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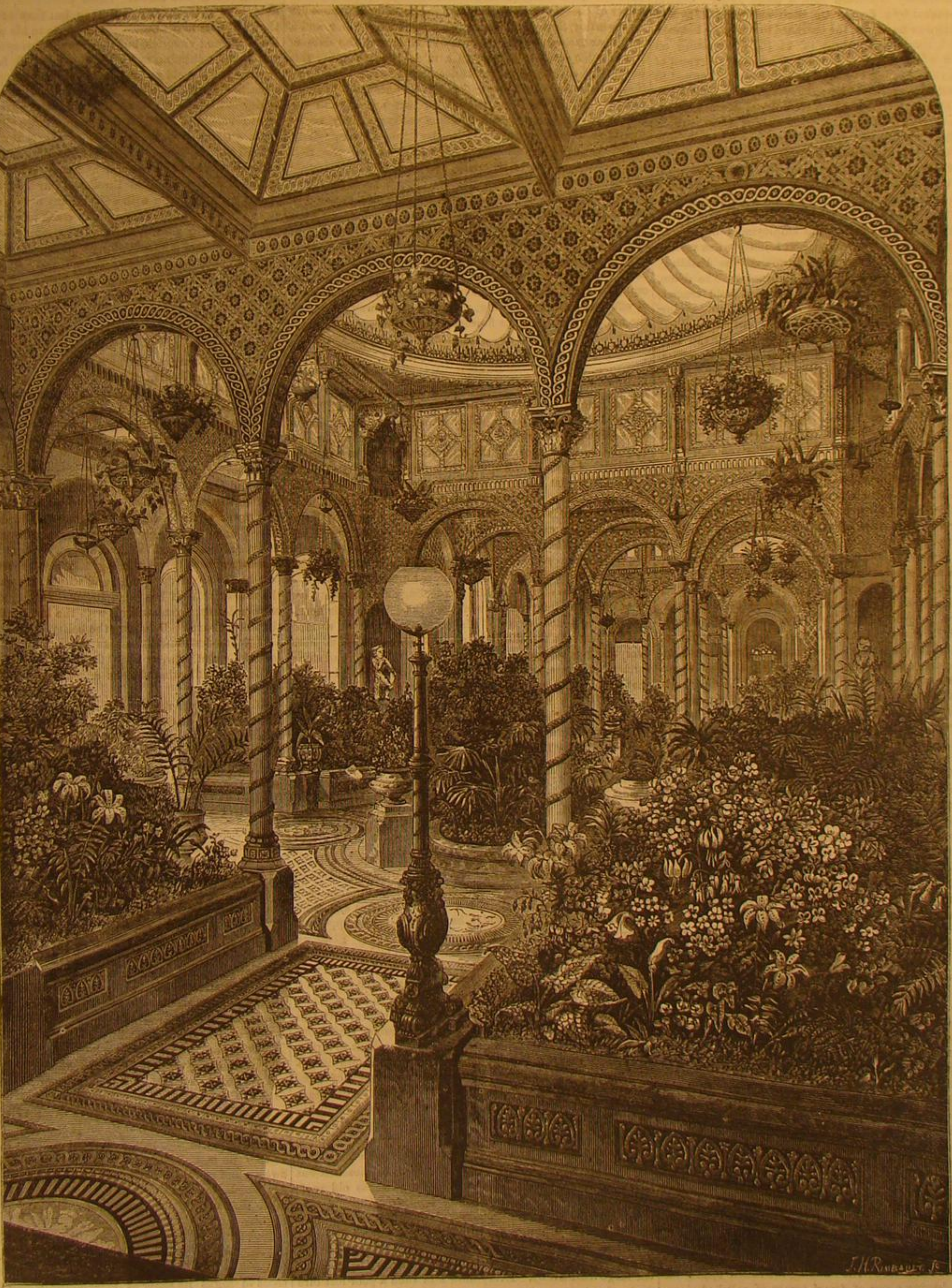
MR. BESSEMER'S CONSERVATORY.

But few iron structures have been hitherto attempted in which the architectural effect has not been more or less marred by the prominence given to large bolted flanges, tie rods, cross braces, or other like devices, which, however necessary in a structural point of view, certainly do not add to the beauty of the building, unless it be of the plainest or most utilitarian description. In the design we now lay before our readers, however, there are no signs visible by means of which the whole is put together; not one flange, tie, or bolt of any description being shown in the whole of the building, externally or internally. The castings have all been executed with a degree of care and beauty of finish rarely seen in any large work, and Messrs. Andrew Handyside, of Derby and London, have most fully sustained their high character as founders, in the execution of the work intrusted to them. The original plan, we understand, was made by Mr. Bessemer, and the details worked out under the able superintendence of Messrs. Banks and Barry. Many of the perforated castings employed in this structure, are of extreme beauty



BESSEMER'S CONSERVATORY. ENGLAND.

and delicacy of finish. Among the heaviest are some from three to four tuns in weight each, while there are thousands of others not exceeding four or eight ounces.

The conservatory has two floors or crypts, extending entirely beneath it. The lower one receives a supply of fresh air through a perforated stone screen facing the grounds, and forms the cold air chamber. Above this is a second space of equal area, divided from the lower one by a stone floor. The upper space contains a coil of ten pipes of 4 in. diameter, the coil being about 100 ft. in circumference, and giving over 1000 square feet of heating surface. The ceiling of this upper or hot-air chamber is covered by 5 in. York flags, laid on rolled iron beams. On the upper surface of these flags the tesselated floor of the conservatory is laid. Ten large slide valves (all connected by a rack and pinion) admit cold air from the chamber below at equidistant parts to the surface of the hot water pipes. After passing over and among these pipes, the air enters the conservatory through numerous perforated brass panels, in such quantities as may be desired. Massive brick piers pass through these floors, and support the sixteen columns on which the upper part of the structure rests.

The conservatory is formed with a large square central area surmounted by a dome. On each side of the square there are bays or transepts, the entrance to which is beneath three arches, rising to a height of 14 ft., and resting on columns, of which there are sixteen. The dome is formed of rolled iron ribs, meeting together in the center and united to a large pendant perforated boss; the ribs (40 in number) are separated by extremely light iron ornamental casting, forming a framework which is glazed with stained glass, which encircles the dome in three distinct bands; exterior to this stained glass is a plate-glass covering, each plate being curved to the true shape of the dome; the plates are each 7 ft. long, the joints so arranged as to be rendered invisible behind the stained glass panels; the glass is ground on both sides, and embossed in a bold trellis pattern, giving to the whole a most beautiful effect. The employment of ground glass for the dome gives it an apparent solidity when viewed externally from the terrace that surrounds the building, which much increases its architectural beauty. The dome, which is 40 ft. in hight, rests on a series of bold trusses, springing from the sills of the upper windows, and forming a division between them; these trusses are perforated on all sides, and are highly ornamented. The ceiling of the central part surrounding the dome is formed into deep soffits, each filled with elaborately designed perforated gilt panels, with an azure background formed by the flat iron roof above them. In the upper part of the central space there are six windows on each side, each one composed of a single sheet of ground plate glass, engraved and painted in pale tints. These windows all open by an ingenious contrivance worked by an attendant from the cold-air chamber below, which is sufficiently lofty to admit of ready access.

The iron columns have a spiral groove running around them, in which small spheres are fitted, by stringing them on a copper wire, giving an effect which simple casting could never accomplish; these spheres are all gilt, and give to the fresh gray tint of the columns a great relief; the capitals are all built up with separate acanthus leaves of very light and elegant form, and are also gilt. The arches, which rest on these columns, are all double castings, placed back to back, and are most exquisitely molded in a perforated pattern, through which the light falls in ever varying clusters of rays as one walks about the conservatory. There are thousands of rosettes on these perforated screens, all cast separately, and screwed in place, so as to get a bold relief, well undercut, an effect which founding in mass could not have.

The external walls are pierced with large circular-headed windows, glazed with a single sheet of plate glass, with a small Greek border etched around the edge, and narrow margins of colored ground glass of a soft gray tint etched in patterns. The walls are entirely incased with polished marble in pieces so large as to show no joints. A richly-molded architrave of red Devonshire marble surrounds each window and door, and relieves by its warm color the spaces between the windows, which are of dark Bardillo marble, against which are placed three-quarter columns of white veined Sicilian marble. The shafts of all twenty-four columns and the angle pilasters are 10 ft. in length, each in a single piece, and surmounted by capitals carved in white Carrara marble. Above these is a rich entablature of veined Sicilian marble running over the Bardillo, which is ornamented over each window and door, with a rich incised pattern of arabesque scroll work gilt in all the sunk part. The whole of the marble work was executed by Mr. Hartley, of Pimlico. One bay or transept forms the end of the adjoining drawing room, having two glass doors and a window between looking into it. It is from this window that the view was photographed which we have engraved. The right-hand bay abuts on a billiard room, having a central door and two large windows looking into it; and opposite to this are two similar windows, and a central door leading on to a raised terrace, 90 ft. in length, paved with squares of black and white marble, and extending all along the garden front of the house. The fourth bay is also divided by three equal arches, in each of which there are mirrors of 14 ft. high by 7 ft. wide, passing down below the floor line, and thus continuing the pattern of the pavement. These mirrors are silvered by a deposit of pure silver, and are not easily injured like those coated with tin-foil and mercury. They are kept warm at the back by a hot-air chamber, which prevents any deposition of moisture on them; they thus, at all times, reflect clearly the whole interior of the building, giving it apparently double its real size. Around the sides of the building are raised spaces for the flowers, having a sort of dwarf screen of polished dove-colored marble, in which are numerous gilt brass panels for the supply of warm air from the chamber below. In the central space beneath the dome is a large basin, richly molded in beautiful veined Bardillo marble, with four pedestals of the same material at the angles, which serve to support vases of white marble, containing some beautiful specimen plants. The basin is filled with rare exotic ferns, and has a fan palm in the center. Eight similar marble pedestals are also formed in the dove marble screen before named, on which are some choice specimens of Majolica vases by Minton, and two from Sèvres, and containing rare plants. Pendant from the ceiling are six Majolica flower baskets containing choice ferns and other drooping foliage. There are also eight suspended Roman lamps in bronze, with lotus leaves forming clusters of flowers in gas jets, and also four other suspended Roman lamps of classical design, giving in all eighty gas burners, by means of which the whole building may at night be brilliantly illuminated; there are also near the drawing room door a pair of exquisitely chased bronzed candelabra, which on ordinary occasions give sufficient light for walking in the evening. The floor is composed of encaustic tiles and tessera tastefully arranged in panels of quiet colors (so as not to interfere with the brilliant colors of the flowers). In this design are embodied mosaics representing Spring, Autumn, Summer, and Winter, and a fifth near the entrance represents Old Time with the date of the erection of the building on a table beneath him; this beautiful floor was erected from designs prepared by Messrs. Simpson, the London agents for Maw's encaustic tiles; at each of the four angles of the central part are life-size figures of boys executed in biscuit china at Sèvres, they represent Love, Pleasure, Folly, and Repose; they are exquisitely modeled, and of a pure white, standing against the rich crimson background of the niche, and supported by pedestals of Devonshire marble.

At six different parts there are semicircular spaces left above the doors or windows, and these are filled by spirited groups of chubby children in alto relievo, modeled by Wynn, and executed in copper bronze by Messrs. Elkington. It is only fair to add that much of the richness of effect and real beauty of the whole is due to the excellent taste of the decorator, Mr. Schmidt, who has managed to give a rich glow of effective color and gilding, without in any way lessening the natural beauty of the flowers and foliage.—*Engineering.*

BELLS AND BELL TOWERS.

[From the Contemporary Review.]

The long, winding staircase seems to have no end. Two hundred steps are already below us. The higher we go the more broken and rugged are the stairs. Suddenly it grows very dark, and clutching the rope more firmly we struggle upwards. Light dawns again, through a narrow Gothic slit in the tower—let us pause and look out for a moment. The glare is blinding, but from the deep, cool recess a wonderful spectacle unfolds itself. We are almost on a level with the roof of a noble cathedral. We have come close upon a fearful dragon. He seems to spring straight out of the wall. We have often seen his lean, gaunt form from below—he passed almost unnoticed with a hundred brother gurgoyles—but now we are so close to him our feelings are different; we seem like intruders in his lawful domains. His face is horribly grotesque and earnest. His proportions, which seemed so diminutive in the distance, are really colossal—but here everything is colossal. This huge scroll, this clump of stone cannon-balls, are, in fact, the little vine tendrils and grapes that look so frail and delicately carven from below. Amongst the petals of yonder mighty rose a couple of pigeons are busy building their nest; seeds of grasses and wild flowers have been blown up, and here and there a tiny garden has been laid out by the capricious winds on certain wide stone hemlock leaves; the fringe of yonder cornice is a waste of lilies. As we try to realize detail after detail the heart is almost pained by the excessive beauty of all this petrified bloom, stretching away over flying buttresses, and breaking out upon column and architrave, and the eye at last turns away weary with wonder.

A few more steps up the dark tower, and we are in a large dim space, illuminated only by the feeblest glimmer. Around us and overhead rise huge timbers, inclining towards each other at every possible angle, and hewn, centuries ago, from the neighboring forests, which have long since disappeared. They support the roof of the building. Just glancing through a trap-door at our feet we seem to look some miles down into another world. A few foreshortened, but moving specks, we are told are people on the floor of the cathedral, and a bunch of tiny tubes, about the size of a pan-pipe, really belong to an organ of immense size and power. At this moment a noise like a powerful engine in motion recalls our attention to the tower. The great clock is about to strike, and begins to prepare by winding itself up five minutes before the hour. Groping amongst the wilderness of cross beams and timbers, we reach another staircase, which leads to a vast square but lofty fabric, filled with the same mighty scaffolding. Are not these most dull and dreary solitudes—the dust of ages lies everywhere around us, and the place which now receives the print of our feet has, perhaps, not been touched for five hundred years? And yet these ancient towers and the inner hights and recesses of these old roofs and belfries soon acquire a strong hold over the few who care to explore them. Lonely and deserted as they may appear, there are hardly five minutes of the day or night up there that do not see strange sights or hear strange sounds. As the eye gets accustomed to the twilight, we may watch the large bats flit by. Every now and then a poor lost bird darts about, screaming wildly like a soul in purgatory that cannot find its way out. Then we may come upon an ancient rat, who seems as much at home there as if he had taken a lease of the roof for ninety-nine years. We have been assured by the carillonneur at Louvain that both rats and mice are not uncommon at such considerable elevations.

Overhead hang the huge bells, several of which are devoted to the clock—others are rung by hand from below, while somewhere near, beside the clock machinery, there will be a room fitted up, like a vast musical box, containing a barrel, which acts upon thirty or forty of the bells up in the tower, and plays tunes every hour of the day and night. You cannot pass many minutes in such a place without the clicking of machinery, and the chiming of some bell—even the quarters are divided by two or three notes, or half-quarter bells. Double the number are rung for the quarter, four times as many for the half-hour, while at the hour, a storm of music breaks from such towers as Mechlin and Antwerp, and continues for three or four minutes to float for miles over the surrounding country.

The bells, with their elaborate and complicated striking apparatus, are the life of these old towers—a life that goes on from century to century, undisturbed by many a convulsion in the streets below. These patriarchs, in their tower, hold constant converse with man, but they are not of him; they call him to his duties, they vibrate to his woes and joys, his perils and victories, but they are at once sympathetic and passionless; chiming at his will, but hanging far above him; ringing out the old generation, and ringing in the new, with a mechanical, almost oppressive regularity, and an iron constancy which often makes them and their gray towers the most revered and ancient things in a large city. The great clock strikes—it is the only music, except the thunder, that can fill the air. Indeed, there is something almost elemental in the sound of these colossal and many-centuried bells. As the wind howls at night through their belfries, the great beams seem to groan with delight, the heavy wheels, which sway the bells, begin to move and creak; and the enormous clappers swing slowly, as though longing to respond before the time.

At Tournay there is a famous old belfry. It dates from the twelfth century, and is said to be built on a Roman base. It now possesses forty bells. It commands the town and the country round, and from its summit is obtained a clear view of the largest and finest cathedral in Belgium, with its five magnificent towers. Four brothers guard the summit of the belfry at Tournay, and relieve each other day and night, at intervals of ten hours. All through the night a light is seen burning in the topmost gallery, and when a fire breaks out, the tocsin, or big bell, is tolled up aloft by the watchman. He is never allowed to sleep—indeed, as he informed us, showing us his scanty accommodation, it would be difficult to sleep up there.

On stormy nights a whirlwind seems to select that watchman and his tower for its most violent attacks; the darkness is often so great that nothing of the town below can be seen. The tower rocks to and fro, and startled birds dash themselves upon the shaking light, like sea birds upon a lighthouse lantern. Such seasons are not without real danger—more than once the lightning has melted and twisted the iron hasps about the tower, and within the memory of man the masonry itself has been struck. During the long peals of thunder that come rolling with the black rain clouds over the level plains of Belgium, the belfry begins to vibrate like a huge musical instrument, as it is; the bells peal out, and seem to claim affinity with the deep bass of the thunder, while the shrill wind shrieks a demoniac treble to the wild and stormy music.

