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WILLIAM BAXTER AND HIS INVENTIONS.

William Baxter is the son of George Baxter, a Scotch engineer, who, in the year 1805, emigrated to America with his family, settled near Morristown, N.J., and in that locality constructed two of the first cotton mills built in this country.

The subject of this sketch, the youngest son, was born November 22, 1822, and is, therefore, now 51 years of age. When a boy he was placed at work in his father's factory, thus inheriting and acquiring mechanical taste and skill in no small degree. Even when quite a child, he made several ingenious improvements in his father's machinery, and at the age of 12 he was placed in the machine shop of Alexander Paul, of Paterson, where he worked upon the first locomotive ever built in that city. He soon after went with Stephen Vail, of Morristown, and was one of the assistants of Professor Morse in bringing out the magnetic telegraph, helping to put it in operation for the sending of the first message. Returning to Paterson, he remained in that city from 1840 to 1846, superintending the erection of machinery and making many inventions and improvements. Meanwhile he was an extensive reader and a hard student, becoming familiar with the works of the best authors on mechanical engineering, and acquiring the French and Spanish languages. His reputation extended, and he became favorably known as a designer and constructor. He was engaged for some time with the Newark Machine Company, Newark, N. J., where he made the pleasant and profitable acquaintance of Seth Boyden.

In 1851 he was called to Mexico, to erect an extensive cotton factory. For ten years Mr. Baxter was engaged in that country, in works of great magnitude, among which may be mentioned a cotton factory at Talamantes, another near Penyon Blanco (an Indian pass), where he built up a new town in the desert, naming it Belen, which, in English, is Bethlehem; also a woolen factory at the same place, and a large number of extensive mining works at Parral and other places. At Santa Catarina, he constructed a reservoir or artificial lake for the irrigation of the hacienda of Señor Montez, about 20 square leagues in extent, and which also furnished power for mills. In all he erected in Mexico some fifteen different works. The dams at Belen and Santa Catarina were very difficult jobs of engineering, all previous attempts to hold the water at those places having been failures. They were built across cañons at the foot of the Sierra Madre mountains, where the gorges were 300 to 400 feet in width, in which ran torrents, often rising 60 feet in a few hours during heavy rains. It was prophesied that these structures would never stand, but they still remain firm. They were constructed upon a new principle, unlike any previous work. The masonry was from 30 to 40 feet high, 60 feet thick at the base, and 10 feet at the top, sloped on both sides, in curved lines, which received and discharged the water horizontally and without shock, thus preventing those excavations by the plunging of the water, so destructive to such works; they were also curved or arched against the streams, and the abutments planted against the solid rock of the mountains. These great reservoirs, with their gates and sluices, were the admiration of all the engineers of the army of occupation.

WILLIAM BAXTER.

For one of the cotton factories he constructed a turbine wheel, made of gun metal and finished as highly as a steam engine, the design being an improvement upon the French turbine of Fourneyron. The machine, giving a larger percentage of the power of the stream than any previous form, excited considerable interest among French engineers, several of whom examined it and transmitted drawings and details of the same, together with particulars of the calculations, to the French Academy of Sciences.

These works were carried on under great disadvantages, necessitating not only the procurement and manufacture of material but the instruction of workmen. Machinery, besides, had to be built, and roads constructed; while, in addition to these difficulties, the labor had to be prosecuted in the proximity of hostile Indians, and required constant military protection. Every establishment, however, erected in Mexico proved a financial success.

During these years Mr. Baxter received from the government of Mexico, both Imperial and Republican, the highest marks of consideration ever extended by them to any private citizen, unless it may have been Mr. Seward. He was offered decorations and even titles, and was urged by the State of Chihuahua to establish and take the presidency of a college of arts and sciences, on the plan of the Cornell University

BAXTER'S STEAM CANAL BOAT.

which he declined to do on account of the disturbed state of the government at that time. He was frequently furnished with official passes by both the governments of Maximilian and the Republic, of which the following is a specimen, and shows the high regard in which he was held by all parties, he being strictly neutral in all their struggles:

"BY THE PRESIDENT OF THE REPUBLIC OF MEXICO.

"*To all the Authorities, both Military and Civil, wherever this may be presented*:

"The bearer of this, Don Guillermo Baxter, an American engineer, is passing through the country on his own private business, and you are hereby commanded to give him whatever protection and assistance he may require, and a military escort when he shall demand the same, Señor Baxter being worthy of the most distinguished consideration.

BENITO JUAREZ."

On his return home, in 1867, he traveled from Durango to the city of Mexico with the President and Cabinet, under the protection of their military escort, making extensive examinations of the mining districts through which they passed.

Since that time, Mr. Baxter has been constantly at work on one mechanical problem after another. On his way home to the States, more as a diversion than otherwise, he whittled out of a piece of pine a model of what is known as "the Baxter adjustable S wrench," which, by means of its peculiar shape, enables the workman to reach parts of complicated machinery previously inaccessible. This indispensable little tool is to be found in factories and workshops in every part of the world. It is manufactured at Birmingham, Conn.

Having established his residence at Newark, N. J., Mr.

Baxter turned his attention to the invention of a small, compact, portable, safe, and economical steam power, which should be so easy to manage as to warrant its introduction for all uses among the people. This resulted in bringing out, in the year 1868, the now widely known and justly celebrated Baxter engine. Already thousands of these engines are in use in all parts of the country, and many have been and are being sent to foreign lands. They are manufactured by the Colt Fire Arms Company, Hartford, Conn., on the interchangeable principle, each piece being made in duplicate, which is the first instance of this feature in the manufacture of such machinery.

In these matters, Mr. Baxter has received most valuable aid and assistance from Mr. William D. Russell, President of the Baxter Steam Engine Company.

Mr. Baxter's next work was the invention of a steam street car, which is attracting great attention, and can hardly fail to be one of the first to come into extensive if not general use, as soon as the prejudice against the application of steam to that purpose shall have been overcome. These cars are built at the celebrated Remington Works, Ilion, N. Y.

His last triumph is the successful introduction of steam in canal navigation, a problem which had previously baffled all the engineering talent which had been applied to it. It had long been considered impossible; but the State of New York, having offered a large reward for its solution, a great number of competitors came forward, and Mr. Baxter has just been awarded the first prize. The difficulty has never been the mere use of steam for propelling boats on canals, but to compete with horse power in economy, and thus to cheapen transportation. The official record of the trial trip gives credit to the Baxter boat for a speed of 3·09 miles per hour, upon a consumption of $14\frac{83}{100}$ lbs. coal per mile, carrying a load of more than 200 tuns in addition to her machinery and fuel, which may be condensed as follows: One tun of freight, sixty miles, at a cost of one cent for coal; or, in other words, it is carrying freight at twice the speed and half the cost of the horse boats. It was estimated by the Commissioners of Award that this result would effect a saving of $4,000,000 per annum on the Erie canal alone, and it is calculated that, when the system shall have been generally introduced, the yearly saving on all the canals of the country will not fall short of $10,000,000; it will also double the capacity of all canals, being a complete solution of the problem of cheap transportation, enhancing the value of every acre of land in the West, but being no greater boon to the producer than to the consumer, inasmuch as it will reduce the cost of bread on the sea board, while enhancing the price of wheat in the Western granaries.

It would be difficult to overestimate the value, to the community and to the world, of such lives as Mr. Baxter's. The fame such men achieve is rarely commensurate with their deserts. Soldiers, statesmen, orators, authors, artists, all are likely to stand more conspicuously forth before their fellow men, but impelled by his imperative instincts, the mechanical inventor calls to his aid, and into exercise and active use, executive and financial ability; he inspires men to the establishment of new industries, and the employment of thousands of hands; he gives work to both capital and labor, and is the leading force of civilization. No better example can be given of the truth of this assertion than reference to the army of men employed in various capacities upon the inventions of Mr. Baxter, and the number of skilled mechanics required, not only in the manufacture, but in their operation. The portable engine, the street car, and the steam canal boat, all require engineers, and it is not impossible that a hundred thousand young men will, by the influence of these inventions, acquire the necessary knowledge and be lifted to a higher level than they now occupy.

It is not likely that Mr. Baxter will now rest upon his laurels; he is just in the prime of life and in vigorous health, and it is far more probable that, under the impulse of his wider experience, and the stimulus of constantly increasing reputation, his active brain will be at work upon new and perhaps greater problems.

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Contents:

(Illustrated articles are marked with an asterisk.)

FORMIC FUNGUS FARMERS.

A short time ago there was discovered in Texas a race of diminutive grangers who had solved the transportation problem by the simple and sensible plan of raising all the grain required for their communities, each for itself and at its own doors, and letting other communities do the same or go hungry. They were ants, clever little fellows, whose agricultural operations were carried on with the utmost system and success, and who were thought to be the only creatures not human who had arrived at so high a stage of civilization. Other harvesting ants collect the chance productions of the fields or trust to the husbandry of man for their supplies of grain; but these are independent farmers, who surround their colonies with grain land, which they keep clear of useless growths by nipping in the bud every plant except the rice grass whose seeds they intend to gather for their winter store, thus giving evidence of no small degree of calculation and forethought, as well as industrial economy.

But it appears that they are not alone in this sort of thing, and that their operations are slight and simple compared with those of the *oecodoma* of Central America, better known as leaf cutting ants. These leaf cutters have long been notorious as the most destructive of all the insect pests of tropical America, the tender-leaved fruit plants introduced from other localities suffering especially from their ravages. Indeed, multitudes of plantations of orange, mango, and lemon trees have been stripped and destroyed by them, so that in many parts this otherwise profitable industry has had to be given up entirely.

Their nests generally consist of a cluster of low mounds, pierced by tunnels, from half an inch to six or eight inches in diameter, and situated in a little clearing made by killing the shrubbery through the persistent biting off of buds and leaves, evidently to secure sunshine and a free circulation of air. Leading out from these mounds are well marked paths, it may be half a mile long and several inches wide, thronged like the streets of a great city with busy workers bringing in leafy burdens or hurrying outward for a load. As far as the eye can distinguish their tiny forms, says a recent observer, troops and troops of leaves are seen moving up toward the central point, and disappearing down the tunneled passages. The out-going, empty-handed hosts are partly concealed among the bulky burdens of the incomers, and can be distinguished only by looking closely. "The ceaseless, toiling hosts impress one with their power, and one asks: What forest can stand before such invaders? How is it that vegetation is not eaten off the face of the earth? Surely nowhere but in the tropics, where the recuperative powers of Nature are immense and ever active, could such devastations be withstood."

But wonderful as the operations of these leaf cutters are in the open air, they are as nothing to those that go on under ground. Hitherto the use made of the leaves gathered in such immense quantities has been a mystery. Some have thought they must be used directly as food; others, that they were employed in roofing the ants' underground chambers; but no one suspected their real use until the secret was disclosed to the observer already quoted, Mr. Thomas Belt, in the course of certain mining operations which he was superintending in Nicaragua.

On two occasions, earth cuttings were made from below up through very large nests of these ants, in such a way as to lay their operations clearly open to observation. The tunneled passages were found to lead to numerous connected chambers about the size of a man's head, usually three fourths filled with a flocculent mass of light and loosely connected bits of leaves, withered to a brown color and overgrown with a minute white fungus. Mixed with this substance were numbers of ant nurses with pupæ and larvæ.

By numerous observations, which he describes at length, Mr. Belt became convinced that this fungus growth was the real food of the ants; and all of their outside operations were tributary to its cultivation! In other words the leaves are collected, as human farmers collect marl and guano, for indirect use as fertilizers. The ants do not confine themselves to leaves, but take any vegetable substance suitable for growing the fungus on. Nor do they take leaves indiscriminately, grass, for example, being always rejected; and when any ant, more stupid or less experienced than ordinary, makes the mistake of carrying in unsuitable leaves, they are promptly brought out and thrown away. Great care is also taken in regard to the condition of the leaves carried into the chambers. In case a sudden shower comes on, the wet pieces are deposited outside, to be picked up and taken in when nearly dry, should the weather clear up promptly; when spoiled by too much rain, they are left to rot on the ground. On the other hand, in very dry and hot weather, when the leaves would wither on the way to the nest, the ants wait until sundown before going out, or do their gathering wholly in the night.

When a community migrates, the fresh fungus growths are carefully transported to the new burrows in the jaws of the middle sized workers, the larger members of the community acting only as directors of the march or defenders of the rest in case the column is attacked. The nurses already mentioned are the smallest of all, and their duties lie wholly underground, in cutting up the leaves and attending to the young ants. They never carry leaves, but may sometimes be seen running out along the paths with the others, apparently for the fun of the thing; for instead of helping the rest, they perch themselves on the pieces that are being brought in, and so, like petted children, get a ride home.

As might be expected with creatures who have developed so complicated a system of industrial economy, these ants are extremely clever. A single illustration will suffice to show their practical good sense. To drive off a colony which had established themselves in his garden, Mr. Belt gave their nest a soaking with carbolic acid and water. The effect was all that could have been desired. The marauding parties were at once withdrawn from the garden to meet the danger at home; the whole formicarium was disorganized; and big fellows came stalking up to repel the supposed invader, only to descend again in the utmost perplexity. By the next morning a new nest had been established, some yards distant, and the survivors were busy carrying their supplies thither. It happened that between the two stations there was a steep slope. Instead of descending this with their burdens, the ants cast them down at the top, whence they rolled to the bottom, where another relay of laborers picked them up and carried them to the new burrow. It was amusing, says Mr. Belt, to watch the ants hurrying out with bundles of food, dropping them over the slope, then rushing back immediately for more. Is it possible to attribute such a sensible, and at the same time exceptional, division of labor to anything radically different from human intelligence?

GRANITE and macadam are to be banished from the city of London, the Streets Committee having determined to lay down in future nothing but asphalt or wood.

A MODEL TRANSATLANTIC STEAMER.

We have heard it asserted that there is scarcely a steamer crossing the Atlantic that could not be sunk by a few blows from a heavy sledge. We have received ample evidence, in recent ocean disasters, that the action of the waves alone may strain a modern vessel so that she is considered unseaworthy by a modern captain. Such matters are of grave interest to the traveling public, and they may be glad to know that it is possible to build vessels that will be able to withstand much more severe usage. In the early days of iron shipbuilding, it was pointed out, by the best authorities, that the way to make a vessel safe and strong was to build it with a double skin, making, as it were, a ship within a ship. One of the most noted vessels of modern times, the Great Eastern, was constructed in this manner, and our readers may remember that she ran aground in New York harbor, tearing a hole in her outer skin something more than eighty feet long, and that it was not even necessary to dock the vessel to repair the damage. Of course, a vessel built in this manner is much more expensive than one of the ordinary construction, and it is scarcely necessary to remark that very few examples of this kind are to be found in the mercantile marine. Steamship owners and the traveling community seem in general to have opposing interests, the former desiring to build and run vessels as cheaply as possible, while the latter are more interested in the strength of the ship and the efficiency of the officers. It is with great pleasure, then, that we call the attention of our readers to an exceptional case, that of a company which seems disposed to use the best vessels that can be built, regardless of cost. We refer to the company operating the Red Star line of steamers, formerly running from Philadelphia to Antwerp, which have recently changed their place of sailing to this port. Only three vessels of this line, the Nederland, the Vaterland, and the Switzerland, are as yet completed, but several others are in course of construction. Our readers may remember that not long ago the Nederland ran ashore on the New Jersey coast, in making what appeared to be an effort to reach Philadelphia overland, and that, after having been aground for about two days and exposed to a pretty severe storm, she was floated again and taken to Philadelphia, apparently uninjured. We need scarcely remark that not every steamer crossing the Atlantic could be expected to behave as well under such circumstances. The Switzerland, the other vessel belonging to this line, reached New York on the 8th instant, this being her first voyage. She is 350 feet long, 40 feet beam, has 33 feet depth of hold, and is of about 2,800 tuns burden. The vessel is divided by bulkheads into 6 watertight compartments. Each bulkhead is composed of two thicknesses of plate, with a space between, the plates being strongly stayed together. The ship has a double skin, the distance between the outer and inner skins being between 18 and 20 inches, the main and berth decks being built double, in the same manner. The main deck is covered with heavy planks, and the inner skin of the vessel is sheathed with wood. These compartments between the skins are fitted with good sized pumps which can be worked either by hand or by engines on the upper deck. The steam pumps in the engine room are unusually large for a vessel of this size, and it would seem as if nearly every safeguard that could be required, in case of a leak, was provided in the present instance. The door of each watertight compartment can be closed from the upper deck, by means of a screw.

The Switzerland has a compound engine, the length of stroke being 48 inches, and the diameters of the two cylinders, 40 and 80 inches. There are accommodations for 160 first class passengers, and for about 900 in the steerage.

Without going very fully into details, we trust that we have shown that the vessel under consideration is one of the most substantial crafts that can be built, and offers security to passengers that cannot be guaranteed in the case of the ocean steamer as ordinarily constructed. Our readers may rest assured, also, that, when ocean travelers demand such safeguards to be provided on all lines, they will be forthcoming, and not before.

LEFT HAND WRITING.

A correspondent asks for the best way of holding the pen in writing with the left hand, and the best angle of slope for the letters. No absolute answer can be given in either case. Hands differ, and what would be an easy position of pen for one person might be a very awkward one for another. Each writer must be governed by the necessities of his individual case, to be discovered rather by thoughtful observation of his own writing than by the study of rules. It is enough to say that the ideal position figured on the covers of copy books can be maintained but for short periods without excessive fatigue, and only by persons having slender hands. It answers well enough for writing as a fine art, but is altogether too stiff and tiresome when much offhand writing is to be done. What is true for the right hand is equally true for the left. A good deal depends, too, on the mode of writing, whether the motion is a wrist stroke or a finger stroke or a combination of the two.

Equal freedom must be allowed in regard to the angle or slope of the writing, previsiag that the greater the departure from the perpendicular the greater the danger of illegibility; while a slight slope to right or left adds much to the gracefulness of the script without making it perceptibly less easy to read.

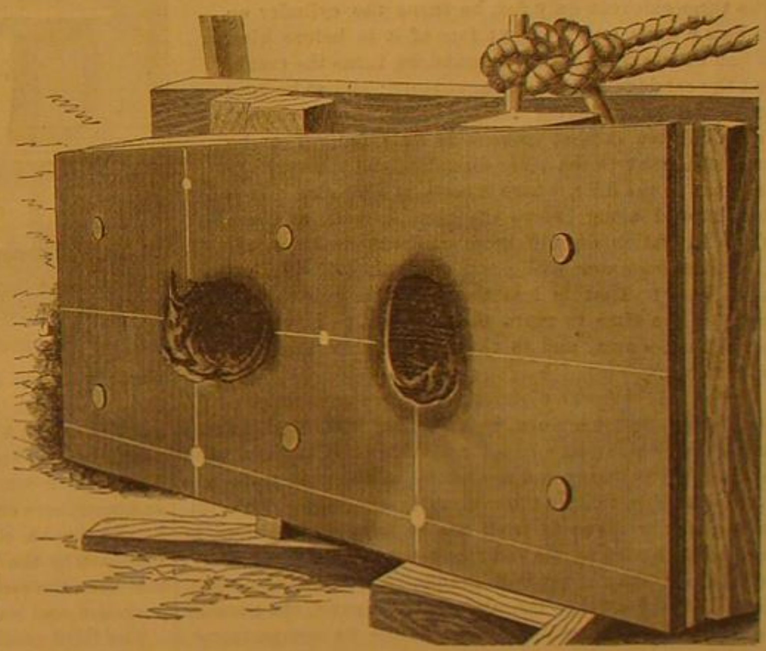
In writing with the left hand, the easiest position would seem to be with the body square before the table, the arm making an angle of about forty five degrees with the front line of the table, the line of writing being at right angles with the direction of the arm. In this position the writing is naturally "back hand," about twenty degrees from perpendicular. To the present writer, whose left hand practice began rather late in life, in consequence of an accident which threatened the disabling of the right hand, it is much the easiest way, in left hand writing, to hold the pen reporter-fashion between the first and second fingers, as in this position the pen is held steady with the least effort, and is not so likely to wander from a uniform slope. It is well, however, to accustom one's self to a variety of positions, especially when much writing has to be done, since, by changing the posture, the labor of writing may be thrown on different sets of muscles, and rest obtained without ceasing to write.

One of the clearest and most graceful left hand writers of our acquaintance writes a style that cannot be distinguished, save in a slight peculiarity in shading, from normal right hand penmanship. To one watching the process, the writing appears to be done upside down. The pen is held between the thumb and forefinger in the regular way; but the paper is placed so that the line of writing is perpendicular to the front of the body, the direction of the writing being toward the body. It seems most natural, however, for the writing to slope to the left when the left hand is employed.

There is a special advantage in using the left hand to write with, and one that we have never seen commended. The hand is never in the way of vision. The pen point is always in plain sight, and so is the paper to be written on. There is, consequently, no inducement to stoop forward or to turn the head so as to throw the eyes out of focus. It is a common fault with those who write much that the left eye has a shorter range than the right. It is overworked and compelled to adapt itself to nearer vision. In writing with the left hand, these evils are avoided. An upright posture is the easiest, and the eyes are equally distant from the paper.

RUBBER AS A DEFENSIVE ARMOR.

