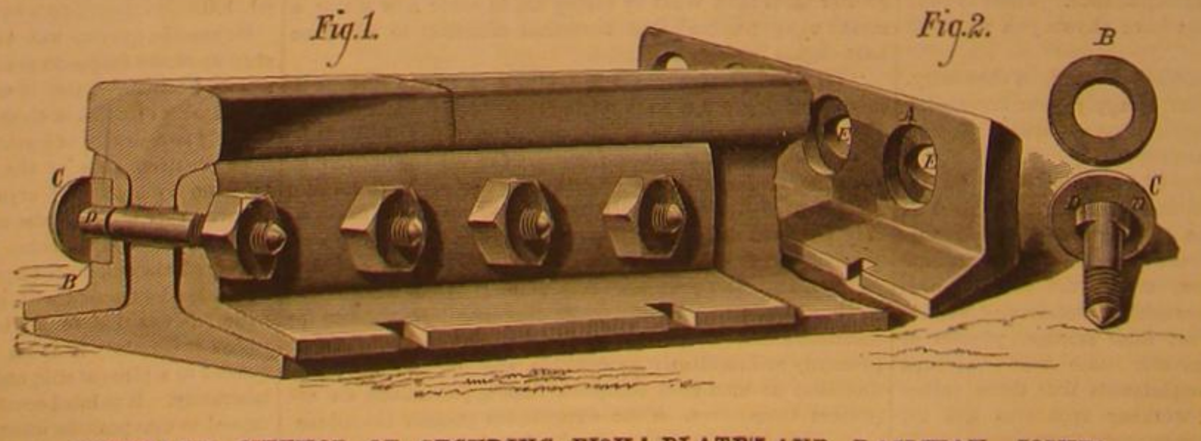
KAFER & DE LACY'S STEAM HEATER FOR DWELLINGS.

A section of one of the tubes enlarged, shown in Fig. 2, exhibits an inner tube, about which is coiled a spiral guide dividing the interior of the outer tube into a continuous spiral channel. When the fire is started, the water contained in the last mentioned portion, becoming heated, rises, and its place is taken by the cold water which descends in the inner tube. By this arrangement a constant circulation is maintained in both tubes, in the directions indicated by the arrows. Tubes thus constructed, we are informed, have been in successful operation for seven years. Each tube, in fact, is a separate boiler, and each being fastened by its upper end only, is free to expand and contract independently of all other portions of the boiler, so that any undue strains from this cause are avoided. They are secured to the water and steam drum, by taper screw threads, and when once made tight they will remain so. They may be readily removed, however, in a few moments when desired.

Patented through the Scientific American Patent Agency. Application for additional improvements is now pending. For further information address the inventors and manufacturers, Messrs. Messrs. Kafer & De Lacy, Trenton, N. J.

METHOD OF SECURING FISH PLATES TO RAILWAY JOINTS.

In the annexed engraving we illustrate a new method of securing rails in the fish plates, which is so constructed that the injurious strains, occurring at the joints by the passage of trains over the rails, are obviated. The arrangement is also such that the bolts are prevented from turning or working loose, which is another important feature. In Fig. 1 the invention is shown in place, in Fig. 2 the various parts are separated.



DITTMAN'S METHOD OF SECURING FISH PLATE AND RAILWAY JOINTS.

The fish plates are secured as represented, on each side of the joint. In one of the plates are formed a series of sockets, A, in which rubber rings, B, Fig. 2, are inserted. Through these rings pass the bolts, C, which are secured on the opposite side of the other fish plate by nuts. As the head of each bolt impinges upon the elastic rubber, it is claimed that, through this means, the strains on the fish plate bolt and nut are prevented.

To keep the bolt from turning, two small wings, D, Fig. 2, are formed on the shank near the head. These are deep enough to enter the oval recess, E, of the fish plate when the bolt is drawn into place tightly by the nut. This construction rigidly secures the bolts in position, so that there is no danger of their turning. The various parts are firmly bound together, and the rubber further serves to take up the yield of the bolt under strain, and thus prevents the turning of the nut on the thread.

The invention tends to considerable economy in the construction of railroads, as it obviates, in some degree, the frequent replacing and repairing of worn connections; and at the same time it adds to the safety of the road, especially under high speeds of travel.

Invented by Mr. Caspar Dittman. Patent recently allowed For further information address the Star Nut Lock Company, Leacock P. O., Lancaster county, Pa.

The Tellier Refrigerating Machine.

We recently examined with much interest a Tellier refrigerating machine which has just been erected and is now in operation in a large brewery in 47th street in this city. The operation of the apparatus is based on the alternate expansion and compression of methylic spirit vapor, the former producing intense cold and the latter reducing the vapor to a liquid form, ready for new vaporization. The cold gas is carried through a series of large plates in a cooling chamber, over and under which plates a powerful air current is driven by a fan blower. This current, which showed by the thermometer a temperature of 32° Fah., is conducted directly to the cellar or other locality to be cooled. The principle advantage of the machine is its economy, there being practically no waste of the vapor, and it being possible to make from 6 to 8 tuns of ice per day of 10 hours by the aid of pumps of from 5 to 7 horse power. Both the principle and the operation of the apparatus are very interesting, and as we expect shortly to publish a fine large engraving, together with a complete description of the entire apparatus, our readers may anticipate something of more than ordinary practical scientific value; especially as this machine embodies the very latest improvement in the process of the artificial production of cold, adaptable to so many important manufactures and preserving processes.

New Smoke Condenser.

At the Queen Louisa coal mine, near Zabrze, in Upper Silesia, there are two pairs of Cornish boilers, each 21·5 feet long and 5 feet in diameter, placed in boiler rooms off the main drawing level, about 120 yards below the surface, for the purpose of driving a 44 inch Tangye pumping engine, and a double cylinder horizontal engine for drawing coals from the dip workings. The smoke from these boilers was at first conveyed to an upcast shaft through a drift only partially protected by a lining of masonry, until the deposit of finely divided soot, often in a state of ignition, was so constant as to give rise to a fear of the ignition of the coal. It was therefore decided to adopt a means of cooling the smoke before admitting it into the flue drift. The condenser consists of an upright cylinder of boiler plate, about 14 feet high and of 5 feet internal diameter, with twelve horizontal diaphragms placed at equal distances apart. Each of these diaphragms is made of a double thickness of sheet iron, perforated with a great number of round holes 0·2 inch in diameter. They are of the same size as the internal diameter of the tube, but from each a segment about 1 foot in breadth is cut off, the cut edge being placed alternately opposite to those of the adjoining plates above and below, so as to form a serpentine passage for the smoke, which is admitted at the bottom through two circular orifices of about 2 feet in diameter, one for each pair of boilers. Water from the top falls through the plate in a fine shower, and is discharged through an 8-inch pipe at the bottom. The upward current of smoke is maintained by a Schiele's exhauster of 13 inches diameter, the distance traveled, owing to the obstructions caused by the diaphragms, being about 51 feet. The aperture for the discharge of the cooled smoke is about 12 inches in diameter. The supply of water for the condenser is taken directly from the discharge main of the pumping engine, and afterwards flows off by the adit. The apparatus works well, no soot now being deposited in the flue drift; but the resistance to the current is greater than was estimated, and the exhauster and its 5 horse power engine, being insufficiently powerful to maintain the flow at a proper speed, are to be replaced by another of 15 horse power. The exhaust steam from the engines is discharged into the smoke drift, and contributes something towards increasing the draft. The experiments up to the present time show that the efficiency of this class of condenser is dependent chiefly on the power of the exhauster, on the distance traversed by the smoke, and the perfect division of the water, and not to any great extent on the quantity of water employed.

A New Elevated Railway.

A party of gentlemen, including several well known engineers, recently visited the works of Messrs. Clarke, Reeves, & Co., at Phœnixville, Pa., in order to witness trials of a new project for an elevated railroad, designed by General Roy Stone for rapid transit purposes in this city. About 800 feet of track, raised on posts, had been constructed, and this included a curve of 90 feet radius. The engine and car rests on a single rail, and are steadied by wheels bearing against two rails placed below, so that there are really three tracks. The locomotive was driven by two rotary engines. The car had two tiers of seats, and accommodated 60 passengers. The operation over the short space was satisfactory.

The objections to the plan are obviously to be found in the difficulty of arranging the switches, and of causing one line to cross another at the same level. The advantages are its low cost, about $100,000 per mile of single track, its safety—for it is impossible for the vehicles to run off the track—and the fact of its occupying a comparatively small portion of the street. These taken into consideration, the plan is perhaps one of the best of those based on the elevated principle. The inventor, we learn, is endeavoring to obtain the consent of the authorities of this city to build an experimental section of some 500 feet in length along the street which crosses the City Hall Park on the north side of the post office.

Three times the weight in pounds per fathom equals the working load in hundredweights of good hempen rope

BLACK COCKATOOS.

The gardens of the Zoölogical Society, London, have recently been enriched by the acquisition of the great black cockatoo of New Guinea and the adjacent islands. The structure and habits of this bird render it one of the most remarkable of its tribe. Its favorite food in its native state consists of the kernel of the canary nut, which grows on a lofty forest tree abundant in the islands where the birds are found. These nuts are so excessively hard that it requires a very heavy hammer to break them; but they are readily opened by the extraordinary mandibles of the bird, which, taking one in its bill and holding it against the notch in the narrow upper mandible by means of the singular, horny-tipped cylindrical tongue, cuts a notch in it by sawing the cutting front edge of the lower mandible from side to side. This done, it is enabled to break off a small piece of the hard shell by a strong bite, and then, with the long tip of the upper mandible, it picks out the kernel piecemeal. The tongue itself is very singular, being a bright red cylinder with a horny black tip, and having two roots diverging to each side of the lower jaw. The appearance of the bird is remarkable. The bill is of immense size and strength; the head very large, possessed of powerful muscles to wield the jaws, and covered with a feathered crest. Than this singular bird perhaps no living animal offers a more striking example of the exact relation that always exists between the structure of an animal and its habits. It is evident that the form of its extraordinary bill alone enables it to live upon a kernel that cannot be obtained by any other bird.

THE GREAT BLACK COCKATOO OF NEW GUINEA.

The coloring of the animal is almost as remarkable as its structure. The entire plumage is slaty black, powdered with the white excretion from the skin that is so abundant in cockatoos, pigeons, and some other birds. The bare, skinny cheeks are of a blood-red color, varying in intensity with the health and condition of the bird. The scientific name of the species is *microglossa aterrima*.

THE IGUANA FAMILY.

The lizard tribe furnishes one of the most universal and persistent types in all natural history. No country is entirely without them, and none but the very earliest geological formations fail to furnish specimens of this remarkable race. Of the iguanas, the characteristics are mainly the horny scales which cover the body, and the toes, which are distinct and free. The serrated crest along the ridge of the back is generally present; and the teeth are usually set in a common alveolus, but sometimes they are attached to the free edge of the jaw bone.

The specimen herewith represented is a native of Australia, where eleven species of the tribe have been found, all of which are described in Dr. Gray's catalogue. One observable feature is the long, conical tail, covered with overlapping scales. The head is flat and triangular, and the small scales covering the upper parts of the body are intermixed with a kind of thorny tubercles, seen also along the back of the body. The elevated crest along the backbone is not found in this instance, but the scales all over the body are elongated and sharp-pointed, so that the animal is furnished with ample exterior protection.

AN AUSTRALIAN IGUANA.

The color of the upper part of the head, the feet, and the lower part of the face is yellowish; the throat and the sides of the neck are of a deep black color, and the sides of a brownish hue; the back is grayish brown, and the belly and chest show yellowish spots surrounded with circles of brownish black, on a clear brown skin.