All through the still summer night the belfry lamp burns like a star. It is the only point of yellow light that can be seen up so high, and when the moon is bright it looks almost red in the silvery atmosphere. Then it is that the music of the bells floats farthest over the plains, and the postillion hears the sound as he hurries along the high road from Brussels or Lille, and, smacking his whip loudly, he shouts to his weary steed as he sees the light of the old tower of Tournay come in sight. Bells are heard best when they are rung upon a slope or in a valley. The traveler may well wonder at the distinctness with which he can hear the monastery bells on the Lake of Lugano, or the church bells over some of the long reaches of the Rhine. Next to valleys, plains carry the sound farthest. Fortunately, many of the finest bell-towers in existence are so situated. It is well known how freely the sound of the bells travels over Salisbury Plain. The same music steals far and wide over the Lombard plains from Milan Cathedral; over the Campagna from St. Peter's at Rome; over the flats of Alsatia to the Vosges Mountains and the Black Forest from the Strasbourg spire; and, lastly, over the plain of Belgium from the towers of Tournay, Ghent, Brussels, Louvain, and Antwerp. The belfry at Bruges lies in a hollow, and can only be seen and heard along the line of its own valley.

To take one's stand at the summit of Strasbourg Cathedral at the ringing of the sunset bell, just at the close of some effulgent summer's day, is to witness one of the finest sights in the world. The moment is one of brief but ineffable splendor, when, between the mountains and the plain, just as the sun is setting, the mists rise suddenly in strange sweeps and spirals, and are smitten through with the golden fire which, melting down through a thousand tints, passes, with the rapidity of a dream, into the cold purples of the night.

Pass for a moment, in imagination, from such a scene to the summit of Antwerp Cathedral at sunrise. Delicately tall, and not dissimilar in character, the Antwerp spire exceeds in hight its sister at Strasbourg, which is commonly supposed be the highest in the world. The Antwerp spire is 403 feet high from the foot of the tower. Strasbourg measures 468 feet from the level of the sea; but less than 403 feet from the level of the plain. By the clear morning light, the panorama from the steeple of Notre Dame at Antwerp can hardly be surpassed. One hundred and twenty-six steeples may be counted, far and near. Facing northward, the Scheldt winds away until it loses itself in a white line, which is none other than the North Sea. By the aid of a telescope ships can be distinguished out on the horizon, and the captains declare they can see the lofty spire one hundred and fifty miles distant. Middleburg at seventy-five, and Flessing at sixty-five miles, are also visible from the steeple. Looking towards Holland, we can distinguish Breda and Walladuc, each about fifty-four miles off.

Turning southward, we cannot help being struck by the fact that almost all the Belgian towers are within sight of each other. The two lordly and massive towers of St. Gudule's Church at Brussels, the noble fragment at Mechlin, that has stood for centuries awaiting its companion, besides many others, with carillons of less importance can be seen from Antwerp. So these mighty spires, gray and changeless in the air, seem to hold converse together over the heads of puny mortals, and their language is rolled from tower to tower by the music of the bells. "*Non sunt loquellæ neque sermones audiantur voces eorum.*" ("There is neither speech nor language, but their voices are heard among them.") Such is the inscription we copied from one bell in the tower at Anvers, signed "F. Hemony, Amstelodamia (Amsterdam), 1658.

AN INTERESTING SKETCH OF THE DISTINGUISHED AERONAUT, JOHN LA MOUNTAIN.

The following sketch of La Mountain is from the pen of George Demers, of the Albany *Evening Journal*. Mr. Demers accompanied him in six of his balloon voyages:

John La Mountain was not an ordinary man, and his death calls for something more than a passing mention. Though deficient in those advantages which are imparted by early education, he possessed marked natural genius, great resoluteness of purpose, and much inventive ability; qualities that in other spheres might have won him success in life, but which, devoted with enthusiasm to the profession of ballooning, got him fame only as an eccentric and intrepid adventurer.

La Mountain did not become an aeronaut for the purpose of the mountebank exhibitor. His necessities compelled him to make ascensions for public amusement. His higher object was to render aerial navigation of practical use in the great enterprise of modern progress and commerce. He never was a convert to the belief that balloons could be propelled in any direction at will, and in despite of adverse currents, by the aid of machinery. But he early became satisfied that there is a current in the atmosphere corresponding with the Gulf stream in the ocean, and flowing steadily over a very wide belt, from west to east. His own experience and that of others, amply confirm this opinion. He concluded then, that as balloons had been kept in the air for many hours at a time under ordinary circumstances, it was possible, by making one of superior capacity, to mount into this upper current, float with it across the ocean, and land at will, for instance in England, in sufficient proximity to London to make the voyage of immense value, in the saving of time it would accomplish. Acting upon these ideas, he was determined to be the first aeronaut who should cross the Atlantic.

So soon as he could obtain sufficient means by his exhibitions, Mr. La Mountain began the construction of a balloon in which he hoped to accomplish his daring scheme. Everything about it was most perfect. The silk, of extra quality, was manufactured expressly for him, and under his supervision, by the Messrs. Ryle, of Paterson, N. J. The rope for netting he made himself at a factory near Troy, subjecting every fiber and strand to severe tests. Great care was used in oiling and coating the silk. Adroit mechanism insured absolute control of the valves. When the "Atlantic" was completed, it was undoubtedly the strongest and most symmetrical, as well as the largest balloon ever floated in any country.

By way of demonstrating the feasibility of his plan, Mr. La Mountain determined upon a preliminary land voyage of great length. St. Louis was fixed upon as the starting point, and he ascended from that city in the presence of an immense concourse, accompanied by John Wise, the veteran Pennsylvanian aeronaut.

The voyagers remained in the air a little over nine hours, during which time they crossed Lake Erie at its largest part, and traveled far into New York State. Unfortunately, in crossing Lake Ontario, they descended for purposes of observation, and became involved in a tremendous tornado of which they had no knowledge when above. This bore them with frightful velocity to the shore, and left the balloon a wreck in the woods of Adams, Jefferson county. In a little more than nine hours the "Atlantic" had traversed a distance of eleven hundred and eighty miles.

Thus ended, for a time, all prospect of the voyage to England. La Mountain was saddened, but not discouraged. All he lacked was money. To obtain this, he resumed his career as an exhibitor. A small balloon was constructed of the fragments of the wrecked "Atlantic." The citizens of Watertown made him a generous subscription, and he started on a pleasure trip from that place, in company with Mr. John A. Haddock, then editor of the Watertown *Reformer*.

The incidents of this voyage will long be remembered. The balloonists had proposed to be back in a few hours. But days passed, and they did not come. Time lengthened and there were no tidings from them. First was uncertainty then doubt, then despair in the minds of friends. All sorts of wild stories and vague speculations were started. The tragic fate of poor Thurston was then fresh in the public mind, and the belief became general that La Mountain and his companion had met a similar death; although there were some wild enough to believe that the insane venture of crossing the Atlantic in a small and unreliable balloon, had been made. At last the mystery was explained. Having no compass, the aeronauts had lost their bearings, and suffered themselves to be carried far into the dense woods of the Ottawa reservation, in Canada. After wandering in their blank mazes for many days, subsisting upon leaves and berries, they were accidentally discovered when in the last stages of starvation, by some Indian scouts in the employ of Mr. Cameron, a lumberman, and thus saved from a horrible death. Their thrilling story was widely published, and graphically pictured by the illustrated newspapers.

After this second misfortune, Mr. La Mountain did not at once renew his Atlantic project. The war of the rebellion began to assume large proportions, and La Mountain was at different times stationed at Cloud's Mills, near Alexandria, at Fortress Monroe, and elsewhere. So long as the armies were lying in camp, as they did during the early portion of McClellan's remarkable career, balloons were of some value.

We last heard of him in public as making an ascension from a town in Michigan. An impatient and careless crowd cast him off before he was ready, without an overcoat or instruments, and the valve rope tied several feet above the basket. He shot like a rocket up into a cloud of mist and sleet, which congealed his blood and froze the valve board fast before he could control it. His only alternative was to climb, with frost-bitten fingers, up the net-work and tear the balloon with his teeth. The rip extended above the hemisphere, the balloon collapsed, discharged its gas, and fell with great velocity from a hight of nearly two miles. The aeronaut was picked up benumbed, insensible, but not dangerously injured. Undoubtedly, the suffering and exposure endured at this time hastened his death.

The career of Mr. La Mountain was peculiarly one of danger and ill fortune. But he faced hazards without a tremor, and endured disaster without a murmur; never faltering in devotion to his leading idea. We accompanied him six times above the clouds, and saw him twice under circumstances of great peril, when he was as calm and collected as if sitting in a parlor—not a muscle relaxing nor a fiber quivering. His fault was a lack of business practicality. But he made up for this, in a great degree, by intense enthusiasm and earnestness. Notwithstanding the success of the Atlantic telegraph had rendered the question of crossing the ocean with balloons less interesting and important than formerly, we believe he would have made the attempt; and in this day of almost marvelous achievements, it is not wise to say that he would have failed.

MINERAL DEPOSITS.

[Lecture by William T. Brigham, before the Boston Society of Natural History.]

The deposits of minerals, the extraction of which forms the subject of mining, are found in two forms; beds originally more or less horizontal, and veins. The form in which a mineral is found is usually the same; thus coal is generally deposited at the bottom of fresh water and appears as a bed. The only other mineral of importance, if we except rock salt, found in this form, is bog iron. This ore is one of the best oxides of iron, and is frequent in the United States and in Sweden. The position of coal beds is usually determined by the dip of the stratum at its outcrop. These beds are often divided by intervening strata of limestone or shale. Augers similar to those used in boring artesian wells are employed to find the depth and thickness of these beds. This mode is extensively practiced in France. It is only within a little more than a century that coal has attained a commercial value, and within that period the scientific college of France sanctioned its use, declaring it not to be a poisonous fuel. Its consumption has now reached such a degree, that in a single year over a hundred and seventy millions of tuns were quarried, and of this quantity England produced one hundred millions of tuns.

By far the greater number of minerals used in the arts are found in the second form, viz.: that of veins, which are as definitely placed as beds. Where an eruptive rock has been forced upwards, breaking a series of strata, a vein is formed in the fracture, and also smaller veins are formed in the surrounding cracks. Accidents and faults occur in veins as in strata, and are caused by disturbances after the deposition of the metallic veins. These accidents are so various, and the veins so intricate, that science is sometimes at fault. This places geologists in bad repute among practical miners, and this feeling was so strong at the time of Prof. Silliman's visit to California, that he was refused admittance to many of the mines. Veins are often heterogeneous in their composition, and a section of a certain Spanish vein exhibited the following substances in the order of their enumeration: Partially decayed rock, or gossan; a brown iron ore; galena, or sulphide of lead; gray sulphate of lead; white sulphate of lead; pure white metal; iron with patches of ocher; barytes with patches of galena; galena in large grains; sulphate of lead; and lastly, the surrounding gossan. This is an extreme example, but veins are seldom simple.

A conformation not infrequent is that of a large vein termed *Vena Madre*, or mother vein, accompanied by smaller contiguous and parallel veins. This may extend for a hundred miles with a veritable width of from six to one hundred feet. Of this character are the celebrated Washoe and Comstock lodes, which latter produced from 1862 to 1865 inclusive, metal equal in value to forty-eight millions of dollars, two-thirds being silver and one-third gold. Lodes are sometimes of such definite width, that miners may and do divide them by the length, each owning a certain number of feet. Thus a vein is worked at several points. The surrounding medium is often quartz, in the fissures of which are found scales of gold. Silver is found in several forms, some of the most noticeable of which are ruby silver, horn silver, and hair silver, the latter being a most beautiful and delicate mesh or net-work much prized for collections.

The extreme hardness of the quartz, and difficulty of separating the metal, often makes the working of a mine impracticable. But here nature comes to our aid. By the action of water during long ages, the enveloping rock is decayed, and the golden scales and nuggets washed down, and deposited, together with a large amount of foreign matter, in the beds of the streams. These streams have been, by volcanic or other action, covered to some depth, with soil. The uncovering of these ancient river-beds, and the washing of the deposits there found, constitute placer mining. This method was first discovered in California by a Mormon, a member of Captain Suter's band, who in digging a race-way for a mill found many small yellow particles, which he supposed were gold. Of these he collected a large quantity, and in the autumn of 1848 sent them to San Francisco, then but a village. They attracted the attention of an old Georgian miner, who declared them similar to the nuggets found in the washings of that State. The news spread, and diggings for the valuable deposit were commenced in all parts of the State. In the spring of 1849 the panic extended to the Atlantic coast, and the memorable gold fever set in. During six months of that year no less than ninety thousand people went to California. As they exhausted the stream-beds found in the valleys, they followed the deposit up the mountain. This gave rise to that system of mining peculiar to America, called hydraulic mining. Rapid streams of water are conducted by elevated troughs, resembling old Roman aqueducts, and with immense pressure thrown against the sides of the mountains, washing down the soil, and uncovering these ancient beds. The matter thus washed down is made to pass over ditches constructed so as to catch the particles and nuggets of gold.

Platinum occurs in little flat grains, in appearance resembling dull silver. From this resemblance it derives its name *platina*, meaning little silver. This metal is unaffected by acids, and will not melt under a temperature of 2000 degrees. It is chiefly found in the Ural mountains, and is used in Russia as coin.

Copper is found like silver in veins, often mixed with silica and other impurities. It is very difficult to smelt, and this branch of industry is mainly carried on at Swansea in South Wales. There is also a smelting furnace at Boston. Carbonate of copper gives us two valuable compounds, viz.: blue carbonate, and green carbonate of copper, or malachite. Malachite is largely found in the Ural mountains, and is in common use in Russia. This metal is found pure, in sheets or nuggets, one having been found weighing five hundred tuns. It was so ductile that it was found impossible to blast it, and it had to be cut into sections with cold chisels.

Galena or common lead is found crystallized into cubes and in veins, running through limestone reefs. Owing to the irregularities of the original coral reefs, large cavities or chambers are found in limestone often filled with lead.

Tin is chiefly found in Cornwall in the form of tin stone. It is also obtained by washing, sometimes transparent and sometimes of a gray color, and is called stream tin. Mercury was formerly obtained only at the mine of Almaden in Spain; but soon after the demand arose for it in California, it was found south of San Francisco, and the mine was named New Almaden. These mines are of immense value and extent, but are in the hands of a gigantic monopoly, which will only produce a limited quantity. This cinnabar was used by the Indians for war-paint, and is sometimes found deposited in pouches like lead. Manganese is of a purple color, and to its presence the amethyst owes its beautiful hue.

Metals are sometimes found in solution in the sea, and certain seaweeds possess the power of secreting silver. Old copper sheathings also collect by galvanic action an appreciable amount of silver.

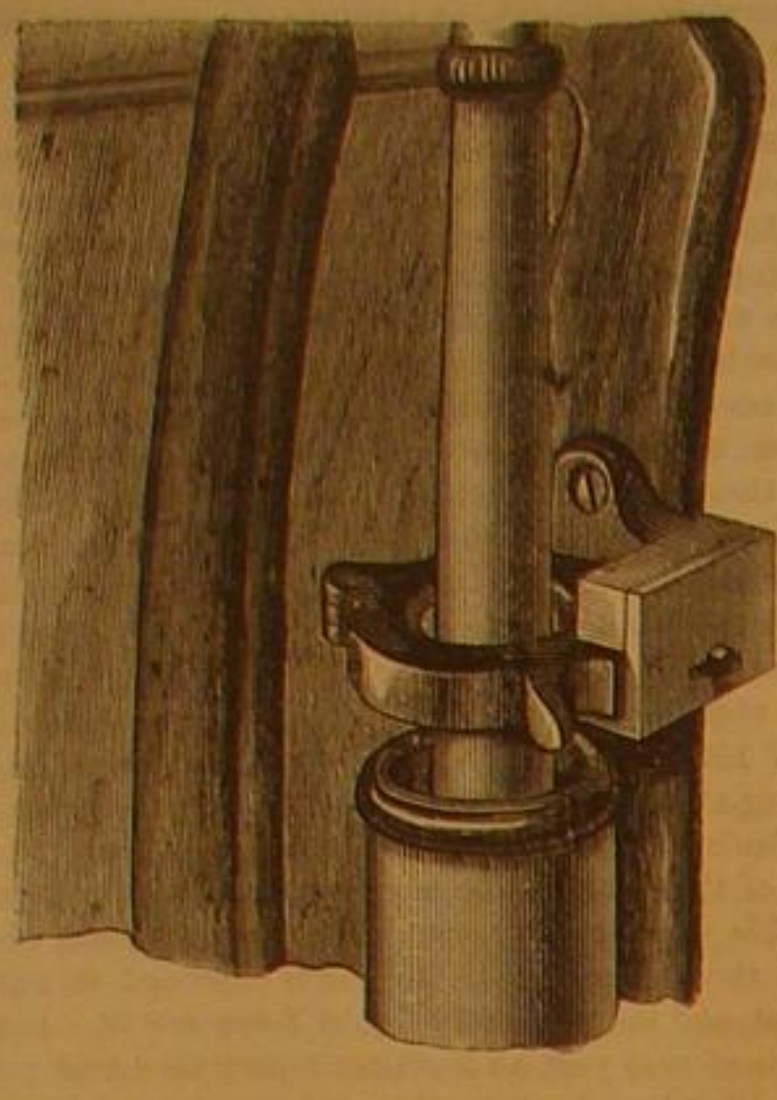
The lecturer briefly called the attention of the audience to the providential distribution of the various natural deposits. Coal, wood, and limestone are necessary to the successful working of iron mines, and in all countries where iron abounds, these materials are also at hand. When mining had reached such a stage that works were abandoned from inability to keep the mines clear from the water which collected, the steam-engine was invented and first used only for this purpose. The necessity for an increased amount of appropriate fuel then arose, and was supplied by the discovery and use of coal. Thus science supplies the needs and emergencies of the arts.