We have before us a petition for the relief of Jonathan L. Jones, recently submitted to Congress, in which the memorialist prefers a claim against the United States for the sum of $500,000 for compensation for the use of his patent dated April 15, 1862, for improved defensive armor upon the gunboats Essex, Choctaw, and Lafayette, in their operations against Vicksburgh and the Confederate batteries on the Mississippi river during the late war. This armor was composed of one inch of iron plating, backed by one inch of vulcanized india rubber and twenty three inches of solid timber, covering the portions of the hulls abreast the boilers, the forward and after casemates, and the pilot houses. Thus protected, the boats went repeatedly into action, passing Vicksburgh, destroying the ram Arkansas, and participating in other engagements, during the course of which they were struck, it is alleged, by heavy projectiles, an aggregate of 276 times without the same penetrating that portion of the armor constructed on the memorialist's plan. Shot, it is admitted, passed into the vessels at various times, but never through the parts protected by the armor. A host of letters affidavits, etc., are submitted in corroboration of the assertions advanced; and with the apparently plain claim nicely made out, Mr. Jones goes in for the above mentioned grab. It forcibly reminds us of the efforts of the claimant in the famous Tichborne case.



On the 3rd of October, 1863, Mr. Jones' own target, made of materials furnished by himself, consisting of four one inch wrought iron plates and four sheets of rubber one inch thick, backed by twenty inches of solid oak, was set up against a clay bank in the Washington Navy Yard. The first four inches of the shield nearest the timber were composed of alternate layers of rubber and iron; and the two sheets of one inch rubber and two one inch wrought iron plates were added, the latter being on the outside of the target. The first shot, weighing 169 lbs., was fired from a 11 inch gun at 84 feet distance. It went entirely through plates, rubber, and timber, and penetrated the bank a distance of 12 feet. Diameter of shot hole, 11½ inches. On the 6th of October, the target was placed at an angle of 45° to the line of fire, and a similar shot fired at it. The ball again penetrated everything and entered 6 feet into the clay bank. The holes made by the shot are shown in the annexed engraving, made from the target at the time and published in the SCIENTIFIC AMERICAN. In order fully to prove the inefficiency of Mr. Jones' shield, another target was made, of simply 4 one inch iron plates, backed by 20 inches of solid oak, for comparison, to indicate the effect of the rubber. The first shot fired under similar circumstances to the above went through and penetrated the bank 5 feet. The second projectile, at an angle of 45°, broke in pieces and glanced off, leaving a fragment in the plating. If the members of the committee to whom Mr. Jones' claim has been relegated desire further evidence, we would refer them to the files of the Ordnance Bureau in the Navy Department, as to the detailed account of the tests conducted upon targets Nos. 45 and 46 in the Pencote battery. Further, a year before Mr. Jones produced the above mentioned shield, which failed so conspicuously, a Mr. Bennett, of New York, furnished a rubber plate one inch thick, for target No. 10 in the same series of experiments, and this also was repeatedly penetrated, according to the official report "the same as by previous shots fired at other targets made in the usual way without rubber." Target No. 18 was made of two thicknesses of one inch wrought iron plates backed by 1½ inches of rubber, 7 inches of yellow pine, and three beams 12 inches square running lengthwise the shield. The shot tore through the plating and rubber as before and penetrated the bank for 17 feet. Target No. 21 had two inches of rubber between two one inch iron plates and 7 inches of pine, with beams as before. This was pierced with equal facility by two shots. Target No. 37 was faced with 4 one inch rubber plates and backed with 4½ inches of scrap iron and 20 inches of oak. All the rubber was forced off. Trials at similar targets without the rubber proved the latter to be of no value.

It would be idle for us to proceed further in disproving Mr. Jones' assertions. Leaving out the above experiments altogether, it is a very simple matter to show that even theoretically the inventor's ideas are false. Rubber alone in the form of plates or blocks opposes a resistance to projectiles of about fifty per cent of that of oak. The balls go through it almost as if it were tallow. Now when it is conceded that the shot easily penetrated targets unprovided with the material, it is palpably absurd to suppose that the addition of a substance so easily pierced would add materially to the general resisting power.

That there is any truth in the "philosophy" of the results said to have taken place, namely, that the rubber causes a diffusion of the force through its elasticity, we cannot for a moment admit. As in the converse case of shooting a tallow candle through a door, no time is afforded in the passage of the shot through the single inch of iron for its force to act and react before the penetration is effected.

How Commodore Porter could have been ignorant of the experiments which proved the inefficiency of the rubber, we fail to understand; nor can we reconcile the letters of the officers in its favor in any other manner than by supposing that the results ascribed to the armor must have been due to other causes, a fact which we think would have been apparent had the gentlemen considered the subject in the light of the simplest mechanical laws.

In justice to Mr. Jones, however, it may be added that although his shield could not have repelled the shot, it nevertheless may have served some useful purpose, as the crews of the vessels evidently believed in it; and hence, going into action with a greater confidence in their safety, they perhaps performed better work. This, however, is hardly worth $500,000 to the people.

PHOTOGRAPHY AT THE BOTTOM OF THE SEA.

Dr. Neumayer has recently exhibited before the Berlin Geographical Society a photographic apparatus designed for the determination of the temperature and of the currents at great depths in the ocean.

The invention is composed of a copper box, hermetically sealed and furnished with an exterior appendix made like a rudder. In the interior is a mercury thermometer and a compass, each enclosed in a glass receptacle in which are admitted traces of nitrogen gas. A small electric battery completes the apparatus. When the latter is allowed to descend attached to a sounding line, the action of the current on its rudder causes it to assume a parallel direction, thus indicating the set of the flow by the relative position of compass, needle, and rudder. The thermometer of course shows the surrounding temperature. In order to fix these indications, a piece of photographic paper is suitably disposed near the glass cases containing the instruments. Then at the proper time a current of electricity is established through the gas in the receptacles, causing an intense violet light, capable of acting chemically upon the paper for a sufficient length of time to allow of the photography thereon of the shadows of the compass needle and of the mercury column. Within three minutes, it is said, the operation is complete, when the apparatus is hoisted and the paper removed.

AN AMERICAN RIVER NILE.—The valley of the Rio Grande del Norte, in New Mexico, recalls the features of the Egyptian Nile. A large population is entirely dependent upon the river. An annual rise of the waters carries a muddy sediment, superior in fertilizing properties, as was proved by analysis, to that of the great African river. While the amount of phosphoric acid is nearly the same, the amount of potash is considerably higher. Thousands of acres are lying idle along the valley of the stream, awaiting the enterprising farmer.

FATTENING CHICKENS BY MACHINERY.

It seems to be generally admitted by *gourmands* that no chickens of mechanical fattening have such exquisite flavor as those submitted to the process. In the Gardens of Acclimatation at Paris, this is very scientifically practised under the direction of M. Odile Martin. "Its advantages," say the authorities, "do not consist in the rapidity of the process alone, but above all in the special quality of the meat thus produced. It is solid, very tender, exceedingly fine-grained, not overfat (which would not be an advantage), very white in color, and of a flavor quite exceptionally excellent."

If this is so, of course there is no help for the chickens. They must perforce enter their *épinettes*, and be mathematically crammed. Behold here the ingenious contrivance of the Gardens of Acclimatation for manufacturing this "exceptionally excellent" flavor!

It is a huge cylinder with fourteen faces, each in five stories of three compartments each. It holds, therefore, 210 fowls. The cylinder is hollow and empty, except for the axis on which it turns. This hollow construction renders it easily ventilated and kept clean. Before it is a box for the operator. This box, or carriage, moves up and down by pulleys. The *gaveur*—that sounds less offensive than crammer—operates thus: Commencing at the bottom of one of these fourteen faces, he seizes with the left hand the neck of the chicken; and pressing on each side of the beak, the bird is forced to open its mouth, as any lady knows who has doctored a sick chicken or canary. The *gaveur* then introduces the metallic end of the rubber tube into the throat of the chicken, and by a pressure of the foot on a pedal the food rises, and at the same time the amount passing through the tube is indicated on a dial in front of the operator. It is therefore a skillful operation; for the *gaveur*, whatever other motions are necessary, must pay strict attention to the needle on the dial, or he will give his chicken too much or too little. The three chickens duly fed, he turns the cylinder on its axis a little, and the next face of it is before him. When he has completed the round he turns the crank, and the carriage rises to the next story; and so he goes on to the top. Having completed the upper circuit, every chicken in that *épinette* is duly fed. Then he turns the crank in the other direction, and the carriage descends to the floor, where it rests on a railroad. It is then moved along before the next *épinette*, and the whole operation on 210 more chickens is repeated. A skillful operator will *gave*, or cram, 400 chickens in an hour! That is less than nine seconds to each one; for the time to move the cylinder, to move the carriage up, down, and to the next *épinette*, must be counted out.

Under this *épinette* régime, it requires an average of fifteen days to fatten a duck, eighteen for a chicken, twenty for a goose, and twenty-five for a turkey. The food used for chickens is barley and corn meal mixed with milk into a dough so thin that no other liquid is necessary. The ordinary quantity given is from ten to twenty centiliters, or from seven tenths to one and four tenths of a gill each time; but this quantity is reached gradually. When the maximum that any chicken can assimilate is found, the number indicating this quantity is placed before its compartment, and the *gaveur* must measure it exactly on the dial.

Truly this is an age of wonders. What a labor-saving invention this *épinette* must be to the chickens! Maybe it is not wise to give these details. What if some enterprizing American should be thereby tempted to invest his whole fortune in a grand improved automaton steam power *épinette*, warranted to feed ten thousand chickens a minute! —*Harper's Magazine.*

FATTENING CHICKENS BY MACHINERY.

JUPITER'S SATELLITES.

M. Camille Flammarion, the distinguished French astronomer, says in *La Nature* that on March 25 last the planet Jupiter offered in the telescope the curious aspect of being unaccompanied by any of his satellites. The first was concealed behind the disk. The second and third passed over the face of the planet, accompanied by their shadows, and the ourth was at its greatest elongation and hence far out of the field. The appearance of the planet is shown in our

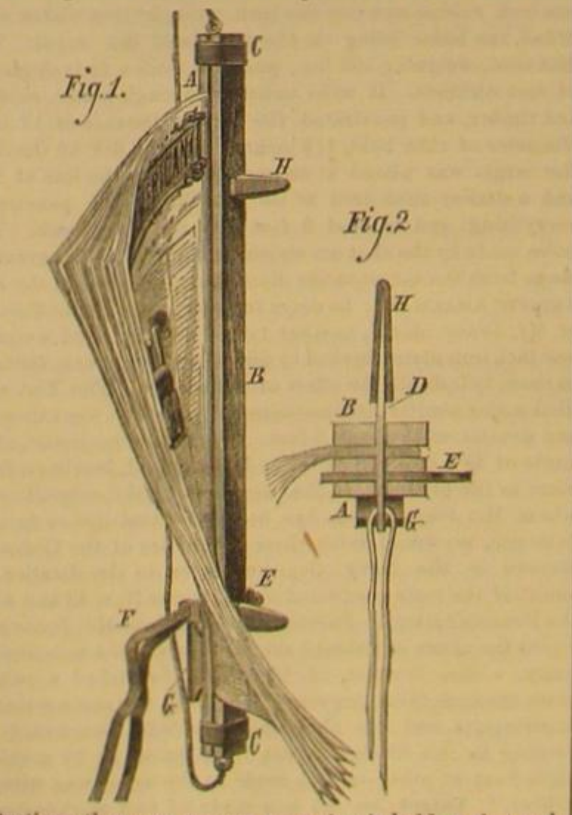
illustration, the disk being divided into parallel zones, the darkest of which extended below the equator for some 20°. Above this was a broader and lighter band, and then a white region, terminating at about the 50th degree of latitude in a gray zone. On the white belt was projected a black spot, No. 1, near which was a second circle, No. 2, of a grayish color. A third point was with difficulty discernible at 3, passing along the upper limit of the gray band. By noting the changes in position of these spots, M. Flammarion reached the conclusion that No. 1 was the shadow of the third, and No. 2 of the second satellite, both of which were passing over the planet, and that No. 3 was the third satellite itself. Consequently at the period of observation there must have been upon Jupiter two total simultaneous and contiguous eclipses of the sun.

The various shades of the spots lead to the determination of some curious and important facts regarding the satellites. The second satellite was evidently more luminous than the third, since it remained invisible on the white zone; while the third was even darker than the gray belt over which it traveled. The latter in fact was hardly brighter than the shadow of the second. Stranger still, the shadow of the third was blacker than that of the second. This cannot be ascribed to the 0·5″ difference in size, or to the effect of the penumbra, for the latter is practically nothing; and hence M. Flammarion considers it due to refraction produced across an atmosphere enveloping the second satellite. It is well known that in certain eclipses of the moon the refraction produced by the terrestrial atmosphere is so considerable that even the central region of the lunar disk is not totally darkened, and remains red like the entire moon.

The third satellite, ordinarily white, appeared darker, and hence must either have become changed in the physical condition of its atmosphere or else have turned another side. Dawes, Lassell, and Secchi have, however, all distinguished spots on the body; and to the exposition of these, its clouded appearance was probably due. Hence it revolves, but, unlike our moon, in a period different from that of its revolution around the planet.

THE NE PLUS ULTRA NEWSPAPER AND MAGAZINE FILE.

In the ingenious form of file represented in the annexed



illustrations, the newspaper or magazine is held so that each page succeeds the other in regular order throughout the entire volume, similarly to the pages of a book. Every journal is clamped securely in its place, and after the numbers, making a volume, are complete, binding by tapes may be quickly and easily effected without necessitating the displacement of a single paper. For libraries and reading rooms, where many periodicals are received which are subsequently bound for preservation, we think that this invention will prove quite convenient, as it saves the necessity of re-arranging the copies after removal from the files, and of the somewhat tedious process of piercing each one in order to pass through the tapes which temporarily hold the sets together for the binder.

Fig. 1 of our engraving gives a perspective view of the file with papers clamped therein. There are two bars of wood or other suitable material, A and B, of which the rear bar, A, is the thickest. These are held together by rubber bands, C, which, secured to bar, A, slip over the ends of the bar, B. Any other convenient and similar fastening may be employed. Through both bars, at a suitable distance from each end, are slots, through which pass blades, D, the forward ends of which are made lancet-shaped, to enable them to pass readily through the papers. As shown in the sectional view, Fig. 2, these blades are secured in the rear bar by pins, E, which pass through said bar and through holes in the blades. The rear ends of the latter project, and have eyes through which tapes, F, are threaded. At G are rubber blocks, which serve as fenders to keep the projecting extremities of the blades from marring the wall against which the file may be suspended. Sheaths, H, of wood or other material, are also provided to protect the sharp ends of the blades, and there is a cord attached, as shown, for hanging up the device.

In using the file the caps, H, are removed, and bands, C, slipped off. The bar, B, being removed, is laid in proper position upon the back margin of the last page of the paper, when both the latter and the bar are pressed against the points of the blades, so that the same pass through the slots in the bar. The bar and paper are then pressed back against the bar, A, and the bars and caps replaced. When the file is full, the pins, E, are removed, and the blades and tapes drawn through the bars. The bar, B, is then detached as before described, the papers are removed, and the tapes are tied behind, forming a volume ready to be laid away or sent to the binder.

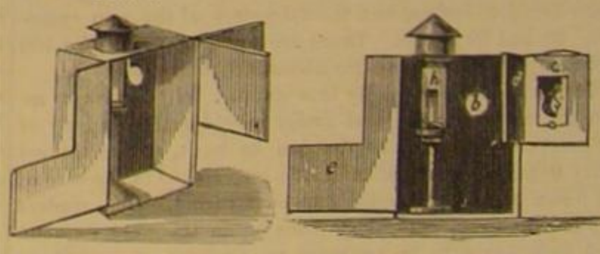
Patented through the Scientific American Patent Agency, March 24, 1874. For further information regarding proposals to manufacture, royalty, etc., address the patentee, Mr. Alexander L. Whitehall, Watseka, Iroquois county, Ill.

THE WONDER CAMERA.

A "wonder camera" is a sort of magic lantern, so contrived as to enable one to use opaque objects for projection upon the screen instead of glass transparencies. For example, if a photographer wishes to show his customer how an enlargement from a carte will look, he simply has to put the carte in the "wonder camera" and "throw it up." Many enlargement scales may be made in this way. Any person may make a "wonder camera" for himself on a plan given by Mr. T. Carter. He says:

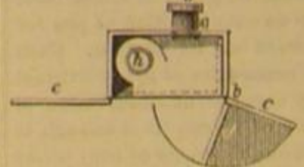
"After experiment I have succeeded in making the above

FIG. 1. FIG. 2.



instrument in a very simple manner. It consists of a wooden box, with a top made of tin or sheet iron; the chimney is made of the same material. The lens is the same as used upon a camera for making photographs. At the back of the box (as will be seen by reference to the elevation and plan Figs. 2 and 3) are two doors placed upon hinges.

FIG. 3.



When the box is in use, the door, *e*, is kept closed. The other door consists of two parts placed at right angles to one another; the object of this is to fill the opening in the door, *e*, while the pictures are being attached to *c*; when *c* is swung into position opposite, the lens, placed at *b*, *d*, is carried to one side. If stereoscopic views are to be shown, a slit may be cut, at *e*, through which they may be inserted without opening the box. The door, *e*, should be cut off a little at the bottom so as to admit air. The light is placed at *h*, as nearly opposite the picture as possible. It should be a strong light; an argand burner is the best. At the back of the light is a piece of tin, bent into the form of a reflector. The light coming from *h* strikes *c*, and is reflected through the lens upon the screen. The plan of the box is represented with the top removed. I have given no dimensions, as they will depend upon the focal distance of the lens and hight of the light. Care must be used to have the distance from the lens to *c*, when closed, equal to the focal distance."—*Photo. News.*

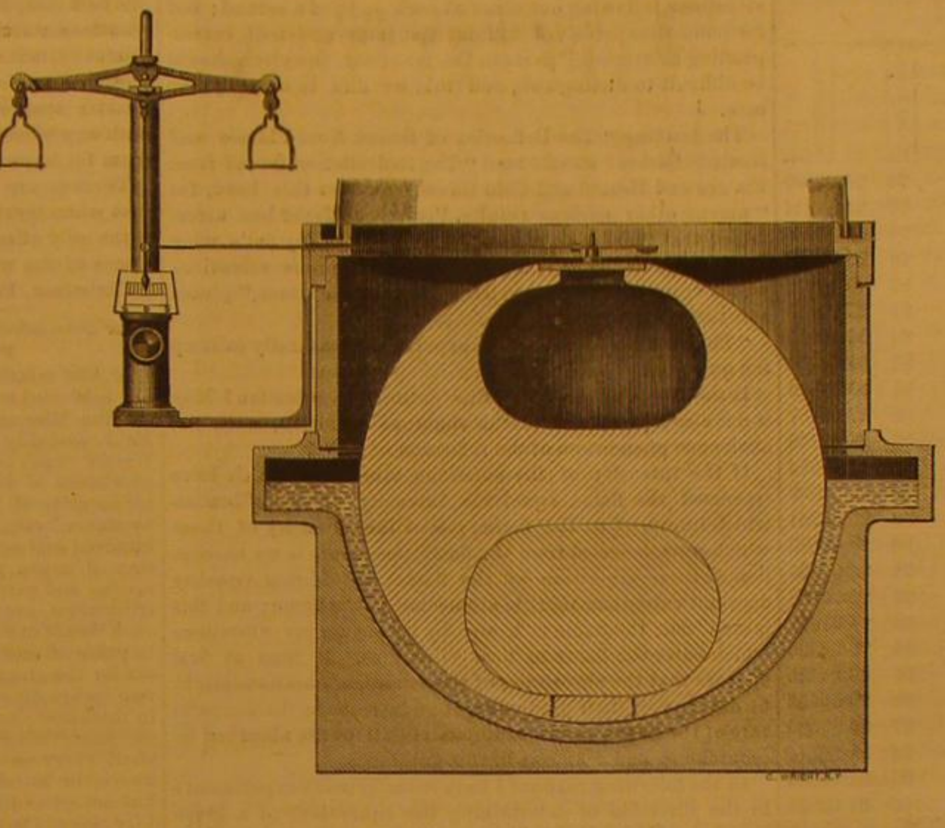
IN India, a timber bridge of 205 feet span has been erected, principally of satinwood.

Correspondence.

SOLAR ATTRACTION AND THE EARTH'S ORBITAL CENTRIFUGAL FORCE.