A Lesson for Brakemen.

A railroad brakeman, who had been celebrating his grandfather's birthday, was arraigned before a Detroit police court. "You run on the cars, eh?" asked the court. "Yes, sir." "And you belong to that class of men who open the door as the train stops at Pontiac, and yell out 'Upontyack!' at the passengers." The man was silent. "It makes my bones boil to think how I've been used on these railroads," continued His Honor. "The seats are locked, the water cooler empty, the windows won't stay up, and every few minutes you open the door and cry out 'Jawkun' for Jackson, or 'Kl-a-zoo' for Kalamazoo. I believe I'll mark you for six months." "Please, sir—" protested the prisoner. "I must strike a blow at this great evil somewhere, and I might as well commence on you." "Please, sir, I was never here before, and it's my first drunk in four years." His Honor leaned back and chewed the corner of a blotting pad while he reflected. Finally he said: "Well, I'll let you go, though I'll be blamed for it. Now, sir, after this you want to adopt a different style. When the train approaches a station, you want to go through the car like a cat, smile gently, and say in quiet tones: 'Ladies and gentlemen, this train is now in the outskirts of the beautiful city of Ypsilanti, and such of you as desire to step off will please make ready; and may health and prosperity ever attend you.' What an innovation that would be, sir! How the travelin publicg would rush for your road! Will you do this, Mr. Wellington?" The prisoner promised, and was allowed to go.

Too Much of a Good Thing.

Messrs. Smith and Potts, inventors of the ingenious adding pencil which we illustrated and described a few weeks ago, send us a pathetic appeal to stop the avalanche of letters, orders, and inquiries which have poured in upon them since the notice of their invention appeared in our columns. They want the "wholesale waste of stamps" arrested, because they do not sell pencils, but only the rights to manufacture them. We hasten to comply with the request. Our readers, excepting those desiring to purchase rights as aforesaid, will please stop this reckless "waste." There are plenty of inventors and manufacturers who want their letters. Those who have written to the above parties without getting their orders filled are advised to consult our advertising columns and the illustrated inventions which appear in each issue of the paper. They will always find some new article in which they can invest to advantage.

A Transatlantic Pigeon Post.]

Experiments are now in progress in England, in training a variety of carrier pigeon indigenous to Iceland, the object being to establish, if possible, a pigeon transatlantic mail between the United States and England. The bird is of great docility, intelligence, and spirit, and is naturally ocean-homing. Its speed is over 150 miles per hour, and it is said to be able to return to its habitation from any part of the world. A pair of these pigeons recently carried despatches from Paris to a lonely spot in a wild and rocky part of Kent, within ten miles of London, in one and a half hours. Should the present efforts to educate the birds prove successful, next summer will find an almost daily ocean mail in practical operation, as it is believed that the flight from continent to continent can easily be accomplished between sunrise in one hemisphere and sunset in the other.

Recent Arctic Explorations.

The Pandora, a small screw steamer which left England for the arctic regions in search of relics of the ill-fated Franklin expedition, recently returned to Portsmouth after a brief but eventful voyage of three months duration. Following Sir John Franklin's track, the vessel, after leaving Upernavik, steamed to the westward and penetrated further in that direction than any other ship has yet succeeded in doing. A yacht, abandoned by Sir James Ross, was found beached and in fair condition; and the storehouse built by the same explorer, together with the graves of some of Franklin's men, were visited. The Pandora brings back the news that the Alert and Discovery, of the British expedition, are now in Smith's Sound, and that there are indications that that body of water is comparatively free from ice.

The ease with which the Pandora, small as she is, accomplished so long a journey—one which Franklin, with his sailing ships, occupied two years in performing—in the brief period abovementioned, augurs well for the success of Captain Nares. The efficacy of steam is fully shown; and as the Polaris hardly merited the designation of a steamer, the Pandora is really the first to prove what even moderately powerful engines will do toward breaking through the ice floes. With the channel as open as is reported, and driven on by their strong machinery, it is not impossible to believe that the Alert and Discovery have already attained the borders of the open polar sea.

New Life-Preserving Mattress.

Interesting trials of the Gay safety mattress were lately made at the Maritime Exhibition, Paris. This mattress folds in two, longitudinally, forming a double belt, with attachments to fasten it to the person in such a way that it cannot possibly be displaced. It is formed of a double row of *boudins*, or "sausages," made of cork cuttings tightly compressed by machinery within a waterproof impermeable case, and the whole covered and incased in No. 7 canvas. The cork ribs are about 8 or 9 inches wide, and half that in thickness. The whole forms a mattress, one like which is intended to be placed in each sailor's hammock, cot, or berth, it makes a bed which, contrary to what might be expected, is elastic and easy to lie on. Its weight is about 6¼ lbs., and it suffices to sustain in water the weight of four men, so as to save their lives, as was conclusively shown by the experiments on this occasion.

The celerity with which this valuable aid can be rendered available was shown by the fact that a man lying thereon in the hammock, on a given signal, drew out the safety mattress, arranged and put it on, fastening it perfectly, and jumped into the water, a l within the space of three quarters of a minute. Thus every one on board a ship may have at immediate command, in case of accident, the means of enabling him or her to float without other aid in the water, even assisting others, and so to await the arrival of further aid, by ships or boats; thus materially multiplying the chances of safety, which, after all, is the utmost that can certainly be attained, be the life-saving apparatus what it will.

Another important point in this appliance is that, as was also shown, the motion of the limbs, as in swimming, are entirely free and unfettered by the mattress, when thus used as a cincture; moreover, in case of wreck and being cast ashore, this appliance is calculated to afford great protection to the body, and mitigate the shock if the wearer be thrown by the waves against a rock or beach; or should any one or more of the separate cork ribs be cut or damaged in any way by such collision, being independent, the cincture as a whole retains its buoyancy and life saving power unimpaired.

AFTER filing a saw, place it on a level board and pass a whetstone over the side of the teeth until all the wire edge is off them. This will make the saw cut true and smooth, and it will remain sharp longer. The saw must be set true with a saw set

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Positions of Planets for November, 1875.

Mercury.

Mercury rises on the 1st of November at 6h. 8m. A. M., and sets at 4h. 37m. P. M. On the 30th, Mercury rises at 5h. 58m. A. M., and sets at 3h. 45m. P. M.

Mercury should be looked for about the middle of the month, in the early morning, south of east. It will rise some time before the sun, and may be known by its soft white light.

Venus.

On the 1st of November, Venus rises at 7h. 28m. A. M., and sets at 5h. 20m. P. M. On the 30th of November, Venus rises at 8h. 39m. A. M., and sets at 5h. 27m. P. M. It should be looked for after sunset, a little south of the place where the sun was last seen.

Mars.

On the 1st of November, Mars rises at 1h. 12m. P. M., and sets at 10h. 33m. P. M. On the 30th, Mars rises a little after noon, and sets at 10h. 27m, P. M.

Mars can be seen from night to night to change its place among the fixed stars. Its path has lain among the stars of *Sagittarius* and *Capricornus*, and in November it reaches the smaller stars of *Aquarius*. Mars and Saturn are in conjunction on the 21st.

Jupiter.

Jupiter is very unfavorably situated for observation. It rises at 6h. 48m. A. M., and sets at 5h. 2m. P. M. on November 1st. On November 30th, it rises at 5h. 26m. A. M., and sets at 3h. 25m. P. M.

Saturn.

Although low in altitude, Saturn is still well situated for recognition. On the 1st, it rises at 1h. 46m. P. M., and sets at 11h. 46m. P. M. On the 30th, Saturn rises at 11h. 55m. A. M., and sets at 9h. 57m. P. M.

On the 21st Mars and Saturn are in conjunction; Saturn is a few minutes of arc above Mars. They can be seen directly south at about half past five at an altitude (in this latitude) of 32½°.

Uranus.

On the 1st, Uranus rises at 11h. 47m. A. M., and sets at 1h. 41m. P. M. of the next day. On the 30th, Uranus rises at 9h. 45m. P. M., and sets at 11h. 48m. P. M. of the next day. It is among the small stars of *Leo*, which rise before the well known stars of the Sickle.

Neptune.

Neptune rises at 4h. 38m. P. M. on the 1st, and sets at 5h. 52m. A. M. On the 30th, Neptune rises at 2h. 43m. P. M., and sets at 3h. 56m. next morning. It is so remote that it cannot be seen without the aid of a good telescope.

Sun Spots.

The report is from September 29 to October 20, inclusive. The picture of September 29 shows a group of spots near the center. In the photographs of September 30, October 2, and October 4, the only change shown is that caused by the revolution of the sun on its axis. On October 5 this group was still visible with a glass, while another group and two small spots, near the center, which had not been seen the day before, were observed.

Photographing and observations of the sun were interrupted by clouds from October 4 to October 8; and from that date to October 19, no spots have been seen.

The picture of October 20 shows, near the eastern limb, two elongated spots, followed by two very small ones.

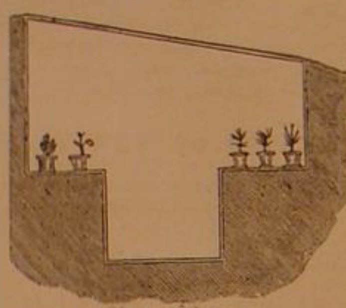
Cork-Leather—A New Fabric.

M. Horeau exhibits, at the French Maritime Exhibition, what may be regarded as a new fabric, under the name of *cuir-liége*, or cork-leather, which possesses a somewhat remarkable combination of qualities, adapting it for many and various special applications and uses, of which the most important relates to military equipments. *Cuir liége*, as its name implies, is prepared mainly from cork, and has all the characteristics of leather, for which primarily it is a substitute; its most singular peculiarity consists in the change operated in the cork by the treatment adopted. Thin sheets, or pieces of cork, are covered on each side by an extremely fine India rubber skin, with any ordinary textile fabric outside of all, the whole becoming one *quasi* homogeneous tissue; and whereas the cork sheets in their primal condition are porous and penetrable by water, friable and brittle, and endowed with very little strength and cohesion, having only the positive qualities of lightness and non-conduction of heat; yet when treated as above described, the resulting product, *cuir-liége*, is extremely supple, and, so to say, malleable, endowed with great strength to resist tensile strain, and, while retaining its comparative lightness and impenetrability to heat, it is rendered waterproof and impermeable to moisture. This new material may be crumpled up, rubbed and wrung like linen and calico in the wash, doubled up any number of times and hammered with a mallet, without injury; the interior web of cork, which is the basis of the fabric, neither cracks nor tears in any way, but preserves its unity and entirety. In regard to its waterproof character, the *experimentum in corpore vilo* is perfectly conclusive; boots, shoes, and other articles, formed out of *cuir liége*, are seen swimming in water, without the wet penetrating, or at all deteriorating them; aquaria are formed of *cuir-liége*, either in one piece or in several pieces, sewn together, and there is no penetration, no exudation, no trace of moisture on the external surface, nor leakage at the seams. In evidence of the strength of the material, a weight of nearly half a tun remains suspended indefinitely by a strap about 2 inches in width and ¼ inch in thickness, which has an external resemblance to leather, but is only *cuir-liége*. Externally, according to the textile material used in combination with the cork, the appearance varies, resembling leather, American cloth, macintosh, or other waterproof materials, but endowed with far superior qualities.

EARTH PITS.