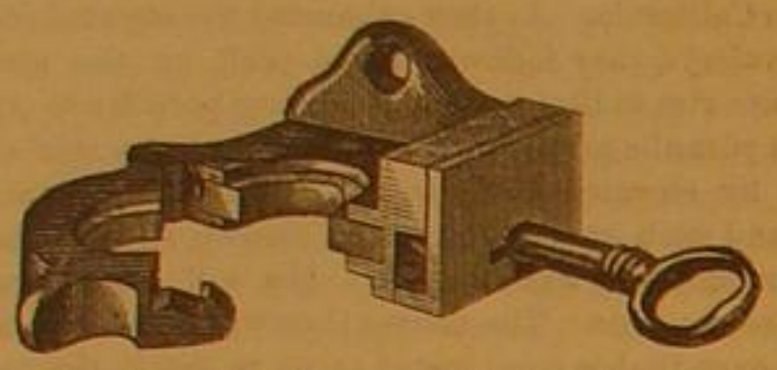
Cement for Fastening Instruments in Handles.—A material for fastening knives or forks into their handles, when they have become loosened by use, is a much-needed article. The best cement for this purpose consists of 1 lb. of colophony (purchasable at the druggists'), and 8 oz. of sulphur, which are to be melted together and either kept in bars or reduced to powder. One part of the powder is to be mixed with half a part of iron filings, fine sand, or brickdust, and the cavity of the handle is then to be filed with this mixure. The stem of the knife or fork is then to be heated and inserted into the cavity; and when cold it will be found fixed n its place with great tenacity.

HILL'S LOCKING WHIP SOCKET.

This is not only a tasty, but an efficient device for locking whips in their sockets.

The lock is securely fastened to the dash, as shown, so that when the whip is placed in the socket, it is clasped by the semicircular hasp of the lock, which corresponds to a semicircular recess in the plate of the lock, as shown in the engraving.





Both the interior of the hasp and that of the recess which forms its counterpart, are lined with thick leathers, cut in the form of halves of a flat ring, and let into grooves formed in the interior side of the hasp and the recess. This prevents rattling and wear.

The whole arrangement is small, neat, strong, and convenient. The lock is of that kind known as spring locks, and requires the use of a key only to unlock it. The attachment is rather ornamental than otherwise, and will effectually insure whips from theft.

Patented, through the Scientific American Patent Agency, Sept. 28, 1869, by W. S. Hill, whom address for further information at Manchester, N. H.

Our Moscow Exchanges.

We have received several numbers of the Moscow German paper, *Moskauer Deutsche Zeitung*, and are gratified to see with what discrimination and freedom the editor discusses all questions of education and politics. If the paper were printed in New York it could not enjoy greater license. It is also refreshing to observe that way off in the interior of Russia editors know how to indulge in those pleasing personalities that give style and character to papers nearer home. Among other items, we find one headed, "A New Yankee Speculation," giving an account of the proposed sale in New York of excursion tickets around the world, including board and lodgings at hotels, and all incidentals. The paper says that the arrangements are nearly completed, and that such a ticket will cost $1,200, and that the scamper around the world can be accomplished in ninety days.

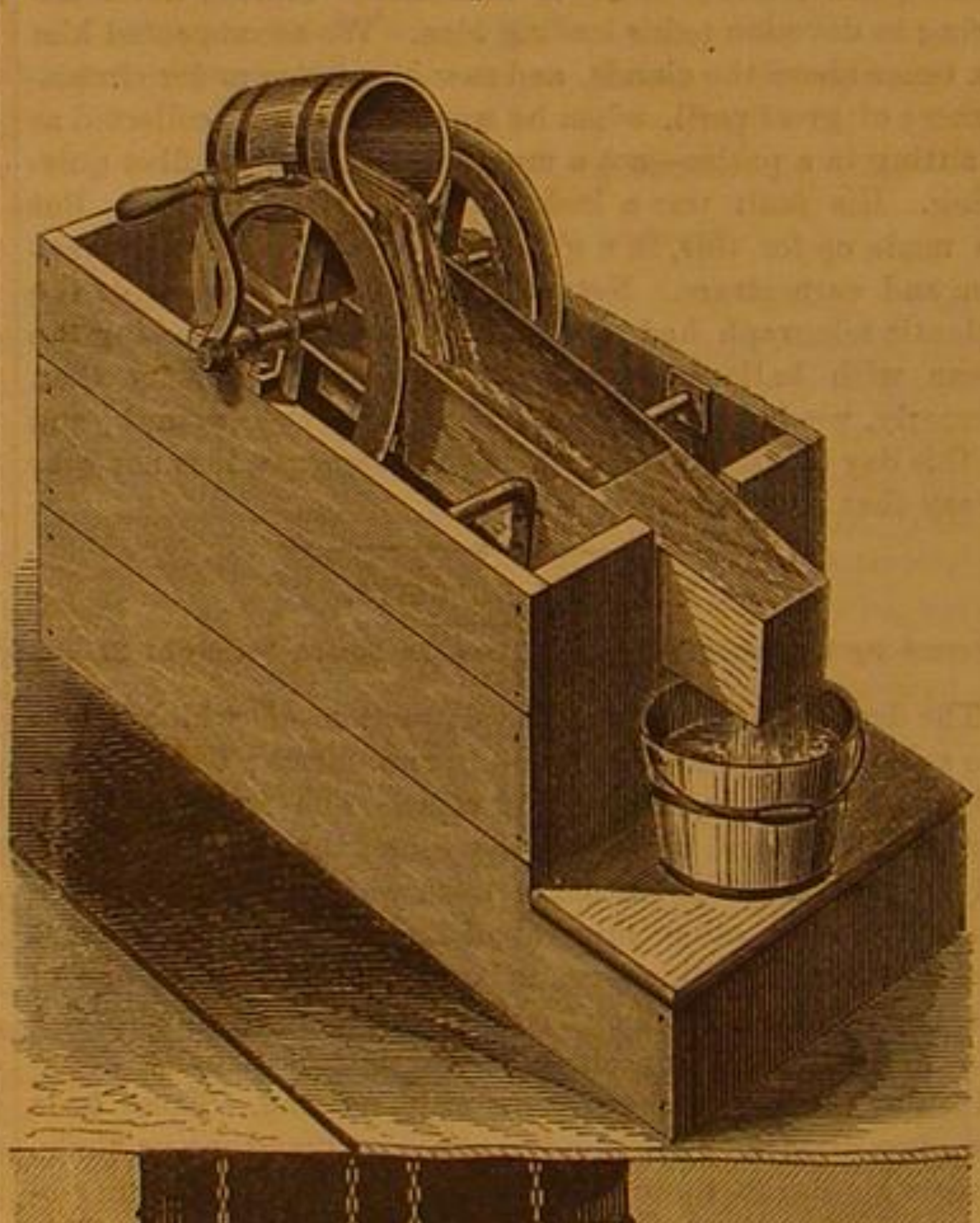
The Peforated Implements of the Stone Period.

Sir John Lubbock and the other archæologists are inclined to hold that the perforated axes and hammers of stone are coeval with the commencement of the bronze period. That many of them really do belong to this period there can be little doubt, since bronzes and stone are frequently found buried together, and it is well known that stone weapons continued to be made and used after the introduction of bronze. But this by no means proves that all perforated stone implements are to be referred to this period, and the present number of the "Archiv für Anthropologie" contains a paper by Rau, showing the mode in which they might be formed before a knowledge of bronze existed. M. Rau considers that the holes were made in two ways, or perhaps by means of two different borers. The more highly finished holes are of equal diameter throughout, and present a smooth surface, and exhibit at short distances from each other a succession of circular grooves. Such perforations as these, he thinks, were effected by means of a hollow cylinder of bronze. But there is another kind of perforation, the surface of which is more or less smooth, but which is not marked by the lines or grooves above mentioned. These perforations are constricted in the center, so as to present one section, more or less of an hour-glass form, indicating that they have been bored in from opposite sides. These, he thinks, belong exclusively to the stone period. In both methods it is probable that hard sand and water were employed to assist the process. His view is supported by an examination of weapons in which the perforations have not been completed, but carried only through a portion of the thickness of the stone. In the former class of borings, the hole on section presented somewhat of the appearance that would be presented by the bottom of a champagne bottle on section, the periphery being more deeply bored than the center; whilst, in the latter class of borings, the bottom of the depression was simply rounded and rather narrower than the superficial margin. M. Rau has been able to produce borings in a hard stone exactly resembling those on the weapons of the stone period, without the aid of any metallic instrument, but merely by means of the rounded extremity of a piece of hard wood made to rotate with a bow-drill, together with a little sand and water. The stone on which he experimented was a piece of diorite, so hard that a well-tempered knife-blade only marked it with a metallic streak, and of the same kind as that formerly employed, on account of its combining hardness with tenacity, in the construction of various weapons during the stone period, and still used for the same purposes by the North American Indians of the present day. In commencing the perforations, which required infinite patience, M. Rau found it advantageous to attach a piece of wood, with a hole in it, on the stone, which prevented the boring instrument from perpetually slipping off. Two hours' severe work were required to deepen the perforation by the thickness of an ordinary tracing with a lead pencil, and, though with many interruptions, he was fully two years in completing it. It was found requisite to add fresh sand every 5 or 6 minutes. When serpentine rock was experimented on, the perforation was accomplished with very much greater rapidity.

HAMILTON'S WATER ELEVATOR.

Ewbanks, in his treatise on "Hydraulics and Mechanics," has compiled a history of the various devices adopted in all parts of the world for raising water, from the earliest period of which we have any record up to a recent date. To obtain this essential to life, the minds of even the most rude and uncultivated savages have been stimulated into the invention of quite ingenious devices; and in modern times improvements in methods of elevating water form a large proportion of the inventions for which protection by patent is solicited.

The invention herewith illustrated is a good one, not only for shallow but especially for deep wells beyond the capacity of the atmospheric pump. It probably eliminates the element of friction to as great an extent as it can practically be done; and, therefore, applies a maximum proportion of the power to the useful work to be accomplished.



Our engraving gives an excellent idea of the device. Two grooved pulleys keyed to a shaft carry each an endless chain to which buckets are attached in the manner shown.

When the shaft is rotated in the proper direction, the buckets successively descend and fill, and are drawn to the top, when in passing over the center of the elevating shaft they empty their contents into the spout.

The spout is not fixed, but is pivoted in such a manner that it tips to allow the buckets to pass on their descent for a further supply; and it is also so balanced that as soon as the bucket has passed, it falls immediately into its normal position.

We judge that more water can be elevated by a given power, through a given distance, in a given time, by this apparatus than by the use of any pump; and the number of buckets may of course be multiplied, when it is desired to apply steam, or other power greater than can be applied to an ordinary hand machine like that illustrated.

Apparatus of this kind has the advantage over pumps that wells are constantly kept open, and the water being stirred at each drawing keeps the water thoroughly aerated.

This invention was patented, through the Scientific American Patent Agency, Feb. 1, 1870, by W. G. Hamilton, of Milton, Wis. Address as above for further information.

DENN'S IMPROVED GRIDIRON AND CAKE BAKER.

We have forgotten the name of the *gourmand* who said, that, if he were an autocrat, the individual who should presume to

fry a beefsteak in his dominions should be himself fried. The punishment proposed, though somewhat severe, is not much more so than the pains of dyspepsia which Nature meets out to those who will eat fried meats contrary to her express commands.

But without proper appliances, the broiling of meats, undoubtedly the most wholesome as well as the most appetizing mode of cooking them, involves many positive inconveniences, such as the smoking of walls, the dripping of grease, and other annoyances which we need not specify.

The object of the present invention is to do away with all these inconveniences, and to provide a gridiron whereby not only broiling but other culinary operations may be performed, and by which the bad health arising from the continual use of fried meats may be avoided.

It consists of three principal parts, shown separately in the engraving. The gridiron, B, its cover, C, and the wire gridiron, D, which may be used inside of the other, when desired, to broil food that would fall through the bars of the other, such as oysters, or it may be used as a corn popper or bread toaster.

The cover may be used as a cake baker by placing it on the top of the stove with the hollow side of the handle up. It will be seen by an inspection of the engraving that the gridiron has a rim or projection on its underside to rest on the ledge in the hole of the stove, the rim being narrower at the part toward the handle for the purpose of giving the bars an inclination in that direction, to cause the gravy to flow out into the hollow handle and be saved for use.

It will also be seen that the device, when in use, makes an air-tight cover to the hole, preventing the escape of smoke into the house, and keeps up the draft in the stove.

The patentee is, we are informed, in receipt of numerous testimonials as to the efficiency of this device, from those who have it in use.

The sizes range from No. 6 to No. 10, inclusive, and are made to fit the corresponding numbers of stoves and ranges; they may also be made oblong so as to occupy both the openings over the fire space, being more convenient for large families or restaurants in that form.

This device was patented, through the Scientific American Patent Agency, June 23, 1868, by Clayton Denn, of Frankford, Pa., who will sell State, county, or the whole right for the United States. For particulars, apply to, or address the patentee, No. 4,506 Trenton avenue, Frankford, Pa.

Purification of Water from Smoke Impurities.

Several correspondents recommend the use of permanganate of potassa for purifying water from the impurities derived from coal smoke. Enough of the salt to give the faintest possible tinge to the water is recommended to be added, and as the coloring property of this salt is very great, a little used in this way would purify a large quantity of water. After standing twenty-four hours the impurities will all be precipitated, and the sudsing property of the water is not impaired. Our Western friends who have been greatly troubled with smoke-soiled water will do well to make a trial of this simple remedy.

THE BITRICYCLE, A FRENCH INVENTION.

We illustrate herewith a curious French invention, more on account of its unique character, than from any belief in the merit of the device. Our object also is to arouse the attention of inventors to the fact that there is still much room for improvement in construction of vehicles designed either for passengers, or the transport of wares and heavy materials for building and other purposes.

An attempt has been made in the construction of the "bitricyle" to secure immunity from overturning by broadening the base of the vehicle to such a degree that the center of gravity can in no instance fall outside of the base, and this is undoubtedly secured. The increased width of the vehicle resulting in the attainment of the above object, is an inconvenience for city travel, on account of the crowded state of the thoroughfares.

One smiles to think what a delightful snarl a crowd of these vehicles would produce in *any* of our New York thoroughfares, not to mention Broadway.

But an attempt has been made to carry out a correct principle in throwing the bulk of the weight upon wheels of very large size. It is well known that such wheels entail less work than small ones in proportion as roads are rough. With perfectly smooth and hard roads, perfectly round and inelastic wheels of different sizes would manifest no difference in draft, all other things being equal.

The plan of putting the large wheels in the center of the vehicle appears to us a very unmechanical contrivance, as it is manifest that on uneven surfaces the weight must be more or less unequally divided between the wheels—and it is easy to conceive of circumstances, in which only two of the wheels, or even the one central wheel on each axle, should temporarily bear all the load. The use of springs can only compensate for this irregularity to a certain extent; beyond that, we judge the rolling of this vessel upon her central wheels, over a rough road, would be something remarkable.

The inventor of this curious vehicle seems to have forgotten that immunity from overturning may be secured by lowering the center of gravity with a given width of base, as by widening the base while keeping the center of gravity at the same hight.

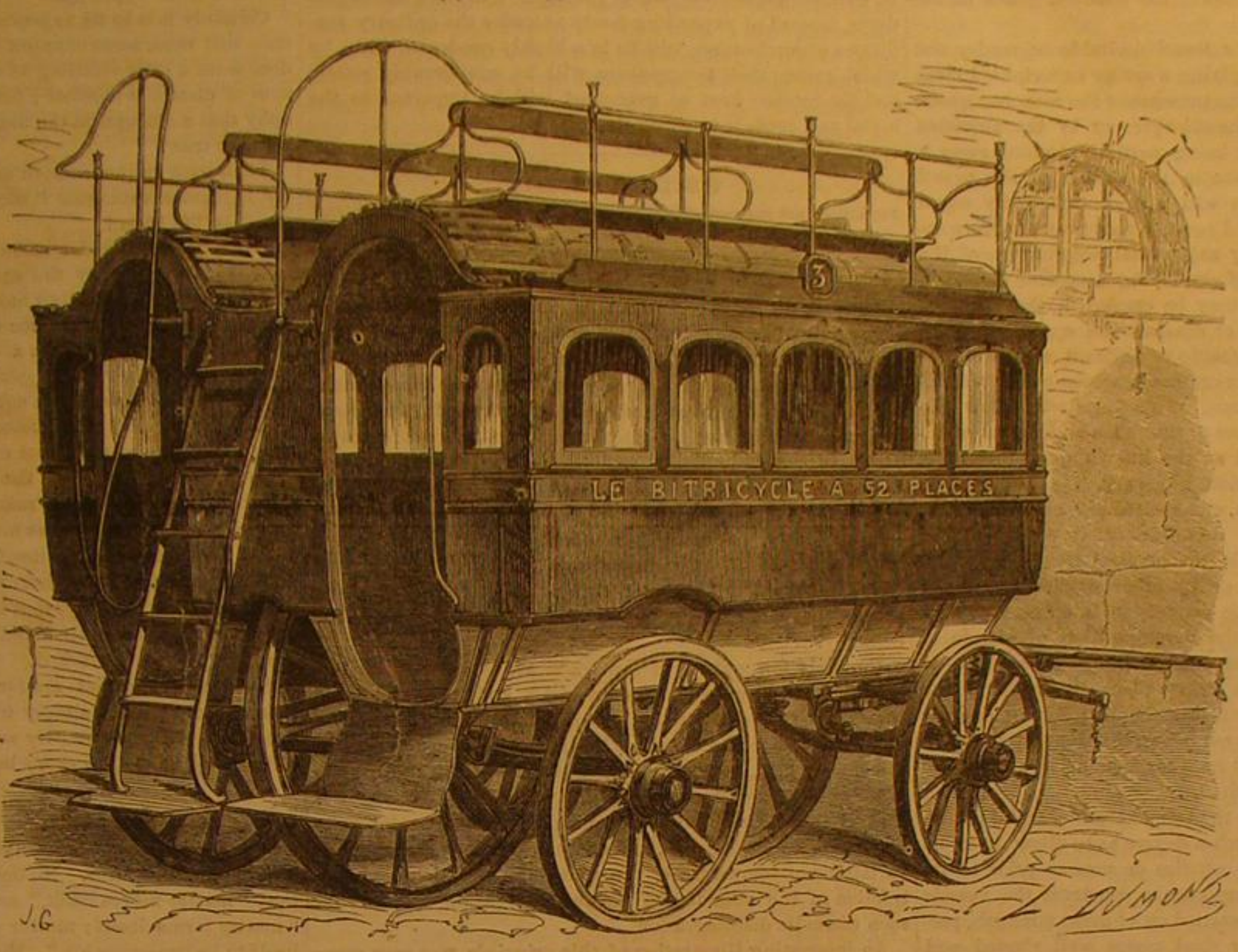
For all heavy draft vehicles, we believe that the hind wheels might be made much larger than at present is the case, with advantage; provided the construction of the vehicle is such as to throw the weight of the load mostly upon the larger wheels. The use of crank axles with such wheels would let down the body sufficiently to admit of easy loading.