To the Editor of the Scientific American:

The accompanying illustration represents an instrument constructed for the purpose of proving, by actual practical test, that the sun's attractive energy is balanced by the centrifugal force called forth by the earth's orbital motion round the sun. I desire it to be distinctly understood, however, that my intention is not to demonstrate what astronomers proved centuries ago, namely, that solar attraction is counteracted by the centrifugal force resulting from the orbital motion of the earth round the luminary. Léon Foucault, in his celebrated experiment of swinging a pendulum from the dome of the Panthéon in Paris, simply intended to furnish ocular proof of the correctness of the assumption that our planet rotates round an axis at right angles to the equator. So with regard to the instrument under consideration: the object is simply to furnish ocular proof of the correctness of the assumption that the sun's attractive energy is counteracted by the centrifugal force developed by the orbital motion of the earth round the sun. The reader is aware, from previous statements in these columns, that my scheme consists in presenting a highly polished iron globe, floating on the surface of mercury, to the sun at the moment of rising or setting, the terrestrial attraction being then exerted at right angles to the line of solar attraction, hence incapable of interfering with its action. From previous statements the reader is also aware that experiments, conducted with the new instrument ts sunrise and sunset, have established the fact that, although a tractive force of a few grains is capable of moving the polished iron globe over the surface of the mercury, yet no movement whatever takes place when it is subjected to the pull exerted by the attraction of the sun as stated. A brief description will suffice to explain the nature of the instrument. The illustration represents a section through the center of the iron globe and the circular cistern which contains the mercury. Two spheroidal cavities, it will be seen, are formed in the globe, the upper cavity being empty while the lower one is filled with a metal of much greater specific gravity than iron, the object being to retain the vertical axis of the floating globe in a fixed position. A movable ring is applied at the upper part of the mercurial cistern, admitting of a free rotary motion while the cistern remains stationary. To the said ring an angular bracket is secured, supporting the central column of a delicate chemical balance. Obviously this arrangement admits of the scale beam being turned in such a direction that it points toward the rising or setting sun, without disturbing the mercurial cistern or its contents. The lower end of the vertical index of the scale beam is connected with the floating iron globe by means of a straight steel wire, as shown in the illustration; this wire extending beyond the vertical axis of the globe, a small counter weight being applied at the extreme end of the extension in order to relieve the balance from disturbing influence. To prevent dust from lodging on the mercury, a glass shade covers the cistern, resting in a groove at the upper part of the rotating ring, the shade also preventing currents of air from agitating the sensitive globe during experiments. Such is the nature of the instrument constructed for comparing the energy of solar attraction and orbital centrifugal force, which Dr. Vander Weyde says he has "disposed of" by his discovery that a "floating object is identical with a lever scale, as the liquid balances the floating body," and because (see his communication inserted May 23) he understands the instrument "only too well, so well indeed as to know that even the attraction of the rising and setting moon can never affect such an arrangement." I will not detain the reader by demonstrating the absurdity of mixing up questions concerning lunar attraction with a question relating solely to the comparative energy of the earth's orbital centrifugal force and solar attraction. I deem it necessary, however, to point out briefly the utter fallacy of Dr. Vander Weyde's stated objections. It requires but a slight acquaintance with dynamics to perceive that his first objection has absolutely no bearing on the question. Of course, the weight of the floating iron globe is balanced by the weight of the liquid metal which supports it; but how can the pull exerted by the rising sun on the iron globe be affected by the earth's attraction because the weight of the globe is balanced by the weight of the fluid mass which it displaces? The second objection urged by Dr. Vander Weyde, that my instrument is incapable of showing that solar attraction balances the earth's orbital centrifugal force because the instrument is not affected by the rising and setting moon, scarcely needs refutation. It will suffice to state that, when the floating iron globe is presented to the rising sun, the mercury which supports the globe remains perfectly level, because the centrifugal force which acts on the fluid metal exactly balances the sun's attractive energy. But, in presenting the instrument to the rising moon, the unbalanced pull exerted by its attraction on the mercury will produce an inclination of the surface of the latter in a direction opposite to the satellite. Obviously, that inclination will bring the floating globe under the influence of terrestrial attraction to an extent exactly balancing the lunar attraction. Having called the reader's attention to Dr. Vander Weyde's objections, it would be inconsistent not to notice the communication from Mr. Hugo Bilgram, published in the Scientific American of May 23, concerning my demonstration on page 291, current volume. Mr. Bilgram says: "Though Captain Ericsson in his communication of March 14 proved to be master of the subject, he evidently overlooked one point." This "overlooked" point your correspondent thus adverts to: "Though solar attraction does balance the orbital centrifugal force while the sun is rising, it will not do so three hours afterwards." Now, the sole object of my demonstration was to prove that such *is* the fact, my figures showing that, although solar attraction exactly balances orbital centrifugal force at sunrise, the energy of solar attraction gradually overcomes the orbital centrifugal force during the diurnal revolution, until at noon the difference amounts to 0 0001312. My demonstration also proved that a weight of 20,000 pounds suffers a diminution of 0·001546 of a pound during six hours of diurnal rotation, owing to the very cause which Mr. Bilgram asserts that I have overlooked!



Referring to the experiments which have been instituted with my solar attraction instrument, it will be well to observe that, although the energy of lunar attraction is practically imperceptible, it has been deemed best to conduct the observations when the moon is in the first quarter, its attraction being then exerted at right angles to the line of solar pull. Let us now consider whether the observations have been conducted on a sufficiently large scale to warrant definite conclusions. The weight of the iron globe employed being 181·47 pounds, calculations based on the relative mass of the sun and the earth and other known data show that the pull of the sun amounts to 748 grains. The startling fact that the floating iron globe, while subjected to such a considerable direct horizontal pull, remains stationary, at once suggests the following question: Is the surface of the mercury in the cistern perfectly level in a line pointing east and west,—does not solar attraction raise the surface of the fluid metal at the eastern edge of the cistern, thereby producing an inclined plane which solar energy is incapable of causing the iron globe to mount? This important question the writer has disposed of by the following device: Two open cisterns containing mercury, connected by a horizontal tube, are placed twenty feet apart on a level stone foundation. Above the center of each cistern a micrometric mechanism is applied, by means of which the hight of the mercury may be measured with the utmost precision. The two cisterns with their connecting tube being placed east and west, and time allowed for the mercury to come to a state of perfect equilibrium, the micrometers are adjusted.

This adjustment, it should be particularly observed, is made when the sun is in the zenith, at which time its attraction evidently cannot disturb the equilibrium of the fluid metal in the connected cisterns. The contact of the micrometers and the mercury is then examined from time to time during the diurnal revolution, the final observation being made when, near sunset, the two cisterns point towards the luminary, at which moment the attractive force, tending to disturb the equilibrium of the fluid metal, is at its maximum. Regarding the result of the observations conducted P. M., it may be briefly stated that, when the micrometers are properly adjusted, not the least excess of elevation of the level of the mercury in the western cistern is produced by solar attraction, at the moment when the attractive energy is exerted in the direct line of the two cisterns. Persons familiar with cosmical questions will say that, in case the sun and moon should be nearly in conjunction when the observation is made, lunar attraction will sensibly affect the equilibrium of the mercury in the cisterns. The relative energy of terrestrial and lunar attraction at the earth's surface being in the mean ratio of 320,602 to 1, a difference of level in the cisterns amounting to 0·000748 of an inch takes place under the stated conditions. Consequently this difference calls for a correction, after the adjustment at noon, readily effected by turning one of the micrometric screws through an arc of 8° 40′, the pitch being thirty-two threads per inch. The perfectly level state of the mercury in the cistern of the solar attraction instrument having been established by such accurate means, the absence of any motion of the floating globe when subjected to the pull of the rising and setting sun furnishes positive ocular demonstration of the fact that the sun's attractive energy exerted on the mass of the iron globe is exactly balanced by the centrifugal force resulting from its orbital motion round the luminary. No reflecting observer, aware of the actual amount of the solar pull (748 grains), can witness the perfect repose of the floating iron globe on the level surface of the mercury, at the moment when the sun is rising, without being impressed with the importance of what he beholds. Again, if he has previously calculated the curvature of the orbit in which the instrument is moving, he can assert that the velocity of the floating iron globe round the sun must exceed 18 miles per second, in order to develop, by centrifugal force, an energy capable of counteracting the pull which he *knows* the globe is subjected to while he is watching its repose on the surface of the fluid metal.

J. Ericsson.

The Planet Mars.

To the Editor of the Scientific American:

A few particulars relating to the future movements of Mars may be of interest to your readers:

At the present time this planet is badly situated for observation, being nearly at its greatest distance from the earth and but a few degrees east of the sun. The next opposition of Mars will not occur until the 20th of June, 1875. The planet will then be seen near the well known Milk Dipper of *Sagittarius*. This opposition will not be a very favorable one, however. The low altitude which the planet will attain in our northern latitudes will render it difficult to obtain good views. Moreover, on account of the ellipticity of the orbits of Mars and the earth (especially that of Mars), the planet is much farther from the earth at some oppositions than at others; and on this occasion, it will not be as well situated in this respect as is sometimes the case.

At the next following opposition, however, which will take place in the first part of September, 1877, Mars will be very favorably situated for observation. The planet will, on this occasion, arrive nearly at its minimum distance from our globe; and as it will be situated but a few degrees south of the equinoctial, it will, when on the meridian, be at a convenient altitude for observation in these latitudes.

It happens, in 1877, that Saturn will arrive in opposition to the sun nearly at the same time as Mars. Both planets will be seen, near the time of their opposition, close together, in the constellation *Aquarius*, near the line which separates that constellation from *Pisces*.

At the next opposition, in November, 1879, Mars will not be well situated, but a favorable opposition will occur again in 1892.

At present, the perihelion point of the orbit of Mars is in heliocentric longitude 333° 45′, and the aphelion is in heliocentric longitude 153° 45′. Mars is therefore most favorably situated when its opposition occurs in the latter part of August, while the most unfavorable oppositions take place in the latter part of February. In the former case the apparent diameter of the planet reaches 23·5″, and in the latter case it is only about 13″.

St. Catherine's, Ontario. J. M. Barr.

Laying Out Railroad Curves and Gear Wheels.

To the Editor of the Scientific American:

In your issue of April 11, 1874, I notice an article from the pen of H. C. Parsons, concerning the laying out of railroad curves. Having felt the need of some simple mode for this operation, I discovered the following method, which I find sufficiently correct and easy of application. I append a sketch, the rule for its application, and tables of coefficients with which to ascertain the chords. These tables are calculated especially for laying out gear wheels, by using the angular or chordial pitch instead of the arc; therefore it must always be borne in mind that the pitch mentioned is the chord of the arc.

Rule.—Divide the circle into a convenient number of equal parts of degrees and minutes, then use one half of the same for the changes on the instrument, in establishing points. Then apply rule 2 of my table of coefficients for gears, which will give the chord of the arc of each division of the circle.

Example: What will be the angle for the instrument and the length of the chords for a circle of 600 feet radius, divided into 36 parts of 10° each? Answer: The angle will be 5°, and the chord of the arc will be 104 58 feet.

By this method at least one third of the circle can be laid without moving the instrument, or the latter can be shifted to any point of the circle, whenever any obstructions or irregularities of the land make it requisite to do so. By dividing the circle into many parts, the chords can be brought down to any desirable length.

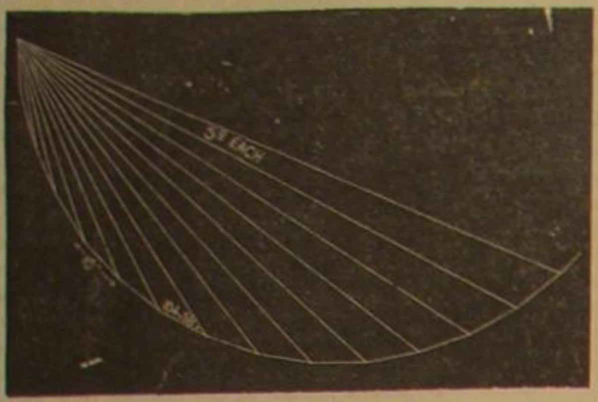


TABLE OF COEFFICIENTS.

No. of Teeth.	Coefficient.	No. of Teeth.	Coefficient.	No. of Teeth.	Coefficient.	No. of Teeth.	Coefficient.
		26	8·29616	51	16·24500	76	24·20000
		27	8·61370	52	18·56313	77	24·51824
		28	8·93131	53	16·88127	78	24·83650
4	1·41421	29	9·24898	54	17·19942	79	25·15476
5	1·70111	30	9·55671	55	17·51757	80	25·47302
6	2·00000	31	9·88450	56	17·83573	81	25·79128
7	2·30480	32	10·20233	57	18·15390	82	26·10955
8	2·61316	33	10·52021	58	18·47207	83	26·42782
9	2·92380	34	10·83811	59	18·79024	84	26·74610
10	3·23607	35	11·15604	60	19·10842	85	27·06437
11	3·54980	36	11·47400	61	19·42661	86	27·38266
12	3·86403	37	11·79198	62	19·74481	87	27·70094
13	4·17876	38	12·10998	63	20·06300	88	28·01922
14	4·49399	39	12·42800	64	20·38121	89	28·33751
15	4·80942	40	12·74600	65	20·69943	90	28·65580
16	5·12609	41	13·06406	66	21·01764	91	28·97409
17	5·44247	42	13·38211	67	21·33585	92	29·29238
18	5·75906	43	13·70017	68	21·65407	93	29·61067
19	6·07581	44	14,01824	69	21·27230	94	29·92896
20	6·39270	45	14·33631	70	22.29053	95	30·24725
21	6·70971	46	14·65441	71	22·60876	96	30·56555
22	7·02681	47	14·97251	72	22·92700	97	30·88385
23	7·34400	48	15·29062	73	23·24524	98	31·20214
24	7·66129	49	15·60874	74	23·56350	99	31·52044
25	7·97866	50	15·92686	75	23·88174	100	31·83874

Rule 1: To find the diameter of a wheel when the pitch and number of the teeth are known: Multiply the coefficients in the table, corresponding to the number of teeth, by the given pitch, in inches and hundredths; the product will be in inches and hundredths.

Rule 2: To find the pitch of a wheel, when the diameter and number of teeth are known: Divide the given diameter by the coefficient in the table corresponding to the number of teeth, and the quotient will be the pitch.

Rule 3: To find the number of teeth in a wheel where the pitch and diameter are known: Divide the given diameter by the given pitch, and the number in the table corresponding to the quotient will be number of teeth.

These tables were computed by two distinct processes, at seven places of decimals, and are warranted not to vary more than $\frac{1}{100}$ of an inch in the diameter of a wheel of 200 teeth and 3 inch pitch.

New Bedford, Mass. H. C. CRANDALL.

Professor Mayer's Discoveries in Acoustics.---A Note from the Author.

To the Editor of the Scientific American:

Will you permit me to correct two erroneous statements in the accounts you published of my discoveries in acoustics, recently read before the National Academy of Sciences?

Under the heading "The Duration of the Sensation of Sound," for "he concludes that the whole ear vibrates as one mass," etc., read as follows: The following table gives the notes, the number of their vibrations, and the duration of their residual sensations, (the French notation, used by König, is adopted):

Note	No. of vibrations. per second.	Duration of residual sensation of the sound.
C_1	64	$\frac{1}{16}$ sec.
C_2	128	$\frac{1}{26}$ "
C_3	256	$\frac{1}{47}$ "
G_3	384	$\frac{1}{66}$ "
C_4	512	$\frac{1}{75}$ "
E_4	640	$\frac{1}{95}$ "
G_4	768	$\frac{1}{109}$ "
C_5	1024	$\frac{1}{135}$ "

Calling D, the duration of the residual sensation, and N, the number of vibrations per second of the note, we have:

$$D=\left(\frac{53248}{N+23}\right)\cdot 0001$$

Now carrying this law (which we discovered by means of vigorous experimental measures) downwards and upwards, through the range of audible sounds, we have, for 40 vibrations per second, the residual sensation lasting $\frac{1}{11}$ of a second after the vibrations which caused the sound have ceased; while for 40,000 vibrations per second, we have a residual sensation of only $\frac{1}{506}$ of a second. If we apply the law to vibrations below 40, where they produce, not a continuous sound, but explosive sensations in the ear, we reach a remarkable result, thus: 30 vibrations per second give a residual sensation of $\frac{1}{10}$ of a second; but if the residual sensation is $\frac{1}{10}$ of a second, why is it that 30 impacts on the ear, in one second, do not blend? For they follow one another at each $\frac{1}{30}$ of a second. This is explained by the fact that co-vibrating parts of the ear, corresponding to sounds produced by vibrations fewer than 40 per second, do not exist, and therefore there are no bodies to co-vibrate and keep up their oscillations after the cause which set them in motion, has ceased to exist, it follows that in other cases the ear is vibrated only as one mass, and the duration of these oscillations of the whole ear are far too short to remain the $\frac{1}{30}$ of a second. This supposition also explains why the higher notes, fur beyond those used for musical sounds, produce continuous sensations, though we have every reason to believe that no co-vibrating parts of the ear correspond to them; with these high notes, the ear vibrates as a mass, but the duration of this vibration is sufficient to keep up sonorous vibrations, following one other at each $\frac{1}{5000}$ of a second; but for notes thus perceived without the intervention of corresponding co-vibrating parts in the inner ear, the pitch should be difficult to distinguish, and this we find is actually the case.

The heading "The Reflection of Sound from Flames and Heated Glasses" should read "The Reflection of Sound from Flames and Heated and Cold Gases." Under this head, for "among other curious results, Professor Mayer has ascertained that there is an absorption of sound in the bat's wing flame; that the flame is heated by the sonorous vibrations which enter it as such, and issue as heat vibrations," please substitute the following:

"The contemplation of these experiments naturally calls up the question:

Is the action of the flame due entirely to reflection? May it not also absorb part of the sonorous vibration, as in the analogous phenomena of the reflection of light?

If the intensity of the sonorous vibrations which have traversed the flame equal the intensity of the vibration which impinged on the flame, *minus* the intensity of those which were reflected from the flame, then there is no absorption of these vibrations by the flame; but if this equality does not exist, then there is absorption in the flame; and this means that the flame is heated by the sonorous vibrations which enter the flame as heat vibrations. It thus at first appears that the absorption of the sonorous vibrations might be detected by their production of an increase in the temperature of the flame, just as sonorous vibrations are absorbed by caoutchouc, and reappear in this substance.

In the following manner I have recently made experiments in the direction of determining the equivalent of a given sonorous aerial vibration, in fraction of a Joule's unit of 772 foot pounds. I stretched between the prongs of an Ut^3 tuning fork a piece of sheet caoutchouc, 100th of an inch in thickness, and about ½ inch broad. The effect of this rubber on the vibrating fork is rapidly to extinguish its vibrations, with which the rubber itself is heated; and if a fork be vibrated continuously, by one and the same force, when the rubber is stretched on it and then when it is taken off, the aerial vibrations produced by the fork are far more intense in the latter circumstances than in the former. By a method described by me in the *American Journal of Science*, February, 1871, I now measured the relative intensities of the aerial vibrations, in these two conditions of vibration. The sheet of caoutchouc was now enclosed in a compound thermobattery, and the fork vibrated during a known interval; the rubber was heated by the vibrations, which would have appeared as sonorous vibrations, if the rubber had been removed from the fork. The amount of heat given to the caoutchouc was accurately determined, by the deflection of a Thomson reflecting galvanometer, connected with the thermo battery; and by knowing the interval during which the fork vibrated, and the amount of heat given by the caoutchouc during this interval, and the equivalent of the heated rubber in water, I calculated the intensity of the sonorous vibration in terms of a thermal unit, from which I at once obtained the value of the sonorous aerial vibrations, when the fork was not heating the rubber, in other words, when it vibrates freely. I thus found that the sonorous aerial vibrations, during ten seconds, of an Ut^3 fork placed in front of its resonator, equaled about the 100,000th part of a Joule's unit; that is, they can be expressed in the work done in lifting 54 grains one foot high. This quantity of heat, which is equal to the heating of 1 pound of water one 100,000th of a degree Fah., expressed the amount by which the gas flame would be heated, if it absorbed all of the sonorous vibrations issuing from the Ut^3 resonator. But this is such a small fraction of the entire heat in the flame that it is far within the actual fluctuations in temperature in the flame; and, even if the flame were constant in temperature, this small increase could not be detected by any known thermometric method. We cannot therefore determine the amount of absorptive power of a flame, or sheet of heated air, for sonorous vibrations, by experiments on their increased temperature, when sonorous vibrations impinge on these bodies."

ALFRED M. MAYER.

Stevens Institute of Technology, Hoboken, N. J.

Turbine Water Wheels.

To the Editor of the Scientific American:

In our experience, if we have a flood of water with reasonable head, almost any kind of wheel, if it be large enough, will do; but when we come to substitute a turbine for an overshot wheel, on light streams, we find that it is a nice matter to decide on the size the wheel should be to give sufficient power and to use the water economically. We venture to say here that there have been more failures in turbines on light streams on account of using too large wheels than from all other causes combined; and we set it down as a well established fact, without having reference to any water wheel pamphlets, that there are now in use and have been for some years several different makes of turbine wheels that will give from seventy-five to eighty per cent. when working with seven eighths to full gate; and persons interested can inform themselves more satisfactorily by corresponding with parties having wheels in use than by consulting pamphlets on the subject

It is said that the best wheels afford almost all their power at five eighths gate or under. Now this is entirely at variance with our experience. Putting in a turbine wheel, on a light stream, that would be large enough to drive the machinery at half gate would be a failure simply because of the small percentage yielded, and consequently the use of too much water for the amount of power given.

Substituting large wheels operating at from one quarter to one half gate, for small wheels requiring seven eighths gates, results in the use of much less water for a given effect, and is also at variance with our experience and can only be based on the idea that the wheels give a better percentage at one quarter than at three quarter gate, which is not the case with any wheels we are acquainted with; but there is ample room for improvement in turbine wheels in that direction.

There is one advantage in using large wheels, and it is that when there is a flush of water it can be utilized, which is the only offset to the loss of power in running at ordinary stages of the water. J. BROOMELL.

Christiana, Pa.

New Steamboat Law. Authorized Increase of Steam Pressure on the Mississippi.

"AN ACT relating to the limitation of steam pressure of vessels used exclusively for towing and carrying freight on the Mississippi river and its tributaries:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled: That the provisions of an act entitled "An act to provide for the better security of life on vessels propelled in whole or in part by steam," etc., approved February twenty-eighth, eighteen hundred and seventy-one, so far as they relate to the limitation of steam pressure of steamboats used exclusively for towing and carrying freight on the Mississippi river and its tributaries, are hereby so far modified as to substitute for such boats one hundred and fifty pounds of steam pressure in place of one hundred and ten pounds, as provided in said act for the standard pressure upon standard boilers of forty-two inches diameter, and of plates of one quarter of an inch in thickness; and such boats may, on the written permit of the supervising inspector of the district in which such boats shall carry on their business, be permitted to carry steam above the standard pressure of one hundred and ten pounds, but not exceeding the standard pressure of one hundred and fifty pounds to the square inch.