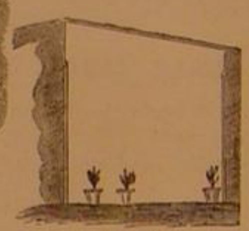
The object of a cold pit is to get heat from the earth below and to shut out the cold above. The degree of heat thus obtained will vary with the shape. A broad sash, for instance, which rests on the top of the ground, with the sides of the frame considerably exposed, and where the warmth of the earth comes up only from the bottom of the shallow space, will afford only partial protection, and may be employed to cover half hardy plants. In Fig. 2, while the glass is much less exposed to the sweep of winds by being nearer the earth's surface, and the sides of the frame are banked up and protected, there are three times the warmth derived from the earth at the two sides as well as on the bottom. To this style of pit, the drawings of which we take from the Albany *Cultivator*, may well be given the name of earth pit. By covering the glass sufficiently with mats, etc., in severe weather, such a pit as this will preserve plants from great cold. Fig. 1 represents a good pit, so arranged that the attendant may enter through a door at the end and

Fig. 2.



Earth Pit with Sunken Walk.

Fig. 1.



Earth Pit.

pass through the whole length. Such a pit may be from 10 to 12 feet wide, and of any desired length. One of the first requisites of a pit is perfect drainage.

FLOWER POTS.

As many of our readers, agriculturists and others, live far from the large cities, and have to depend on their own skill for many minor articles of household economy, a few simple directions for making flower pots will be useful to them. They are published by Mr. McIntyre, gardener in one of the London parks, in the *Journal of Horticulture*.

Fig. 1 is the model, which is made of tin, copper, or zinc, either of the two latter being cheaper in the long run. It is 2¾ inches in width at the top and 1¾ inches at the bottom, inside measure, and about 2¼ inches in depth. Fig. 2 is the pot when made. Fig. 3 is the bolt, which is about 5 inches in length of half inch round iron, to which is soldered a shield of stout tin an inch in diameter; this shield is an inch from the end of the bolt. Fig. 4 is the mold (inverted), which is made of wood; the size of the plug is 1¾ inches across the top, and 1 inch across the bottom, and 2¼ inches deep.

The composition of which the pots are molded may consist of various ingredients, provided they do not destroy its adhesive character. Strong loam, of the fat greasy kind, as we believe it is termed, is the best staple, and to this is added a little leaf mold and cow dung. Cocoa nut fiber (not the dust), wool threads, fragments of straw, hay and chopped turf, may also be mixed with the mass, which must be thoroughly incorporated, and worked up to the proper consistence with water. In making the pots a hole is made in the bench, through which the spindle of the bolt, Fig. 3, passes, having previously been put through the hole in the model, Fig. 1. Some of the composition is then placed in the model, pressing it around the edges, but always taking care to have a superfluity of the composition. The plug, Fig. 4, is then placed in the center of the model, a slight indentation in its bottom being made to fit over the end of the spindle of the bolt, Fig. 3. The plug is then pressed home, and turned gently to the right, while the model is turned to the left. The superfluous composition is then removed with a knife, and the pot removed by pushing up the bolt. If the composition is at all sticky, it will be found advisable to dip the plug in water before pressing it into the model, and the latter will also require an occasional dip. The pots as molded are placed in an oven, or in the hot sun, where they speedily dry, and if the composition has been well tempered they will stand a good deal of storing. The dimensions given are only approximate, and for small pots; other sizes can easily be estimated from them, and the thickness of the pots can be varied to suit the wants, or according to the judgment, of the maker. When well made and of proper materials, these pots will stand the winter and spring in frames, though the roots of the plants often work through them. Of course, when bedding out, the pot is put in the ground as well as the plant, and thus, while avoiding any check from shifting, the plants are provided by the rapid softening of the pot in the damp soil with food which they speedily appropriate. These pots are so easily made, and the implements cost so little, that we recommend a trial of them to all who practise the bedding-out system.

The Brotherhood of Locomotive Engineers.

The annual convention of the Grand International Division of the Brotherhood of Locomotive Engineers opened at Irving Hall, in this city, on the 20th of October. The attendance was large, including delegates from all parts of the United States and Canada. An address of welcome was delivered by Mr. Clarkson N. Potter, which was responded to by First Grand Engineer F. S. Ingraham, of Ohio. Grand Chief Engineer Arthur, of Cleveland, in his opening speech noted the growth of the brotherhood, and very justly condemned the efforts which some railroad managements have directed toward lowering the wages of the engineers. He mentioned several cases of disagreement between railroad authorities and engineers which had been amicably settled through the arbitration of the Society.

Occupation of New Houses.

It is possible to avoid danger from dampness of new houses by passing air through them rapidly enough to prevent its becoming saturated with moisture. Air which contains no watery vapor is neither pleasant nor wholesome. It should be two thirds saturated; and if this proportion be not much exceeded no injury can arise from such vapor only, and there seems no reason why, if it be derived from a damp wall, it should be injurious if not in excess—that is, if the air be changed rapidly enough to prevent it becoming too damp.

DECISIONS OF THE COURTS.

United States Circuit Court.—Southern District of New York.

PATENT PLANER MACHINE.—H. D. STOVER AND J. A. FAY & CO. *vs.* E. S. HALSTED AND G. W. MERRITT.

[In equity.—Before Shipman, J.—Decided August, 1875.]

Shipman, J.:

This is a bill in equity praying for an injunction and an account, and is founded upon letters patent of the United States, for an Improvement in Planing Machines, which patent was issued to Henry D. Stover, one of the complainants, on July 23, 1861. The other complainants, J. A. Fay & Co., are a corporation and the assignees and owners of an undivided half interest in so much of the patent and of the invention covered thereby as is embodied in the third claim of said patent. The assignment was executed September 14, 1868.

The third claim of the patent of H. D. Stover—improvement in planing machines, July 23, 1861—namely, "The arrangement of matching cutters to be adjusted both laterally with each other and vertically upon the bedpiece, essentially as described, in combination with the platen, so that the planing and matching of the piece may both proceed at the same time, or either the planing or matching may be done separately, whether the platen be made movable with the piece secured thereupon or the platen be fixed and the piece be made to move thereon," held valid.

The claim, though not expressed with accuracy, should be construed *ut res magis valeat quam pereat*.

The inventor intended to claim a surfacing and matching machine, in which the matching cutters were adjusted laterally and vertically, in combination with the platen, and were so adjustable vertically that the matching mechanism could be mechanically dropped below the platen when surfacing alone was to be done.

The movable or fixed character of the platen is not a necessary part of the improvement to which the third claim relates, and might have been omitted therefrom.

The term "matching-cutters" in the claim signifies "matching mechanism;" and the claim is infringed by the Merriam machine, in which the matching spindles alone are dropped below the bed, the heads with the cutting blades having been first removed.

The corporate character of a corporation complainant being averred under oath in the bill of complaint, and the same not being denied in the answer, but simply proof thereof being called for: Held, that the fact of incorporation was in effect admitted by the pleadings.

[*S. A. Duncan* and *George Gifford*, for complainants.
W. J. A. Fuller, for defendants.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 10 to September 30, 1875, inclusive.

AIR ENGINE.—A. K. Rider, Walden, N. Y.
BALE HOOP, BUCKLE, ETC.—J. M. Seymour, Newark, N. J.
BLASTING POWDER.—H. Courtellle, New York city.
BOILER FURNACE.—Z. S. Durfee, New York city.
BUTTON FASTENER.—Z. Young, Philadelphia, Pa.
CABINET, ETC.—H. Smith, Jamestown, N. Y.
COMPRESSING INGOTS, ETC.—G. W. Billings, Cleveland, Ohio.
COMPRESSING SCRAP METAL.—L. J. Atwood, Waterbury, Conn.
CORSET SPRING, ETC.—H. Kellogg, Milford, Conn.
GENERATING OZONE.—F. W. Bartlett, Buffalo, N. Y.
HARVESTER.—S. Johnston, Brockport, N. Y.
HEATER.—A. H. Mershon, Philadelphia, Pa.
HYDROCARBON FURNACE.—R. B. Borland, New York city.
LOOM.—C. H. Chapman, Shirley, Mass.
LOWERING BOATS.—J. Ferguson, Chicago, Ill.
MAGNETO-ELECTRIC MACHINE.—J. B. Fuller, Brooklyn, N. Y., *et a.*.
MAKING GAS.—W. H. Spencer, Brooklyn, N. Y.
PRISON ALARM, ETC.—J. B. Cook *et al.*, Memphis, Tenn.
PUMP.—J. N. Rowe, Rockland, Me.
PURIFYING GAS.—P. Sweeney, New York city.
RAILWAY BEARING.—B. M. Livermore, New York city.
REFRIGERATOR.—I. Allegretti, New York city.
RETORT LID, ETC.—H. Collinson, Boston, Mass.
SEED DRILL.—W. A. McClintock, Pittsfield, Ill.
SEWING BOOTS, ETC.—C. Goodyear, Jr., New Rochelle, N. Y.
SEWING MACHINE.—C. S. Cushman *et al.*, Philadelphia, Pa.
SOAP.—S. S. Lewis (of Brooklyn, Mass.), London, England, *et al*
STITCHING BOOKS, ETC.—H. G. Thompson, Milford, Conn.
TACK-ROLLING MACHINE.—H. A. Williams, West Medway, Mass
TYPE-SETTING MACHINE.—A. C. Richards, New York city.
VALVE.—W. B. Chisholm, Cleveland, Ohio.
VEHICLE SPRING.—G. Godley, Philadelphia, Pa.
WAGON, ETC.—G. P. Carr, Altoona, Pa.
WATCH, ETC.—A. H. Potter, Chicago, Ill.
WELDING CHAIN, ETC.—Pittsburgh Chain Company, Pa.
WHEEL.—G. Leverich, New York city.

Recent American and Foreign Patents.

NEW TEXTILE MACHINERY.

IMPROVED WEFT-STOP MECHANISM.

Thomas Isherwood, Westerly, R. I.—This is a novel weft-stop motion, whereby the tension of the weft against the feelers, when the shuttle flies from box to box, and during the time the latter is going back, will actuate said feelers. In the absence of the weft, this device causes the shipper to be thrown off half a revolution sooner than when the action is caused by the weft being carried against the feelers by the reed, thereby stopping the loom in the same pick in which the weft breaks. By this means both loss of time and waste of yarn will be saved, as all the picks made in fancy looms using two or more shuttles, after the break, have to be taken out by the weaver. It is also designed to be so contrived that it will not be in the way of the weaver in taking out and putting in the shuttles.

MACHINE FOR FORMING IMITATION BUTTON HOLES.

John Kenny, Dover Road, England.—This machine includes thirteen new devices, and is intended for employment by shoemakers and other workers in leather. Its object is to form a corded button-hole tag, and this is done by cutting a strip of leather into sections with slotted ends, applying a cord across the middle of each section, and so tightening the cord, and compressing the whole between dies.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED CULTIVATOR AND HARROW.

Isaac P. Pickering, Table Grove, Ill.—The standard of the plow stock has a head made in two parts, bolted together for the reception of the movable teeth. The latter are pointed at one end, and shovel shaped at the other, so that either end may be employed. To form a cultivator, one, two, or more heads may be used, and four, more or less, heads may be used to form a harrow.

IMPROVED REVERSIBLE PLOW.

Myron R. Hubbell, Wolcott, Vt.—This is an improved reversible plow which is so constructed that the point of draft attachment may be changed from one side of the beam to the other by the operation of turning the mold board. The novelty is found in the mode of connecting the draft rod and mold board, which is quite ingenious.

IMPROVED CHURN.