We have seen this construction adopted for trucks used in moving heavy iron castings, blocks of stone, etc., with unquestionable advantage, and economy of labor, both to man and beast, yet for city trucking and farm work the high box or platform still prevails.

Of course the enlargement of the fore wheels cannot be carried beyond a certain point, on account of the resulting incapacity to turn shortly, a prime essential to a city truck; but it appears to us that the combination to be sought in the improvement of draft vehicles is the lowering of the load and the enlargement of the wheels.

In omnibuses likely to be run into by other vehicles, it seems necessary to raise the body so as to be in some measure out of the reach of injury from the contact of trucks, etc., which might endanger the passengers should they strike the body of the vehicle.

The vehicle we illustrate is made to carry fifty-two persons inside and out, the inside being divided into two compartments, as shown. A canopy, or awning, in hot and in wet weather, is used to shelter the outside passengers.



THE BYTRICYCLE.

THE BESSEMER PROCESS UNDER PRESSURE.

Our readers, who have read the article on page 184, current volume, Scientific American, entitled "A Visit to a Steel Manufactory," and who have felt sufficient interest in what is known as the Bessemer process, to have become familiar with its details, will at once understand the working of the improvement of which we give an engraving, and which has just been patented by Mr. Bessemer in the United States.

It has been found that when certain kinds of iron are treated after the Bessemer method the degree of heat attained upon the influx of air into the converters is very much inferior to that produced when other kinds are worked.

The object in the present invention is to force the air into the converters under pressure, and thereby to secure a greater volume of oxygen to support the combustion than is done in the ordinary way. The purer qualities of pig iron are advantageously worked in this way. In the old process the degree of heat obtained, when Swedish charcoal pig iron and some other varieties were worked, was insufficient to maintain fluidity in the mass until it could be poured into the ingot molds. Hence, a portion becoming hard gave rise to the formation of shells or "skulls"—as they are called—in the casting ladles. When malleable scrap or steel in solid state is worked with pig iron this evil is greatly increased.

The engraving which we copy from *Engineering* is accompanied with the following detailed description. Perhaps no invention of modern times illustrates better the fact that simplicity of construction may often secure the greatest advantages. This simple device of Mr. Bessemer is said to totally obviate the difficulty we have specified.

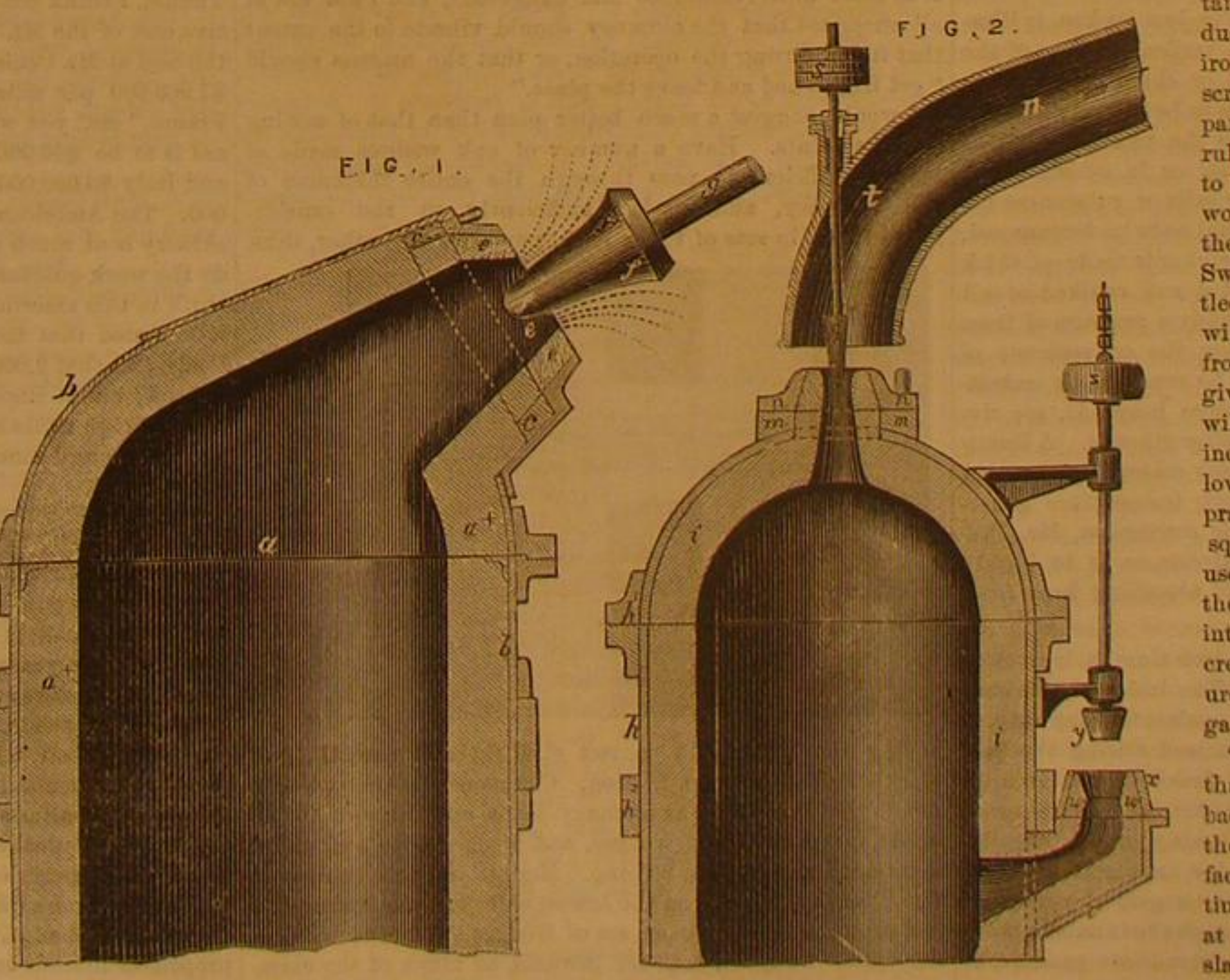
"Mr. Bessemer makes the converting vessel of great strength, securely riveting and caulking all the laps and joints so as to render it air tight as near as may be, and he, by preference, forms the mouth of the vessel circular instead of oval, and of a smaller size than usual, lining the mouth with a single ring of well-burnt fire clay, or composition of clay and plumbago. He also forms the metal part of the mouth of the converter with a movable dovetailed flanged ring, so that the fire-clay mouth of the vessel may be readily taken out and renewed, by unbolting or uncottering the iron ring which retains it in place.

"In the annexed engravings; Fig. 1 is a vertical section of a Bessemer converter constructed on this plan, *a* being the upper part of the converting vessel; a^{x} the lining of ganister, and *b* the strong riveted iron shell or vessel on the inside of the mouth of which the iron hoop, *c*, is riveted; while *d* is a flanged iron ring beveled on the inside, and secured by screwed studs or cotter bolts to the hoop, *c*. A molded ring, *e*, of fire brick or other suitable refractory material, forms the escape opening or mouth of the vessel; it is retained in place by means of the flanged ring, *d*, and when it is worn out or damaged the ring, *e*, may be renewed by unfastening the ring, *d*; a mixture of fire clay and ganister being first smeared over those parts of the ring, *e*, which come in contact with the lining, a^{x}, and with the beveled interior of the ring, *d*, for the purpose of making the joint air-tight.

"The aperture in the movable mouth of the vessel thus formed may in some cases be made small enough to retain the gaseous products, resulting from the combustion of the carbon or other matter contained in the pig iron, under a pressure much above that of the surrounding atmosphere, so that the combustion going on in the converting vessel may be under "high pressure," as described in our account of Mr. Bessemer's new melting furnaces, which appeared on pages 187 and 197 of our last volume. The contraction of the mouth of the vessel would in this case be greater than is shown in Fig. 1 for the purpose of retaining the gaseous products under considerable pressure, so that the gaseous products resulting from the combustion of carbon and other matters in or among the fluid metal would be prevented from expanding freely, and by reason of the combustion so taking place under a pressure much greater than that of the external atmosphere a more intense heat would be produced and imparted to the metal.

"The amount of pressure thus obtained should vary with the heat-producing properties of the carburet of iron operated upon and the quantity of scrap or other unfused metal forming part of the charge, so that no precise rule can be laid down as to the pressure to be employed; but as a guide to the workmen, Mr. Bessemer states that for the conversion of the purer kinds of Swedish charcoal pig iron, and for mottled or white hematite pig iron mixed with gray, a back pressure in the vessel from 8 to 15 lbs. on the square inch will give good results, and in but few cases will a pressure of 20 lbs. per square inch be necessary; while a pressure as low as 3 or 4 lbs. will be of but little practical advantage, and below 2 lbs. per square inch he lays no claim to, as a useful effect. It will be understood that the pressure of the blast of air forced into the converting vessel must be increased in proportion to the back pressure caused by the penning up of the gases within the vessel.

"Mr. Bessemer, however, remarks that the mode of obtaining the required back pressure by simply diminishing the outlet, does not offer all the desired facility of regulating the pressure from time to time during the process, while at the same time the accumulation of slags in the aperture may in some cases reduce the area of outlet so much as to retard the inflow of air through the tweers. For these several reasons the opening in the mouth of the converting vessel may be made much too large, if left open to retain the gaseous matters in the converter at the high pressure desired; such larger sized mouth being provided with a conical stopper inserted in the opening, and so arranged as to be advanced or further withdrawn by being itself movable or by the motion of the vessel on its axis, the vessel being made to advance towards or recede from a fixed conical



THE BESSEMER PROCESS UNDER PRESSURE.

stopper. Mr. Bessemer, however, prefers to use a movable conical stopper attached to the end of an iron rod, as shown in Fig. 1. The conical piece of fire-brick, *f*, is circular in form, and spreads outward in a curved line at f^*, for the purpose of deflecting the flame and preventing its too powerful action on the iron rod, *g*, which supports the cone, *f*. The rod, *g*, protrudes through the back wall of the converting house, or may be supported on a bracket or piece of iron framing in connexion with the standards which support the vessel, and by means of a screw or lever, the cone, *f*, is made to advance further into or recede from the mouth of the converter, thus increasing or diminishing the area of the annular opening at c^*, and regulating the pressure of the confined gases in the vessel.

"In some cases it may be found desirable to render the stopper, *f*, self-acting by applying a spring or weighted lever to press it forward against the pressure of the escaping gases, so that either by reason of its enlargement by the accretion of slags on its surface or by being partially burned away it will occuppy such a position in the mouth of the vessel throughout the process as will give a sufficiently equal amount of back pressure, and prevent that pressure from exceeding what is necessary by any partial clogging up of the escape opening; or in lieu of employing a conical stopper a flat or other shaped surface may be employed, the object in either case being to enlarge or contract the opening for the escape of flame as found desirable at different stages of the process. The pressure of the confined gaseous products is indicated by a mercurial column. This gage will allow the workmen to employ from time to time such an amount of internal pressure in the vessel as the known qualities of the material he employs may render necessary.

"When crude molten iron, or remelted pig, or refined iron is decarburized, or partially decarburized, or converted into refined iron, or into malleable iron or steel by the action of nitrate of soda or potash, or by other oxidizing salts, or when such decarburation or conversion is effected by any other processes in which the decomposition of nitrate of soda or potash, or other oxygen yielding salts alone or mixed with metallic oxides takes place in, or below the fluid metal in a converting vessel or chamber, a large amount of heat is absorbed and rendered latent, thus tending to solidify the metal and rendering it unfit for forming into ingots or castings without being remelted.

"To obviate this and raise the temperature of metal (while so treated or converted) to such a degree as to allow it to be cast into ingots or other cast articles or masses prior to its solidification, Mr. Bessemer proposes to construct the vessels in which the process is to be carried on of great strength, preferring to use stout iron or steel plates well riveted and caulked, and, if needful, further strengthened by stout hoops. The mouth of the vessel is to be made very small, Mr. Bessemer preferring for that purpose to employ a well burned fire-brick ring, into which a long taper cone of the same material is placed. The cone is fastened to a long rod working in suitable guides, so as to keep it central with the mouth of the vessel. The space between the exterior of this cone and the interior of the fire-clay ring determines the area of outlet for the gaseous products given off during the time that the decomposition of the nitrate or other oxygen yielding materials is going on, and a weight or spring lever acting on the rod to which the fire-clay cone is attached may be made to regulate the amount of pressure required to lift the cone and permit the escape of the gaseous matters.

"The arrangement of which we have just spoken is illustrated in Fig. 2, which represents a vertical section of the upper portion of a converting vessel or chamber in which molten pig or other carburet of iron is to be treated either by the injection of the fluid nitrate into the molten metal, as patented by Mr. Bessemer in March last, or in which vessel the nitrates or other oxygen yielding salts or substances are so brought in contact with the hot metal as to be decomposed. The outer shell, *h*, of the vessel or chamber is made of thick plates of iron or steel securely riveted and caulked at all joints, and capable of withstanding safely a pressure of from five to ten or more atmospheres. For the convenience of lining the vessel, the upper part may be removed by unbolting the stout flanges, h^1, and one or more hoops, h^2, are riveted to the exterior of the vessel to strengthen it. A lining of fire-brick, ganister, or other refractory material, *i*, is used to defend the outer shell from the high temperature generated within, and previous to its use for conversion, Mr. Bessemer prefers to make a fire in the interior so as to highly heat the lining and lessen its power of absorbing heat from the metal.

"On the upper part of the dome an iron ring, *m*, is riveted, to which a flanged ring, *n*, is fitted. The inside of this ring is conical, and is made to embrace the conical fire-clay ring, *p*, through which the gaseous matters evolved during the process are allowed to escape. A cone of fire-clay or of iron, *g*, is attached to the guide rod, *r*, for the purpose of closing or diminishing the area of the outlet opening in the fire-clay ring, *p*, and on the upper end of the rod, *r*, are placed weights, *s*, to regulate the pressure. The rod, *r*, is guided vertically upward and downward by passing through the tubular guides and stuffing-box formed at *t t*, on the curved exit passage, *u*, which leads to a chimney, and conveys away the gaseous products escaping from the converting chamber.

"On one side of the vessel or chamber is a projection, *v*, on the upper part of which a ring of fire-brick, *w*, is retained in place by a conical flanged iron ring, *x*. The opening in the ring, *w*, serves for the admission of the molten metal to the vessel, after which the cone, *y*, smeared with fire-clay is lowered down into the opening of the molded fire-brick, *w*, and by means of the weight, *z*, is retained in place and prevents the escape of gaseous matters during the converting process.

"The cone, *y*, and its rod and weight, *z*, are suspended by a chain in the position shown during the period of running in the metal. When the metal so run in comes in contact with the nitrate or other oxygen yielding materials large volumes of gaseous matters are evolved, these matters instead of escaping freely from the converter rapidly accumulating in the vessel until the pressure within it is sufficient to raise the cone, *g*, and escape by the small annular opening thus made, the pressure being regulated by the weight, *s*. Hence the combustion of the carbon contained in the molten iron by reason of its union with oxygen derived from the decomposition of the nitrates or other oxygen yielding materials will be effected under considerable pressure; and the gaseous products, instead of expanding freely as under the ordinary conditions of combustion, will be in a highly condensed state, by which means their temperature will be considerably raised, and the intense heat so generated will be imparted to the metal and cause it to retain its fluidity."

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Straightening Chimneys.

Messrs. Editors:—I was much interested in the account in your number of March 12, of straightening the tall chimney at Barmen, Prussia. Anything relating to building and maintaining chimneys of great hight involves questions of much interest to a great many people in these days of steam and machinery; and, judging from the numerous cases reported of the deflection of such chimneys from the perpendicular, and the methods adopted to straighten them, there is a want of more and better information on the subject.