Approved January 6, 1874."

To the Editor of the Scientific American:

A recent act of Congress, regulating the management of steam vessels, authorizes tow and freight boats on the Mississippi river to carry a steam pressure of 150 lbs. to the square inch, instead of 110 lbs. as heretofore, in standard boilers of 42 inches diameter and one quarter of an inch thick. I presume that, by standard boilers, is meant such as are ordinarily well made of good average material and single riveted. However this may be, the pressure stated is clearly in excess, and very dangerously so, of that allowed by the rules generally adopted by first class engineers. A boiler 42 inches in diameter and one quarter of an inch thick, with 150 lbs. to the square inch, is subjected to a strain of 12,600 lbs. to each square inch of sectional area of the solid plate, or fully one quarter of the ultimate tensile strength of good boiler iron. According to Fairbairn, in single riveted work the strength is reduced to 0·52 and in double riveted work to 0·7, of that of the solid plate. Under the above circumstances, therefore, a good new boiler, if single riveted, would be subjected to a working pressure equal to nearly one half of that at which it might be expected to tear asunder, or, if double riveted, to more than one third of the breaking strain. The rule given by Bourne for the thickness of locomotive boilers is to multiply the diameter in inches by the pressure per square inch and divide by 8,900, which, in this instance, would require the shell to be about seven tenths of an inch thick. For marine boilers he allows 3,000 lbs. per square inch of sectional area of plates. Now it does not appear that there is any legitimate reason why the owners of boats, used simply for freight or towing, should be allowed to subject their employees to imminent danger from explosion, while persons merely passengers are protected by law from such danger. That the pressure stated is really known to be dangerous needs no further proof than the fact that it is confined to that class of boats; and since it must be admitted that all citizens are entitled to equal protection, why not the officers and men serving in these vessels? It may be said that they voluntarily expose themselves with full understanding of the circumstance, but this is not always the case, and, if it were, would not be a good argument. An explosion of one of the above mentioned boats occurred in March last, causing the loss of sixteen lives. Dare we say that those lives were less precious because they belonged to engineers, firemen, deck hands, or others forced by the necessity of providing for themselves and families to work under constant dread of danger and death? JOHN LEPPER.

Washington, D. C.

OF all solid substances found upon the earth, carbon is both the hardest and the softest. In the form of diamond, it is the hardest. In the form of graphite, it is the softest. Both diamond and graphite are the same in chemical composition.

SCIENTIFIC AND PRACTICAL INFORMATION.

TESTING BELTING LEATHER.

M. Eitner proposes the following simple method of determining the value of leather employed on belting. A cutting of the material about 0·03 of an inch in thickness is placed in strong vinegar. If the leather has been thoroughly acted upon by the tanning and is hence of good quality, it will remain, for months even, immersed without alteration, simply becoming a little darker in color. But, on the contrary, if not well impregnated by the tannin, the fibers will quickly swell and, after a short period, become transformed into a gelatinous mass.

NO WATER IN THE SUN.

M. Janssen states that Croce-Spinelli, in his recent balloon ascension to an elevation of 25,000 feet, finds by spectroscopic observation that the lines in the spectrum, ascribed to the vapor of water, are due to the terrestrial and not to the solar atmosphere; since when the former, by reason of the elevation, is greatly eliminated, the bands are also in like proportion decreased. It may therefore be considered that in the sun there is no watery vapor, at least in appreciable quantity, and that consequently the temperature of that body is not yet sufficiently lowered to allow water to form.

THE SWEDISH EXPEDITION TO THE NORTH POLE.

M. Nordenskjold has recently found, in the ice and snow of the Arctic polar sea, a black dust. This he had melted, and subsequently submitted it to chemical analysis, which has proved that it is composed of nickel and cobalt, and similar in constitution to the meteorites. It seems probable, therefore, that the powder is actually due to the disintegration of these aerial bodies at a short distance from the earth.

The regions which this intrepid traveller has lately explored are the most inhospitable on the globe. He has traversed ice seas, the level of which rises to over three thousand feet above that of the ocean, and which are rent with huge crevasses often entirely concealed by snow and fog, rendering their exploration an enterprize of the greatest danger. M. Nordenskjold is now organizing a new expedition to start in the spring of 1875.

HYDROGEN ALLOYS.

In pursuing their investigations into the metallic combinations of hydrogen, MM. Hautefeuille and Troost have succeeded in obtaining a definite hydride of sodium. They have since compared this product with the hydride of palladium, in order to determine the density of the hydrogen, could it be solidified under like conditions. The hydride of palladium, having a density equal to 11, if the density of palladium, itself equal to 11·7, be considered, admitting that no variation in volume takes place, the density of the hydrogen is found to be 0·62. Repeating the same calculations for the hydride of sodium, the number 0·63 is obtained. Palladium, however, is much heavier than water, while sodium is lighter; and hence it is believed that the figures 0·63 more truly indicated the density of hydrogen under the above conditions. This number is very near to that which represents the density of lithium, and tends to confirm the opinion that hydrogen is one of the true metals.

A LUMINOUS SIGNAL FOR GEODESIC OPERATIONS.

M. Laussedat proposes, for the above purpose, to direct a spy glass from one station toward a second point, to which the signal is to be transmitted. In the focus of the instrument, he places a diaphragm having a very small aperture; so that, on looking through, the field of vision will be restricted to the tower, steeple, or other locality at which the receiver of the signal is stationed. The eye piece of the telescope is then removed, leaving the diaphragm, and behind the latter is placed, in the axis of the instrument, a light, the conjugate image of which, produced by the conveying glass, falls precisely on the opening of the diaphragm. The luminous ray transmitted through the telescope will fall directly on the edifice comprised on the restricted field of vision, and not elsewhere, and the light is therefore invisible to all without that field. The observer will perceive the objective of the telescope illuminated over all its surface; and necessarily the larger the diameter of the glass, the farther will the signal be visible.

A Chemical Centennial.

Dr. H. Carrington Bolton, of Columbia College, has suggested the idea that, as centennial celebrations are now in order, the present year is eminently appropriate for the organization of a social réunion among the chemists of the United States, in commemoration of events alike important to Science and civilization. Dr. Bolton considers that since so many remarkable discoveries in chemistry were made in 1774, we may date the foundation of modern chemical science from that period, and that consequently the year 1874 marks the lapse of the first century. It is pointed out that in 1774 Scheele first isolated chlorine, recognized baryta as an independent earth, and published his essay on manganese. Lavoisier was engaged in an investigation of the cause of the increase in weight of tin when calcined in close vessels, a research leading to the most important discoveries. Wiegleb proved alkalies to be true natural constituents of plants. Cadet described an improved method of preparing sulphuric ether. Bergmann showed the presence of carbonic acid in lead white. On the 27th of September in that year, Comus reduced the "calces" of the six metals by means of the electric spark, before an astonished and delighted audience of savants. On the first of August, 1774, Priestly discovered oxygen, the immediate results of which were the overthrow of the time-honored phlogistic theory and the foundation of chemistry on its present basis.

The proposition has already been acted upon, and the New York Lyceum of Natural History has passed resolutions appointing a committee of five, consisting of Dr. Bolton and Professors Chandler, Wurtz, Leeds and Seeley, to correspond with the chemists of the country with the view of securing their coöperation in the observance of the anniversary. The time fixed, we understand, is the first of August. The idea is a good one and doubtless will be favorably received by the profession.

The Iron Trade.

The *Bulletin* of the American Iron and Steel Association says:

There are 175,000 men who are usually employed at rolling mills, furnaces, etc., out of employment today in consequence of the depression in the iron business; to these must be added many mechanics and others whose business has not been prosperous, or has been partly or wholly destroyed because the iron business upon which they depend has been prostrated.

More than one half of the rail mills of the country were wholly idle on the first day of January last, and the same number remain idle to day, while others are only running a part of their time. Few mills are running to the extent of their capacity. The amount of work now done by merchant bar mills, car wheel makers, car and locomotive builders, and other branches of business intimately connected with the railroad interest, is fully one half less than it was a year ago.

Merchant bar mills, plate mills, founderies, machine shops, and other establishments not dependent upon the railroads for orders have as a rule less business than during the first month of the panic.

Of the 666 completed furnace stacks in the country, the whole number in blast on the first of January last was 400; out of blast, 266. The aggregate number of furnaces out of blast at this date is as great as it was in January.

The decline in prices is as follows:

Principal Articles.	April, 1873.	April, 1874.
Rails at eastern mills	$82.00	$68.00
Bar iron at Pittsburgh	4 1·5c.	2¾c.
Gray forge pig iron at Pittsburgh	$42 00	$28 00
No. 1 Lehigh pig iron at Philadelphia	47.00	33.00

These figures represent an average decline in prices during the past year of over 30 per cent. When it is considered that the prices one year ago, which we have used for comparison, were lower than they have been previously, that money was then abundant and sales for cash were of daily occurrence, and that mill owners and furnacemen then had orders months ahead and now rarely know that they will be able to sell tomorrow what little they make to day, the extent of the disaster to the iron business which yet survives the panic is readily seen.

The Iron Dome of the Capitol.

The iron dome of the Capitol at Washington is 300 feet high, and is surmounted by a metallic statue. In reply to an enquiry, as to whether there was a daily movement of the statue, due to the heat of the sun, the architect, Mr. Clark, gives the following particulars:

The statue on the Capitol has a motion resulting from the unequal expansion of the opposite sides of the dome. The entire length of the line of oscillation of the plummet from the eastern limit to the western limit is only four and a half inches, which would make the inclination in the morning two and a quarter inches to the west, and in the afternoon the same distance to the east. This apportionment of the distance for morning and evening, however, is not strictly correct, and for this reason: that in the morning the east side of the dome is rapidly heated, while the west side is chilled by radiation through the night. Now as the sun passes to the western side of the dome, this side is heated, but as the east side still retains a good portion of its heat, the expansion is more nearly equalized on both sides and the inclination of the statue to the earth to some extent counteracted, so that the inclination to the west is a little greater than that toward the east. The variation is probably about the same all the year around, the extra contracting by cold on one side of the dome during the winter producing the same effect as the extra degree of expansion by heat on the other side in the summer."

Electroplating with Cobalt.

The following process of George W. Beardslee, of Brooklyn, N. Y., is stated to form a thick and useful covering, which will very perfectly protect the plated surface from the action of the elements, and form a most beautiful plating, very white, exceedingly hard and durable, tenaciously adherent, and not liable to tarnish:

Dissolve the pure metal cobalt in boiling muriatic acid, and evaporate this solution to dryness. Then dissolve from four to six ounces of the salt thus obtained in a gallon of distilled water, to which add ammonia sufficient to show on test paper the solution just slightly alkaline. Then prepare an anode of the metal cobalt, in granular form or roken into small pieces, free from impurities, as follows: Take a plate of carbon, or of some other material that is a conductor of electricity, but not susceptible of being attacked by the plating solution, and place it within a sack or envelope made of some material that is neither a conductor of electricity, nor attackable by the solution, formed with open meshes or interstices through which the solution may freely circulate. This envelope should be made to conform in shape to the carbon plate, and large enough to leave a space between it and the plate of, say, one half an inch to one inch; then fill this space with the granules of cobalt, which will, as is evident, surround the plate and be in contact with it.

By an anode thus constructed, a large surface of the cobalt is readily and conveniently exposed to the action of the solvent, and the steady flow of the entire battery current through the cobalt is secured, thereby rendering the dissolution and deposition of the metal steady, uniform, and very perfect.

This anode is to be connected with the copper pole of the battery by connecting the wire to the carbon plate and suspending in the plating solution before described, and the article to be plated is connected in the solution with the zinc pole in the usual way. A battery power of from two to five cells (Smee's battery) will be sufficient to do good work. Care should be taken not to permit the solution to lose its slightly alkaline character, as, if this is not maintained, the plating operation will be rendered imperfect, the tenacity, adherence and uniformity of the deposit becoming thereby impaired.

The Open Treatment of Wounds.

A very remarkable study of surgical cases in the hospital at Zürich has lately been published by Dr. Kroenlein, illustrating the new so-called "open" treatment of wounds advocated by Professor Rose. He compares two periods of several years each, during the first of which the wounds, amputations, etc., were treated by bandaging in the ordinary way.

The results of the two series were, as regards mortality per cent., as follows:

	Bandaging.	Open Treatment.
Thigh	86·1	35·7
Leg	58·3	18·1
Foot	35·2	20·0
Upper arm	55·5	14·0
Forearm	16·6	0·0
Hand	0·0	0·0

Critical researches by the author show that this remarkable result was due neither to the age and sex of the patients, nor to the method of amputation, but solely to the after treatment.

The principal maxims followed by Professor Rose (the present director of the clinic) in the treatment of wounds are to secure absolute rest after arrest of bleeding, and to provide for perfect freedom of discharge and scrupulous cleanliness. Another principle is to interfere with the healing process of wounds only when special indications are afforded, and to consider stitches and bandages of all kinds as interferences to be so avoided. The air to which the wounds are freely exposed in the open treatment must, of course, be pure, and the system accordingly includes the use of energetic ventilation. In the hospital at Zürich, the ventilation is obtained only by constant opening of the doors and windows, a proceeding which, it is true, renders the heating arrangements often insufficient in winter.

The advantages claimed for this open method are:

1. There is no pressure or constriction by dressings.
2. An irritation of the wounds by changing the position and external applications is avoided.
3. There is no danger of infecting the wounds by impure articles.
4. The danger of retention of matter is small.
5. The state of the wounds may be controlled at any time by simply lifting the coverlets.
9. As healing by the first intention is given up, as many ligatures may be applied as are desirable, and thus secondary hæmorrhage may be better avoided.
7. The air of the wards is not infected by emanations from the dressings, as in the case is other methods, except Lister's.
8. There is less need of material for dressings, therefore less expense.

Naturally these statistics have excited much attention among surgeons, and corroborative evidence is not wanting to support Professor Rose's views. Mr. Richard Davy, F. R. C. S., writes to the London *Medical Times and Gazette* that the open treatment of wounds has been practised among his surgical cases for the last five years; the results arrived at have been gratifying, and his firm conviction is that all so-called dressings, to the majority of wounds, are not only needless but injurious.

Amputations, resections, wounds for removal of tumors, injuries, etc., are exposed freely to the atmosphere of the ward. The exceptional cases that receive dressings are burns, scalds, and subcutaneous operations.

The treatment that the wounds are subjected to consists in their adjustment by metallic suture; the atmosphere surrounding the bed is attended to, as to purity and temperature; the surface of the sore is occasionally cleansed by an aqueous spray (the most delicate brush, that destroys itself by usage), and the margins are gently freshened up by a small hog's bristle brush (a separate one for each patient), dipped into clean tepid water.—*Medical and Surgical Reporter.*

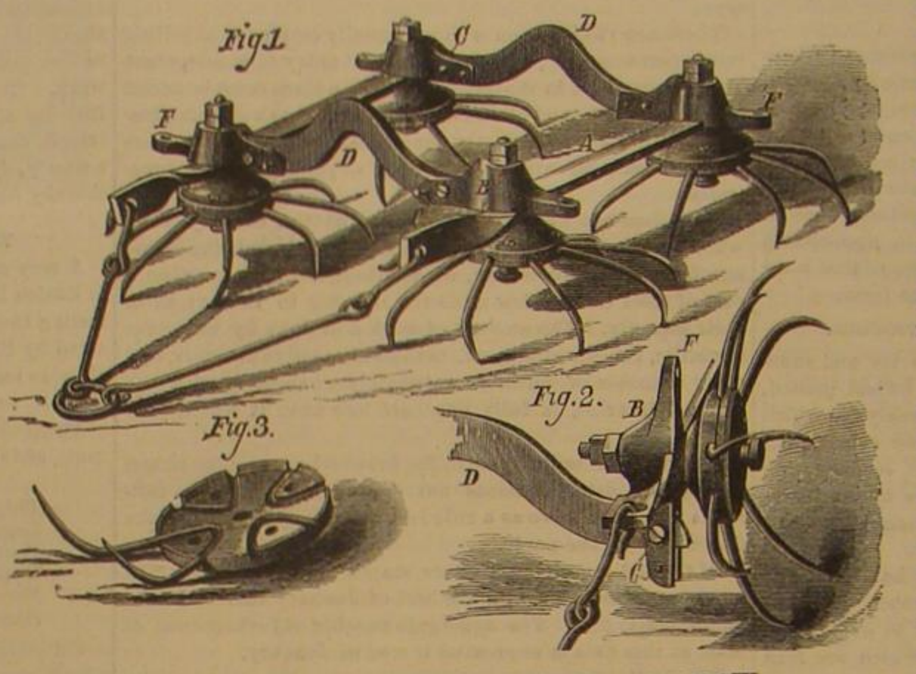
FROM a comparative pay schedule given in the *Naval Gazette*, Portsmouth, England, it appears that engineers receive rather more than twice as much pay in the American Navy than is given in the British Navy. For example, an American engineer receives $2,800 per annum, and the British engineer, $1,100 per annum.

TO DYE LEATHER BLUE-BLACK.—Take of beeswax 3 ozs., black resin 2 ozs. Melt together, and then add: Prussian blue 1 oz., lampblack ½ oz. While the mixture is cooling, add turpentine till a suitable consistency is obtained. It should be applied with a soft rag, and the leather afterwards polished with a brush.

THE TARANTULA WHEEL ROTARY HARROW.

The accompanying engraving represents a novel and, doubtless, very useful agricultural implement to which, from its odd and spider-like appearance, the above appropriate name has been applied. It is a rotary harrow, composed of several wheels, each containing a number of teeth which operate in a manner below described. The wheels are so arranged that they may be turned from a horizontal into a vertical position, thus enabling the device to be conveniently transported from field to field.

At A are two bars, to the inner sides of which are attached brackets, B, through which pass the vertical shafts of the wheels, said shafts being secured by the nuts above. The inner ends of the brackets, C, are slotted to receive cross bars, D, which are secured to them by two bolts, as shown, by removing one of which the connection may be changed from a rigid to a flexible one if desired. In Fig. 2 is shown the position of a wheel when turned vertically on the connection, as above described, as on a hinge. The bars, D, are made with a bow or arch in the middle, to enable the harrow to be used for cultivating corn or other vegetables planted in rows. The harrow teeth are made in U shape, with their ends bent downward and to one side, Fig. 3. The hubs are constructed in two parts secured together by bolts which also pass through the bends of the teeth. The latter are received in grooves, as represented in Fig. 3, and are thus securely clamped and held. The journals are made longer than the hubs in order that the wheels may have play to enable them to adapt themselves to the surface of the ground.



THE TARANTULA WHEEL ROTARY HARROW

As represented in our engraving, the device is adapted for use as a cultivator, but it may be readily changed to a harrow by hooking the draft bars to the eyes in the brackets, shown at F, at right angles to the beams.

The advantages claimed for the invention are as follows: It is durable, and, being constructed of iron, cannot decay when left out in the field. It is simple in construction. It will run, we are informed, deeper or shallower, as desired. Each tooth cuts through ground three times as far as the distance passed over, owing to the rotation of the wheel, thus harrowing the soil to three times the extent of a simple drag machine. The convenience of moving, afforded by the vertically adjustable wheels, is also a point of merit. There is, besides, a reversible motion in every other wheel when drawn, double harrowing the ground in every direction.

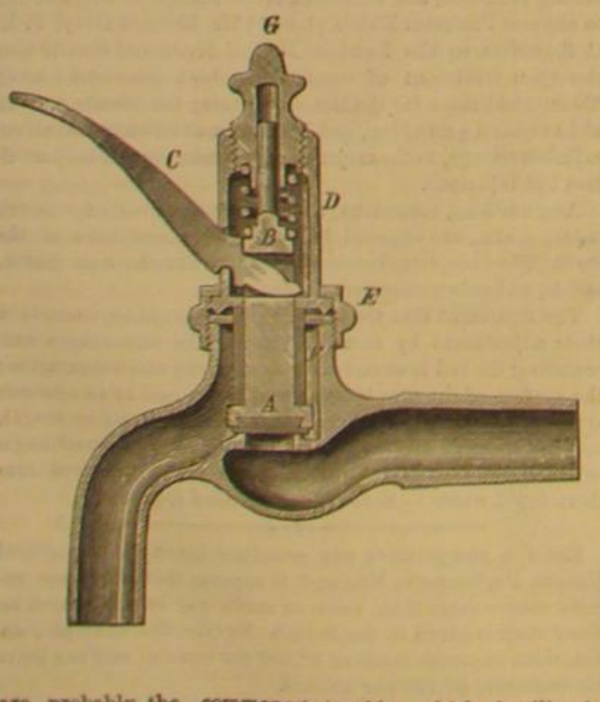
The teeth, it is stated, never choke or clog in any trash, but pull up all that has been plowed under, and scatter it regularly over the surface. None of the soil, consequently, becomes mixed with the refuse, so that the danger of wheat or winter crops freezing, from the springing up of the ground, is largely obviated. For preparing the soil for wheat, we are informed, the machine is especially adapted; and as a cultivator, the inventor states the device to be of great merit.

Two sizes of this harrow are manufactured, one of six wheels, cutting from six and a half to seven and a half feet, making one cultivator. The other and larger size has eight wheels. In field harrowing it is run four wheels abreast, cutting nine feet and nine feet ten inches. By removing two bolts, it is changed into two cultivators. We learn that, in repeated trials, the machine has proved very successful.

Patented through the Scientific American Patent Agency, April 7, 1874. For further particulars address the inventor, Mr. D. L. Benson, Tamaroa, Perry county, Ill.

HOTZ'S PATENT SELF-CLOSING FAUCET.