Elias Groat, Napa, Cal.—In this churn the dasher consists of two oscillating comb-shaped frames, the fingers of which swing between each other, so as to effect very great agitation of the cream in a simple way. There is a fluted or corrugated contrivance of the fingers or beaters, which greatly increases their efficiency, and also simple and novel devices for disconnecting the shafts readily, to allow of taking out the beaters and putting them in, as is requisite for cleaning out the churn.

IMPROVED MIDDLINGS PURIFIER.

Alvin F. Ordway, Beaver Dam, Wis.—The middlings are admitted to an inclined rack at the lower end of the air trunk. As they slide down this rack and so become spread out, a blast of air from beneath carries them up through a series of inclined racks in the trunk, which gives them a zigzag motion. On leaving the trunk the particles have a rotary movement, and come in contact with a vertical partit on, around which the light materials pass to a fan blower, while the flour falls and escapes through a spout.

IMPROVED FEEDER FOR THRASHING MACHINES.

Alexander Washington Lockhart, Sacramento, Cal.—The feed arms rest upon the inclined feed table, and are notched at their upper edges and tapered to their lower ends. By means of eccentrics they are given a to-and-fro motion in opposite directions, so that as they move downward they will push the grain to the thrashing cylinder, but will not carry the grain with them when they move upward.

IMPROVED SEEDLINGS PULLER.

John S. Swaney, Marengo, Iowa.—To the shaft at one side of its center is attached a polygonal hub, having eight sides, to the faces of which are hinged an equal number of jaws, which are made in the form of sectors, and which together form a wheel. These jaws, as the machine is drawn along, grasp the plants and lift them up by the roots, holding the same by pressing against the rim of a wheel. Then a wedge enters between the jaws and wheel, and forces the former outward, causing them to drop the plants, which fall upon a receiver, where they are removed and bound in bunches.

IMPROVED WHEEL PLOW.

James Flow, Pilot Point, Tex.—The plow frame is arranged with one side longitudinally adjustable upon the axle, and the plow beam is slotted and so combined with guides that the plow may be gaged to take more or less land as desired.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SLIDE REST FOR METAL-TURNING LATHES.

George F. Ballou, Pawtucket, R. I., assignor to Henry N. Fisher and John E. Whitcomb, Waltham, Mass.—The slot in the stationary part of the ordinary slide rest is usually cored out at one part sufficiently to insert the nut, which is then attached to the slide by screws after the same is in place. In the present invention the slot and also the nut chamber are extended to the end of the stationary part, so that the shank and nut can be slid into place at the same time that the slide is put on. The idea is to admit of the slide rest being easily taken off or placed in position without detaching the nut.

IMPROVED OSCILLATING JOINT FOR PITMAN CONNECTIONS.

Albert K. Smith, Nebraska, Ohio.—This is a new mechanical device of which it would be difficult to convey a clear idea without the aid of drawings. It is adapted to the connection of a pitman and the object to be moved, also to a crank pin. It is easily detachable, and made so that any slack occasioned by wear can easily be taken up.

IMPROVED PIPE TONGS.

Alexander McDonald, Halifax, Canada.—The fixed jaw, which is the larger, has a hooked end. The forward end of the movable jaw is V-shaped and corrugated. The jaw last mentioned is attached to the stationary jaw by pivoted bars, which are governed by a set screw, so that the space between the jaws may be arranged for different sizes of pipe. The construction generally is such as to secure a large gain in leverage.

IMPROVED SUCKER ROD SOCKET.

Plympton E. Jenks, Petrolia City, Pa.—This is a new instrument for extracting pieces of broken socket rods from oil wells. It terminates in a socket which fits down over the piece; then a wedge is forced down which jams the piece between it and the socket walls, enabling the fragment to be easily lifted out.

IMPROVED PISTON ROD STUFFING-BOX.

Joseph M. Searle, Stanhope, N.J.—This is a self-adjusting packing box for piston rods, and the essential feature is a conically recessed cup which, impelled by a spiral spring, acts against the natural exit of the steam. The idea is to obviate the continual screwing up of the box to prevent leakage.

IMPROVED OILER FOR CRANK WRISTS.

Charles Kurth, Chattanooga, Tenn.—A pipe leads from an oil receptacle to a bore in the crank pin. Said bore has a branch at right angles, which extends to the surface of the pin. The oil runs from the vessel into the pin, and at the lower half of each revolution of the latter escapes so that a continuous supply is furnished to the crank without necessitating the stoppage of the engine.

IMPROVED TUNNEL.

Olney H. Dowd, New York city.—This inventor proposes to construct a tunnel of narrow sections of elliptical tube, the shape being selected on account of the facility which it offers of transporting the sections to be added, through other sections already in position. He provides means for carrying the sections on trucks through the tunnel, also a means of fastening the sections and packing them, and also a contrivance for holding the cage or case employed in advance of the wall for digging out the bore from being pressed back by the pressure on the head of the case.

IMPROVED AIR VALVE FOR PUMPS.

Simon Smith and Isaac S. Collins, Mauch Chunk, Pa.—The object here is to furnish air to the pump and relieve it of strain, and to save wear on the valves, etc., by preventing pounding. This is done by a valve, suitably arranged in the plug usually inserted in the pump chamber for drawing off the water. This valve is governed by a spring, and its play may be regulated. At each stroke of the piston it rises and admits a small quantity of air.

IMPROVED CAR COUPLING.

Lewis Sibley, Ramapo, N. Y.—On one drawhead is a vertical slotted plate. The other has an arrow headed rod provided with a weighted arm attached at right angles to its axis. When the arrow head is vertical, it easily enters the slot, the weighted lever arm being raised. Dropping the lever turns the arrow, which thus engages in the plate. The principal advantage is offered in the speedy manner in which cars can be uncoupled.

IMPROVED CAR STARTER.

Thomas Murgatroyd, St. Joseph, Mo., assignor to himself and Ferdinand Schoen, of same place.—There is a main lever provided with a hook which fits on the axle. To this lever another lever is pivoted, and this last has a forked end which bites into the flange of the car wheel, turning the same upward, and so starting the car.

NEW HOUSEHOLD ARTICLES.

IMPROVED SPRING ROCKING CHAIR.

Stephen Fallon, Brooklyn, N. Y.—This is a rocking chair *minus* rockers—the places of which are supplied by coiled springs which support the seat. The springs are attached to a round which crosses the pedestal, and are provided with simple devices whereby their tension may be quickly adjusted.

IMPROVED CLOTHES DRYER.

Harrison V. Osborne and Robert Hay, Trenton, Mo.—This aims at the abolition of that unwieldy article of kitchen furniture the clothes horse, and substitutes therefor a neat rack composed of bars separated by washers and pivoted upon a vertical pin, which, by a suitable bracket, is secured to the wall.

IMPROVED PILLOW.

Gardner T. Barker, Pittsfield, Mass.—This is simply a sack made in two compartments. In one, which forms the upper side of the pillow, feathers or similar materials are placed; the other and larger division is left empty, to be filled with dry leaves or sticks, the device being primarily intended as a convenience in the camp.

IMPROVED PORTABLE LUNCH HEATER.

Maria Bradley, New York city.—Mrs. Bradley offers to workmen who carry their dinners with them to the shop a simple means of keeping their meals hot, and hence rendering them much more palatable. The device is a pail divided into several compartments for various kinds of food, and containing a receptacle having a chimney for the reception of a lamp, by which the contents can be quickly warmed.

IMPROVED DOOR CHECK.

Edwin S. Grauel, Dayton, Ohio.—This is a sliding spring-acted plunger, with hinged head piece and rubber extension, that is thrown by a projecting pin into contact with the floor, and retained by the ends of the head piece locking into ratchet teeth of the casing, the rubber being drawn back into the casing on closing the door. The object is to hold the door open at any desired point, for which purpose the device seems well adapted.

IMPROVED SEWING MACHINE CASTER.

Benoni P. Pratt, Chicago, Ill.—This inventor has devised a caster combined with a simple shoe and frame, so that it can be easily clamped to the feet of sewing machines unprovided with casters. The same invention would probably answer well for chairs or any other article to which it could be applied.

IMPROVED BED BUG TRAP.

Edmund G. Watkins, Georgetown, Cal., assignor to James B. Watkins, same place.—This is a new idea for the extermination of bed bugs. Instead of poisoning them, this inventor makes a trap in which there are several cells or sections. In these dark holes the bugs are sure to congregate, and then all that remains is to remove the apparatus and treat the inmates to any form of death which revenge may dictate.

IMPROVED ASH PAN.

James M. McHelm, Carlisle, Ky.—This is an ash pan, an ash sifter, a poker, and a shelf for heating irons, all combined in one. The poker is worked by a handle from outside, which causes it to rise up between the bars. The shelf for the irons is attached to the frame which supports the ash sifter just above the ash pan, which last is in the form of the drawer.

IMPROVED CRADLE.

Joseph B. Nelbach, Utica, N. Y.—Springs keep the rockers in place upon the edges of a pedestal frame, and also hold the cradle from upsetting in case a child should attempt to climb in or out.

IMPROVED STOVE LEG.

Ira A. Lovejoy, Denver, Col. Ter.—In this device, the inventor provides a really needed improvement in the means of fastening stove legs in place, for at present, when a stove is lifted, the legs frequently fall out. In the present invention, recessed socket projections are made on the underside of the hearth plate, and into these a curved and braced tongue from the leg tightly fits.

IMPROVED SOFA BEDSTEAD.

John B. Kline, Cincinnati, Ohio.—This lounge is so constructed that it may be converted into a bedstead by pulling out the seat section, and then swinging up to the level of the latter a supplementary section which is stored away underneath. The whole takes up but little space.

IMPROVED KITCHEN CABINET.

George Holt, Minneapolis, Minn.—This is a cabinet containing receptacles for nearly everything used in the kitchen, all stowed away in the smallest space. There is an iron board, a dish cupboard, drawers for flour, etc., for spices and for cutlery—a bread board, a knife scourer, a grater, and a vegetable cutter. Besides all these, there are closets for storing large articles, and good sized drawers for table linen.

IMPROVED WASHING MACHINE.

Thomas B. Kirkwood, Dublin, Ind.—The body is hung on trunnions, to adapt it to oscillate, and thus press or squeeze the clothes between a vertical stationary dasher and fixed abutments of the box. Each side of the box works independently of the other side, and can be independently operated. The return stroke, usually lost on ordinary machines, is utilized in this by working the garments in the second compartment. There are several other usefu points which tend to adapt the machine to its especial purpose, and to economize the power applied.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WHIFFLETREE.

Patrick McGlew, Des Moines, Iowa.—This invention obviates the necessity of giving the trace a sharp bend or twist in attaching it to, and detaching it from, the whiffletree. The trace is attached to hooks on the end of the tree, after passing through stout straps, secured to the forward side of the same.

IMPROVED PLANER CUTTER SHARPENER.

Garry Manvel, Rochester, N. Y.—In this device the cutter is fastened in jointed clamps so that it can be swayed forward and backward relatively to the stone, so as to vary its bevel. There is a weighted lever for pressing the cutter on the stone, and other useful attachments for adjusting, etc.

IMPROVED CARRIAGE SPRING.

John Fredenburgh, Greene, N. Y., assignor to himself and J. F. Smith, same place.—This is a simple torsional spring for vehicles composed of a steel rod socketed at both ends rigidly to lever arms swinging in opposite direction from each other. The effect is to create a torsional strain in the steel rod, through the separating of the lever arms.

IMPROVED MACHINE FOR JOINTING STAVES.