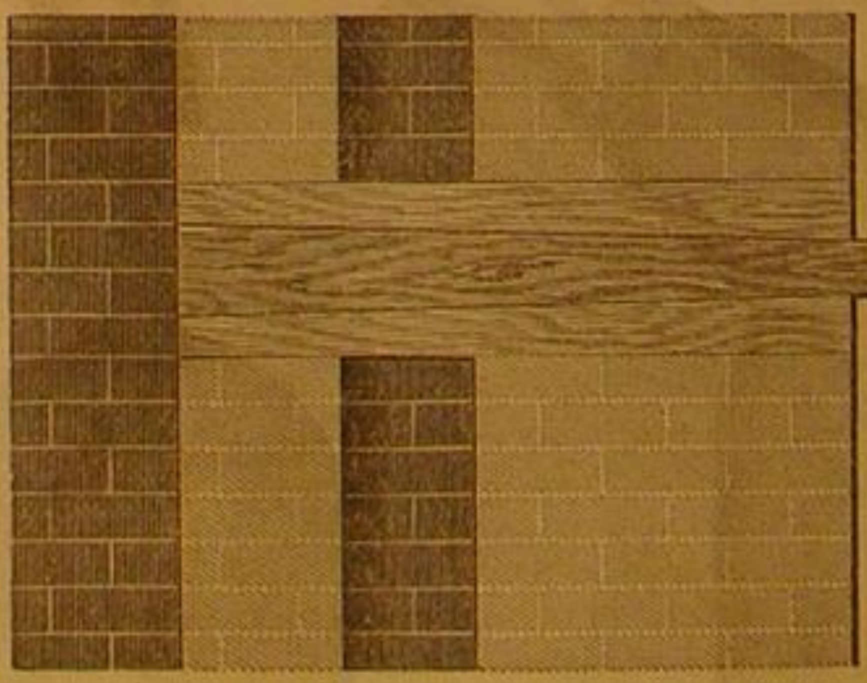
In reading the account above mentioned, I did not see any allusion to what is an indispensable part of all chimneys of that kind, namely, the inner chimney, or core. If that was absent, that fact alone would account for the deflection of the chimney.

Probably few outside of the trade are aware that the tall chimneys that surround us in cities and manufacturing towns are each composed of two separate and distinct chimneys, one inside the other. The inner one to conduct away the smoke, heat, and gases, and the outer one to support the inner one, and protect it from the weather. The reason is that if the outer chimney were subjected on the inside to heat more or less intense, and on the outside to the ordinary variations of temperature, the unequal expansion and contraction of the outside and inside of the same wall would soon cause its disintegration.

An interesting illustration of this principle was seen some years ago in this city, where a chimney was built with the core carried up inside, detached from the outer chimney, as it should be, until it reached the top, where, instead of dropping the inner chimney, and forming the coving, or crown, with the outer chimney, leaving the inner one free to expand or contract, they were connected with each other and built up together. The consequence was that when the fires were started and the inner chimney was subjected to heat, its expansion caused it to lift the whole crown up clear off the outer chimney, causing a horizontal fracture 3 or 4 inches in hight.

In regard to the Barmen chimney before mentioned, I would say that I consider the method adopted to straighten it as most unworkmanlike and dangerous, and I am not at all surprised that the chimney should vibrate to the extent that it did during the operation, or that the masons should "get frightened and leave the place."

I would suggest a much better plan than that of sawing out the joints. Have a number of oak wedges made of length sufficient to pass through the entire thickness of the chimney, and project sufficiently on the outside. Place them in sets of three each, one over the other, thus,



having the surfaces in contact straight and smooth, and blackleaded to diminish friction. Commence on the opposite side to that in which the chimney leans, cut through to the inside, insert one set of wedges, and wedge above and under them until they take a bearing. Repeat the process around the chimney, except on the lowest side, leaving spaces of a foot or more between each set of wedges. Then by driving the center wedge in each set inwards, as much of the chimney as rests on them is gradually lowered just at the places and to the amount required to bring it to an exact perpendicular. When that is done, brick up the intervening spaces, loosen and withdraw the wedges, and brick up in their places.

In conclusion I would say that my experience in that kind of work leads me to believe that sufficient care in planning and executing constructions of this kind is not always taken; and when a chimney like that at the Charlestown Navy Yard, in the building of which expense was a secondary consideration, swerves from the perpendicular, to the extent that it does, to say nothing of the large number of others that give trouble in many ways, it behooves those whose business requires tall chimneys, to look well to the construction thereof.

Boston, Mass. Chas. A. Fox.

Matter and Motion.

Messrs. Editors:—In your article on page 175, in reply to Mr. Blake, you quote from four writers, to show that the term inertia is not always used to mean the same thing; when, if I can understand them, they agree as to the definition of the word, though one of them denies the fact of which it is the expression.

Certainly it is to be expected that new discoveries in science will work some changes in our ideas of things, but it does seem a little startling to say that the idea of the inertness of matter is obsolete; for is it not a principle of philosophy that a conception the negation of which is inconceivable must be true?

Then with respect to such motions as are imparted to matter, is it conceivable that it moves itself? If not, what else can it be but inert?

But suppose it under some circumstances to move itself; how is it done but by the exertion of force? And are not the force and the resulting motion commensurate? Then it follows (why not?) that force and motion are correlative, and that a given force produces a commensurate motion and no more; because inertia is opposed to it, and an equivalent of inertia is exchanged for an equivalent of motion. Except for this plain and easily understood principle, what would prevent an infinite motion from ever so small a force?

So it appears to me that the argument of Mr. Nichols and your own from molecular motion to the denial of inertia is a pure *non sequitur*, as it does not seem to alter the case at all, to say that matter moves itself.

The absurdity of the alternative to which the denial of inertia forces you, namely, that it is a natural property of matter that it moves itself about from place to place, is too absurd not to be remarked.

As to the idea that matter does either as molecules or masses move itself, I simply wait for the proofs, which when they come will undoubtedly astonish the apostles of the new philosophy, as well as every body else.

S. H. Wilder.

Deep River, Ct.

[Our correspondent must not put his own language into other people's mouths. No one has to our knowledge said that "matter moves itself," any more than they have said "matter forms itself; matter extends itself; matter makes itself to be impenetrable." What those who deny the state of rest in matter, say, is simply that matter constantly moves; and that under certain conditions, the motion of portions of matter decreases simultaneously with increase of motion in other portions; the increase and decrease being equal in all cases. It is believed by many that motion is an essential property of matter, as much as extension; in fact, that the so-called essential properties of matter, are merely concomitants of motion; that matter and motion are coexistent, and that neither can be recognized by the human intelligence without the other.—Eds.

Relative Cost of Hoosac and Mt. Cenis Tunnels.

Messrs. Editors:—Your recent article upon the Hoosac Tunnel, I think conveyed a wrong impression as to the relative cost of the Mt. Cenis tunnel and the Hoosac. You place the cost at Mt. Cenis at $1,500,000 per mile, and at Hoosac $1,900,000 per mile. By reference to Buffum's "Sights in France," etc., you will see that the cost of the Mt. Cenis tunnel is to be $26,000,000, of which France pays $20,000,000 and Italy $6,000,000, making the cost per mile over $3,335,000. The American engineers claim that their drilling machinery is of much superior construction, enabling them to do the work quicker and cheaper, and there appears to be truth in this assertion. For example, in the book referred to, it is stated that the drills are used up pretty fast at Mt. Cenis, and that 2,000 drills will be broken up before the work is done; but at Hoosac it is stated that not more than 50 of the Burleigh drills have been employed, all told; all are still good, although some of them have been in use for over 3½ year?

B.

Spontaneous Combustion of Oil Scrapings.

Messrs. Editors:—On reading the article on Spontaneous Combustion, published in Vol. XXII., page 121, Scientific American, it instantly reminded me of what I myself saw about two years since. I was then engaged as foreman for a manufacturer of oil silk. In this process the belts of silk when dipped in the oil are hung upon hooks and part of the dripping oil falls to the floor. In the course of a few months the accumulation upon the floor is considerable. In the instance alluded to the proprietor ordered me to scrape the floor and put the scrapings in barrels and place them in a certain corner of the room up stairs. I refused to do it, explaining to him the danger of combustion, but my argument was ridiculed, and the scrapings were collected by the proprietor himself in three barrels and placed as described. They remained there but two days, and on the morning of the third I entered the rooms about six o'clock, A. M., and noticed a dense blue smoke. Feeling positive that the gas could not have produced it, I at once searched for the cause, and soon found it. I at once seized the nearest barrel which blazed from the bottom in a most terrific manner, and notwithstanding the intense heat, I succeeded in removing it out of the building. On returning I found it had set fire to the floor plank, an inch and a quarter thick. This extinguished, I drew away the second barrel, which also burst into blaze from the bottom as soon as moved. The same result took place with the third, so that only for my timely entrance I feel certain the flames would have caused a loss of $30,000.

The above I submit as a warning to all engaged in the manufacture of such goods to place the scrapings from the floor where they can have free access to open air.

GARRET W. ANDERSON.

Peekskill, N. Y.

Effect of Compressibility on Buoyancy.

MESSRS. EDITORS:—I have read the following answer in the column devoted to correspondents, No. 10, current volume: "Any solid substance which will begin to sink in water, will sink, if unobstructed, to the bottom. The reason is this. Any solid now known, is more compressible than water; compressing it increases its specific gravity and renders it less buoyant than before the pressure was put upon it. As it goes down then, its tendency to sink is increased rather than diminished." I have found the assertion contradictory to the established figures of recent experiments relating to the compressibility of liquid and solid substances; the coefficient of compressibility of water is about fifty-millionths for each atmospheric pressure, while that of mercury is but three millionths. Solid substances are far less compressible than liquid ones; so the coefficient of compressibility of iron is 0·5 millionth only, for the same pressure; this being deducted from its coefficient of elasticity demonstrated by M. Wertheim to be exactly equal; the formula has been adopted by M. Grassi for the correction of observed compressibility in piezometer.

This being admitted, the specific gravity of water will be increased more rapidly in comparison with the iron, when submitted to the same pressure and at the ratio of one hundred to one.

Describing by d, the difference of specific gravity between water and any heavier solid substance; by c, the coefficient of compressibility of water; and by $\acute{c}$, that of the solid; the value of required condensation of water, expressed by x, to counterbalance the specific gravity of the heavier body, can be found by the following equation: $x = \frac{dc}{c - \acute{c}}$

Applying the formula to iron (specific gravity 7·8), the water to be equalized with its specific gravity put in the same condition of pressure, its primitive volume must be diminished 7·8787 times; that means, a compression equal to 157,574 atmospheric pressures, to a water column equal to one-fourth the terrestrial radius; passing this limit, the iron will float on the stratum.

This manner of calculation supposes that the coefficients of compressibility preserve their proportional value at this enormous pressure, which is not determined; but at all events, it demonstrates sufficiently that the tendency to sink will be diminished rather than increased, as the solid substance goes down in the water. M. W. BEYLIKZY.

New York.

Absorption of Oxygen by Charcoal.

MESSRS. EDITORS:—On page 189, current volume, an inquiry is stated by a correspondent, "Is there not in the property of charcoal to absorb oxygen a source of cheap extraction of this gas from the air?"

Two French chemists, MM. Laire and Montmagnon have been making experiments in this direction, and find that 100 measures of wood charcoal, freshly burnt, absorb 985 of oxygen and only about 705 of nitrogen. They proposed to pump out the oxygen and nitrogen from the charcoal and pass it over fresh coal, and re-pump it until the greater part of the nitrogen was eliminated and tolerably pure oxygen remained.

The direction in which experimenters should work is to find some substance, charcoal, membrane, etc., that will filter out the nitrogen and permit the oxygen to pass.

The late Mr. Graham came near the accomplishment of this result by using shavings of india-rubber, but the details of his process are wanting. Oxygen and nitrogen are so different in their properties that we ought to discover an easy way of separating them. J.

New York city.

Machinery Wanted at the South.

MESSRS. EDITORS:—I perceive you have noticed our annual State Fair that is to take place, commencing on the 23d of April.

I thought to drop you a memorandum of what is needed in our State, so that inventors throughout the United States could see what we most needed, and have their articles on hand.

Cart or wagon wheels of new pattern; force pumps to supply great bodies of water to our sugar houses; horse-power brick machines are much wanted—those that require that the bricks should be least exposed to the sun preferred. Every kind of new patent boilers for fuel is an object with us now; also knitting machines of all kinds; saw mills of all kinds, with new patent head blocks; cross-cut saws that will saw a tree up into fire wood where it falls, and a machine to split the wood. M. SCHLAHE, JR.

Plaquemine, Parish of Iberville, La.

Wear of Locomotive Wheel Tires.

MESSRS. EDITORS:—During the last few years I have been engaged in turning locomotive tires, and I have noticed that almost invariably the tires on the forward driving wheels were worn from $\frac{1}{32}$ to $\frac{3}{32}$ of an inch smaller than those on the back wheels.

The instances noted were from locomotives with four driving wheels and the ordinary four-wheeled truck in front. Can you or some of your readers give a reason for this excess of wear on the forward driving wheels of locomotives?

Clinton, Iowa. HIRAM R. JONES.

Dangerous Stoves.

MESSRS EDITORS:—In your issue of March 12, there is an article headed "Dangerous Stoves," I therefore take the liberty to inform the writer and your numerous readers that, in my estimation, feet or legs to a stove are a superfluous nuisance. In selecting my stove, I took particular notice it had a large base that dipped down well below the bottom on which the fire rests; I then made a frame of wood just to fit under the stove, and covered it with zinc. I then placed the stove upon this platform, minus legs and feet, in two or three inches deep of ashes, and built a fire, and have feared no danger from fire or the stove falling down. I manage to heat four rooms with one stove in the following manner: In the ceiling of the living room over where the stove sits (for it don't stand) there is a ventilating thimble which allows heat to pass into a chamber sufficient to warm it and make it comfortable in all kinds of weather. The stovepipe passes through a side wall into a "drum," [which heats a bed-room, then up through the ceiling into another room to heat a chamber bed-room, thence into the chimney.

Now for the results; the heat is all expended in the house just where it is most needed, and the wood consumed is no more than is commonly used to warm one room. I would say that my stove is soap stone No. 2, and does not get cold from the time the fire is lighted up in the fall till it is taken down in the spring. JNO. T. SMITH.

Cedar Rapids, Iowa.

Dangerous Stoves.

MESSRS. EDITORS:—I see an article on page 173, present volume of your paper, headed "Dangerous Stoves," made so by the legs falling out, and the stoves falling down.

A similar accident took place a number of years since with my stove, nearly killing a small child. A neighbor met with a similar accident in which a kettle of boiling water was precipitated on a child, scalding it to death.

To prevent a like occurrence, we procured a half-inch drill, drilled a hole through the bottom plate of the stove and legs, counter sunk the hole in the plate to prevent the head of the bolt to be placed in it, from rising above the plate; the bolt extending through the legs to receive a nut which was screwed up tight, holding the plate and legs firmly together, all was quickly and cheaply done; since then, when we buy a new stove, the first thing done is to fasten the legs in this manner. The expense and time required to do this are so small that all stove makers and menders should be compelled to make preparation to have their stove legs so fastened before sold.

E. G. PATTER.

Bellevue, Iowa.

An Error Corrected.

"It is said a new description of lava is being thrown from the crater of Vesuvius since the last eruption, consisting of crystallized salt. This beautiful phenomenon has hitherto been unknown in volcano natural history. The scientific bodies are engaged in investigating."

MESSRS. EDITORS:—I clipped the above from the New York *Christian Leader* of Jan. 1st. I first saw it in that paper, and on the 8th of January it made its appearance in the SCIENTIFIC AMERICAN, with the exception of the last brief sentence of six words. I am of the opinion it is time it was corrected. If corrected in time, I am in hopes those investigators alluded to, will not hazard their precious lives by penetrating into the bowels of Vesuvius on a salt-exploring expedition, until they have read Humboldt's Cosmos, Vol. V., page 413. It is:

"Common salt is from time to time found as products of sublimation, even in lava streams on Hecla, Vesuvius, and Etna, in the volcanic chain of Guatemala (volcano of Izalco), and above all in Asia, in the volcanic chain of the Thian-shan. MRS. GEORGE HENRIUP.

Geneva, N. Y.

Lacquer.

No. 1.—Shellac, 120 parts; sandarach, 45 parts; mastic, 30 parts; amber, 30 parts; black resin, 90 parts; dragons' blood; 30 parts; turmeric and gamboge, each 24 parts; rectified spirit, 1,000 parts. Digest until dissolved; then strain. No. 2.—Seedlac, 120 parts; sandarach, 120 parts; dragons' blood, 16 parts; gamboge, 2 parts; turmeric, 2 parts; Venice turpentine, 50 parts; clean sand, 150 parts; rectified spirit, 1,000 parts. Digest in a sand bath, and strain. No. 3.—Seedlac, gamboge, and dragons' blood, each 120 parts; saffron, 30 parts; rectified spirit, 1,000 parts. Digest with heat, and strain. No. 4.—Seedlac and sandarach, each 120 parts; dragons' blood, 15 parts; turmeric, 2 parts; gamboge 2 parts; Venice turpentine, 60 parts; spirit of turpentine, 1,000 parts. Digest with heat and strain. Aloes is sometimes used to give it a dark color.

ADHESION OF AIR TO GLASS.—M. Auguste Houzeau has called the attention of the French Academy to the presence of nitrogen in what was supposed to be pure oxygen. He shows that it is extremely difficult to get rid of the film of air adhering to glass vessels, even after considerable "sweeping" with currents of oxygen, or other gas. In his experiments on the production of ozone by the electric shock, he found it necessary to make the narrow tubes he employed red hot, and while they were in that state to pass oxygen currents through them

New Blue Pigment.

The new pigment is obtained in the following way, according to the directions of M. Tessié du Motay, and can be easily prepared in a few days. Take of tungstate of soda, ten parts; tin salt—protochloride of tin, eight parts; yellow prussiate of potash, five parts; prechloride of iron, one part. Dissolve these substances separately in as small a quantity of water as possible. Mix the solution of the tin salt with that of the tungstate of soda, and the solution of the perchloride of iron with that of yellow prussiate of potash.