Overflowing basins, leaky faucets, and burst water pipes



are probably the commonest troubles which families in cities have to endure. Plumbers' bills in cities are, as a rule, excessively high, and when, in addition to this expense, the hapless landlord finds himself compelled to pay for the services of a plasterer to repair soaked and fallen ceilings, and of a painter to make good his disfigured walls, it becomes very clear, to him at least, that an invention which will render water pipes proof against leakage and an overflow of basins is of infinite importance. Faucets which will stay tight, and not require re-grinding every few months, are also an important desideratum. We can assert, from our own experience, having the Hotz faucet some time in use in this office, that it meets all the requirements of a faucet better than any other we have used.

Hotz's self-closing faucet, a sectional view of which is represented in the annexed engraving, is an invention which has been in use some four years, during which time it has withstood severe tests of both frost and heat. The construction consists in a rubber-faced stop valve, A, from the top of which rises a spindle, B, which is slotted to admit the point of a thumb lever, C. D is an upper cylinder, which is flanged and united to the body of the faucet by a union, E, with suitable packing. At the bottom of the cylinder is an annular septum, through which rises the spindle, B. Between the valve, A, and this annular septum, the spindle has, slipped over it, a piece of rubber tubing, F, which abuts against the septum and makes a watertight joint, so that no water can rise into the cylinder. The spindle, B, is made small at the top, and over this portion, and resting upon a shoulder, is placed a coil spring. The upper part of the latter abuts against a male screw, G, which fits into a female screw at the top of the cylinder. Screw G has a milled head, by which it is easily turned up or down to adjust the tension of the spring to the pressure of water against the valve, A. By so regulating the screw that the tension of the spring is just sufficient to overcome the pressure of water against the valve, it is evident that the pipe in connection with the faucet is provided with the means of relieving itself the moment any extra pressure begins within. The tension of the spring, in such case, being overbalanced, the valve will be lifted from below, and water allowed to escape until the equilibrium is restored. No further explanation is, we think, necessary to render it obvious that, so long as the mechanism is properly adjusted and free to work, it is hardly possible for an excess of strain to happen in the pipe.

While this advantage is of first importance, there are others claimed, which are perhaps of nearly equal value. The faucet being self-closing, the danger of its being left running by accident, causing overflow, is obviated. Its construction is such that no grinding of metallic surface is necessary. The deterioration of the piece of rubber tubing and the valve face cannot but be slow; and when worn out, their replacement is a very easy matter, accomplished at a trivial cost. It will be observed that the valve can be regulated to any pressure, and that the water, striking the valve, meets a cushion which is elastic, and hence there is no jarring or hammering of the pipe due to the sudden turning off. Not only is this the case in the single faucet operated; but should the flow from any other cock be quickly stopped, the shock is communicated to the rubber valve which, after lifting, relieves the pipe instantly. From the same cause range boiler explosions will be prevented. Finally, a direct saving is claimed in the cost of pipe, because the heavy tubing necessary to withstand concussions, freezing, and similar forces is rendered unnecessary.

We have had submitted to us reports of several cases which exemplify the successful working of the device, in instances where pipes froze solid throughout a house but no rupture took place. The inventor gives several illustrations (in a pamphlet he has published which parties desiring further information should send for), showing the variety of forms in which the faucet is manufactured in order to suit hydrants, closets, etc.

Considerable ingenuity is shown in the bath tub arrangement, in which the faucet is so governed that it allows water to escape until a sufficient quantity is drawn, when it automatically closes. This is accomplished by a float fastened to a chain of suitable length, attached to the faucet lever. When the float hangs from the latter, its weight is sufficient to raise the valve. The water then runs into the tub until it reaches the float, which it buoys, relieving the lever, and so causing the valve to be shut by its spring.

For further particulars address the E. P. Gleason Manufacturing Co., corner Mercer and Houston streets, New York.

Time Telegraph of the Reading Railroad Company

The manner of giving the correct standard time of the Philadelphia and Reading Railroad Company, to all its telegraph stations, 255 in number, along the main road and all its branches, is as follows: At three minutes to 4 o'clock P. M., daily except Sunday, all business along the lines is suspended; and by means of a series of repeaters, all the lines of this company, 36 in number, are arranged so as to be operated and controlled by one operator at the Reading office, who has a chronometer before him, from which the correct time is given. Commencing at three minutes to 4 P. M., the Reading operator says "time" on the lines, which calls the attention of all operators to adjust their clocks, and is continued at short intervals until five seconds to 4, when he opens the circuit. At 4 o'clock he makes one tap; at fifteen seconds after 4, two taps; at thirty seconds after 4, three taps; at forty-five seconds after 4, four taps, and at one minute after 4, five taps. By this arrangement every telegraph station is able to get the correct time to the second, daily, and thereby have the railroad clocks and watches of the employees properly adjusted, which is a very important matter in the management of a railroad.

MR. PROCTOR has returned to England from America. He recently gave an intensely interesting lecture at St. George's Hall, Langham Place, on the progress of astronomy in America. Mr. Proctor showed that in many respects the Americans were in advance of Englishmen, both in their instruments and the courageous and rapid manner in which they conduct scientific enquiries. He spoke highly of the manner in which he was received, listened to, and treated in the States.—*English Mechanic.*

CARON'S FOUNTAIN MARKING BRUSH.

Our engraving represents a simple form of fountain brush which will, to porters having goods to mark, expressmen, bulletin writers, and others who have occasion for its use, prove, we think, a handy and time-saving invention. It consists of a rubber tube, A, Fig. 1, lined within with a material known as Frink's indestructible rubber lining, which, we are informed, resists the action of acid compounds. The tube is some five or six inches in length, and has on its upper end a cap and ferrule in one, provided, as shown, with a ring, for suspending when not in use. The lower end has also a ferrule, and is threaded to receive a metal funnel, B, as shown in section, Fig. 2. Over the end of the funnel the brush is slipped. In use, the funnel is removed from its ferrule and the handle filled with ink. The former is then returned; and on being held to write, the liquid flows down to the brush through a small tube, C, which extends up into the extremity of the funnel. It will be seen that the necessity of a pot of ink is avoided, and consequently the hand of the operator ordinarily employed in holding the same is left free. The interior construction is of the simplest description, with no mechanism to get out of order. The ink flows freely, and, from its gradual feed and large supply, lasts for a long time. By its use marks can be easily made on uneven surfaces, such as coarse sacking, which cannot be done, except with considerable difficulty, with the ordinary brush. Fine or coarse lines are readily

traced, as the flow is regulated by the pressure of the hand upon the compressible tube.

Further particulars, regarding sale of rights, etc., may be obtained by addressing Mr. William A. Caron, No. 145 Union street, Springfield, Mass., or Mr. F. W. Wentworth 45 Green street, Boston, Mass.

EMANUEL CHURCH, CLIFTON, ENGLAND.

The large and commercially important city of Bristol is so crowded with docks and warehouses that its merchants are driven out of town for residences; and the beautiful parks and avenues of Clifton, which crown the noble downs overhanging the opulent metropolis of western England, are studded with many exceptionally fine public buildings. One of the best of the recent structures is a church of the perpendicular order, of which we present a view. The building, says the London *Builder*, from which we select the engraving, is spacious and lofty, measuring internally 122 feet by 60 feet, and the roof carried through a uniform hight of 60 feet. The chancel is apsidal, and measures 39 feet by 28 feet. The nave is of five bays, with lofty arcade arches springing from circular columns. Arcades of two bays divide north and south chapels from the chancel, designed for vestries and organ chamber.

The church is built of the native stone, of a reddish tint, with bands of deep red sandstone. The dressings are of Bath stone; the chancel steps and dais of Limerick marbles and encaustic tiles. The reredos is carved with subjects in high relief. The steeple reaches to a hight of 222 feet, the tower being 108 feet, the spire 114 feet high.

The Polysphenic Ship.

Proceeding from the well known fact that when flat bottomed vessels are urged forward by a strong propelling force their bows are lifted, and in that way some advantage of speed is gained, Mr. Charles Meade Ramus, M. A., Trinity College, Cambridge, designed a ship in which the bottom was composed of two parallel and consecutive inclined planes, so that, being simultaneously lifted fore and aft by two similar lifting forces at the highest rate of speed, it might be able to so maintain its equilibrium as neither to drop forwards nor turn over. Experiments with models showed that a vessel so constructed would, when driven at a sufficiently high speed, rise evenly over the water, so as to skim over it. Further trials proved the superiority of five or six inclines over the lesser number. From the results of his experiments Mr. Ramus calculates that 5,000 horse power will give to a 2,000 tun ship any speed up to sixty knots an hour. Having employed rockets as the propelling power in his experiments, the idea was suggested of using the vessel as a rocket float. Mr. Ramus estimates that a 100 lbs. rocket would be capable of driving a float of one tun displacement at a hundred knots an hour to a distance of two miles. This float, he adds, would carry quite half a tun of explosives, and it is at least very doubtful whether the sides of any ironclad would resist the shock of the explosion that would take place on contact.

Effect of Heat on Textile Fabrics.

Recent experiments on disinfection by means of heat, made by Dr. Ransom, of Nottingham, England, show that white wool, cotton, silk, and paper may be heated to 250° Fah., for three hours without apparent injury, although the wool will show a faint change in color, especially when new. The same may be said of dyed wools and printed cottons, and most dyed silks; but one kind of white silk easily turns brown by this heat, and pink silks of some kinds are also faded by it. The same temperature will, if continued for a longer period, slightly change the color of white wool, cotton, silk, paper, and unbleached linen, but will not otherwise injure them. A heat of 295° Fah., continued for about three hours, more decidedly singes white wool, and less so unbleached and white cotton and white silk, white paper, and linen, both unbleached and white, but does not materially injure their appearance. The same heat, continued for about five hours, singes and injures the appearance of white wool and cotton, unbleached linen, white silk, and paper, some colored fabrics of wool, or mixed wool and cotton, or mixed wool and silk. It is noteworthy that the singeing of any fabric depends not alone upon the heat used, but also on the time during which it is exposed. In these experiments the heat was obtained by burning gas with smokeless flames, and conducting the products of combustion, mixed with the heated air, by means of a short horizontal flue into a cubical chamber through an aperture in its floor, and out of it by a smaller aperture in its roof. Fixed thermometers showed the temperature of the entering and out-going currents, which represent the maximum and minimum temperatures of the chambers. A self-acting mercurial regulator maintained the temperature of the entering current at any required degree.

The Woolwich Furnace.

The Royal Gun Factory, at Woolwich, has been for some time past conspicuous for its efforts to economize fuel, both for steam and manufacturing purposes, and it is now possessed of a novelty in furnaces, in which the economy of fuel is a striking feature. It is at present applied both to reheating and puddling, and its consumption of fuel and yield of iron taken with scrupulous accuracy.

The saving of fuel is, over a period rising to six months, an average of 40 per cent, while the saving in fettling in the puddling furnace is scarcely less remarkable. The durability of the furnace is also much greater, and the provision against an excess of free air—the pestilent source of waste in the iron trade—is peculiar and effectual in saving iron, whether in reheating or puddling. The plan on which the furnace is constructed is to provide an ordinary furnace with an upcast at the rear of the existing combustion chamber, and in contact with it. The products of combustion from the furnace are led into the said upcast by passing either over, under, or around the body of the furnace. In the upcast is placed a conical cast iron tube in a vertical position, and between the sides of which and the upcast are spaces for the free circulation of the products, the heat of which is taken up by the cast iron vessel or tube. This tube is fitted with a hopper at the top, and check dampers, by which the fuel is let into it without the intrusion of air. Its capacity is equal to containing 12 cwt. of coal, which is kept up by regular charges of about 2 cwt. Its temperature is usually at a bright red heat, and as the fuel descends it is freely rarified. It is provided with an outlet into the combustion chamber, through which a constant stream of carbureted hydrogen is passing over the fuel on the fire bars, taking up the free air passing through the interstices of the fuel, and arresting their wasting action in the furnace. The remainder of the fuel that becomes coked is passed by the same channel on to the fire bars coked and hot, so that no cold fuel passes into the combustion chamber. The amount of heat thus carried back into the furnace, and which is the great economizer, can be partially estimated from the fact that, in place of the waste gases passing off at some 3,000 degrees, it does not exceed 500 degrees, as they escape into the stack beyond the region of utility. These furnaces are not complicated by mechanical aids, the combustion being carried on by in-draught. They are easy of adaptation to existing plant, incur but a trifling expense, and give great durability to the bricks, being free from the chemical action so common to furnaces of less perfect action. The present puddling furnace has yielded 250 tuns of iron—the work of an ordinary furnace—and is far from its termination. Here a want, urgently pressed upon our attention by ironmakers, seems to be met.—*The Engineer.*

EMANUEL CHURCH, CLIFTON NEAR BRISTOL, ENGLAND.

ASTRONOMICAL NOTES.

Observatory of Vassar College.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for June, 1874.

Mercury.

On the 1st of June Mercury rises at 5 in the morning and sets at 8h. 15m. in the evening. On the 30th, Mercury rises at 6h. 40m. A. M., and sets at 9h. 2m. P. M. This planet should therefore be seen after sunset during the latter part of June.

Venus.

On the 1st of June Venus rises at 6h. 8m. A. M., and sets at 9h. 22m. P. M. On the 30th, Venus rises at 7h. 9m. A.M., and sets at 9h. 33m. P. M.

On the 3d of May Venus and Mars were so nearly at the same point of the heavens that, in a telescope of large field, the two could be seen at the same time, giving an excellent opportunity to notice the difference of color. Both are very small at present, being far from the earth.

Mars.

On June 1, Mars rises at 5h. 6m. A. M., and sets at 8h. 12m. P. M. On the 30th, Mars rises at 4h. 36m. A. M., and sets at 7h. 42m. P. M.

Jupiter.

On the 1st Jupiter rises at 0h. 36m. P. M., and sets at 1h. 8m. the next morning. On the 30th, Jupiter rises at 10h. 51m. A. M. and sets at 11h. 18m. P. M.

On May 2 the shadow of Jupiter's fourth satellite passed across the disk of the planet, just skirting the northern edge, appearing like a small black spot. It was seen for 2h. and 15m.

On May 3 Jupiter's third satellite was occulted, that is, the planet seemed to pass over its satellite.

On May 7 the first satellite made a transit across the planet, or the satellite seemed to pass over the planet.

On May 14 the shadow of the third satellite passed across the face of the planet, as a brownish-black spot, not perfectly round. It was seen for about 3 hours.

The broad belt of Jupiter, always seen near the middle of the disk, is at present slightly rosy in color.

Saturn.

Saturn is very beautiful in the early morning, about 4 A. M. It rises at 11h. 29m. P. M. on the 1st of June, and sets at 9h. 21m. the next morning. On the 30th of June it rises at 9h. 33m., and sets at 7h. 21m. the next morning.

Uranus.

Uranus is not well situated for observation and requires a good glass. It rises at 8h. 48m. A. M. on the 1st, and sets at 11h. 10m. P. M. On the 30th it rises at 7h. 1m. A. M., and sets at 9h. 21m. P. M.

Neptune.

It is useless to attempt to see Neptune at the present time. It rises just before daylight on the 1st of June, and sets in the afternoon. On June 30th it rises a little before 1 A. M., and sets at 1h. 54m. P. M.

Meteors.

Meteors were frequent on the morning of April 28; one brighter than Jupiter was seen at 3h. 15m. A. M., starting from *Taurus*.

On the morning of May 12th, from 3 A. M. to 3h. 30m. A. M., meteors were somewhat frequent.

Sun Spots.

The record is from April 18 to May 15. The number of observations is larger than usual. Generally speaking, the spots have been of good size, rather more numerous than usual this year, and have shown little change from day to day. A very interesting series of photographs has been obtained of a group which was first seen on May 7. Reckoning by its subsequent movements, it was then about 12 hours since the sun had turned it fully in sight (or since it had entirely cleared the eastern limb to an observer on the earth). When it was half way to the center, its daily motion was about equal to its width; at the center its motion was about once-and-a-fourth its width. Comparing from day to day, there were very gradual changes, so that its recognition was unmistakable. These small successive changes reached, however, such an amount that, after crossing the disk and reaching the western limb, there could be no likeness traced between its appearance then and its appearance on the 7th. It was seen during eleven days. The ingress and egress were not observed; but estimating by the rate of the passage when near the limb, it occupied twelve or thirteen days for the entire passage from limb to limb, its course being nearly a diameter of the disk. Its rate was more rapid over the latter half of its course, showing that it must have had a motion besides that due to the sun's revolution on its axis. When in the center, twenty-five constituent spots were counted on the photographed disk (which has a diameter of 3¼ inches). It had then widened to three times its breadth when at the edge.

Faculæ were conspicuous on May 17, but have generally been infrequent.

Zodiacal Light.

This phenomenon, so seldom seen in the spring later than March, was noticed on the evenings of May 3, 5, and 8, stretching very obliquely from the northwest towards the stars of *Castor* and *Pollux*.

Barometer and Thermometer.

The meteorological journal from April 18 to May 17 gives the highest barometer, May 11, 30·41; the lowest barometer, April 26, 29·41; the highest thermometer, May 10, at 2 P. M., 88°; the lowest thermometer, April 18 and April 29, at 7 A. M., 31·5°.

Amount of Rain.

The rain which fell between the morning of April 20 and the morning of April 21 amounted to 2·58 inches.

The rain which fell during the day of April 23 amounted to 0·43 inches.

The rain which fell during the night of May 15 and the morning of May 16 amounted to 0·33 inches.

SOCIAL SCIENCE.

The American Social Science Association is now in session in this city. Several able and learned papers have been read and discussed, from which we give below brief abstracts of the conclusions reached. President Gilman, of the University of California, spoke in reference to that State as a social study. He considers that California is rapidly becoming the center of bullion operations for the world, and that, through the resistance of the State to a paper currency circulation, it has had no share in the panics which have visited other sections of the country. California was one of the first States to inaugurate hostility toward the predominant influence of railroad corporations and monopolies. Erroneous impressions, the speaker stated, exist in the East regarding the state of society, but the future will show that in California the best forms of Christian culture and civilization are to be in the ascendant, education is to be widely diffused, and the favorable sky and soil are to render the physical conditions of life enjoyable to an immense population.

Mr. David A. Wells read a lengthy and exhaustive paper on the rational principles of taxation. It would occupy too much space for us to trace the cogent arguments adduced by the learned speaker, but the general conclusion to which his investigations lead is that the rational principle of taxation is to tax but comparatively few articles, tangible property and fixed signs of property, for in this way only can taxes be assessed equitably, uniformly, and economically; and then leave them to diffuse, adjust, and apportion themselves by the inflexible laws of trade and political economy.

Professor Benjamin Peirce discussed the subject of ocean lanes for steamships, and advocated a systematic organization of the paths of the Atlantic steamers, so as to remove the principal source of the dangers of collision. He considers that, when the number of steamers is increased tenfold, as it will be before many years, each vessel will be in direct proportion liable to destruction from the above cause. The meridian of greatest danger is that of 50° west of Greenwich, as in that locality dense fogs, squadrons of fishing vessels, and stranded icebergs abound. The speaker said that the route taken by the Cunard line reduces the dangers to the least amount, and in conclusion suggested that some provisions on the subject, introduced into marine policies, might be wise and effective. It might be well also to have the logs of all steamers examined, and to cause an adverse report to be a serious and dreaded result.

In a paper on American and European railroads, Mr. Gardiner G. Hubbard, of Boston, dealt with the question of cheap transportation. He quoted the opinion of the Senate Committee, that the only means of securing and maintaining trustworthy and effective competition between railways is through national and State ownership or control of one or more lines which, being unable to enter into combination, will serve as regulators of other lines. If two parallel routes between 400 and 500 miles apart, with the Mississippi river in the center, are extended from the Gulf to the Canadian boundary, they will embrace the best cotton, corn, and wheat lands in the world. A short canal will connect the Mississippi with the lakes. A comparatively small sum will open these routes for three quarters of the year. The Senate Committee believe that the most advantageous channels of commerce to be created and improved by the government are the Mississippi river, the northern lines by the lakes, a central line by the Ohio, through Virginia to Richmond, and the southeastern route by the Tennessee, through Alabama and Georgia to the ocean.

The first will open the Mississippi from the Falls of St. Anthony to the Gulf of Mexico. The northern line will open a navigable way through the lakes, the St. Lawrence, the Welland, Erie, and Caughnawaga and Champlain canals, and the Hudson river to New York. The other lines will open the Ohio and Tennessee rivers to their head waters, and thence connect by canals or freight railways with the ocean at Richmond or Savannah. The House Committee recommended a double track freight railway from the Mississippi river to New York, with branches to Chicago and St. Louis, and that government aid shall be given by indorsing the bonds of the company for one half the actual cost of the road, the rates of freight to be fixed and incorporated into the charter. The Senate Committee report favorably on this plan, and it is difficult to understand why they gave the preference to the Richmond route. The cost of the canal and slack water navigation, they estimate at $55,000,000, or nearly the same as that of the freight railway, and the freight charges will be nearly 10 per cent less by the latter, with a saving of from two to three weeks in time. The railroad will never be closed, while the canals will be frozen at least one month in each year. The benefits that will result from the opening of such a road to the whole country can scarcely be overestimated. The cost of transporting grain from the west will be reduced one half, which will be equal to a saving of $47,000,000 on the product of 1872. This reduction will enable us to compete with Russia for the supply of Great Britain, and give a market for all our surplus. It will reduce the price of breadstuffs to every consumer in the East, and, in an equal ratio, the freight on merchandise and manufactures to consumers in the west. The speaker admitted the inexpediency of government undertaking that which can be performed by private enterprise, but believed that this is the only way in which the needed relief can be obtained.