Benjamin Barker, Ellsworth, Me.—This machine, of which a good idea cannot be obtained without detailed drawings, is the first which has been invented for rapidly pointing machine staves with bevels and bilges perfectly proportioned to their different widths. It adds one more to the category of barrel-making machines which of late years have completely revolutionized the cooper's trade.

IMPROVED BUCK-SAW FRAME.

Porter B. Towle, Haverhill, Mass.—In this invention is given a new way of making substantial saw frames. Three nearly straight pieces of wood are joined by corner pieces of metal inserted in slots in the end, and nails are inserted through both wood and plates.

IMPROVED SLEIGH.

Robert B. Parks, of Princeton, Ill., assignor to himself and John R. Parks, same place.—We have here a sleigh made without tenons, mortises, or joints, and consequently, being free from these sources of weakness, it is without doubt a strong and substantial vehicle. The supporting frames with runners and braces are made of a single piece, either wood or metal, and are attached to the seat.

IMPROVED REIN HOLDER.

Hugh Gilmore and Joseph T. Spencer, St. Louis, Mo.—This hitching attachment is applied to the hind axle of a vehicle, and made to gear with cogs on the hub of the hind wheel, by the action of a pivoted foot lever at the front part or dash board, which causes a hitching line connected to the bridle bits to be wound up and tightened, so that the horses are brought to a stop by the automatic action of the wheels on the hitching mechanism. This does away with the ordinary hitching devices, and at the same time offers a handy means of controlling runaway horses.

IMPROVED CHILDREN'S CARRIAGE.

Leonard B. Harrington, Jr., Boston, Mass.—This inventor has devised a new way of constructing the body of children's carriages so that the same is self-supporting, without the aid of ribs, stays, or frame work in the inside. This is done by an outside rib on the edges. The appearance of the body is improved, and bent wood may be used in its manufacture.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED STENCIL PLATE.

William M. Kellie, Nashville, Tenn.—Instead of cutting of a stencil of several letters from a single plate, this inventor proposes to cut the letters on small separate plates, and then to join the latter to form words by means of overlapping grooves and spring clamps.

MACHINE FOR MIXING AND MOLDING AN IMPROVED COMPOSITION FOR ARTIFICIAL FUEL.

Emile F. Loiseau, Philadelphia, Pa.—The first invention relates to improvements in the apparatus for mixing and molding artificial fuel, for which letters patent have been granted to same inventor under date of February 17, 1874, and which was described and illustrated on page 319, vol. 29, of the SCIENTIFIC AMERICAN. The invention consists mainly in the construction of the molding or compressing cylinders with cavities connected with each other by small channels, and in arranging at the ends of the alternate rows of cavities, near the ends of the cylinders, small recesses for preventing the contact of larger portions of the metallic surface of the cylinders. The composition is fed in granulated state to the molding cylinders by a top hopper with revolving stirrer shafts.

The new composition for artificial fuel consists of coal waste, pulverized clay, and diluted rye and lime paste, thoroughly mingled in suitable proportions.

IMPROVED ARTIFICIAL LEG.

Cornelious Collins and James H. McCalla, East Melrose, Iowa.—The object of this invention is to allow the heel to turn conveniently upon the ankle joint. It consists of a cushion of rubber and hinged rods. The cushion is seated between the ankle and instep, in little recesses, preventing it from being displaced, and it is held up firmly to the ankle by one of the rods, which is permanently fastened. The foot is clamped against the cushion with the requisite pressure by the adjusting nut on the other rod. A spring of rubber together with the cushion and the pivot, forms a very easy and efficient joint.

IMPROVED GLASS TOOL.

Thomas Carr, Rochester, Pa.—At the present time paddles and forks are used for transferring glassware, when finished, into the annealing oven; but for want of proper means for discharging the ware, they are jerked and otherwise manipulated to get the ware off and lodge it in place. To avoid this difficulty, this inventor adopts the simple expedient of combining a pusher with the glass paddle, so as to discharge the ware when placing it into the oven.

IMPROVED MEANS FOR REEFING AND FURLING SAILS.

Edward Rawley, North Union, Me.—This invention includes a triangular topsail set immediately above the gaff of a fore and aft sail. The tack of the upper sail reeves through an eyebolt on the gaff, thence up through rings on the back of the sail to a block, and thence to the deck. The idea of thus arranging this rope is to give increased support to the jaws of the gaff, and at the same time to admit of the easy handling of the topsail.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries

J. J. P. can harden strips of iron by the method described on p. 69, vol. 31.—H. E. Jr. will find a good recipe for mucilage on p. 251, vol. 33.—W. A. B. will find directions for making a rust joint on p. 213, vol. 32.—S. T. C. will find rules for proportioning boats on p. 299, vol. 28.—D. M. will find a good recipe for blacking on p. 283, vol. 31.—Soap-making is described on p. 218 vol. 28.—J. C. McG. will find directions for polishing shirt bosoms on p. 203, vol. 31.—T. T. will find a rule for ascertaining the horse power of an engine by referring to p. 33, vol. 33.

(1) M. C. S. asks: We often have occasion to make a large quantity of an alloy composed of 80 parts of copper to 20 of tin. What is the best flux to prevent the slagging of the metals? The furnace is a large reverberatory one. A. Use a little potash, or a mixture of potash and soda, putting it on top when the metal is melted.

(2) W. B. says: 1. I am building a boat 80 feet long, and will use 13 foot side wheels. Wha sized hub should I use? A. Two feet in diameter. 2. How many spokes would be best? A. Twenty. 3. What should be the size of the paddles? A. About 18 or 20 inches long, and 8 or 10 wide.

(3) J. S. C. says: Owing to the situation of the earth's aphelion at the present time, the northern spring and summer is seven and a half days longer than the southern spring and summer. Now when the earth's aphelion comes to be situated at a point in the earth's orbit opposite to what it is at present, will the spring and summer for southern latitudes be seven and a half days longer than the northern? If not, what is the difference that will then exist? A. There will be no difference.

(4) N. S. T. asks: 1. How can I describe a circle whose circumference shall pass through one angle and touch two sides of a given square? A. This is the problem of passing a circle through any three points, not in the same straight line, which is given in nearly every work on geometry We understand you to mean the vertex of the angle, in speaking of the angle. 2. How can I draw the geometrical representation of a circle of any given size and from any given point of vision? A. You will find it fully explained in the "Student's Draftsman's and Artisan's Manual," by Professor Warren.

(5) J. E. W. and others.—We do not know what is meant by an engine of 25 nominal horse power, as this term has no fixed signification.

(6) J. B. L. says: In your issue of January 1874, is an article on cheap telescopes, signed B., in which he mentions a meniscus lens of 1 inch in diameter and 48 inches focus as a proper objective for a small telescope. 1. I propose to get one 1½ inches diameter and 48 inches focus; and would like to know if it would not make a more powerful object glass than the one selected by your correspondent. A. A lens of 1½ inches diameter will not be more powerful than one of 1 inch, if the focal length is the same; but it will admit more light. The form of the larger lens must be very perfect, otherwise the images will not be as sharp. It is for this reason that diaphragms are used to cover up the imperfections of large inferior lenses. 2. Is it a rule that the focus should be any ratio to the diameter? A. There is no rule for focus and diameter; but 1½ inches is a rather small diameter for 4 feet focus, and only highly illuminated objects can be distinctly seen through such a telescope, of which the great defect is want of light. 3. Will a plano-convex ½ inch in diameter and of 1 inch focus make a good eyepiece? A. A plano-convex will make only a tolerable eyepiece. 4. What would be right? A. Have two such lenses in the eyepiece, combined on the Huyghenian principle. 5. What would be the power of the instrument constructed of the glasses proposed? A. The power of a telescope is found by ascertaining how often the focal length of the eyepiece goes into that of the objective. Your eyepiece being 1 inch, its length is contained 48 times in the focal length of the objective: and the magnifying power will be 48. With a ¾ inch eyepiece it would be 64; with a ½ inch eyepiece, 96; and the same eyepiece, used with an objective of 48 feet focus, would give 1,152.

(7) E. G. A. asks: How can I obtain membership of the American Association for the Advancement of Science? A. You have to be proposed by a member at the next meeting, in Buffalo, N. Y., August, 1876, and then you pay $5 initiation fee and $3 annual dues.

(8) W. A. H. asks: 1. Is it possible that any opaque substance may be colorless? A. When opaque substances are colorless, they are white or black. Chalk is white, and coal is black; this means that coal absorbs the luminous rays, while chalk reflects them: if not all, at least equal quantities of each colored ray. 2. Does it follow that opacity of matter is consequent upon laws of color and light? A. Of course opacity of matter as well as transparency depends as much on the laws of light and color as in the material. 3. What constitutes opacity of matter, aside from the general definition of not being transparent? A. Opacity of matter depends on the internal structure of the substance: if it is adapted to transmit light with a certain degree of perfection, it is called transparent; if the light is transmitted only imperfectly, it is called translucent. 4. Why is not colored glass opaque? A. Colored glass may be opaque, and may be made so as well as transparent or translucent; it is used in the imitation of various colored gems, some of which are opaque and some transparent. For instance, the onyx is translucent, with opaque layers, in a variety of colors.

(9) J. M. S. says: I have a small spyglass which magnifies very well, but the view is slightly indistinct. Can anything be done to improve it? A. See if the lenses are clean and not scratched; see if they are put in right, and not reversed, as is sometimes done after cleaning them, which will spoil the best glass. Perhaps the objective needs a diaphragm, a black disk with a hole in the center, placed outside in front of the objective; this addition will often make very inferior glasses more distinct. Make several of these diaphragms, and find out which suits best. The smallest holes give the most distinct images, but admit the least light, and *vice versa*.

(10) W. B. says: I have a double lens microscope; the lenses are 1¾ inches in diameter and 0·2 inch thick in the center. I wish to make a field glass of it; how long a tube should I make? Must I use both lenses or only one? Must I have a smaller lens for the eyepiece, or should this be a plain glass? A. A microscopic lens cannot be used at all for an object glass in a telescope, and it makes a very bad eyepiece. Try an object glass of 17 inches focal length; and if it is of good glass, you may perhaps use the strongest power of your microscope, but you will see everything upside down. The object glass will cost you as much as a whole telescope or field glass. We advise you to leave the microscope as it is, and buy a field glass ready made; it will be the best and cheapest in the end.

(11) H. W. P. asks: 1. How can I construct a celestial eyepiece for a telescope with a 2 inch achromatic objective, of 20 inches focal length, that will magnify 100 diameters? A. Make the proper combination of two lenses, as we have already described, and give it a focus of $\frac{1}{5}$ foot or $2\frac{2}{5}$ inches, as the focal length of the objective divided by that of the eyepiece is equal to the magnifying power. 2. What is the composition of speculum metals, for reflector mirrors? A. Use 66 per cent copper and 34 of tin, or 7 parts copper, 3 zinc, and 4 tin, or 2 lbs. copper and 14 ozs. tin. 3. Is there any work published giving information as to the grinding and polishing of lenses? A. You will find an article on this subject in Ure's "Dictionary of Arts and Manufactures," under the head of "Grinding Optical Glasses." Also read the article "Glass;" it probably contains all you want to know.

(12) J. G. says: We find that we cannot make dry cellars in Louisiana. Will it do to sink a watertight tank 25 or 30 feet into the earth? Would the air become foul at the bottom? A. Tanks, of not too great a diameter, with plank bottoms and with proper cribwork bracing, might be built and used for cellars as you suggest; but if they are to be employed for the storage of fruit, proper means of ventilation would have to be provided. A box tube extending to the bottom and provided at top with a hood, arranged with a vane to open always towards the windward, would utilize the force of the wind for this purpose. After the air is fully changed, the tube could be closed with a valve, when the air confined below would gradually become of the temperature of the earth at that depth.