The two mixtures so produced are then to be added to each other, the whole thoroughly shaken, and allowed to stand for some hours. The precipitate produced in this way is caught on a filter, and then when slightly washed and drained, is spread on earthenware plates and exposed to the sunlight for a day or two. The precipitate, at first an undecided blue, gradually assumes a more marked shade. After a day's exposure to light the substance is powdered and washed on a filter with water, so as to free it from soluble matters. It is again spread out and exposed to light for several days longer, until a pure blue tint is developed. It is again powdered and preserved for use.

The new blue is of a beautiful tint, resembling the variety of Prussian blue, called "Berlin blue," but it possesses more "body" than the latter.

In order that our readers may be able to judge of the value of this substance we give M. Tessié du Motay's analysis of it. He finds that it contains in one hundred parts—

Moisture	7·85
Tin	31·69
Iron	5·42
Cyanogen	19·44
Blue oxide of tungsten	35·60
	100·00

It is evidently a mixture of the finer variety of Prussian blue with the remarkable blue oxide of tungsten.

So far for the composition of the new pigment: its properties may now claim our attention. It is believed to be quite unalterable by light, because it is produced by the same agency; and M. Tessié du Motay remarks that it is illogical to suppose that the power which has produced the new blue will also destroy it. So far as the logic is concerned we think that little importance need be attached to such an argument, as there is no good reason why the action of light should not go on to destruction of the color; but we are rather inclined to think that preservation of the pigment in darkness would be very likely to destroy the color of the blue oxide of tungsten, as it has a considerable tendency to pass by oxidation into tungstic acid or anhydride—a greenish-yellow substance; but the presence of the Prussian blue is, to a certain extent, a safeguard against this danger.

It is well known that ordinary Prussian blue is easily bleached by an alkali, as our readers are no doubt aware that it is not very unusual for grocers to write on their blue papers in which they usually make up tea with a weak solution of caustic potash; wherever the colorless liquid comes in contact with the blue liquid, the Prussian blue used in preparing the paper is bleached, the letters or figures then appearing as white on a blue ground. The new pigment is but slightly altered by similar treatment, as the oxide of tungsten is unaffected by alkalies.

Again; the beautiful ultramarine blue so largely used in painting is unchanged by treatment with an alkali, but very readily decomposed and the color destroyed by very weak acids, though the latter have no effect on Prussian blue. M. Tessié du Motay's new pigment resists this treatment likewise, so that, while possessing a shade of color intermediate between ultramarine and Berlin blue, it resists the reagents which destroy the two other pigments.

It is only necessary to add that tungstate of soda can be manufactured in large quantities and at a very low rate, since a mineral of tungsten, called "wolfram"—tungstate of iron and manganese—occurs in considerable quantities in Cornwall accompanying the ores or tin. This wolfram is a nuisance to the Cornish miner, who would be glad to find a good market for it; and therefore, since all the other materials, including solar light, are cheap, the "photographic blue" bids fair to attract some attention—more especially since it is less likely to be injured by the prolonged action of light than other blue pigmants.—*British Journal of Photography*.

AT a recent meeting of the Paris Academy of Sciences, M. Feil exhibited specimens of flint glass of great density (Faraday's glass) obtained by a new process, enabling masses of this material to be manufactured, weighing from 25 to 35 kilos., perfectly pure, homogeneous, and free from striæ, and of a density equal to, and even greater than that of Faraday's. He also showed specimens of imitation precious stones, such as emeralds, sapphires, and white and colored rubies, as well as a specimen of a deep violet blue, rich in tone, and of a brilliancy surpassing that of the finest amethysts. They are stated to be nearly equal in hardness also. The author, in his communication, states that he uses for the flint glass aluminates of lime, of lime and baryta, of lead, and of bismuth, etc., and for crown glass, aluminates of magnesia, silicates of magnesia, and of alumina.

MIXTURE FOR CLEANING FURNITURE.—Cold-drawn linseed oil, 1 quart; gin, or spirit of wine, half a pint; vinegar, half a pint; butter of antimony, 2 ounces; spirit of turpentine, half a pint. N. B. This mixture requires to be well shaken before it is used. A little of it is then to be poured upon a rubber, which must be well applied to the surface of the furniture; several applications will be necessary for new furniture, or for such as had previously been French polished or rubbed with beeswax.

Improved Apparatus for Measuring Liquids.

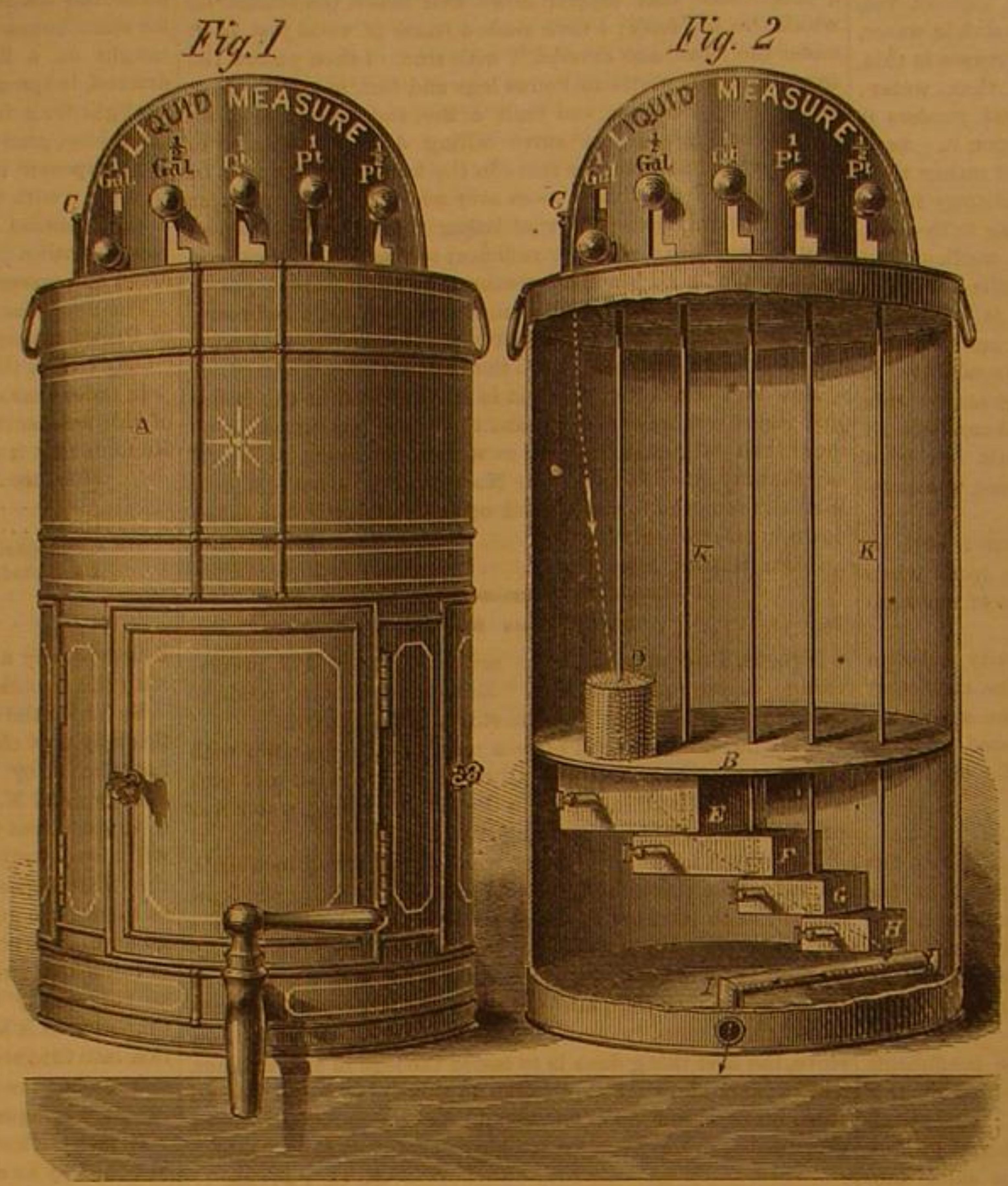
A means whereby the measurement of liquids could be accurately accomplished without the use of sets of measures into which various liquids must be drawn, has long been a desideratum. The possibility of drawing the required quantity with rigid exactness, directly into the vessel designed for its transportation, is something much to be desired, both as a matter of convenience and of cleanliness. In the case of inflammable liquids, such measurement is also desirable on the score of safety, since the near approach of any artificial light is not necessary.

With the apparatus herewith illustrated, liquids may be accurately measured in drawing, when there is light enough to place the receiving vessel properly; and the annoyances and inconveniences attendant upon the use of portable measures are wholly avoided.

The operation of the apparatus will be at once understood by inspecting the engravings; Figs. 1 representing the complete device, and Fig. 2 showing the same in vertical section.

In these engravings, A represents the outer case, divided into an upper and lower chamber by a diaphragm, B; any convenient quantity of liquid being poured into the upper chamber through the opening at C. It is drawn when wanted through the strainer, D, and subsequently through the measuring chambers, E F G H, and through the tube, I, out through the faucet into the vessel destined to receive it; the dotted line showing the course of the fluid from its entrance to its exit from the apparatus. The chambers, E, F, G, H, and the tube, I, hold, together, one gallon in this instance; but they may be made to hold any quantity desired. The chamber, E, holds half a gallon; the chamber, F, one quart; the chamber, G, one pint; the chamber, H, a half pint, and the tube, I, also one half pint. The measurement of these chambers and the tube, I, are adjusted to accuracy by screw spindles, L.

The upper chamber of the apparatus and the measuring chambers, E,F,G,H, and I, communicate with each other only when valves actuated by the rods, K, are raised. The rods, K, are inclosed by vertical tubes, which ascend to the top of the case; and vent tubes (not shown in the engraving) are also supplied to each measuring chamber so that the flow may be rapid.



LIQUID MEASURING APPARATUS AND STORE CAN.

The valve rods, K, are held up by springs, so that, when it is not desired to draw any liquid, the chambers all communicate; and of course the measuring chambers will instantly fill and keep full so long as one gallon remains in the upper chamber. The state of the liquid in the upper chamber may be indicated by any suitable form of gage. Thumb knobs at the top of the rods are arranged as shown, and marked one gallon, half gallon, one quart, one pint, and half pint. The thumb knobs engage in the horizontal portion of the slots in which they slide, by a slight rotary movement, so that any valve once closed will remain closed until the knob is released.

If it be desired to have a half pint of the liquid, the knob so marked is depressed. This closes the valve corresponding to the knob, and all flow from chambers above the pipe, I, is cut off. Upon opening the faucet, only the contents of the pipe, I, will be discharged; that is, a half pint. If one pint is desired the knob corresponding to that measure is depressed, and so on for all intermediate measures up to the full measuring capacity of the apparatus.

Each of the several chambers has an inclined false bottom, so that full delivery of its contents is secured, and the chambers are reached for regulating and sealing through doors shown in Fig. 1.

The apparatus may be applied to the filling of barrels, a large size being made for that purpose, and is capable of extension to all wholesale and retail measuring. It may also be connected to liquor casks and applied to milk cans, for which it seems particularly suited, as the measures can be made so as to be readily reached to scald and clean them.

Patented by Martin McDevitt, of Hampton, Va. For further particulars, or for State, county, and town rights, address McDevitt & Woodward, Hampton, Va.

The Fire at Hoosick Falls.

The Troy *Times* gives the particulars of the fire on Sunday in the village of Hoosick Falls, by which all of the works of the Walter A. Wood Mowing Machine Company on the north side of the Hoosac river were totally destroyed, excepting one large storehouse. The fire broke out in the main building connected with the works, the machine shop, and destroyed that edifice, the carpenter shop, the blacksmith shop, one storehouse, the office, the foundery, a building in which castings were cleaned, and five tenement houses, occupied by the families of seven of the operatives of the company. The patterns of the company were not injured—the men employed at the works rushing into the pattern shop and removing them at the risk of their lives. The loss is upward of $400,000; and upon it there is an insurance of $245,000, in nearly fifty different companies.

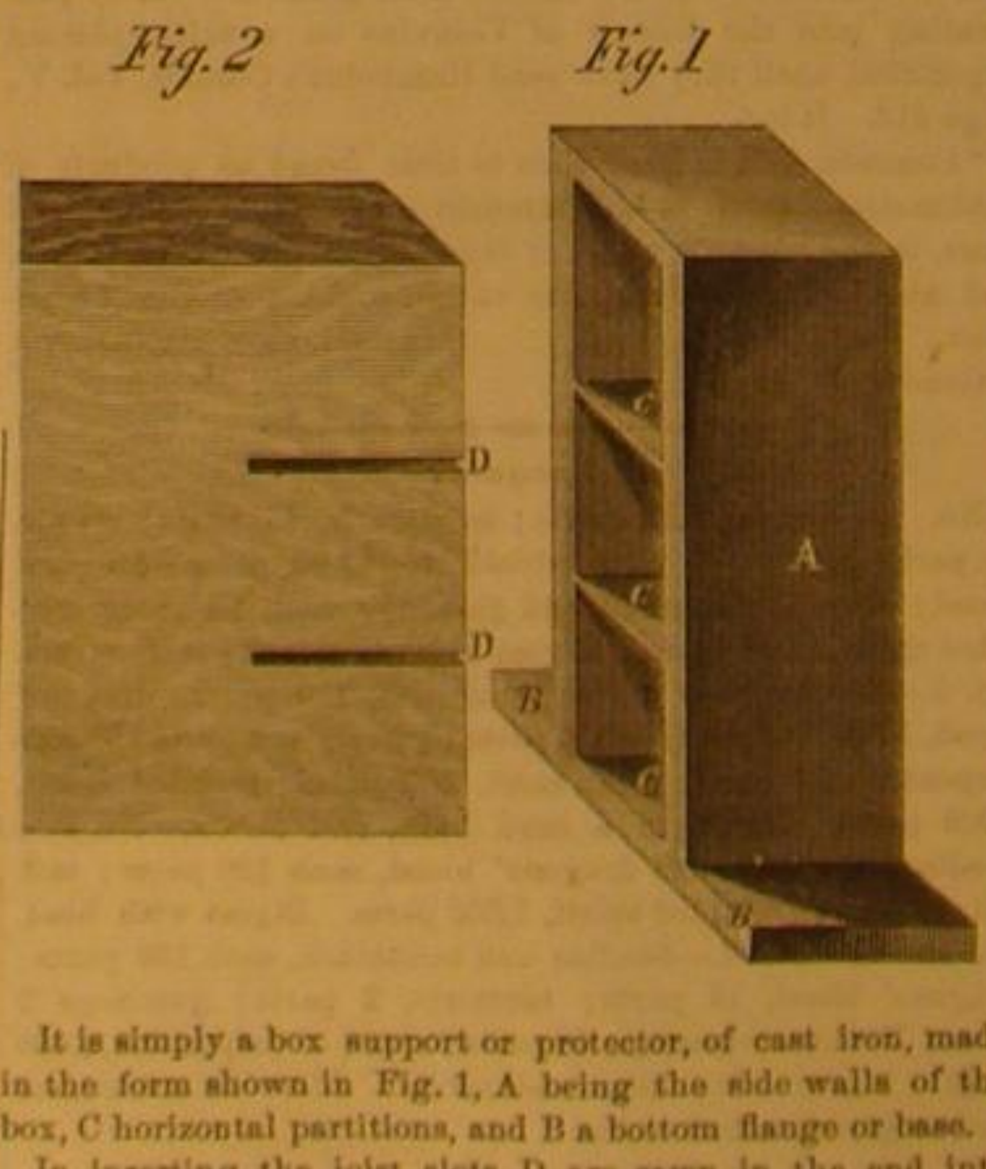
The buildings on the south side of the river were uninjured. These consist mostly of the Caledonian Mills (formerly the Merritt property), and will be kept running as formerly. Immediately upon the extent of the calamity being determined, Mr. Wood gave orders for the erection of new works, the plans were prepared, and to-day a large force of men is engaged constructing the new shops. It is believed the new foundery will be in operation soon—the cupola of the old one being available for use immediately.

In 1859, also, the works were destroyed by fire. Mr. Wood then set himself with his accustomed energy to the task of rebuilding them, and in two weeks they were in operation.

Previous to the late fire the company were turning out one hundred and fifteen machines per day, and within a week it is thought arrangements will be made by which at least fifty per day will be manufactured. Four thousand complete mowing machines were stored in the storehouse which was not burned, and these will be sufficient to enable the company to keep up with their orders.

GALMANN AND RUHE'S IMPROVED JOIST PROTECTOR.

It is well known that the ends of joists placed in walls, particularly in lower floors, are in the ordinary way, exposed to dampness, and consequent decay. In the device we herewith illustrate, we think, an adequate remedy for this has been found.



It is simply a box support or protector, of cast iron, made in the form shown in Fig. 1, A being the side walls of the box, C horizontal partitions, and B a bottom flange or base.

In inserting the joist, slots, D, are sawn in the end, into which the partitions, C, enter when the joist is placed in its proper position. This gives a greater number of bearings.

We think this device, simple as it appears to be, is a very practical and useful one, and have no doubt it will meet with with favor from architects and builders.

Patented, through the Scientific American Patent Agency, Feb. 1, 1870, by H. Galmann and Charles Ruhe, of Buchanan, Pa. Address as above for further information.

It is thought the Mont Cenis tunnel will be completed about the end of January, 1871.