Dr. J. Foster Jenkins, speaking of tent hospitals, said that the tents should be made of cotton, rather than flax. They should have board floors, either covered with oilcloth, in order to prevent fluids from sinking into the wood, or, preferably, waxed or coated with paraffin. All tents should have a double roof; the ventilation will be better and they will be drier. Both should have openings near the ridge for ventilation. The heating in winter should be by stoves placed underground at the end of the tent, with pipes carried through under the floor.

Fluid Extract of Chestnut Leaves.—Dr. J. Eisenmann, of Vienna, has experimented with a fluid extract made from the leaves of the European variety of *castanea vesca*, as a remedy for whooping cough which had but recently entered into the spasmodic stage, and in which the subsequent course of the disease could be well ascertained. The results were so favorable that the author calls the attention of European physicians to this remedy.

COMMISSIONER'S DECISIONS.

CLAIMS FOR THE ARTICLE AND APPARATUS IN ONE PATENT.—IMPROVEMENT IN THE MANUFACTURE OF WATCHES.

[Decided May 11, 1874.]

Leggett, *Commissioner*:

This applicant comes before the Office with three applications for patents, comprehending, respectively, watch case bezels, watch-case centers, and watch-case backs. In each application the article is claimed and also the die by which it is made. The Examiner requires that each application shall be divided. I had occasion to consider the matter of division of applications in the case of Murray and Wuterich. (*Official Gazette*, vol. 3, p. 559.) I do not find any reason now for departing from the tenor of the decision in that case, in which it was stated that the division of applications is a matter entrusted under the law to the discretion of the Commissioner; and that the general rule established by the Supreme Court of the United States is that but one distinct subject of invention can legally be embraced in a single patent. Nor have I any doubt that the facilitation of official examinations and the prevention of mistakes in the granting of patents renders it important to the public, and for the true interest of inventors, that the discretion of the Commissioner in enforcing the rule of unity of subject matter in each patent should be exercised to carry the operation of the rule as far as is consistent with reason and justice in every instance. But it cannot be ignored that there are some cases where two things, in one sense entirely distinct, are yet so intimately connected as to have been not only one in inception in the mind of the inventor, but to be inseparable in practical use. A die and its counterpart—the article it forms—are often of this kind. The watch bezel under consideration, for instance, could not be made to be of any use in the manufacture of watches except substantially in the manner here shown—that is, it must be struck up from ductile metal with a die. It could not be profitably cast, spun, or made by hand. Its excellence is due to its form and to its being made of a single piece. The die which is employed must, therefore, always be used to make this article. If two patents were granted, one for the die and the other for the bezel, each might defeat the other, unless the manufacturer should own both. One would always be as ineffectual without a right under the other as one half of a pair of shears without the other half. It cannot, I think, be good policy to require a division of applications in such cases. So far as the decision in the case of Murray and Wuterich may seem to sanction divisions of applications in cases of this nature, I desire to restrict its operation as authority for Examiners in the practice of the Office.

The decision of the Examiner is overruled.

COMBINATION CLAIMS.—IMPROVEMENT IN ENVELOPE COUNTING MACHINE

[Decided May 9, 1874.]

Thacher, *Acting Commissioner;*

The Examiner objects to the second and third claims "because they do not include the elements necessary to a complete coöperative, unitary result."

The claims are as follows:

2. The tilting table N, in combination with the main double inclined table B, substantially as and for the purposes described.

3. In combination with the tilting table N and main double inclined table B the combined slide and pusher plate I *e*, substantially as shown and set forth.

The tilting table and the double inclined table serve the purpose of furnishing a way, first in one direction and then in the other, along which the bunch of envelopes is to be passed.

These two devices, in combination with the pusher, constitute that portion of the apparatus which is necessary to force the bunches along the table, inclined first in one direction and then in the other.

These results are unitary in character. They are not, to be sure, complete; nothing short of the finished operation of the machine can be called a complete result. If a legitimate combination must contain all the elements necessary to a *complete* result, there can be but one combination claim on any machine, and it must necessarily contain all the devices found in such machine.

The Examiner fails to distinguish between a *unitary* and a *complete* result. A complete result may be the combined effect of several unitary results.

It is undoubtedly correct that a combination must contain all the essential elements necessary to secure some distinct and definable result in the operation of a machine, and such result may be called, for want of a better term, *unitary*. It is only necessary to inquire whether this is done to determine, in any given case, whether the combinations claimed are proper or not.

As stated above, in my opinion, the two claims to which objection is made do include all the elements necessary to unitary results.

The ledge, which the Examiner requires to be included in the combination in each case, is for a distinct purpose, to wit, the support of the elevated ends of the envelopes. It is, perhaps, a consequence of the tilting table and double inclined way, but is not a necessary device to the operation of those elements in the performance of the limited function ascribed to them. In fact, if the faces of the double inclined table were made somewhat wider than half the length of an envelope, no support for the outer ends of the envelopes would be required.

The decision of the Examiner is reversed.

DECISIONS OF THE COURTS.

United States Circuit Court---District of New Jersey.

IMPROVEMENT IN PILE LOOMS.—WILLIAM WEBSTER *et al.* *vs.* THE NEW BRUNSWICK CARPET COMPANY.

Nixon, *District Judge:*

This bill is filed against the corporation defendant for infringing certain letters patent No, 130,961, issued to William Webster, August 27, 1872, for "a new and useful improvement in looms for weaving pile fabrics."

This answer denies the infringement, and sets up as a defence a prior invention by one Ezekiel K. Davis; and that letters patent were granted to him for inventions in looms for weaving pile fabrics, dated February 9, 1869, and numbered 86,651; that the looms which the defendant had in use, and which were alleged in the bill of complaint to infringe the Webster patent, were constructed and operated in conformity to the description contained in the said patent to Davis; that defendant had a licence under said patent to use said looms, and that they rightfully and lawfully used under said licence.

The Court stated that it was a fair deduction from the testimony that Davis acquired all of his knowledge on the subject from the inspection of Webster's original drawing, made by him in the winter of 1865-66, and exhibited to Davis and others in the spring of 1866. That he did not comprehend the value of the invention, or that he did not then deem himself to be its original and first inventor, is also to be inferred from the fact that it was not claimed in his patent of the subsequent year.

The delay of Webster in taking out his patent after he had completed his invention seems to be satisfactorily explained. Under the circumstances it was not unreasonable. It is the old story of poor inventors patiently waiting at the door of rich capitalists. The Bigelow patent was about expiring and Webster's new wire motions could only be used in union with some of the patented ingredients of the Bigelow loom. As he was unable to make an arrangement with the Higginses, who were licencees of Bigelow, in regard to the adoption of his improvements, and as he could not get others, like Weaver or Beattie, to unite with him from fear of suits for infringements, he was obliged to wait, either for the death of the Bigelow patent or until the heart of capital should relent, in order to give his invention to the world under circumstances that might afford him some compensation for his years of thought and unrequited effort.

The Court gave a decree for the complainants according to the prayer of the bill, holding substantially as follows:

In a patent for a loom for weaving pile fabrics one claim was for "the lay and its rigid shuttle box, the pivoted vibrating wire trough, the reciprocating driving slide, and the latch moving thereon," and "operated by the wire box," all in combination, and the wire trough was described as vibrating horizontally upon a pivot at one end, to and from the shuttle box; and it was held that a wire trough vibrating upon a horizontal rock shaft underneath was the equivalent of the one described; and a loom with such a wire trough, but in other respects like the one described in the patent, was adjudged to be an infringement.

A patent for a combination is infringed by the use of a similar combination, although one of the elements is omitted, and another is substituted for it, unless the substituted device is a new one, or performs a function essentially different, or was not known at the date of the patent as a proper substitute for the one omitted.

Where the inventor of an improvement upon a patented machine could neither make an arrangement with the owners of the patent to adopt it nor use it without infringing the patent, nor induce others to take it up, and was poor, he was held not to have lost his right in it, although he delayed applying for a patent until another person had made the improvement and obtained a patent for it.

[*C. A. Seward* and *B. R. Curtis*, for complainants.

George Gifford and *Wayne Parker*, for defendant.

Recent American and Foreign Patents.

Composition to be Applied to the Surface of Paper for Artificial Flowers.

Paul E. Vacquerel, New York city.—This is a composition for protecting and preserving the vegetable paper applied to artificial flowers, consisting of colophony, gum dammar, and camphor, spirits turpentine, poppy seed oil, kerosene, and castor oil. It is an improvement on the composition patented by the same inventor, October 21, 1862.

Improved Scroll Saw Table.

George Halkett Patullo, Dexter, Mich., assignor to himself and David A. Boggs, same place.—This invention relates to the mode of adjusting the tables of scroll and similar saws for sawing scrolls or other forms, square or on a bevel; and consists in the construction and arrangement of parts, by means of which the table is rotated on its pedestal while standing level or at any desired angle with the saw.

Improved Hand Potato Digger.

Horace S. Phelps and Alfred Phelps, Franklin, N. Y.—In using the machine, the upper end of a jointed handle is pushed outward, which raises one set of prongs away from another set, and allows the latter to be thrust into the ground in the manner of an ordinary fork. The end of one handle is then drawn toward another handle, which forces the prongs into the ground to meet the others, inclosing the potatoes between the prongs The operator then lifts the digger upward, draws it toward him, shakes out the dirt, and drops the potatoes into a basket by pushing one end of a handle outward, leaving the parts in position for the prongs to be again thrust into the ground.

Improved Mitten.

Solomon J. Clute and Daniel M. Durfee, Rockwood, N. Y.—This invention relates to the old and well known class of one fingered mittens, and consists in constructing them from a number of pieces, cut with much economy of material. The palm comprises a piece, which is the palm of the forefinger, another piece, which is the side and back of the front finger and part of the back of the hand, with an extension to take the place of the fourchette of the first finger. The edge of the said extension is sewn to the edge of the part not so extended. The palm and back are formed from the junction of the fore and second fingers at the back of the wrist. An extension takes the place of the fourchette of the forefinger, and is sewn to the edge of the palm, along the inside of the second finger.

Improved Hydrant.

Michael Allen, Schenectady, N.Y.—To pack the joint so as to prevent leakage between the bar connecting the valve with the screw which operates to open and close it and the bottom of the groove in which it works, is a thimble in the passage, an elastic ring, and an adjusting nut, by which the inner end of the thimble is pressed watertight on the bar.

Improved Steam Mining Pump.

Andrew N. Rogers, Central City, Col. Ter.—This invention consists of a reciprocating steam cylinder with a stationary piston and a continuous acting force pump in a light strong frame, having apparatus by which it can be conveniently suspended by ropes and pulleys, so as to be conveniently adjusted as the work progresses. The steam is conducted down to the engine by pipes, and the water is forced up by other pipes, of which sections will be added on as the engine descends. The invention also consists of certain improvements in the construction of the engine and the pump to adapt it for the use for which it is intended.

Improved Plow.

John M. Tingley, Clifton Hill, Mo.—This is an improved short beam plow so constructed that the beam may be adjusted to cause the plow to run deeper or shallower, and to take or leave land, without removing a bolt, and which will enable the beam to be easily detached without removing a bolt. The invention relates specifically to the combination, with the standard and beam, of devices for adjusting the beam.

Improved Hose Patch.

Oscar E. Phillips, Richmond, Va.—The object of this invention is to provide ready and convenient means for repairing hose or pipes employed for conducting water or other liquid, when from over pressure or other cause they have burst or holes have been made therein; and it consists in a metallic patch composed of an inner and an outer plate, between which the hose is clamped by means of one or more screws.

Improved Screw Forming Machine.

Peter H. Howell, Black River Falls, Wis.—This is a guide attachment for swaging machines by which stove and other pipes may be produced with screw threads, so that they may be readily put together and disconnected and the slipping of the same or escape of ashes or sparks be effectually prevented. The device consists of two main standards which carry a vertically and laterally adjustable arm with two wheels, on which the stove or other pipe is placed and fed, under suitable inclination, to the swaging machine.

Improved Violin Bow Rosiner.

Thomas H. Hathaway, New Bedford, Mass.—This is a pocket case for the rosin, which may also be employed for a handle while applying the rosin to the bow hair; and it consists of a little paper or leather case of approximately elliptical form in cross section, open at both ends to allow the bow to be drawn forward and back through it, and provided with end flaps which close the ends and fasten together along one side. In this a piece of rosin is secured, about half filling it and extending from end to end, so as to be rubbed along the string without having to touch the rosin by the hand.

Improved Hay Loader.

Carmi O. Benton, Topeka, Kan.—The axle is bent at right angles near each end, to bring its middle part sufficiently near the ground. To the bends are attached bars, the forward parts of which meet and have an eye to hook upon the middle part of the axle. The bars project to the rearward, and rakes are pivoted to them. When passing from place to place, by unhooking the chain, the rake may be turned up to rest upon the elevator frame. The latter may be adjusted closer to or further from the ground, as may be required. To an endless apron, at suitable distances apart, are attached cross bars, which are provided with prongs, by which the hay collected by the rake teeth is taken from said teeth, carried up the frame, and deposited upon the wagon. The elevator is operated by the advance of the machine.

Improved Cotton Scraper and Thinner.

Charles T. Dollahon, Pitman, Ark.—This invention consists of a master wheel, the axle of which is mounted on the left hand side of the beam, from which a bar extends to the rear end and supports a number of cultivators for cultivating the right hand side of the row, while the wheel runs along the left hand side, and is followed by a scraper on that side. A shaft geared with the master wheel extends across to the left hand side, and has a crank at that end connected with a horizontal elbow lever, which works a chopper, and causes it to chop out portions of the row at certain distances apart. The elbow lever is connected with the crank by contrivances arranged so that it can be thrown out of gear and remain inoperative while the machine is running along one side of the row, as it is only necessary for it to work during one passage of the scrapers, while they are required to run twice along the row, once on each side. Thus the machine scrapes off on one side, cultivates on the other, and chops out, all at the same time, and by running both up and down the row scrapes off and cultivates both sides.

Improved Ice Pitcher.

Joseph B. Cox, Mount Laurel, N. J.—This invention consists in providing a cup on the front side of the pitcher for containing sponge, and a gutter which communicates with it. The water accumulating in the gutter will be taken up by the sponge, so that it cannot be spilled in handling the pitcher, as it would be liable to be if allowed to remain in the gutter.

Improved Vapor Bath.

Volney Miller and Horace Cole, Andover, Mo.—There is a small case for confining the vapor, which incloses the whole of the body except the head. There is a vertically adjustable seat under which is a vapor-distributing pan, under which the alcohol lamp is burned. Suitable dampers are provided to regulate the entrance and escape of the vapor.

Improved Die for Welding Links.

John B. Baugh, Detroit, Mich.—This invention consists of a bed die and of two wedge-shaped link dies, which latter work in the bed die and are raised therefrom by a lever which throws up wedges and allows the link to be removed. The face of the steam hammer which strikes the link in the operation of welding has an orifice which receives the top part of the link and thereby keeps the link in place when the welding blow is struck. By this apparatus the operation of welding links for car couplings and for other purposes is greatly facilitated.

Improved Milk Safe.

Hiram Babcock, Aplington, Iowa.—This invention consists of a safe provided with hollow sliding shelves, which are closed at the sides, but open at the ends, where they connect, by slotted apertures, with air chambers at both sides of the shelves, through which a current of air is kept up by regulating draft holes and a pipe connection with chimney.

Improved Medical Compounds.

Robert R. Roberts, Bonham, Texas.—The first compound is prepared for use in the form of pills, of about the weight of three grains each, and consists of podophyllin, leptandrin, extract of butternut bark, extract of rhubarb, extract of jalap, powdered capsicum, sulphate of quinine, and salicine. These pills operate as a tonic as well as a cathartic, and are successfully employed in the treatment of a great variety of diseases. The second compound is also in pill form, and consists of podophyllin, leptandrin, extract of rhubarb, extract of jalap, extract of butternut bark, making a three-grain cathartic pill. These pills are employed for the cure of various diseases, more especially those which affect the bowels and digestive organs.

Improved Clothes Pounder.

David Graffin, Catasauqua, Pa.—This machine for washing clothes may be used with an ordinary wash tub. The invention consists in a disk made concave upon its lower side, and convex upon its upper side, to which is attached a standard and cross handle. Under the disk is secured a semi-spherical knob, and at equal distances from each other are attached four radial semi-cylindrical blocks, the ends of which are rounded off. Midway between each two blocks are attached radial blocks, which are grooved transversely, and the space between each two grooves is rounded off into semi-spherical form. In the spaces between the latter blocks are attached short radial blocks, the ends of which are rounded off, and in which are formed two or more transverse rounded grooves. The concavity draws the clothes in beneath it, so that they will receive the full force of the blows. As the device is raised, its concavity tends to draw the clothes up with it, which loosens the clothes and causes them to move, so that they may become more quickly saturated with water.

Improved Lamp Trimmer and Extinguisher.

William Walton, Williamsburgh, N. Y.—This is an attachment for lamp burners, so constructed that it may be used for trimming the wick and extinguishing the flame, and which shall be simple in construction, convenient in use, and effective in operation. There is a flat wick tube, around which is fitted a sleeve, from which, upon the opposite sides of the wick tube, project two jaws, the upper ends of which are inclined inward, so as, when the sleeve is pushed up, to meet above the top of the tube and pinch off the wick. Suitable devices prevent the jaws from pressing against the wick before they have risen to the proper hight above the tube. When the jaws come together, they may form a close cap over the top of the wick tube, and thus extinguish the wick.

Improved Watch Case Spring.

Levi Stone, Mount Vernon, Ohio.—This invention relates to wire springs for watches, and consists in providing one end with a fastening brace, whereby the same spring may be adapted to any case by cutting off a little, more or less, from the end of the brace.

Improved Pump.

George W. Robaugh, Lee Summit, Mo.—This pump consists of a central tube, which guides a piston in the usual manner, surrounded by an outer tube of larger diameter, forming a chamber around the inner tube, and discharging the water from a pipe extending upward from the base of the outer tube. The outer tube has an extension of smaller diameter, in which a second piston with a central valve is guided, it being attached to the extension of the upper piston rod. The lower part of the extension tube connects by a common conical valve in the usual manner with the well tube. The water is raised by the up stroke of the lower piston through the bottom valve into the lower part of the main tube, passing on the down stroke through the valve of the lower piston into the upper part of the main tube, until the same is nearly filled. Each up and down stroke forces then, by the joint action of the pistons and the pressure caused thereby, the water through the discharge pipe, so that a regular and continuous stream of water issues therefrom.

Improved Grinding Wheel.

John T. Henry, Hampden, assignor to himself and Joseph Munger, Waterbury, Conn.—To form a secure and durable attachment of a stone or wheel to its arbor, the same is cut thicker at the center, or around the central opening, and provided with circular shoulders to engage with corresponding shoulders on clamps. One clamp bears against a collar, while the other is forced up and tightly clamps the wheel by a nut.

Improved Portable Fence.

James L. Griffin, Cusseta, Tex.—This improvement in fences consists of half dovetail projections on the ends of the panels, by which the meeting ends of the panel are locked together within a long yoke extending from bottom to top of the panels, and are fastened with a key. The panels are mounted on stakes or blocks, and supported by braces. The object is to furnish a light and cheap fence, which can be manufactured at the mill, and carried into the field ready to put up, and which can be readily taken down and moved about as wanted.

Improved Press.

John Gramelspacher, Jasper, Iowa.—This invention consists of a brake lever pivoted at the middle in the top of the follower stem, and having a fulcrum on each side of it on a rod working up and down through a guiding and supporting beam. The rod also works through a griping pawl, which allows it to descend freely, but gripes and holds it against rising, so that the fulcrum of one side descends while the other is holding the lever for pressing the follower down. This causes the follower to be forced down quickly by the vibrations of the levers.

Improved Stove Pipe.

David Boyd, New York city.—An annular flue is left between outer and inner pipes for the passage of the smoke and heated gaseous products of combustion. By this means, instead of a central column of ascending heat, the heated gases are spread out into a thin layer, and are compelled to part with their heat before being discharged.

Improved Furnace Attachment for Steam Boilers.

Thomas Hall, Lawrence, Mass.—This invention consists of a frame, which is placed on the rear ends of the grate bars at the fire bridge, being open at the bottom, with forward projecting top piece and connecting sides, to which a front plate is attached. This plate extends laterally across the casing, and is inclined diagonally toward the top corner of the same, and is there provided with recesses, through which a current or sheet of air is connected and thrown forward to mingle with the fire gases for their more complete combustion.

Improved Dough Kneader and Cutter.

Frank Möckli, Galveston, Tex.—This invention is an improved instrument for rapidly and thoroughly kneading dough, and for scraping, rolling and cutting the same, and consists of a main part of U shape, with curved lower part and ends, which main part is used for kneading the dough, while a knife at the upper end serves for scraping and cutting. There is a roller at the lower end for rolling the dough, and suitable cutters applied at the sides for stamping out cakes. A handle at the inside of the lower end serves, in connection with the upper curved end, for the convenient handling of the instrument during kneading.

Improved Window Screen.

George F. Sarles, Bedford Station, N. Y.—This invention consists of an arrangement of the sash in the window, so that the net can be used at the top or bottom of the window, and shifted from one to the other without interfering with the sash.

Improved Plumber's Joint.

Isaac F. Van Duzer, Middletown, N. Y.—A T coupler, of lead, joins a branch to the side of a pipe. It has a groove along the top to receive the side of the pipe in it, and a hole through the center, at right angles to the groove, for the pipe. The couplers are made of lead, so as to slip on the pipes easily to form the basis of the joint. They are fastened by solder, overlapping them at the edges, and flowing in between the parts at the joints, and into the holes, if necessary.