Our jail being of poor brickwork, prisoners often break out. Would this be a remedy: Build up a single brick wall within the present wall, leaving open space of 6 or 8 inches, and fill this space with dry sand up to the roof? Could any one pass out through the wall till all the sand from above had run out? A. Your plan is an ingenious one, and might answer if the walls were well anchored together. An entirely new wall, however, of stone work, consisting of large stones laid on good cement, would be far preferable if you could accomplish its erection.

(13) H. F. S. asks: 1. Would tungstate of soda do for saturating a rug, to prevent ignition by sparks from a wood fire? A. Yes. 2. How strong should the solution be? A. Dissolve as much as you can of tungstate of soda in hot water sufficient for the rug.

(14) S. W. asks: How do practical opticians give the final adjustment to microscope objectives which are composed of superposed lenses? With two lenses there is no difficulty, as there is only one distance to determine; but with three the trouble is greatly augmented, owing to the innumerable changes which may be made in the distances with that number of lenses. I have tried various formulas, some as published and others original, but I have not found one by use of which I could take an arbitrary distance for two of the lenses, and finding by trial the best position for the other. A. This is a subject on which it is utterly impossible to give satisfactory written explanations; it has been the great problem of such men as Lister, Hartnack, Tolle, Wenham, etc., and to which they devoted a great part of their lives. But you must consider that you can never take an arbitrary distance of two of the lenses and make it all right with the addition of a third; the distances are all determined by the curvature of each lens.

(15) F. G. says: Please describe the process of charging electro-magnets. A. Electro-magnets are charged by surrounding them with helices of copper wire and then passing a strong current from a battery through the helices. Artificial magnets of steel are charged by rubbing them with a powerful permanent or charged electro-magnet, commencing at the center and passing to the ends several times in succession. Care must be taken to use the same end of the charging magnet for one half of the new magnet, and the opposite end for the other half.

(16) J. L. T. asks: 1. What are the elements of a Hill battery? How are they put together, and what exciting liquid is used? A. Copper and zinc. The copper plate, to which is soldered an insulated copper wire, is placed at the bottom of a jar of water in which a little sulphate of zinc has been dissolved. A zinc casting is then suspended from the top of the jar so that it just dips below the surface of the water, after which a handful of sulphate of copper crystals is dropped in and the battery is ready for action. None of the copper crystals should be left in the zinc; care, also, must be taken to keep the blue line from quite reaching the latter. A wire from the zinc and the insulated wire from the copper plate form the terminals. 2. What is a Lockwood battery? A. Same as the Hill, with the exception that a long spiral copper wire is substituted for a copper plate in the latter. 3. How was House's battery made? A. We believe there is no such battery in use. House originally used the Grove battery to work his printing instrument. 4. I often see the diameter of wire given in decimals of an inch. How may this be reduced to the regular gage? A. The diameter of the different gage wires is arbitrary. What is called the Birmingham gage is used in England and, less extensively, in this country, but it varies with the different manufacturers, as no authorized standard has been made. More exact information is therefore conveyed by simply stating the diameter in inches. An American gage was introduced a few years ago, and is much used; with this gage the numbers run in a geometrical ratio. See p. 363, vol. 28. 5. Am I right in making a condenser as follows? I take a strip of silk, to which I stick tissue paper with varnish, and (with varnish) fasten tinfoil to both sides of the silk and paper, covering the sides to within an inch of the edges. I fold this with another piece of varnished silk to prevent metallic contact. After all is folded, must this tinfoil be made part of the primary current of a Rhumkorff coil? A. Yes, but the alternate tinfoil strips must be connected together so that, in reality, there are two large tinfoil surfaces. These are connected to opposite sides of the break in the primary circuit, one to each.

(17) E. T. H. asks: How are the wires arranged in electrical annunciators so that the electricity generated in a few cups is sufficient for all the wires? If they are all joined together, I should think the electric fluid would find the shortest way back to the battery, and so not touch the wires, but pass through their connections. A. Where only a few annunciators are to be worked, they are commonly all supplied by one battery. In other cases, they are divided up and one battery made to work a given number. Every conductor offers some resistance to the passage of the current; and when several circuits are supplied from one battery, the current in each is inversely proportional to its resistance. The proper way, therefore, is to make resistance of all the circuits equal, when supplied from a common battery; the current will then be alike in all.

How are Pharoah's serpents made? A. See p. 347, vol. 28.

(18) S. W. says: My local battery "boils over," leaving a white coating on the top of the inside and all over the outside of the jar. This is a gravity battery. The same thing occurred when

I used a Daniell battery, with the difference that the deposit on the jar was blue. One curious thing about this performance is that the battery always takes advantage of my absence for this performance. I think it prefers a cold dark night, at all events I can never catch it in the act. I have tried kerosene oil, but it still slops over. What is the matter with it? I have no doubt many other operators owe a dirty office or battery closet to the same cause, and would like to learn a remedy through your paper. A. The white deposit is sulphate of zinc. This always appears when a solution reaches its point of saturation; cold water will contain less of the salt than warm, which accounts for the greater amount that is noticeable when the weather is cold. The simplest remedy is to paint the inside of the jar at the top, or warm it and rub with paraffin from the water level to the edge. The solution should also be kept considerably below saturation, by drawing part of it off from time to time and supplying its place with fresh water.

(19) G. P. H. says: I wish to construct a magneto-electric machine for medical purposes, to be operated by a crank. I have seen one in which a small double cylinder was made to revolve with great rapidity. Of what is the double cylinder composed? A. The double cylinders form an electro-magnet. This is composed of two soft iron cores, around which helices, consisting of many convolutions of copper wire, are first wound; the cores are afterwards united by a flat bar of iron. Connection between the helices is so made that the direction of all the windings would be one way if the cores and joining bar were drawn out straight. This is done by connecting the two inner ends of the coils together, when the windings start at like ends of the cores and go in the same direction. One of the outer ends of the coils is then connected directly with the axis to which the magnet is attached and through this to one end of the box, while the opposite, outer end is connected to an insulated ring placed on the same axis. A small piece or segment is cut out of the ring, and a flat spring from the latter leads to the opposite end of the box. One or more permanent magnets placed in front of the electro-magnet charge the latter twice in opposite directions for each revolution, and the electro-magnet, acting inductively, then produces currents of electricity in the surrounding coils.

(20) R. asks: What is the use of the steam pipe from the top of a steam dome on a boiler to the water barrel of the water gage? Is it to keep the water at a certain level? A. It is for the purpose of furnishing dry steam to the gage.

(21) H. M. asks: 1. In using a portable engine with 5 inch cylinder to run an up and down saw, what length of stroke do I require? A. Let the stroke of saw be 6 or 8 inches. You can run the carriage also with a small saw and a high pressure of steam. 2. Does an up and down saw require more power than a circular to do the same work? A. No, less.

(22) A. D. asks: Is there a gain in power, in having the area of the sails of a windmill equal to the whole area of the circle, over the old style of four sails? A. No.

(23) J. E. M. says: I am troubled with a chimney which draws pretty well except when the wind is in a certain direction; what arrangement for the top of it will surely prevent the smoking? A. You do not give sufficient data to enable us to judge of the cause of the difficulty. It is usually found, however, that when a chimney smokes during the continuance of a wind in a certain direction, it is caused by its being in close proximity to a higher object, such as the ridge of a roof, or a higher building. The remedy in such case would be to extend the flue to a point sufficiently high to overtop the neighboring more elevated structure. There are other conditions, such as the place of the doors and windows of the apartment from which the flue proceeds, their being open or closed, etc., which should be taken into consideration, but of these we are not informed.

(24) J. B. asks: If a rope 300 feet long when coiled up weighs 100 lbs., will it weigh twice or more than twice as much if suspended from the scales? The argument originated about the ability of aeronauts to cause their balloons to descend by that means. A. It will weigh the same in both cases.

(25) E. A. A. asks: 1. How is Hooke's universal joint made? A. It is the common universal joint. 2. Will it transmit power at nearly right angles? A. You should use two joints to turn a right angle.

(26) J. S. E. asks: A water motor makes a great noise in our buildings, roaring and thumping through the pipes. What can be done so that this noise can be stopped? A. Probably an air vessel on the delivery and discharge pipe, arranged so as to cushion the water, will remedy the trouble.

(27) J. S. S. asks: 1. How wide should I make a 20 foot breast wheel under a 12 foot head, to run a circular saw 48 inches in diameter? A. You can calculate it for yourself, on the assumption that the power of the wheel will be from 68 to 70 per cent of that of the water in which it is used. 2. Will cogs with 6 inches face on the side of the wheel, making a circle of 20 feet, be strong enough to run a 48 inch circular saw? A. Yes.

(28) H. H. asks: 1. Given a lathe whose fly wheel is 18 inches in diameter, and crank 1¾ inches long, attached to a treadle worked by foot power, which would give the best result in power and speed (apart from friction), connecting the piston of a small engine direct to the crank to which the treadle is now attached, or to a belt from a 6 inch pulley on main shaft of the engine to a 6 inch pulley on main shaft of lathe, on which the fly wheel is? A. The direct connection would be the best. 2. About what size of cylinder should be used, other parts being in ordinary proportion, for an engine to run a lathe which is easily operated by foot power? What size of boiler is needed? A. Cylinder 1¼ by 1¼ inches. Boiler, 12 inches in diameter by 18 inches high.

(29) J. A. says: I am making a pond and desire to prevent leakage. Your advice will be appreciated. A. See p. 240, vol. 29, for a full description of the best way of making puddle walls, which will apply to your case. The bottom of your pond may be laid in the same manner as the two first courses in the wall.

(30) Y. F. C. says: 1. I am about to make an induction coil 12 inches long, with heads 7 inches in diameter, and a tube or cylinder of pasteboard, perfectly dry and hard. Will it do? A. Pasteboard saturated with paraffin would answer very well, so also would thin sheets of gutta percha. If the latter are employed, several thicknesses should be used. In the construction of large coils, glass or thick gutta percha tubes are commonly employed for this purpose. 2. In insulating the secondary coils, would you use pure sheet rubber upon each layer? A. Pure sheet rubber is good, but would probably be expensive; thin paper saturated with paraffin will answer perfectly well. 3. Should the primary coil be very well insulated from the core, or will the pasteboard of ¼ thickness be sufficient? A. Yes, insulate carefully. A tube ¼ of an inch thick at the ends is sufficient to place between the primary and secondary of a coil 12 inches long; it may even be made less in the middle.

(31) J. H. asks: Can we bring a spring to the house a distance of 260 feet, the fall being about 22 feet, with a slight elbow, and a brook to cross that will make a bow down in the pipe of 2 feet? A. If we understand you, you have a total vertical fall of 22 feet to where the lowest part of the pipe will be, and then a rise of 2 feet to where the water is to be discharged. If this is correct, you have simply to close up the lower end of the pipe, attach a faucet a short distance from the end, and the water will run, notwithstanding the 2 feet rise, whenever you turn the faucet. The pipe should be laid under ground deep enough to avoid freezing. If the spring is higher than the point where you want the water supplied, the water will rise of itself to that point, without regard to the depth it may have to descend below it before reaching it.