OBITUARY--SETH BOYDEN.

We regret to record the death of Mr. Seth Boyden, who, at the time of his death, was one of the oldest, as he had been in his life one of the most prolific, inventors this country has produced. Mr. Boyden invented and commenced the manufacture of patent leather at Newark, N. J., in 1819, having taken up his residence in that city in 1815. He invented a brad machine, in 1816, which largely reduced the cost of manufacturing brads. In 1826 he made the first specimens of malleable castings, and continued in their manufacture till 1831. About this period he devised the first locomotive with outside connecting rods. He also devised a cut-off, and was of much assistance to Professor Morse in working out the details of electric telegraphy. It is said that he produced the first daguerreotype ever taken in this country. He also, in 1849, succeeded in making spelter, and laid the foundation for such success as zinc mining has attained in this country. He subsequently succeeded in imitating Russian sheet-iron, but at a cost which would not admit of competition with the foreign article. One of the latest of his inventions was a machine for making hat bodies, which has gone into general use.

The last time we met Mr. Boyden was about a year since, in a hat-manufacturing establishment in Newark, where his machines were employed. We found him in the office reading proof sheets of a paper upon some subject connected with electricity. Age and the ordinary cares and pains which accompany it, seemed entirely forgotten in his enthusiasm for science; for Mr. Boyden, though a practical man, was one of those scientifically practical men whose zeal is directed by knowledge. Perhaps no man of his time has done more to promote the industrial arts in this country than Mr. Boyden, who, though his inventions have been mines of gold to others, lived a poor man, and died at the age of 82 a poor man, in all except the respect and honor which reward a good life.

Length of Journals.

Another consideration of considerable importance to the smooth and safe working of shafting is the length of the journals. From a number of years' experience I have been led to believe, that with cast iron, one and a half times the diameter of the shaft is the best proportion for the length of the bearing, and with wrought iron, one and three quarters the diameter.

On the question of shafts revolving in the steps of plummer blocks and the proportions necessary to effect motion without danger of heating, it is essential (without entering largely into the laws of friction on bodies in contact) that we should ascertain from actual practice and long-tried experience the best form of journals of shafts adapted for that purpose. The lengths proportionate to the diameters have already been given, but we have yet to consider the dimensions of the journals of large shafts where they are small in comparison with the pressure or the weight they have to sustain. Let us, for example, take a fly-wheel shaft and the foot or toe of a line of vertical shaft extending to a hight of six or seven stories in a mill filled with machinery, and we have the safe working pressure per square inch as indicated in the last column in the following table:

DESCRIPTION OF SHAFT.	Length and diameter of shaft in inches.	No. of square inches in bearing.	Weight on bearing in lbs.	Weights in lbs. per square inch on bearing.
Fly-wheel shaft, wrought iron.......	18 x 14	252	45,024	178·21
Vertical shaft, cast iron..............	— x 11	95	23,061	242·79
Horizontal shaft, cast iron...........	15 x 10	150	6,000	40·00
Horizontal shaft, wrought iron......	6 x 3	18	540	30·00
" "	2 x 4	8	160	20·00

From the above it will be seen that in fly-wheel shafts the pressure should never exceed 180 lbs. per square inch, and in that of the toes of vertical shafts 240 lbs. per square inch. Even with this latter pressure it is difficult to keep the shafts cool, and it requires the greatest possible care to keep them free from dust or any minute particles of sand or other sharp substances getting into the steps. The feet of vertical shafts also require the very best quality of gun metal for the shaft to run in, and fine limpid oil for lubrication to prevent the toe from cutting. It is, moreover, necessary for the shaft to fit well on the bottom of the step, and not too tight on the sides, and to have a fine polish.

Another point for consideration is the proper form of the journals of shafts, and that is, they should never have the journal turned or cut square down to the diameter.

From a series of interesting experiments it has been shown that the square-cut shaft loses nearly one fifth of its strength, and by simply curving out the shaft at the collars of the bearing, the resistance to strain is increased one fifth.—*Fairbairn's Principles of Mechanism.*

The North German Ocean Observatory last year concluded an important examination of the courses followed by steamships between the Lizard and New York, to discover by what route a steamship can accomplish the distance between the two points in question, at various seasons of the year, in the shortest time.

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Contents:

(Illustrated articles are marked with an asterisk.)

GLAZED BRICKS FOR BUILDING PURPOSES.

An article on the "Materials for Economic Building" which appeared in the London *Builder* of Feb. 5, contained a suggestion that for interior walls, and indeed for surfaces exposed to weather, one end and one side of the bricks should be covered with a vitreous glaze.

The suggestion is, in our opinion, an excellent one, and worthy earnest consideration. Not only might increased durability be thus secured without the use of paint, but ornamental effects of the highest order might easily be obtained.

The article in the *Builder* has called forth an interesting correspondence upon the subject, from which it appears that the plan proposed by that journal, namely, the glazing of walls after their construction, by the use of a heated iron plate to fuse the coating of glazing material previously applied, has in it many elements of impracticability.

It is argued that difficulty would be experienced in laying on the glazing material with a brush, where colors had been previously employed for ornamentation, without at the same time disturbing the colors; and that if a glaze sufficiently hard to resist the action of the weather be used it would be impossible to fuse it in the manner proposed. A better way would be to lay the glazing material upon half burned bricks, and complete the burning in a muffled kiln; that is, a kiln with a lining of thin fire-clay, to protect the surfaces of the bricks from dust.

The half-burnt bricks will take color well when it is desired to ornament them. In this case it is suggested that the half-burnt bricks be laid in a wall in the position they are to occupy when put in buildings, and the design painted upon them, after which they are to be taken down and burned as above stated.

It is thought that in this way impervious walls of a highly decorative order might be obtained, and we fail to see any impracticability in the plan. In fact, one of the correspondents of the *Builder* states that he has glazed several common bricks, in imitation of the old Assyrian and Babylonian bricks to be seen in the Museum of Geology, in Jermyn street, London, with perfect success; not only making the bricks non-absorbent, but imitating the colors of the ancient specimens referred to. He also states that he has had perfect success in painting designs and burning them in, and that he is convinced common bricks can be thus glazed at a moderate cost. He also has succeeded in glazing bricks and retaining their bright red color, and states that the bricks thus produced would make highly ornamental interior walls, without the use of plaster, paper, or paint.

A great collateral advantage in the use of such bricks for outside walls, aside from the fact that they need not be painted to render them impervious, is, that their surfaces would be cleaned by every fall of rain, and would therefore always look fresh and bright.

There is no doubt that the prevailing monotony of bricks and mortar, which now pervades many of our American cities, might be greatly enlivened and relieved by the introduction of glazed and ornamented bricks for fronts. What architect will be the first to carry out the idea in this country?

DUALIN—WHAT IS CLAIMED FOR IT.

We are in receipt of a letter from Mr. Carl Dittmar, the inventor of dualin, who, while admitting the spirit of fairness shown in our recent article upon this explosive, sets forth its claims more fully than we were able to do at the time that article was written. We gathered our information from various sources, which we supposed to be reliable, yet Mr. Dittmar states that our showing does not do full justice to the merits of his invention.

While we have not room to publish Mr. Dittmar's communication at length, we will give the substance of it in the present article, and will add that there can be no doubt that if these claims are established, a valuable addition to the list of explosive agents has been made. The inventor expresses his willingness to submit his powder to any and all proper tests and to rest the validity of his claims upon the results.

He claims that dualin is safer than common powder, fully as strong as nitro-glycerin, and cheaper in its application than either, and he asserts that the use of the preparation in Central Europe has proved these claims to be valid.

What will, perhaps, take our readers most by surprise, is the fact that Mr. Dittmar claims to have been the original inventor of dynamite. He says:

"Mr. Alfred Nobel has patented this invention, he has even disposed of the patent right he held for it in this country, yet he is by no means the inventor of dynamite, which I did invent and bring first to Mr. Nobel's notice. I held at that time the position of technical director of the first nitro-glycerin manufactory which Mr. Nobel had ever established in Germany."

It seems strange that Mr. Nobel should have been so universally acknowledged as the inventor of dynamite, or giant powder, if the statements of Mr. Dittmar are correct. Upon the merits of this part of the subject, we cannot, of course, pretend to decide; but we have no doubt Mr. Dittmar is amply qualified to judge of the advantages as well as the disadvantages of dynamite, or giant powder.

He admits that dynamite is a great improvement on nitro-glycerin, but enumerates the well-known inconveniences met with in its use, such as the generation of deleterious gases in mines, its inexplosiveness at low temperatures, the necessity of using an exploder to fire it, etc., etc.

He denies that dualin will explode when brought in contact with flame, unless it is confined in a well-tamped blast-hole, shell, or its equivalent, and he sends us a paragraph from the North Adams *Transcript*, which details an experiment performed with it in front of the Wilson hotel in that town, in which a cartridge of it was set on fire in the road in front of the hotel, without explosion and with effects and appearance resembling a Roman candle when ignited.

He states, moreover, that dualin will explode when wet, notwithstanding what has been said to the contrary, and that he uses and recommends water tamping in preference to all others. As proof of this he instances experiments in Hoosac Tunnel, where seven pound cartridges made of common paper, were placed in blast-holes not only filled with water, but two feet under the surface.

He further asserts that dualin has been found to be at least 30 per cent stronger than dynamite in European experiments, and that "iron plates, 16 inches and 23 inches thick, on which a dyna mite explosion would produce no effect whatever, were rent into fragments by the explosion of a quantity of dualin of less weight than the quantity of dynamite used."

If these statements shall be verified by experience, Mr. Dittmar will certainly lose nothing by permitting his powder to be tested anywhere fairly upon its merits, and he expresses his entire readiness to permit such trials, and to abide by their results.

NATURE'S ELEVATOR.

"What goes up must come down," we boys used to sing in one of our youthful games. The converse, what comes down must have gone up, or have been forced up, leads to the consideration of some of the most stupendous operations of nature.

On all hands we may see these operations proceeding in silent grandeur. Masses of matter, which, aggregated, become almost inconceivable in magnitude, are constantly moved upward from the earth's surface, to descend in due time; again to be raised and again to fall. So the ponderous engine of nature oscillates constantly, without faltering, yet it moves so quietly and with so little friction, that only occasionally, when the thunder shakes the earth, or the hurricane ravages the land and sea, do we note the tremendous power of the common natural forces, which, in the calm summer day or the winter's storm, are always at work about us.

The water constantly accumulating in the air descends and fills the rivers. We see, and wonder at the aggregated power of these torrents as they impetuously rush toward the sea, leaping precipices and sweeping every obstacle before them; but we do not realize the great truth that all the while the silent force of solar heat is transporting to the clouds as much water as the rivers are carrying down.

We stand by some mountain side whose forests are being felled and transported to the valleys, without reflecting that all this vast mass of material was carried up, molecule by molecule, in the atmosphere and in the sap, until its accumulation became so great as to be demanded for the uses of mankind.

The unseen power that does all this work is solar heat. "Where there is life there is heat," and it would seem that heat is essential to all life. At least we cannot conceive of life without heat; and so intimately connected are heat and mass motion that it is difficult to conceive of them as other than co-existent.

Heat is the great primo mover, all else is secondary in natural as well as artificial mechanics. Does falling water turn our wheels? Heat raised the water first. Does wood or coal generate our steam? Solar heat stored up the carbon which constitutes the bulk of that fuel, and set the rivers running and the winds blowing, by which we transport it to our furnaces. Do we employ animals to carry our burdens? The food which nourishes them and enables them to perform labor, was collected by the action of the solar heat.

We find then, all life, all motion, all work traceable to the power of solar heat. This is the great mechanical engine employed by nature to keep everything running. To-day bold inventors are endeavoring to bring this heat into direct subjection, as a motor, but should they succeed, so that coal, wood, peat, or other fuel should no longer be needed to impel machinery, they will only have eliminated a few terms of the great mechanical equation. It is the sun that does the work on the water-wheel and in the steam boiler, as truly as in Ericsson's solar engine.

And in the present state of science there is little doubt, that not only mechanical energy, but every other form of terrestrial energy included in the category of force, may be ultimately traced to the sun as its source. The sun is, in this view, the great central motor of the solar system. From whence it derives its power, what constantly maintains its heat, is one of the grandest problems science has ever grappled with, and one which is not yet solved.

THE MEASUREMENT OF WATER POWER.

This is one of the most simple operations in hydraulic engineering, so far as fundamental principles are concerned. In fact one proposition comprises the whole subject. The weight of water discharged per minute, multiplied into the "head" or the number of feet through which the water is to be applied to work—or, as it is more often termed. "the fall"—gives the power of the flow in units of work, 33,000 of which constitute the conventional horse-power.

Notwithstanding the simplicity of this proposition, considerable care and skill are requisite to avoid errors in practice. The measurement of the volume of an open running stream, although much more simple than the measurement of the flow of liquids through pipes is still a matter of some nicety.

The usual method is the use of the weir, and as this can easily be made and used by any person of medium mechanical skill, we will describe its most approved form and the manner of using it.

The weir is a plate of thin iron with a retangular notch cut out of it calculated to a width sufficient to carry the water to be measured with a moderate depth of stream over the weir. The bottom of the notch must be set level, and this may be conveniently performed by a plumb line attached to an upright, attached to one end of the weir at right angles to the bottom of the notch.

The depth of overfall is measured from the top of a stake, set back of the weir to such a distance that the depression which takes place in the water as it approaches the weir, will be wholly avoided. The top of the stake is made flat, and a common rule may be used to measure the depth of the stream passing over the stake. The proper placing of this stake is a matter of importance, for if it is not set far enough back the measurement cannot be relied upon.

The amount of water flowing per minute over a weir of this kind may be found by multiplying the mean depth over the top of the stake in inches into the square root of the mean depth, and this product by 22·2437. This will give the flow in pounds per minute. The final product multiplied by the fall in feet will give the flow in foot-pounds per minute, which, divided by 33,000, will give the horse-power for each inch in width of the weir; and this multiplied by the width of the weir in inches will give the total horse-power.

The total horse-power, multiplied by the percentage of useful work known to be developed by the wheel it is desired to employ, will give the actual working horse-power that can be obtained from the stream by the use of that wheel.

We append a table from Box's "Practical Hydraulics," giving the amount of flow over a weir one inch in width for various depths over the head of the stake in gallons. To find the flow in pounds for any width of weir and for any depth given in the table, multiply the flow given for that depth by the width of the weir in inches, and that product by 8·331. We would not in making a test employ an overflow of over 18 or 20 inches for ordinary sized streams; but for very large streams; it might be necessary to use a weir of greater capacity.

TABLE OF THE DISCHARGE OF WATER OVER WEIRS, ONE INCH WIDE IN GALLONS PER MINUTE.

Depth.	Galls.	Depth.	Galls.	Depth.	Galls.	Depth.	Galls.	Depth.	Galls.	Depth.	Galls.
In.		In.		In.		In.		In.		In.	
¼	·3338	4⅛	22·37	10	84·43	33	506·1	64	1367	95	2472
⅜	·6132	4¼	23·39	10½	90·84	34	529·3	65	1399	96	2512
½	·944	4⅜	24·38	11	97·41	35	552·8	66	1432	97	2551
⅝	1·319	4½	25·49	11½	104·1	36	576·7	67	1464	98	2590
¾	1·734	4⅝	26·56	12	111·0	37	600·9	68	1497	99	2630
⅞	2·185	4¾	27·64	12½	118·0	38	625·4	69	1531	100	2670
1	2·670	4⅞	28·74	13	125·1	39	650·4	70	1564	101	2711
1⅛	3·185	5	29·85	13½	132·5	40	675·5	71	1597	102	2751
1¼	3·731	5⅛	30·97	14	139·8	41	700·9	72	1631	103	2791
1⅜	4·305	5¼	32·12	14½	147·4	42	726·7	73	1665	104	2832
1½	4·905	5⅜	33·28	15	155·1	43	752·9	74	1700	105	2873
1⅝	5·531	5½	34·44	15½	163·0	44	779·3	75	1734	106	2914
1¾	6·181	5⅝	35·62	16	170·9	45	806·0	76	1769	107	2955
1⅞	6·855	5¾	36·85	16½	179·0	46	832·8	77	1804	108	2997
2	7·552	5⅞	38·01	17	187·1	47	860·3	78	1839	109	3039
2⅛	8·271	6	39·24	17½	195·5	48	887·9	79	1875	110	3080
2¼	9·011	6¼	41·72	18	203·9	49	915·8	80	1910	111	3122
2⅜	9·773	6½	44·25	19	221·1	50	944·0	81	1946	112	3165
2½	10·55	6¾	46·82	20	238·8	51	972·4	82	1983	113	3207
2⅝	11·36	7	49·45	21	256·9	52	1001	83	2019	114	3250
2¾	12·18	7¼	52·12	22	275·5	53	1030	84	2056	115	3293
2⅞	13·02	7½	54·84	23	294·4	54	1060	85	2093	116	3336
3	13·87	7¾	57·61	24	313·9	55	1089	86	2130	117	3379
3⅛	14·75	8	60·41	25	333·8	56	1119	87	2167	118	3422
3¼	15·64	8¼	63·27	26	354·0	57	1149	88	2204	119	3466
3⅜	16·55	8½	66·17	27	374·6	58	1179	89	2242	120	3510
3½	17·48	8¾	69·11	28	395·6	59	1210	90	2280		
3⅝	18·43	9	72·09	29	417·0	60	1241	91	2318		
3¾	19·39	9¼	75·12	30	438·7	61	1272	92	2356		
3⅞	20·37	9½	78·18	31	460·8	62	1304	93	2395		
4	21·36	9¾	81·29	32	483·3	63	1335	94	2433		

MICHAEL FARADAY.*

Toward the end of the last century, in an obscure part of London, over some stables in a yard, lived an honest blacksmith named James Faraday. He was the son of a stonemason and tiler, and was one of a family of ten children, all of whom were laboring men and women in the humblest walks of life.