Improved Planter.

Charles D. Wilson, Kentland, Ind.—This invention is an improvement in a well known class of seed planters, and relates chiefly to the arrangement of a toothed disk or wheel in the hopper, above the apertured seed dropping wheel, and on the same shaft therewith. The face of the toothed wheel has projections or teeth attached to it, which are struck by the projections attached to the seed wheel, so that the seed may be dropped by the advance of the machine.

Improved Sagger.

Benjamin Jackson, Geddes, N. Y.—This invention relates to improvements in saggers employed in the process of backing or burning crockery ware, for the purpose of protecting the ware from the direct action of the fire and the injurious products of combustion. The invention consists in constructing a sagger with a series of internal vertical ribs or bars permanently attached to the walls of the same, and provided with notches. The latter are adapted for the reception of detachable pins, designed to support the ware to be burned.

Improved Nail Plate Feeder.

William H. Field, Taunton, Mass.—For the purpose of inserting the nail plate into the nippers, at the front end of the nipper rod, the attendant works a treadle, releasing a spring clutch and throwing the main shaft out of gear. The nipper rod is simultaneously carried back by its handle. The action of a wedge piece on the nippers causes their opening, and allows the ready insertion of a new nail plate in place of the one fed to the cutters. The V-shaped form of collar admits of the opening of the nippers whether the bar levers are in the upper or lower position, so that no time is lost in adjusting them. The treadle is then released, the spring clutch engages instantly the main shaft, and the weight carries the nipper rod and nail plate forward, and feeds the latter to the cutter knives. The intermittent rotary motion of the nail plate, required for giving the same a semicircular turn for the regular cutting of the tapering nails in alternate direction, is obtained by suitable mechanism.

Improved Water Wheel.

Nelson Conner, Jalapa, Ind.—This invention consists of a double wheel, comprising a horizontal wheel, receiving the water at the periphery and discharging it at the center for the upper portion. Another wheel below receives the water at its center from the upper wheel and discharges it at the periphery. The two wheels are contained between top and bottom horizontal disks, and separated, the one from the other, by a flat annular rim a little wider than the depth of the buckets. It is fitted at the outer edge with the bottom plate of the scroll case, to form a joint to confine the water to the upper wheel as it enters from the chutes. The buckets of the lower wheel are arranged to discharge the water in the contrary direction to that in which it is received on the upper buckets, and in a manner to receive the reactionary force, while the upper ones receive its direct action.

Improved Fence Rail Holder.

John W. Graham, Prairie Depot, O.—This invention relates to means whereby the rails or longitudinal boards, which are usually affixed by nails or other fastenings to fence posts, may be spaced at exactly the intervals desired and in a corresponding manner on all the panels. The invention consists in a rail gage constructed and put together in a novel and peculiar manner..

Improved Railroad Car Brake.

William L. Belt, Little Rock, Ark.—This invention relates to means for operating the brakes of a train of cars from the engine, and consists in combining, with the ordinary vibratory brake lever, a grapple and three rods arranged in a novel and peculiar manner, whereby the brakes are brought into operation the moment the power is applied, without waiting for the cars of the whole train or any two of them to come together.

Improved Lifting Jack.

Maxwell B. Henry, East St. Louis, Ill.—The lifting bar has ratchet teeth on opposite sides, and is worked up and down in a vertical stand or frame by means of a lever, to each arm of which are applied a sliding rod and a pivoted pawl. The rods are flattened and bent near the inner end to form springs, which enable the pawls to yield and slide over the ratchet teeth The rods can also be used to hold the pawls out of engagement with the ratchet bar when the latter is to be lowered.

Improved Commercial Register.

Caleb D. Weeks, New York city.—This invention consists in a commercial register consisting essentially of a series of supply chambers, each having a spiral channel way extending from top to bottom thereof, a series of oppositely perforated and guide tubes, slide tubes, a receiving chamber, a conducting tube, a tilting bottom, cords, and lock box, all combined in a novel and peculiar manner, to serve as a check upon clerks or employees in stores or other places of business.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 24 to May 6, 1874, inclusive.

Agricultural Implement.—A. McMartin, New York city.
Air Engine.—W. Manson, San Francisco, Cal.
Alkali Package.—B. T. Babbitt, New York city.
Anchor.—J. T. Fewkes, Philadelphia, Pa.
Brake and Signal.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), London, Eng
Burnishing Photographs.—J. P. Bass, Bangor, Me.
Combination Lock.—W. F. Rutter, Philadelphia, Pa.
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Extension Table.—F. Osgood, Boston, Mass.
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Ignition Fuse.—W. A. Leonard, Boston, Mass.
Inhaler.—E. R. Gardner, New Bedford, Mass.
Label.—H. Van Geasen, New York city.
Loom.—W. Nuttall *et al.*, Westerly, R. I.
Metallic Cartridge.—H. Berdan, New York city.
Molding Concrete Pipes.—J. W. Stockwell, Portland, Me.
Petroleum Furnace.—L. C. d'Homergue, Brooklyn, N. Y.
Separating Flour, etc.—J. T. McNally, Brooklyn, N. Y.
Sewing Machine.—G. H. Bishop, New York city, *et al.*
Shot Cartridge.—A. B. Kay *et al.*, Newark, N. J.
Sirup Jug.—G. M. Irwin, Pittsburgh, Pa.
Spade Bayonet, etc.—F. Chillingworth, Springfield, Mas
Spark Arrester.—H. G. Holmes, New York city.
Squib, etc.—S. H. Daddow, St. Clair, Pa.
Transmitting Motion.—O. M. Chamberlain *et al.*, New York city.

NEW BOOKS AND PUBLICATIONS.

Compound Engines. Translated from the French of A. Mallet. No. 10 of Science Series. 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

Report on the Determination of the Astronomical Coördinates of Cheyenne and Colorado Springs, made during the Years 1872 and 1873, by First Lieutenant George M. Wheeler, Dr. F. Kampf, and J. H. Clark, Civilian Astronomical Assistants. Washington: Government Printing Office.

Lieutenant Wheeler characterizes this elaborate volume as a step in the direction of uniformity of plan in the prosecution of astronomical work in the western interior; and for this reason, and on account of the value of the observations and calculations, we are pleased to know that it is to be distributed among the officers engaged in making explorations.

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Answers to Correspondents

A. B. E. L. will find directions for making vinegar on p. 58, vol. 30. Eggs can be preserved by the process described on this page. This also answers L.—G. M. will find a recipe for dyeing silk black on p. 89, vol. 26.—H. C. H. can tin cast iron by the process detailed on p. 212, vol. 26.—J. B. E. should try a quick drying oil paint for his varnished thread.—J. F. should read our article on p. 64, vol. 30, on "Indicating Steam Engines."—A. R. and F. H. should address such queries to engine manufacturers.—C. M. can transfer engravings to metal by the process of transferring to wood, detailed on p. 198, vol. 30.—L. E. B. will find a description of a bone fertilizer on p. 193, vol. 29, and p. 163, vol. 30. For mills see our advertising columns.—L. M., E. W. M., and C. H. F. will find the particulars of the offer of a premium for a car coupling by the German railway confederation on p. 162, vol. 29.—C. A. S. can mold rubber by following the directions on p. 283, vol. 29.—X. L. C. R. S. T. should send his name and address.—H. & B. will find a recipe for aquarium cement on p. 90, vol. 30.—R. F. will find directions for constructing a sun dial on p. 409, vol. 30. A sun dial shows solar time, which must be corrected for mean time by the fast and slow tables published in most almanacs.—H. B. B. will find directions for exterminating ants on p. 234, vol. 27.—G. E. F. should consult the booksellers who advertise in our columns.

M. E. T. asks: Is the force of the powder destroyed by putting tissue paper between the ball and the powder? A. No. 2. What is the *modus operandi* of loading a pistol and catching the ball in the teeth? A. A peculiarly constructed pistol is used. 3. Would an invention for coupling freight cars when standing on the top of the car be of use? A. There is always room for a valuable improvement in any department.

J. S. F. asks: Ought there to be any difference in the capacity for pulling between two locomotives, one having a 24 inch and the other a 20 inch stroke, the cylinders being of such diameters as to contain the same number of cubic inches, the valve motion in each being proportional to the stroke, but being alike in every other particular? A. Yes, if steam pressure, piston speed, and other particulars were the same in both engines.

J. S. asks: What is the best non-conductor of magnetism? A. An interval of space.

W. P. says: I have a boiler 24 feet × 42 inches. Water is supplied by an injector. I wish the water to go into the boiler hotter; it takes 50 lbs. of steam to keep up a supply of water. Would it be practicable to run the water from the injector through a coil into a heater, thence to the boiler, and would it require more steam, or would the heater aid the injector? A. Your injector cannot be in very good order, if it will not work with a lower pressure of steam. You do not send enough data to enable us to answer your question definitely. If the use of the heater causes additional back pressure in the engine, it will be a question, to be determined by experiment, whether the heater is economical or not.

J. H. K. asks: How can I estimate the pressure of a column of water 25 feet high? A. Divide the head of water in feet by 2.3, and the result will be the pressure in the base in pounds per square inch.

W. C. S. asks: 1. In the bursting of a steam boiler, where the top of the boiler is thrown off, does all the water instantly flash into steam? If not, does the water that remains in the boiler instantly cool down to 212° when the pressure is removed? A. A large portion of it would suddenly be converted into steam, which might carry off the remaining water mechanically. 2. What is the temperature of water in a boiler working under average pressure? A. Between 300° and 350° Fah.

B. R. K. asks: Where and by whom was the first steamboat made? A. There are authentic accounts of experiments with small steam vessels in Europe, as far back as 1698. The first practical steamboat, on the authority of Mr. Woodcroft, was the Charlotte Dundas, built by Symington of England, in 1801. Regular steam navigation, that is, the running of a steamer regularly, carrying passengers and freight, was effected in America in 1807, by Fulton, and in England, in 1812, by Bell. You will find these facts, and many others of interest in this connection, impartially stated, and in general well authenticated, in Woodcroft's "Sketch of the Origin and Progress of Steam Navigation."

F. H. asks: Why is a common flat iron called a sad iron? A. Possibly from an old north of England word "sad," applied to anything heavy.

B. asks: How can spiral steel springs made of bars ⅛ an inch square be galvanized without destroying the temper? What would be the result of hardening the springs before galvanizing, and upon withdrawing them from the galvanizing bath and plunging them into cold water? Would this harden them if not previously hardened, the heat of the galvanizing tank being probably under 700° Fah.? Could the temper afterwards be drawn to the requisite point, and if so, by what process? A. We think the best plan would be to plate them by means of a battery.

B. W. asks: Can you inform me how Philadelphia ice cream is made, and why it is different from Boston ice cream? A. The difference is due to the fact that genuine Philadelphia ice cream is made out of the purest and richest materials.

J. B. E. asks: How can I dye ivory and get a nice clear red color? A. Use bichloride of tin for the mordant. After having steeped the ivory in this a short time, immerse in a hot solution of Brazil wood or cochineal.

E. H. M. asks: How are toy balloons made? Are they of india rubber or gun cotton? A. The rubber bags are imported from Paris, and they are merely filled here with pure hydrogen.

E. L. asks: How can I prepare paraffin which melts at a temperature of from 95° to 100° Fah.? A. By removing in the course of the distillation those hydrocarbons of the paraffin series which have a lower melting point.

J. B. H. asks: 1. Is there any cure for hydrophobia? What is the best thing for a person to do when bitten by a mad dog? A. The victims are commonly treated by dosing with whisky. 2. What can I do with my dogs to prevent them from going mad? A. Tie stones around their necks and put them under water.

B. & S. say: We are running a 10×18 inches engine at 220 per minute, with a tubular boiler 12 feet long and 52 inches in diameter. The average pressure of steam by gage is 80 lbs. We take the steam from a cast dome with a safety valve on top; the orifice in boiler for dome is 5 inches in diameter, the steam supply being 2¼ inches. The boiler foams very much, running mud and dirt through engine, cutting valve, valve seat, and cylinder rings out in a few days' run. One party says that if we put on a steam dome 24 inches in diameter and take steam from that, it will obviate the difficulty. Is this so? Another says that a surface blow-off will be all that is needed. A. You do not send quite enough data. It would seem, however, that the orifice in the boiler for the dome is too small. We think it quite probable that a larger dome, properly connected, would remedy the trouble to some degree. But we think it would be desirable for you to get a feed water heater (of which there are several in the market) that will remove the greater part of the dirt from the water before it goes into the boiler.

W. F. S. asks: Which is the best form, for accuracy, for the inside of a spirit level tube? Should it be a right line or a curved one? A. It is necessary that the tube should be curved.

E. W. S. asks: Will you give me the philosophy of "blowing up"? If a person lies down on his back, upon the floor, holds himself perfectly stiff, crosses his hands so as to get his arms out of the way, and inhales all the air he possibly can: and three, four or more persons stand around him and at a given signal all raise their arms and take a full breath, then lower their arms, at the same time expelling all the air from their lungs upon the person lying upon the floor: with their index finger they can quickly raise him as far as they can reach. A. We think that the blowing up process is chiefly efficacious in making all the lifters act in unison. It must be evident that if four persons lift a man, each one sustains about one fourth of the weight upon one finger; so that, if this weight is not perceptible, it would seem to be due to the imagination.

N. F. A. asks: What is the best for a person to read for general improvement? A. It would be well for you to get a reliable cyclopedia, which will be a very good work for you to read, for useful information. You will find in it replies to most of your other questions, which are quite similar to many that have recently been answered in our columns.

S. H. asks: 1. What should I read besides the SCIENTIFIC AMERICAN in order to know what has been invented or discovered in any particular line? A. The patent records of different countries. 2. Is there a reward offered for plans to improve the mouth of the Mississippi? A. No. 3. Suppose that a pair of birds were placed so that they could not see other birds of their kind. Would such birds build nests like their parents? If so, what is the philosophy of such knowledge? A. They would. The philosophy of their action we cannot explain. 4. Can iron be melted by sun glasses? Why are not such glasses more in use for heating purposes? A. Yes, but it is not generally a convenient method. 5. What will prevent magnets from attracting iron? A. We do not know of anything. 6. Will magnets wear out? A. Yes.

C. S. A. asks: 1. Which is the stronger, wire rope or the same weight of iron made into a solid rod of the same length? A. The former. 2. Is there any substance that will make more gas, at a less cost, than ordinary blasting powder? What will make the most gas in the shortest time? A. These questions are too indefinite.

E. asks: Why are gunpowder engines not in general use? A. Gunpowder engines are too expensive to run to compete successfully with steam engines.

F. H. T. asks: Is there a substance (produced in making gas from coal) which is somewhat like lime and is composed in a great part of carbon? A. No. 2. Is there a process for plating steel on cast iron? A. We never heard of any.

J. H. A. asks: Is there any law that requires a man who runs a steam fire or stationary engine to have a certificate? A. There is no United States law. Most States, however, have local laws on the subject.

F. C. S. asks: What examination must a person pass to get a license to run an engine? I have made the steam engine a study, and feel convinced that I could run one and take good care of it, but I hear that examiners often try to confuse young applicants. A. The laws vary somewhat in the different States. But so far as we know, the examination required for license to run a small engine relates principally to the care and management of the boiler.

P. S. S. asks: Is Cornell University a good school for mechanical engineers, and, all other things being equal, would it be more advantageous for me to go there and study for a mechanical engineer than to enter some first class machine shop? A. You will need instruction at such a school, and practice in the shops also. We think it would be well for you to take such a course first.

J. M. asks: Are there any high pressure engines on steamers running between Liverpool and New York city? A. No.

W. S. D. says: How can I make a glass globe into a globe mirror? A. Melt together 1 oz. clean lead and 1 oz. of fine tin in a clean iron ladle; then immediately add 1 oz. bismuth. Skim off the dross, remove the ladle from the fire, and before it sets add 10 ozs. quicksilver; now stir the whole carefully together, taking care not to breathe over it, as the fumes of mercury are very pernicious. Pour this through an earthen pipe into the glass globe, which turn repeatedly round.

J. B. S. says: 1. I have a four inch whistle, which, when set at its highest pitch, does not give satisfaction. I propose to put a trumpet on it; of what material should it be made? Will galvanized iron do, or tin, if painted? A. Galvanized iron will answer, but the best material is brass. 2. Should the small end be closed? A. By all means close the small end. 3. How close around the whistle should it fit? A. If we fully understand your question, the closer the fit the higher will be the pitch.

H. P. asks: Why is it that pork shrinks from the bone when boiled, if it is killed in the decrease of the moon? A. This is a popular fallacy.

J. R. L. asks: Would it be practicable for an amateur tourist in a trip around the world to use to advantage photographic implements and materials, instead of sketching, for the purpose of securing pictures of the objects of interest and beauty he might meet? Would it require special care and arrangements to adapt such pictures to the stereoscope? A. There is a great number of amateurs, who travel to every part of the world and take excellent photo pictures, and that too with all their apparatus contained in a box no larger than a small valise.

R. A. asks: Is water an element in a scientific sense? If not, what combination is it? A. Water is a compound of two elements, oxygen and hydrogen, in the proportion of 8 parts by weight of oxygen to 1 part by weight of hydrogen.

W. D. S. asks: 1. How can I make the green and the gold lacquer with which they lacquer clocks, and how is it applied? A. For gold lacquer, take of seed lac 6 ozs., amber and gum guttæ, each, 2 ozs., extract of red sandal wood in water 24 grains, dragon's blood 60 grains, oriental saffron 36 grains pounded glass 4 ozs., pure alcohol 36 ozs. Grind the amber, the seed lac, gum guttæ, and dragon's blood on a porphyry; then mix them with the pounded glass, and add the alcohol (after forming with it an infusion) and extract of sandal wood. The varnish must then be completed as before; the metal articles are heated, and those which will admit of it are immersed in packets: the tint of the varnish may be varied by modifying the doses of the coloring substances. For green, use any green transparent vegetable color, mixed with the above. 2. With which cement can I mend glass ware? A. Use diamond cement. 3. What mixture can I use to stop cracks in walnut furniture? A. Take equal parts of beeswax and sealing wax and mix them by melting them together, or dissolve in alcohol. Color with umber. 4. How is the gilding done on toilet sets and on furniture? A. Use yellow shellac varnish in the desired pattern, upon which lay the gold leaf.

C. H. M. asks: Which is the healthiest State in the Union? A. That State in which the greatest regard is paid to religion, law, and education. In respect to physical advantages, most are in the first rank.

G. D. F. says: Water boils at the sea level at 212°. Here in Argenta, Montana Territory, it boils at 200°. Does the altitude affect the degree as marked on the thermometer, or is it the pressure of atmosphere only which affects the boiling? A. Water does not boil until the tension of the vapor formed by heating it is greater than the atmosphere's pressure. At the sea level, where the pressure of the atmosphere is about 15 lbs. per square inch, the water must be heated to 212° before its vapor has sufficient tension to overcome this pressure. At Argenta, where you are so much above the sea, and have a much less depth of atmosphere above you, the pressure is not so many pounds, and the boiling point is correspondingly lower.

H. W. G. says: 1. Please give me the analysis of crude carbolic acid or dead oil. A. Carbolic acid consists of 12 atoms of carbon, 6 atoms of hydrogen, and 2 atoms of oxygen. The less volatile portion of the fluids produced by distillation of coal tar contain considerable quantities of this substance. It may be extracted by agitation of the coal oils (boiling between 300° and 400°) with an alkaline solution. The latter, separated from the undissolved portion, contains the carbolic acid in the state of carbolate of the alkali. On addition of a mineral acid, the carbolic acid is liberated, and rises to the surface in the form of an oil. To obtain it dry, recourse must be had to digestion with chloride of calcium, followed by a new rectification. If required pure, only that portion must be received which boils at 370°. Commercial carbolic acid is generally very impure. Some specimens do not contain more than 50 per cent of acids soluble in strong solution of potash. The insoluble portion contains naphthaline, fluid hydrocarbons, and small portions of chinoline and lepidine. 2. Are there any fertilizing properties in it, and if so in what proportion? A. We have never heard of its use as a fertilizer.

J. J. asks: If there is any substance that can be used as a flux in melting iron, that will answer as a substitute for limestone? A. Other substances, like caustic soda or fluor spar, can be used, when certain objects are to be obtained.

L. H. says: On p. 267, vol. 20, one per cent of carbolic acid is recommended for removing green moss from brown stone stoops. How much is that to a quart of water? I have a house with white marble stoop, sills, etc. Will the above remove the discolorations, also the iron rust? A. Seventy-five grains to a quart. It will partly remove the discolorations, but not the iron rust.

J. R. S. asks: Can you tell me how glass is made for a microscope? Can I melt and pour it into a mold? A. You could not make a lens suitable for optical purposes by melting glass and pouring it into a mold. Glass for such purposes has to be of wonderful uniformity of structure, and ground with exquisite care.

R. I. B. asks: 1. How can I dissolve common India rubber and then restore it to its former hardness? A. Cut 2 lbs. of caoutchouc into thin, small slices; put them in a vessel of tinned sheet iron, and pour over 12 to 14 lbs. of sulphide of carbon. For the promotion of solution, place the vessel in another containing water previously heated up to about 86° Fah. The solution will take place promptly, and the fluid will thicken very soon. 2. Is there any chemical that will curl human hair without injuring it? A. We do not know of any.

A. C. R. asks: 1. Is electricity instantaneous? A. No. Its velocity is 288,000 miles per second. 2. If two bodies, one heavy and one light, are dropped from a tower or any high point, which of the two will strike the ground first? A. If the bodies are the same in exterior size, the heaviest body will first strike the ground.