(32) W. B. says: I intend building a fruit preserver, with an upper story to stow the ice in, and a lower floor for fruits. Please give me the best plan of construction to prevent sweating and to regulate temperature. A. See p. 251, vol. 31, for description of an icehouse that will give you all the information you require, if you use the surrounding chamber instead of a lower room to store your fruit, etc. If, however, you prefer the room under the ice, elevate the ice chamber high enough for the purpose by providing a strong frame and heavily timbered floor to sustain the stock of ice, and then construct the surrounding chamber the same as described on the page referred to. A cube of ice of 12 feet will keep, better than one of less size, through an unfavorable season.

(33) M. K. asks: What was Dr. Bradley's method of winding helices with uncovered wire? A. The helices are wound by machinery specially constructed for the purpose, but the process has not been made public.

(34) C. R. asks: 1. How should one totally ignorant of electro-plating proceed to learn enough of the art to do a little amateur dabbling, working alone and where he can get no assistance? A. Better read some elementary work on the subject. Sprague's "Electricity, its Theory, Sources, Sources, and Applications," contains much excellent information for amateurs. 2. Do the solutions deteriorate by being kept in a lead tank, and that for some time? A. As a general thing, no; the solution, however, determines that. 3. What is the proper mode of securing the gold and silver contained in the solutions in a tangible, marketable form? A. Two silver processes are commonly recommended: (1) Add sulphuric acid until all the metal is thrown down, and then melt the precipitate after drying; this is a dangerous one and must be effected in the open air, as poisonous gases are given off. The residue must also be fused by degrees, as the cyanide of silver does not fuse quietly. (2) Evaporate the solution to dryness and fuse till the silver is reduced, and wash off the cyanide of potassium. Gold may be precipitated in the same way. Mix the precipitate with an equal weight of litharge, and fuse. After washing the residue, place it in excess of nitric acid, which will dissolve out any other metals present, and leave the gold pure.

(35) G. H. M. asks: I am running a planer and matcher; it has yellow metal boxes, which trouble us by heating. Can you suggest a remedy? A. We have known of several instances in which boxes lined with Babbitt metal have been substituted, for the kind which you describe, with good results.

(36) J. B. W. says: 1. We have a 26 feet x 44 inches boiler. The brick stack is 49 feet high, and was built for burning wood, for which there is plenty of draft. In burning coal it takes 25 to 30 bushels to run 2 pairs burrs for 10 hours. Would it take less coal to keep the same amount of steam if our stack was built up to 65 feet? A. You do not send sufficient particulars. Possibly your grate, which was suitable for wood, is not well adapted for coal. 2. Would sheet iron do for the addition to the stack? A. Yes. You can ascertain the best hight for your chimney by putting on a sheet metal top and fixing it at the best point for your draft.

(37) C. B. R. asks: What is used to whiten the fire pots of cast iron stoves? A. We believe they are generally kalsomined.

(38) R. L. F. says: A friend of mine, a locomotive engineer, says that a man, before taking charge of a locomotive, should first fire one for 3 years. I say this is not necessary in every case. I have a model engine of my own make, fitted with a link motion for reversing which works very well. I have read and studied steam and the steam engine. Would it be necessary for me to fire 3 years in order to take charge of a locomotive? A. Your friend's statement is generally correct, but there are exceptions to nearly every rule.

(39) H. L. C. asks: Is a steam engine of 1 inch bore large enough to run a small light lathe for turning file handles and chalk line spools of soft wood, supposing the steam to be at 30 lbs. to the inch, and engine to cut off at ¾ stroke? A. You do not send sufficient data, but your engine is rather too small.

(40) G. H. J. asks: Is not a breast wheel the best where the water supply is limited and the fall deep? A. We think it would be a question between this and one of the best turbines.

Is phrenology a genuine science? A. We believe that it is based upon correct principles, but it is as yet not fully developed for lack of data. In these respects, it bears some comparison to the science of weather observation.

(41) R. E. A. asks: 1. Please give me directions for making a paper canoe. A. See p. 163, vol. 27. 2. Please give me a recipe for the paste for paper boats. A. Use a fused mixture of equal parts of pitch and gutta percha. 3. Should the paste on one layer be allowed to dry before putting on another? A. Yes. 4. What is the best waterproof paint for it? A. A solution of asphalt in turpentine. 5. Will thick brown wrapping paper do? A. Such paper will answer, but it is advisable to use thinner paper and a greater number of layers.

(42) T. H. says: Some three years ago a neighbor commenced wearing wire spring garters. After wearing them a few months, her limbs began to have strange feelings, such as occasional numbness and nervous flashings up and down the limbs below the garters; and as she did not like them very well she thought she would not wear them and gave them to her sister. After her sister had worn them a few months, she felt numbness, etc. Was the wire charged with electricity or not? A. We do not see how the garters could be charged with electricity to any greater degree than anything else attached to the person. We hardly think the cause of the trouble is electrical.

(43) F. P. M. and all others who wish to commence studying the steam engine should read Bourne's "Catechism," "Hand Book," and "Recent Improvements in the Steam Engine," and Forney's "Catechism of the Locomotive."

(44) R. H. H. says: I have two patents. The drawing in one is attached to the specification with a blue ribbon, and the other with a red ribbon. A neighbor (another patentee) tells me that the color of the ribbon, which is attached to the seal and connects the specification and drawing together, indicates the extent of novelty of the invention. Can you give an explanation? A. The only significance which we have ever heard attached to the color of ribbon used on patents was that it indicated the temperament of the clerk at the time he was preparing the documents to send out. When he is melancholy and out of sorts, it is said he uses blue; when cheerful and happy, red. We do not vouch for the truth of this, but it is the best reason for the difference of colors used which we have ever heard.

(45) S. S. says: In repairing the bell of 1775, do not drill, cut, or waste the precious metal. Mold it in some infusible material; heat the whole mass (bell and mold) to perfect fusion. When cool you will have the same metal that pealed forth notes of independence in 1775, except that lost by oxidation in the process of fusing.

(46) G. D. says: 1. In No. 14 you speak of iodine and olive oil as a remedy to prevent hair from falling off, but you neglect to state how to use it, namely, how often and how long. A. See answer to J. N., p. 138, present volume. 2. Nine men out of ten, over 30 years old, in Chicago are bald or rapidly becoming so. Is it caused by the climate? A. It is attributable as much to the mode of life of your citizens as to any climatic influence.

(47) M. R. says: I wish to make one quart aqua ammonia. How can I make it? A. Place in a capacious glass flask or retort a quantity of either the carbonate or chloride of ammonia: pour over this a strong solution of potassa in water, and apply heat. A copious evolution of ammonia gas will ensue, which should be conducted by means of properly arranged glass tubes, so as to enter beneath the surface of the water (distilled) which it is desired to saturate with the gas. The water should be kept as cool as possible during the operation, as cold water dissolves the ammonia in much larger quantity than hot water.

(48) I. X. L. asks: Has the temperature of a gas after being condensed any influence on its capacity for absorbing heat when allowed to expand, that is, if we condense a gas to a liquid, would it make any difference if we reduced the temperature of the liquid before allowing the expansion to take place? A. It would. This question has been answered several times before.

(49) E. H. says: You give a recipe for making paraffin varnish. I tried it on a sample of bright steel goods, and it would not dry. What was the cause? A. If the solvent used be pure, and the paraffin (not paraffin oil) good, we do not see how a failure could be possible. The recipe is by no means new.

(50) C. B. B. C. asks: What kind of acid shall we use to put names on iron? A. Coat the iron with paraffin, and write with a needle. Dip the iron in strong nitric acid (aqua fortis).

(51) J. P. O. asks: 1. Can air be forced through spirits of any kind? A. Yes. 2. Will said air retain any of the qualities of the spirits it is forced through? A. Yes. The quantity depends upon the dryness and temperature of the air as well as the alcohol. 3. Is there any way to separate that portion which retains the quality from that which does not? A. If we understand your question, no.

(52) J. N. N says. 1. In your issue of October 9 you say "distilled over soap." Do you mean by that expression that the soap is dissolved in the article to be distilled? A. No. 2. We make soap with potash lye, and harden it with salt, would that be considered soda soap? A. It is commonly so called.

(53) W. G. S. says: I have a tube 4 inches long by 1¾ inches in diameter, ⅛ inch thick. I wish to introduce into the tube the blaze from a spirit lamp. What is the best position for the blaze inside the tube, in order to heat it, and not be interrupted by the in and outflow of air? The tube revolves, and I want to have one end closed, except a small hole in the center. A. Unless both ends of the tube be left open, so as to give free access of air to the flame and outlet for the products of combustion, the flame will soon expire. 2. What is the best metal to make the tube of, in order that the blaze will heat it? A. Copper.

(54) F. B. L. asks: How can I make a pliable waterproof paint for cloth? A. Make a solution of gum rubber in hot naphtha over a water bath. This is the so-called rubber varnish.

(55) N. P. B. asks: With what can I varnish printed paper? A. Use dammar varnish thinned with turpentine. Flow the varnish over the paper. Do not use a brush.

(56) A. C. S. asks: 1. Can water glass be mixed with white lead paint? A. It can be readily mixed with the white lead by grinding, etc. 2. Will the mixture be more durable for outside work? A. We do not think it would add anything to the appearance or durability of the paint.

(57) C. T. W. asks: 1. Is there anything I can put in a tooth to kill the nerve? A. If the nerve is exposed, wrap a small pledget of raw cotton around the point of a knitting or darning needle and dip it in creosote; then insert the point with the cotton directly into the hollow of the tooth. The cotton may be left in for a while, covered by a dry piece. Care is needed not to let the creosote drop or run upon the lips or gums, on which it will act as a caustic. 2. Is there any way of loosening the same other than by the use of force? A. We know of no method. Consult a dentist.

(58) R. J. L. asks: Is there a method of making ordinary glue harden rapidly? A. There is nothing that we know of that will give perfect satisfaction in this direction. The addition to glue, when melted, of a small quantity of zinc oxide, plaster of Paris, etc., will cause it to set or harden quickly, but it also greatly deteriorates the adhesive properties of the glue.

(59) O. S. asks: What is the object of filling in between the framework of fireproof safes with cement or concrete? A. The cement, etc., is a very poor conductor of heat. If the filling were metallic, and the safe was subjected to even a comparatively modern degree of heat, owing to the good conductivity of the metal the books and papers contained in the safe would soon be converted into charcoal.

(60) E. S. McC. asks: What black preparation must I use to mark on gold with a pen? A. Use black paint and a brush.

(61) F. J. T. asks: Please inform me of the most economical, practical, and effectual process of evaporation, to condense yeast now in liquid form. A. The process employed in the manufacture of condensed milk would probably be the most economical and effectual method. It consists in boiling the milk in large, airtight boilers from which the air has been exhausted by means of suitable apparatus. The low temperature at which the operation may be conducted under the circumstances prevents the burning and partial decomposition, liable to occur when it is subjected to the ordinary method of distillation.

(62) J. D. says: What makes a good preparation for blacking harness, one that will retain its blackness, and that will not be injurious to leather? A. Ivory black and molasses each 12 ozs., spermaceti oil 4 ozs., good vinegar 4 pints. Mix.

(63) A. D. says: I have a thermometer which has been lying flat for three or four days. I hung it up, when the fluid entirely filled the tube, and it has not yet descended. Please inform me of a remedy. A. It is probably due to the air not having been completely expelled when the instrument was manufactured, or the air may have entered the tube subsequently through some flaw or pinhole. In the former case you had better have the instrument refilled; in the latter, a new tube will be requisite.

(64) A. M. says: Please give me a recipe for coloring gold by acids. I want a rich color. A. Use strong nitric acid, pure. First experiment upon a small piece of gold, until you hit the proper strength of acid and time of exposure.