J. G. asks: 1. How can I make an electrical condenser? A. With sheets of tinfoil. They are fastened on two sides of a band of oiled silk, which insulates them, forming thus two coatings; they are then coiled several times round each other, another band of silk being interposed between them. 2. How is the induction coil connected with it? A. One of these coatings, the positive, is connected with the binding screw which receives the current on emerging from the primary wire; and the other, the negative, is connected with the binding screw which communicates with the commutator and the battery. 3. In Mr. A. Ladigain's electric lamp, with only 1 carbon point, what gas does he supply after having exhausted the air from the tube? A. Pure hydrogen will answer. 4. If I connect one wire from the machine with the carbon, what must I do with the other wire? It stands to reason the current will not flow if the circuit be not complete. A. Connect your wires to either end in such a manner that the carbon completes the circuit with both poles of the battery.

G. S. T. says: I recently found that a lightning rod vendor was using for conductors tubes made of corrugated thin sheet copper, and that he attached them to buildings by nailing strips of sheet zinc around them instead of passing them through glass insulators, claiming that, though glass when dry might be so used, yet when wet, it was of little value and not to be relied on. Is this so? A. Insulators are of no use. The method of attachment described is correct. The important thing in applying a lightning rod is to have a large extent of conducting material at the base or terminal of the rod to the ground. See reply to another correspondent last week.

G. C. R. asks: How are the aniline colors said to be procured from coal tar made? A. Coal tar colors are made from aniline, carbolic or phenic acid, and napthaline, bodies obtained directly or indirectly from the distillation of coal. The reds, such as magenta, are obtained by the action of bichlorides of carbon, tin, or mercury on aniline, and the purples, such as mauve, by the action of oxydizing agents, as bichromate of potassa.

S. G. Jr. asks: How is the beautiful crystalization upon water coolers and on brass mathematical instruments produced? A. By exposing the metallic surface for a few moments to nitric acid.

G. E. P. asks: How can glucose be distinguished from cane sirup? A. The easiest method is by the saccharimeter.

B. W. M. asks: 1. What is the alloy for white metal for harness castings? A. Melt together 1 lb. brass, 1½ ozs. spelter, and 1 oz. tin. Your other question is illegible.

J. E. L. asks: What will keep Russian iron from rusting and becoming discolored during the summer season? A. Immerse in a strong solution of carbonate of soda, out of contact with air. Or coat thoroughly with black lead and keep in a dry place.

D. asks: What colored veil will afford the the best protection to the complexion? Of course an immediate solution would be furnished by a knowledge of the colors which intercept in the greatest measure the actinic or chemical rays of the sun. I know that yellow possesses this power pre-eminently, but as it is a hue which would scarcely be tolerated for the purpose of a veil, I would like to know whether there is any less vivid tint which could be used with similar effect. Blue must be particularly injurious, judging from the fact of its invariable use as a shade to photographers' skylights where the transmission of the actinic rays of the sun is absolutely indispensable. Please also state the effect of the gray veils now so much in use. A. The grey veils will probably serve as well as any for obtaining the object desired.

E. P. H. asks: Can you give a recipe for the manufacture of a sympathetic ink which will fade completely in a short time after being developed, and which cannot be re-developed? A. There is no ink fulfilling all these conditions.

O. F. M. says: I have set up a page of type and I would like to take a stereotype or electrotype plate from it. How shall I proceed? A. To stereotype: Paste together a piece of tissue paper and a piece of printing paper, and lay on the type (with the tissue paper next the metal) which must be well oiled. Cover the paper with a damp rag, and beat on to the type evenly with a hard brush; then add three other thicknesses of soft paper, pasted, and beat as before after adding each piece. Back up with stiff paper. Dry under a moderate heat, and take off the paper mold. You can readily arrange this mold for casting, but a metal matrix, properly constructed, can be cheaply obtained. To electrotype: Take a cast in plaster of Paris, brush plumbago into the matrix, and plate in a copper galvanic bath in the usual way.

A. B. asks: 1. Why does lime water, when breathed on, become opalescent and white, like milk? A. Because the breath contains carbonic acid, and the carbonic acid unites with the lime to form carbonate of lime or chalk. 2. What is photographers' paper made of, and why does it become black when exposed to the light? A. Because it is covered with a wash of chloride of silver, which blackens by exposure to the light.

S. asks: 1. What would be the temperature of a body in space, removed from the influence of the sun? A. The absolute zero is estimated to be —490° Fah. 2. How can common factory cotton cloth be rendered waterproof and transparent, to be used instead of glass for protecting plants? A. Try Canada balsam and rectified turpentine, equal parts. 3. Can chronic dyspepsia be cured? A. Yes.

G. S. B. says: I am constructing a machine in which I require to use an electric spark, and will have but a small place to spare on my machine for it. What can I use to give me a spark that I can conduct to the end of a rod on the principle of the electric gas lighter? I prefer something that will work promptly with very little friction, and that can be made cheaply. What two bodies brought in contact by friction will be cheapest and give the largest spark? A. Attach a shallow cup of brass on the under side to a copper rod of the required length; the end from which the spark is to be drawn should be sharpened down and tipped with platinum. In the cup place a smooth tight-fitting piece of hard rubber; for your movable disk use buckskins conveniently stretched and mounted. Fine oiled silk may be used in place of the buckskin. This answers both questions.

M. O. M. O. B. says: I wish to study mineralogy. What work would be the best for a beginner? A. Dana's "Mineralogy" is the standard work. See our advertising columns for booksellers' addresses.

L. says: 1. F. H. H. asks why does water form an exception to the law of contraction by cold. I would ask, does it? A. It contracts until the temperature has fallen to 39·4°, and then expands until it has reached the freezing point, and is converted into ice. 2. A stone jar filled with melted lard and kept until cold was found to be cracked from top to bottom. Was it the expansion of the lard, or was there a chemical or mechanical mixture of water sufficient to cause the bursting of the jar? A. The jar was cracked by the cause above named.

C. L. asks: What is the best method of preparing a composition for plating metals with gold? A: The best method is that of electro-plating. For plating without a battery, see p. 331, vol. 30.

A. W. M. asks: 1. What must be the length of the rafters of a house, so that the shingles may last as long as possible, the width of the house being 40 feet? A. About 28¼ feet will answer very well. 2. In a combination of movable pulleys, the inclination of the ropes being at any angle, required to find the power, the weight and the number of pulleys being given? It is understood that the ropes are not parallel, and that there is more than one pulley. A. In such a case the relation between the power and weight will generally vary at every position of the weight, since the angles of the cords will be continually changing. But the relation can be found for any position, by calculating the relative distances moved over by the power and weight for a slight displacement. 3. The area of the piston of a high pressure engine is 1,200 square inches, the length of stroke 8 feet, and the pressure of steam upon the square inch of the piston is 32 lbs., the number of strokes per minute being 18; required the number of cubic feet of water which the engine will raise from a mine 350 feet deep, the friction being 1 lb. per square inch *plus* the pressure of the atmosphere? A. You will find answers to this question on p. 64, vol. 30, on indicating steam engines, and on p. 48, vol. 29, on the friction of water in pipes.

G. S. D. says: A friend of mine bought a ring, with a stone in it called aquamarine. The stone is cut like a diamond and is very clear; it cuts glass, but not very well. What is the value of the stone? It is about the size of an ordinary white bean. A. The name of aquamarine is applied to a bluish green variety of beryl, on account of its resemblance to the color of the sea. If it is a genuine aquamarine, it ought to scratch glass readily.

W. B. P. asks: 1. How can I make a hydro-electrical machine? A. Use a small steam boiler, insulated from the ground by glass pillars. The steam is allowed to escape from a number of jets against a number of sharp metallic points. 2. Will such an apparatus make chemical decompositions? A. No. 3. Suppose I have a battery of copper and zinc, and instead of joining copper to zinc, I join copper to copper and zinc to zinc: would it not make a quantity current, joining in the usual way making an intense current? A. Yes. 4. Wind impedes heat and sound; will it impede light? A. It will not impede light. 5. How can I obtain oxygen from the oxide or sulphate of oxide of zinc? A. It could not be obtained from either in an uncombined state. 6. Would clay or brick be porous enough for the porous cup in a voltaic battery? A. No; besides, the acid would act on it. 7. If I nail the copper and zinc together on a piece of dried wood, would the battery work? A. Yes, by running a wire from one to the other so as to complete the circuit. 8. How can I make a crucible out of bone ashes? A. By compressing the bone ashes into a mold of the desired form. 9. In what number of the SCIENTIFIC AMERICAN was that recipe for mending rubber boots? A. See p. 203, vol. 30. 10. Will rubber tubes do to convey chlorine in? A. Yes, but they are rapidly decomposed. 11. Which will break the quickest by heat, thick or thin chimneys for lamps? A. Thick ones. 12. Can I prepare oxygen from the specimen I enclose? A. Your specimen is oxide of zinc. See answer to No. 5. 13. Are not chlorhydric and hydrochloric acids the same as muriatic acid? A. Yes. 14. Are potash and potassa the same, and their salts, such as chlorater of potassa and chlorate of potash, identical? A. Yes.

H. T. H. says: I have a roof covered with canvas that was painted several years ago. The paint is broken in many places, and I wish to remove the old paint. How can it be done without damaging the canvas? A. Use benzine.

N. P. L. says: I have an overshot water wheel which does not give as much power as I want. Can I put in an engine, and belt on to my main shaft to run with my wheel without having the speed of both regulated alike? Will the engine assist the power of the wheel without both running at the same speed? A. It would be better to arrange the engine so as to drive a portion of the machinery separately.

R. A. says: I am building stationary engines which are used for saw mills, etc., and I am troubled with their pounding. They strike hard on turning the centers. A. We could not tell you the remedy without a personal examination. An experienced engineer could readily find the trouble and the means of preventing it. 2. Can you recommend a good practical book on the construction of modern stationary engines adapted to saw and grist mills, etc.? A. There is no book published such as you speak of. It has yet to be written.

R. F. B. P. asks: Is a man who uses his right hand at end of the ax, shovel, or sledge hammer, and his left applied to the center of the handle, a right or left handed man? A. Right handed.

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

A. H. S.—Two are iron pyrites. One is copper pyrites.—C. S. & F. O. S.—It is magnetic oxide of iron.—H. M. F.—The little scales are kaolinite, which is a hydrous silicate of alumina.—A. S.—The stone is valuable for some purposes. It is found in quarries.—F. C. K.—It is galena or sulphuret of lead, and contains 87 per cent of lead.—J. S. N.—It is iron pyrites, and is not worth working as an ore of iron.—R. W. Z.—No. 1 is banded argillite or clay rock. No. 2 is micaceous oxide of iron. No. 3 is actinolite, a silicate of magnesia and lime.—W. F. S.—Partially decayed wood, covered with a variety of vegetable mold.—E. P. H.—It is a fine clay containing a large amount of hydrated yellow oxide of iron. It would probably repay you to have the numerical percentage of iron determined, as it would be necessary to do so before its market value could be determined. A. M. B.—It is fibrous selenite, which is a native crystalized sulphate of lime.—J. S. W.—It is a fine sand, and might be advantageously used in some cases as a polishing powder.—H. M.—It is not iron pyrites. It is blende or sulphuret of zinc.—J. D. W.—They are small crystals of quartz. When of large size and perfect, they are interesting as mineral specimens, and, when cut, are of some value as ornaments.—W. F. S.—No. 1 & 2 are very impure limestone. If polished, they might answer for ornamental purposes. No. 3 is a variety of pipeclay. No. 4 is gray clay.—W. P. B.—No. 1 is a variety of kaolin. No. 2 did not come to hand. No. 3 is crystallized carbonate of lime or calcite.—G. M. R.—No. 1 is greenstone. No. 2 is iron pyrites and galena. No. 3 contains blende or sulphuret of zinc. No. 4 is decomposed talcoid schist. No. 5 is carbonate of lime and iron. The last, if in sufficient quantity, might be used in iron manufacture.

E. F. T asks: How can I print on gelatin?—J. E. B. asks: What is the best stain for staining poplar cigar boxes?—H. M. G. asks: How can I smoke buttons?—S. V. asks: What will remove wall paper that has been put on with gum arabic dissolved in vinegar and copal varnish, without staining the paper?

COMMUNICATIONS RECEIVED.

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

On Eremacausis and Cremation. By H. H.
On a Curious Freak of Nature. By C.H.M.
On a Californian Chute. By J. J. G.
On the Sun's Attraction. By W. B.
On Gravitation. By H. B. W.

Also enquiries and answers from the following:

H. B. B. L. V.—J. F.—G. B. S.

Correspondents in different parts of the country ask: Who sells the best drawing instruments? Where can boys' chemical apparatus be obtained? Who makes card railway tickets, as used in Europe? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

May 5, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

29,500.—File Blanks.—N. C. Lewis. July 22.
29,502.—Pianoforte.—H. Lindeman. July 22.
29,510.—Iron Car.—R. Montgomery. July 22.
29,520.—Photo Camera.—A. Semmendinger. July 22.

EXTENSIONS GRANTED.

28,139.—Sewing Machine.—G. B. Arnold.
28,174.—Picture Hanging Molding.—H. Hochstrasser.
28,175.—Bayonet Frog.—W. Hoffman.
28,181.—Burnishing Boot Soles.—E. T. Ingalls.
28,184.—Mold.—H. Knight.
28,189.—Sugar Drying Machine.—A. W. J. Mason.
28,198.—Cultivator Teeth.—D. B. Rogers.

DISCLAIMERS.

28,139.—Sewing Machine.—G. B. Arnold.
28,184.—Making Cement Pipe.—H. Knight.

DESIGNS PATENTED.

7,411.—Ornamental Vase.—J. W. Fiske, New York city.
7,412.—Hooks.—M. D. Jones, Boston, Mass.
7,413.—Shelf Bracket.—M. D. Jones, Boston, Mass.
7,414.—Coffin Plate.—W. Parkin, Taunton, Mass.
7,415.—Range Front.—J. R. Rose *et al.*, Philadelphia, Pa.
7,416.—Monuments.—J. Sharkey, Brooklyn, N. Y.
7,417 & 7,418.—Jewelry Bases.—S. Cottle, N. Y. city.
7,419.—Saw Handle.—W. Millspaugh, Middletown, N. Y.
7,420.—Coffin Plates.—T. E. Wood, Portsmouth, N. H.

TRADE MARKS REGISTERED.

1,760.—Leather Restorer.—B. F. Bache & Co., Bristol, Pa.
1,761.—Satinets, etc.—A. G. Dewey & Co., Hartford, Vt.
1,762.—Spectacles, etc.—Fellows *et al.*, New York city.
1,763.—Hams, etc.—Guthrie & Co., Louisville, Ky.
1,764.—Flour.—Hensley & Co., Leavenworth, Kan.
1,765.—Orange Bitters.—I. I. Hite, Mellonville, Fla.
1,766.—Printing Presses.—B. F. Renick & Co., Canton, O.
1,767.—Whisky.—Sattler & Co., Baltimore, Md.
1,768.—Mustard.—C. L. Stickney, New York city.
1,769.—White Lead.—J. Alston & Co., Chicago, Ill.
1,770.—Plows.—B. F. Avery & Sons, Louisville, Ky.
1,771.—Soap.—J. Oakley & Co., New York city.
1,772.—Bonnet Boards.—T. S. Scott, Philadelphia, Pa.
1,773.—Cutlery.—F. Wiebusch, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

List of Patents Granted in Canada, May 4 to May 11, 1874.

3,399.—T. P. Billington, Dundas, Wentworth county, Ont. Improvements on farmer's horse power, called "Billington's Improved Farmer's Horse Power." May 4, 1874.

3,400.—G. Bolton, Arnprior, Renfrew county, Ont. Improvements on farm gates, called "Bolton's Improved Balance Gate Attachment." May 4, 1874.

3,401.—A. Margrett and C. H. Moffatt, Orillia, Simcoe county, Ont. Machine for operating the opening and securing of window sashes, called "Margrett & Moffatt's Sash Fastener." May 4, 1874.

3,402.—H. H. d'Abrigeon, Montreal, P. Q.—Improvements on an apparatus for equilibrating millstones, called "d'Abrigeon's Adjustable Millstone Equilibrator." May 4, 1874.

3,403.—W. Todd, Portland, Cumberland county, Me., U. S. Improvements on self-locking car couplings, called "Todd's Car Coupling." May 4, 1874.

3,404.—T. Carpenter, Southampton, Hants county, Eng. Improvements on apparatus for supporting, lowering, attaching and detaching ships' boats, called "Carpenter's Boat Lowering Apparatus." May 4, 1874.

3,405.—T. J. Whitehead, South Paris, Oxford county, Me., U. S. Improvements on combined cooking stoves and hot air furnaces, called "Whitehead's Combined Cooking Stove and Hot Air Furnace." May 4, 1874.

3,406.—S. Taylor, Greenbush, and J. C. Towle, Bangor, Penobscot county, Me., U. S. Improvements on gages for edgers, called "Taylor's Improved Edger Gage." May 4, 1874.

3,407.—O. Thowless, Guelph, Ont. Improvements on window sash fasteners, called "Thowless' Window Sash Fastener." May 4, 1874.

3,408.—W. A. Hawthorn and E. E. Scott, Carson City, Ormsby county, Nev., U. S. Improvement on window fasteners, called "Hawthorn & Scott's Window Fastener." May 4, 1874.

3,409.—A. Crumbie, Brooklyn, Kings county, N. Y., U. S. Improvement on bakers' ovens, called "Crumbie's Improved Baker's Oven." May 4, 1874.

3,410.—William Manson, San Francisco, San Francisco county, Cal., U. S. Improvements on atmospheric power hammers, called "Manson's Atmospheric Power Hammer." May 4, 1874.

3,411.—D. W. Dake. Improvements on a machine and apparatus for working butter, called "Dake's Johnny Bull Butter Worker." May 7, 1874.

3,412.—R. D. Ewing, Toronto, York county, Ont. Improvements in furnaces, by which that class of coal known as slack can be more perfectly utilized as fuel, called "Ewing's Improved Furnace." May 7, 1874.

3,413.—H. B. Morrison, Le Roy, Genesee county, N. Y., U. S. Improvement on breast collars for harness, called "Morrison's Improved Breast Collar." May 7, 1874.

3,414.—O. B. Fuller, Newark, Essex county, N. J., U. S. Improvements in dough machines, called "Fuller's Sheeting Machine." May 9, 1874.

3,415.—J. S. and J. G. Armstrong, Ottawa, Carleton county, Ont.—Improvement in a spring seat for wagon and cars, called "J. S. & J. G. Armstrong's Wagon and Car Seat." May 11, 1874.

3,416.—E. W. Colley, St. Mary's, Perth county, Ont. Improvement in lamp burners, called "Colley's Improved Chimneyless Burner." May 11, 1874.

3,417.—T. S. Bayles, Hamilton, Wentworth county, Ont. Improvements in horse shoes, called "Bayles' Improved Horse Shoe." May 11, 1874.

3,418.—I. Brown, Baltimore, Md., U. S. Improvement to the steam engine, useful in obtaining a greater speed of its workings, and useful improvement as a steam engine circular saw mill for sawing timber and other uses, called "Brown's Steam Engine Circular Saw Mill." May 11, 1874.

3,419.—A. Myers, Salem, Marion county, Oregon, U. S. Improvements in metallic cases for turbine wheels, called "Myers' Improvement in Metallic Cases for Turbine Wheels." May 11, 1874.

3,420.—W. S. Hunter, Stanstead, Stanstead county, P. Q. Improvements on wooden soles for boots and shoes, called "Hunter's Improved Wooden Sole." May 11, 1874.

3,421.—H. L. Gooch, East Machias, Washington county, Me., U. S. Improvements on machines for sawing shingles, called "Gooch's Improved Shingle Machine." May 11, 1874.

3,422.—C. H. Smith, Faribault, Rice county, Minn., U. S. Improvements on machines for sawing wood, called "Smith's Railroad Wood Sawing Machine." May 11, 1874.

3,423.—M. C. Clark, Ingersoll, Oxford county, Ont. Improvements in bed springs, called "Clark's Improved Double Coil Bed Spring." May 11, 1874.

3,424.—J. L. Gregory, St. Louis, St. Louis county, Miss., U. S., assignee of W. Redheffer, Kansas City, Jackson county, Miss., U. S. Improvement in egg beaters, called "Redheffer's Improved Egg Beater." May 11, 1874.

3,425.—S. B. Scott, Montreal, P. Q. Improvement on variable speed motions, called "Scott's Improved Variable Speed Motion." May 11, 1874.

3,426.—F. W. Beckwith and P. Kyle, Merrickville, Grenville county, Ont. Improvements on washing machines, called "The Dufferin Washing Machine." May 11, 1874.

3,427.—F. Dangerfield, Merrickville, Grenville county, Ont. Improvements on washing machines, called "Dangerfield's Washing Machine." May 11, 1874.

3,428.—A. Carleton and W. F. Nufer, Whitehall, Muskegon county, Mich., U. S. Improvements in clothes racks, called "Carleton & Nufer's Improved Clothes Rack." May 11, 1874.

3,429.—A. Berry, Shefford Township, Shefford county, P. Q. Improvements on a machine for milking cows, called "Berry's Cow Milking Machine." May 11, 1874.

3,430.—G. Westinghouse, Jr., Pittsburgh, Allegheny county, Pa., U. S. Improvements on a machine for checking, retarding, and stopping railway locomotives, called "The Westinghouse Driver Brake." May 11, 1874.

Advertisements.

Back Page - - - - - - - - $1.00 a line.
Inside Page - - - - - - - - 75 cents a line.

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