(65) E. W. C. says: I read that, if I take a small phial and place in it a lump of phosphorus and enough olive oil, previously boiled, to cover the lump, the phosphorus, when the air is admitted, will become luminous. Is this a fact? A. Yes. The bottle should be well shaken just before removing the cork. The faint light observed is due to the phenomena of phosphorescence. There is no perceptible increase of temperature.

(66) E. M. asks: Of what material are stove brick composed? A. Usually of a good variety of fire clay, well burnt. The clay consists principally of the silicates of alumina, lime, and magnesia.

(67) N. S. J. asks: How can I make a desirable cement for leather? A. The following waterproof cement has been highly recommended: Melt together in an iron pot equal parts of common pitch and gutta percha, and stir well. This may be kept liquid under water, or solid, to be re-melted when wanted. It is not attacked by water, and adheres very strongly to leather.

(68) J. L. W. asks: How are pictures properly transferred to vehicle panels? A. Cover the picture entirely (taking care not to go beyond the outlines) with a slight coat of fixing varnish, then put the picture on the object to be ornamented, being careful to place it properly at once, to avoid spoiling it by moving. The varnish newly applied being too liquid, the picture should be allowed to dry for about ten minutes, and placed on the object to be ornamented, when just damp enough to be adherent; this done, cover the back of the picture with a piece of cloth steeped in water, then, by means of a knife or penholder, rub it all over, so as to fix every part of it; then remove the piece of cloth and rinse the paper with a paint brush steeped in water; at the end of a few minutes the paper will come off, leaving the painting transferred. Care must be taken that the piece of cloth, without being too wet, is sufficiently so for the paper to be entirely saturated. The picture must now be washed with a wet brush, and dried very lightly with some blotting paper. Keep the ornamented article in a warm, dry place, until dry. The polishing varnish should not be applied until the next day, keeping the pictures meanwhile out of the dust. The latter varnish should be applied as lightly as possible. If dark colored objects are to be ornamented, the picture should first be covered with a mixture of white lead and turpentine, following the outlines of the design, and covering it entirely. When this coat is perfectly dry, proceed as above.

(69) T. K. G. asks: Will a mixture of two parts chlorate potassa and one part sulphur answer as a compound for explosive bullets? A. Use chlorate of potash 6 parts, sulphur 1 part.

(70) J. B. W. says: I have industriously sought for a long time to find the genuine article of camphene. I am informed that it is nothing but spirits of turpentine doubly refined, but no one can tell me the exact process of making. I want such an article as used to be made for burning purposes. A. The so-called camphene is ordinary refined spirits of turpentine. In some cases a little alcohol was added to render the flame less smoky.

(71) J. P. N. says: I have noticed two blue flagstones which appeared to have been outside layers in the quarry, each having on them grooves, the hollows of which were about one fourth inch deep, leaving the ridges some two inches apart; but the grooves, instead of being straight, were regularly zigzagged. I can readily see how straight grooves and scratches are made by the action of glaciers; but how can these zigzag grooves be produced? A. It is not certain that the lines are due to the action of the glaciers; they may have been formed in the rock itself.

(72) A. R., Marienbad, Bohemia, says: Let me correct your answer to W. H. W., on p. 138, vol. 33. The addition of a small quantity of cyanide of potassium to a solution of copper will completely discolor it, even in the presence of an excess of ammonia.

(73) F. McC. and others ask such questions as the following: Are the chances favorable for a young man aged 23, with good English education, a strong love for mathematics and the profession of civil engineering, and some knowledge of algebra and geometry, to become a good civil engineer, by spending his evenings in the study of mathematics? If so, what knowledge of mathematics would be necessary before beginning the practice of the profession? A. Our advice to such a young man is to get a position, if possible, with a civil engineer engaged in active work, such as surveying, prospecting, or constructing. No matter how humble the position at first, if the young man has it in him he is pretty sure to rise; and his own experience will tell him what studies he had best pursue.

(74) H. L. C. says: In answer to R. L. S.'s query as to stone arrow heads, you say "that they were used before the discovery of America." I will add that they are used at the present day by the Indians of the Far West, where they use them for shooting game; but the arrowheads are small compared with some of those found in this State. The size of those now in use is from ½x1¼ inches to ¾x1¾ inches; while I have found several in this State as large as 1½x4 inches.

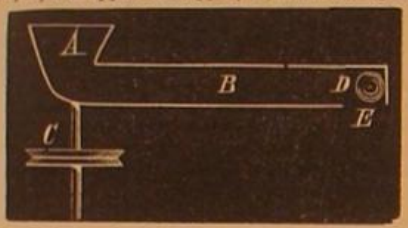
(75) O. C. L, says, in reply to R. H., who asks if it is not unusual for files to be magnetic; I would say that I have often observed it in our own files, but especially in a small punch, which was capable of supporting the weight of a tack. In the case of the punch, it was probably caused by the hammering.

(76) W. E. S. says, in answer to J. H. R. who asks how to make an electro-magnet that will work very slowly: There is really nothing easier than to regulate the ultimate quickness of electro-magnetic action, with a given electromotive force. Everything depends upon the length of the iron core, its thickness, and the adjustment of the armature. For instance, the core of an electro-magnet, which includes not only that portion of the metal which is encased in the helices, but the back connecting piece, may, with a single cell of battery, attract its armature, adjusted to a certain tension, at the rate of 1,000 times per minute: while if we double the length of the core, the armature will be attracted to a bearing, under the same tension and with the same battery, but 500 times per minute. I have a very long electro-magnet which will exert its maximum force but 25 times per minute, while I have another, the core of which is less than 2 inches long, which will attract its armature between 4,000 and 6,000 times per minute. A great deal depends upon the thickness of the iron core; much upon the resistance of the helix; but most upon the length of the core. If I. H. R. will construct an electro-magnet of ½ inch round iron, each limb of which shall be 12 inches long, with a resistance of say 200 ohms of No. 24 wire, I fancy he will have a sufficiently slowly acting apparatus, provided his battery has not too great electro-motive force, and his armature adjustment be proper. Such a magnet could be regulated to exert its maximum force as slowly as 60 times per minute.

(77) E. D. R. says, in reply to a correspondent who asked: "What is bird pepper?" I enclose a specimen with a small limb of the plant. It grows wild all over Southwestern Texas, and is called by Mexicans and Spaniards *chili colorado* which, translated, means red hot. If you taste the enclosed specimen, you will find the name is a good one. It grows up from the root every year. Where it is abundant, the turkeys and prairie chickens feeding upon it become so saturated that it is impossible to eat them. A. The specimen sent is very similar to the cherry pepper of West Africa, which is eaten by small birds, and is used by the natives to spice their favorite dish, palaver sauce, with.

(78) A. S. says, in reply to E. N., and others, who asked how to remove superfluous hair: *Aurum pigmentum* (sulphuret of arsenic) mixed with slaked lime to the consistence of paste, is used in Europe to remove the beard from the face, without soap or razor.

H. A. P. asks: Where is the deepest mine in the world?—G. W. P. asks: Is there anything that will render wood proof against the action of nitrate of silver, which has been used in sensitizing collodion? I want a solution which will not dissolve in either alcohol or ether. I have used asphalt and beeswax; but as they have to be applied hot, they are not very convenient.—R. F. H. asks: If a ball, D, is dropped in hopper, A, while the square



tube, B, is revolved horizontally at a high rate of speed, by means of shaft and pulley, C, it will be thrown by centrifugal force against the end of the tube. Will it be held there, or will it drop through the opening, E?—H. C. asks: How are the edges of the leaves of a book arranged to show a gold edge when closed, and a red edge when open?

COMMUNICATIONS RECEIVED.

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

On Large and Small Wagon Wheels. By M.G.P.
On Stealing Brains. By E. C.
On Some Curious Properties of the Figure 5. By G. R. B.
On American Grape Vines. By S. F.

Also inquiries and answers from the following:
R. K.—J. C. W.—R. G. S.—E. T. H.—F. J.—H. D.—W. S.—C. E. S.—N. D. T.—G. M.—C. C.—G. A. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells pyrometers? What is the price of a good aneroid barometer? Who deals in mica? Who sells theodolites? What does a binocular microscope cost?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,673.—LAMP CHIMNEY, ETC.—T. B. Atterbury, Pittsburgh, Pa.
8,674.—OIL CLOTHS.—J. Barrett, New York city.
8,675 and 8,676.—CASSIMERES.—F. Bosworth, Providence, R. I.
8,677 to 8,679.—CARPETS.—O. Heinigke, New Utrecht, N. Y.
8,680 to 8,684.—CARPETS.—H. Horan, East Orange, N. J.
8,685.—COOK STOVES.—W. J. Keep, Troy, N. Y.
8,686.—TRIMMING.—S. McLaughlin, Philadelphia, Pa.
8,687.—CARPETS.—E. J. Ney, Dracut, Mass.
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8,691.—CARPETS.—T. J. Stearns, Boston, Mass.
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8,693.—CARD BORDER.—M. Bolton, Jr. Philadelphia, Pa.
8,694 and 8,695.—BRACKET.—C. Herter, New York city.
8,696 to 8,698.—GASELIERS.—C. Herter, New York city.
8,699.—CHANDELIER.—C. Herter, New York city.
8,700.—LIGHT.—C. Herter, New York city.
8,701.—LAMP.—C. Herter, New York city.
8,702.—WALL POCKETS.—J. C. Lamm, Hopedale, Ill.
8,703.—DESK.—J. S. Morgan, Brooklyn, N. Y.
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LIST OF PATENTS GRANTED IN CANADA,
October 2 to 5, 1875.

5,241.—R. D. Chatterton, Cobourg, Ont. Car draw bar and spring. Oct. 2, 1875.
5,242.—J. H. Killey et al., Hamilton City, Ont. Steam boiler. Oct. 2, 1875.
5,243.—W. H. Reed, Chicago, Ill., U. S. Air blowers for carbureters. Oct. 2, 1875.
5,244.—L. P. Brunelle et al., Quebec City. Gravity battery. Oct. 5, 1875.
5,245.—N. W. Westcott et al., Providence, R. I., U. S. Knitting loom. Oct. 5, 1875.
5,246.—G. W. Copeland, Malden, Mass., U. S., et al. Boot wax thread sewing mechanism. Oct. 5, 1875.
5,247.—R. Aldred, Glencoe, Ont. Railroad track lifting machine. Oct. 5, 1875.
5,248.—S. R. Smyth et al., Manchester, England. Manufacture of iron and steel, etc. Oct. 5, 1875.
5,249.—F. X. and A. Bellefeuille, Trois Rivières, Ont. Threshing machine. Oct. 5, 1875.
5,250.—L. Dill, Greenville, Ohio, U. S. Car coupling. Oct. 5, 1875.
5,251.—R. D. Robbins, Port Perry, Ont. Mowing and reaping. Oct. 5, 1875.
5,252.—E. E. Hargreaves, Sarnia, Ont. Railway car ventilator. Oct. 5, 1875.
5,253.—T. Harvey et al., London, Ont. Dumping wagon. Oct. 5, 1875.
5,254.—P. J. Ayres, Lindsay, Ont. Buggy and carriage top. Oct. 5, 1875.
5,255.—H. Sells, Vienna, Ont. Combined cider mill and press. Oct. 5, 1875.
5,256.—S. L. Porter et al., Rochelle, Ill., U. S. Railway rail support. Oct. 5, 1875.
5,257.—N. Yagn, St. Petersburg, Russia. Feeding apparatus for steam boilers. Oct. 5, 1875.

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