James had married the daughter of a farmer, and was a member of a peculiar religious sect called Sandemanian, after its founder, and was a thoroughly religious man. He had four children, Elizabeth, Robert, Michael, and Margaret. Michael was born in 1791, and when a little boy used to tend his baby sister in the stable yard, and sometimes was able to earn a penny by holding a horse or running an errand. When he got to be big enough to be trusted with parcels he was regularly installed as a newspaper boy, and on Sundays hurried through with his business so as to be at home in time "to make himself neat and to go to church with his parents." Robert chose the father's profession and was apprenticed to a blacksmith. He appears to have been a generous man, as he used occasionally to give his brother Michael money to go to chemical lectures or to buy apparatus for experiments; but we soon lose all track of him, and his fame never went beyond the sound of his anvil.

We are not told why Michael was apprenticed to a bookbinder rather than to some other mechanic, but can infer that he read the papers he carried and showed an early fondness for books, so that his father placed him at a trade where he could earn something and yet have an opportunity to read. The bookbinder and stationer with whom Faraday learned his trade was a kind master and evidently pleased with the fidelity and industry of his apprentice.

We find that Faraday, while binding books, took occasion to look at their contents, and among other works that fell into his hands was one by Mrs. Marcet, on chemistry. He had a great fancy for proving the accuracy of all the statements in the book by simple experiments, and spent all the pennies he could spare in procuring the necessary apparatus. An article on electricity, in the "Encyclopedia Britannica," particularly attracted his notice, and he set about to construct an electrical machine. His master was so much pleased with the success of this effort that he showed the apparatus to a member of the Royal Institution, who came to the shop to have some work done. This gentleman had some conversation with the apprentice, and finding him uncommonly bright and intelligent, invited him to go to hear Sir Humphry Davy lecture at the Royal Institution. This was a treat of the utmost importance to the young man. He wrote out full notes of the lecture with such drawings and illustrations as he could make, and afterwards sent them with a letter to Sir H. Davy. "The reply was immediate, kind, and favorable;" and some time afterward a grand carriage, with a servant in livery, drove to his humble lodgings with a note, asking him to call to see Sir H. Davy, and offering him the place of assistant, just vacant, at a salary of twenty-five shillings per week, with the use of two rooms at the top of the house. On March 1, 1813, Faraday was regularly appointed by the board of managers to be Davy's assistant. His days of bookbinding were thus brought to an end, and he became himself the maker of books for other people to bind and to prize most highly.

Sir Humphry Davy in a letter to the managers recommending him for the place, wrote that he "had found a person who is desirous to occupy the situation in the Institution lately filled by William Payne. His name is Michael Faraday, a youth of twenty-two years of age. His habits seem good, his disposition active and cheerful, and his manner intelligent."

The youth of twenty-two years had made a marvelous use of his time previous to the appointment under Davy. He had read everything he could lay his hands upon, and in a note book wrote down the names of the books and subjects that interested him. This he called "The Philosophical Miscellany—being a collection of notices, occurrences, events, etc., relating to the arts and sciences, collected from the public papers, reviews, magazines, and other miscellaneous works, intended to promote both amusement and instruction, and also to corroborate or invalidate those theories which are continually starting into the world of science. Collected by M. Faraday, 1809–10."

Fortunately this book has been preserved and can serve as a model for all young men of humble origin and slender means. We are astonished at the extent and variety of his reading at that early day, as gathered from that collection, and as displayed in a correspondence with Mr. Abbott, a Quaker clerk. The letters to Abbott, commencing when Faraday was twenty years of age, are often verbose, inflated, and abounding in big words, but nevertheless display the early training, study, reflection, and anxiety to learn, of the bookbinder's apprentice. Abbott had been educated at a good school, and hence Faraday looked upon him as greatly his superior.

There is a great temptation to quote from these letters, as they cover a period of Faraday's life hitherto wholly unknown to the world. In his first letter he gives an account of some galvanic experiments, and of a pile he had constructed out of disks of malleable zinc (a great curiosity in those days), copper coins, "and pieces of paper soaked in a solution of muriate of soda." He was surprised to find that with seven pairs of plates he could decompose the sulphate of magnesia. In another letter he has a good deal to say about chlorine, and gives the theory of bleaching as maintained by scientific men of the present day. "Pure chlorine has no effect upon vegetable colors; but when water is present it decomposes it, and the oxygen causes the change of color." He writes to his friend some admirable ideas on the subject of lectures, how they should be prepared and how delivered, which show the foundation upon which he afterwards built up his fame as the best lecturer in England. Here is a choice passage, written when Faraday was twenty-one years of age:

"A lecturer falls deeply beneath the dignity of his character when he descends so low as to angle for claps and asks for commendation. Yet have I seen a lecturer, even at this point. I have heard him dwell for a length of time on the extreme care and niceness that the experiment he will make requires. I have heard him hope for indulgence when no indulgence was wanted, and I have heard him declare that the experiment now made cannot fail from its beauty, its correctness, and its application, to gain the approbation of all. Yet surely such an error in the character of a lecturer cannot require pointing out, even to those who resort to it; its impropriety must be evident, and I should perhaps have done well to pass it."

In reference to the choice of a friend he writes: "A companion cannot be a good one unless he is morally so; and however engaging may be his general habits, and whatever peculiar circumstances may be connected with him so as to make him desirable, reason and common sense point him out as an improper companion or acquaintance unless his nobler faculties, his intellectual powers, are, in proportion, as correct as his outward behavior."

And in the same letter he adds: "In every action of our lives, I conceive that reference ought to be had to a Superior Being, and in nothing ought we to oppose or act contrary to His precepts."

We have thus a picture of Michael Faraday before he went to act as an assistant to Sir Humphry Davy. The son of religious parents, himself a thoroughly conscientious man, endowed with good health and indomitable industry, his start in life was such as to inspire his friends with every confidence in his ultimate success. As soon as he entered the Royal Institution he continued the researches he had begun with humble means while working as an apprentice, and, with such a teacher as Sir Humphry Davy, was soon able to overcome all defects of early training. Davy and Faraday were two widely different characters. The former was also of humble birth and had been aided by Mr. Gilbert, who heard that the "boy was fond of making chemical experiments," and had by his remarkable discovery of the metals of the alkalies, rendered his name famous and had won knightly honors. He had become Sir Humphry Davy, and it was not long before he gave up further original investigation, and retired to Geneva, in Switzerland, where he died in 1829. He was always seeking for honors and eternally pining for rank, and in his early treatment of Faraday displayed unworthy traits of character. For example, while traveling on the continent, he declined to accept an invitation to dine because Faraday, his Secretary, was also invited. The host, De la Rive, of Geneva, sent back word, "then I shall be obliged to give two dinners." And Davy opposed Faraday's election to the Royal Society. But Faraday uttered no word of complaint, and never ceased to feel and express gratitude to his early benefactor.

It is probable that no man of science ever lived whose whole life could better serve as a model than Faraday's. Although born poor he never coveted riches, but on the contrary gave up all remunerative occupations in order that he might devote himself exclusively to scientific research. Of humble birth he never sought social distinctions, but declined the offer of knighthood, and utterly refused to accept the office of President of the Royal Society which was pressed upon him. The humility, simplicity, singleness of purpose, and liveliness of disposition never deserted him even in the hight of his prosperity. He was ever ready to help a beginner, and seemed never to forget how he had been aided at a critical period of his life. He was indeed a perfect contrast to Sir Humphry Davy.

In 1821 Faraday was married, and having been appointed superintendent of the house and laboratory, took his wife to reside in the Royal Institution. He never was blest with children, but lived for forty-seven years of perfect happiness with the choice of his youth; the only change being, as he said, "in the depth and strength of its character."

When Faraday first went to the Royal Institution, he took up the study of chemistry with great zeal, and among other important discoveries made by him was that of benzole, to which we virtually owe the whole aniline industry. His researches on the condensation of gases, in which he proved them to be the vapors of volatile liquids; also on regelation, on glass, on steel, on alloys, were among his earliest works; but the crowning glory of his life was the publication of his "Experimental Researches on Electricity," which he commenced at the age of forty and continued during a period of twenty-six years. The value of these discoveries to the world cannot be easily overrated. We can trace them into practical life, in the electric light, in magneto-electric machinery, in electro-metallurgy, in the applications of electricity to medicine, in telegraphy, and in the success of the submarine cable, and yet the work was carried on in penury; he made himself poor that others might be rich, and he has left a name without parallel in the annals of science.

The Queen of England, no doubt instigated by Prince Albert, assigned a house for Faraday's use in the royal park, at Hampton Court, and had it put in thorough repair for his occupancy. Here he spent the declining years of his life, surrounded by affectionate relatives and devoted friends; and in the summer of 1867, while sitting in his arm chair at his study window, was suddenly summoned to his eternal rest.

The same year of his marriage Faraday joined the Sandemanian church by profession of faith, and he afterwards became an elder and used to preach; but in his sermons there was wanting that clearness and precision, that familiarity with the subject, that characterized his lectures on scientific topics. He never adopted the same course of reasoning in religious matters that he did in scientific. In science he believed nothing without the facts or experimental demonstration; but in religion he accepted everything with the humble faith of a Christian.

* "The Life and Letters of Faraday." By Dr. Bence Jones, Secretary of the Royal Institution. 2 vols. 8vo., pp. 427, 499. Philadelphia: J. B. Lippincott & Co. 1870.

Magnetic Iron Sands of Canada.

The American Exchange and Review contains the following epitome of a letter of Dr. T. Sterry Hunt, on the magnetic iron sands of Canada, of considerable interest to iron and steel masters:

"The sands from the crystalline rocks of Canada are in large degree a mixture of nearly pure magnetic ore with a titanic iron ore and garnet sand, the last two ingredients not being attracted by the magnet, and the titanic ore containing from 30 to 35 per cent of titanic acid. The bar iron made from these sands at Moisie is of excellent quality, not alloyed by titanium. The slags, however, contain the titanic acid as silico-titanate. The magnetic portion is separated from the titaniferous sand and from the silex by a magnetic separator which, according to Dr. Hunt, will, in one hour, separate from three tuns of sand, containing one tun of magnetic ore, one tun of ore, containing 99 per cent of magnetic iron, or twenty-four tuns in twenty-four hours. It is six feet long by five wide and four high. These magnetic sands are said to be found on the north side of the St. Lawrence, in quantities practically inexhaustible, from the Saguenay to Newfoundland, at Batiscan, between Montreal and Quebec, and there is a large accumulation at the mouth of Lake Huron; also, on both shores of Lake Erie, and along the seaboard of Connecticut and Rhode Island. The iron sands of Taranaki, New Zealand, are well known. Dr. Hunt places considerable reliance upon the magnetic separator for success in working the sands. This separator is the invention of Dr. Larne, professor of chemistry in the Laval University, Quebec. The advantage arising from these sands is found in their freedom from phosphorus and sulphur.

"In this connection it will be interesting to speak of the metallurgical process of reducing these magnetic sands, as performed at Moisie, a name not found in Lippincott's Gazetteer, and, therefore, needing some notice as a place. Moisie is said to be the seat of the most northern iron works of this continent, and remarkable for the exclusive use of the magnetic sands spoken of above. Moisie is near the mouth of the St. Lawrence, some seventy miles west of Anticosti island, at the mouth of the Moisie river, which empties into the St. Lawrence upon its northern shore. The sands are about half a mile distant on either side of the works, which consist of charcoal bloomeries, or modified Catalan forges, with all their necessary accompaniments. The blast is heated in U pipes, placed in the chimney. The hearths have each a cast iron frame, are three feet square and high, closed by a plate in front for a foot from the bottom, with slag-holes and with a shelf on the level of the tweer, which is semi-circular, with a radius of an inch, placed on one side at an inclination of fifteen degrees. The ore is thrown upon the fire from time to time, as the bloomers see fit, until a bloom is made of the average weight of 200 pounds, and after about three hours' work. An interesting fact appertains to the charcoal economies of the place. The charcoal is burned in kilns cylindrical at the bottom and dome-shaped at the top, of about thirty feet diameter at the base and twenty-five feet high, with walls a foot thick and requiring about 40,000 bricks. They hold about 100 cords apiece, yielding 4,000 bushels of charcoal; require about twenty-five to thirty days' burning, affording a fine coal at a reckoned cost of four and a half cents a bushel, weighing fifteen pounds to the bushel, the wood being almost all fir tree and some birch, but small, and hence denser. The wood is supposed to cost at the kiln eighty cents a cord. Ten of these kilns afford about 40,000 bushels a month, a little more than is sufficient to supply four forges. Four forges make about three tuns of blooms per day, using 1,400 bushels of coal.

"Of the ore, it is interesting to know that the storms work the sand at times as well as could be done by manual labor, leaving the true magnetic ore in irregular patches, and advantage is taken of the beneficial effect of the waves and winds. A patch of sand one hundred yards long by fifty yards wide, averaging two inches thick, should yield about seven tuns of ore. The separation of the ore from sand and impurities is done by washing tables. The gentleman from whose account we have derived our information for this condensed statement, and who visited the place October, 1869, gives a very interesting description of the exceeding isolation of the works, and of the unlimited forests around, together with the loneliness of a situation which, as we have stated, is upon the northernmost boundaries of the iron manufactures of the North American continent."

Polish for Patent Leather Goods.—Take half pound of molasses or sugar, 1 ounce of gum-arabic, and 2 pounds of ivory black; boil them well together, then let the vessel stand until quite cooled, and the contents are settled; after which, bottle off. This is an excellent reviver, and may be used as a blacking in the ordinary way, no brushes for polishing being required.

To Remove Old Iron Mold.—Dr. Thomson recommends that the part stained should be remoistened with ink, and this removed by the use of muriatic acid diluted with five or six times its weight of water, when it will be found that the old and new stain will be removed simultaneously

Hoisting Stone in Quarries.

The dangers that attend the men who go down to the sea in ships and occupy their business in great waters, are scarcely greater than those which await the toilers who descend into the bosom of the earth to win the mineral treasures to which this country, in particuler, owes so much of her greatness. Whether it be in the mine or in the quarry, death or disablement are there awaiting the unfortunates who may happen to fall a prey to them. In the case of mines, we hear too frequently of fatal catastrophes, but, strangely enough, the disasters which occur in quarries rarely find their way into the columns of the press, perhaps because each disaster is, in itself, too insignificant as compared with the wholesale slaughter of a colliery explosion. We have good reason, however, to know that the annual loss of life and limb, in quarrying operations is by no means trivial; unfortunately, too, a large proportion of these quarry accidents are more or less preventible by improvements in the hoisting machinery and appliances used to raise the stone when hewn to the surface of the ground.

A large quarry, in full work, presents a considerable area of operations, and, as a rule, there is but one engine to hoist the material; this is usually placed on the edge of the quarry, at the end of the tramway, along which the stone is taken when raised. The engine is generally on the surface ground, but a sort of step or recess is cut close alongside it, and whose level is about ten feet lower; the tramway is brought to the edge of the quarry along this step so that the lorries for the stone are beneath the engine level. In a large and deep quarry it is evident that nothing in the way of a jib crane can be made available, and a gantry and traveler would be too expensive, even did such an apparatus give sufficient scope to reach all the area in work. Instead, therefore, of either, the following plan is adopted. A large chain is stretched from the enginehouse across quite to the other side of the quarry, and there secured, but not permanently so, this end being shifted from time to time, as the position of the stone being hewn requires. On this chain a sort of carriage runs; it is something like an iron block, with two sheaves set side by side in the direction of their diameters, not of their axis. They are wide and deep enough in the grooves of their edges to run on the chain as on a rail. This block carries a real block, or what answers to one, suspended under but close to the chain; through this the rope or chain for lifting is passed.

It will be evident that the hoisting rope has a merely vertical action, but the block, or "horse," as it is technically called, gives both a vertical and horizontal motion, as the chain is most generally on a considerable inclination.

The *modus operandi* is as follows: When a certain stone is to be raised, the chain is moved over it and the quarry end made fast. The "horse" is run along the chain till "plumb" over the stone. A "toggle" or pin is secured in a link behind it to prevent it moving down the slope of the chain, and the hoisting rope is payed out and the stone hooked on, which is raised till the lifting hook reaches the "horse," when it is secured to it. The engine then draws the "horse" along the chain till the stone is fairly brought out of the quarry, and over the step already described, as well as over a lorry placed there in readiness. A "toggle" is put into a link of the chain to prevent the "horse" going back, the stone is lowered into the lorry, and the operation is complete.

Any person with the most moderate knowledge of engineering must perceive that, however cheap and convenient this arrangement may be, it is fraught with danger to those working or passing beneath the chain; the very best chains carefully tested are uncertain affairs, even when subjected to a simple statical strain, and the strain of the main, or as we may term it, "gantry" chain in a quarry is not a purely statical one by any means, as the "horse," when it begins to move, "jumps" over the links sufficiently to cause a considerable "jar," which, as a matter of course, is constantly breaking the chain, or if the hauling chain or rope from the engine happen to break, the "horse" runs violently down the incline of the chain, and the latter, already, perhaps, loaded nearly to its limit of strength, succumbs to the vibration, and the stone and ends of the fractured chain, in all probability, fall on some luckless workmen beneath.

We have good reason to know that appalling accidents from this cause are common, a fact scarcely to be wondered at, seeing that there is no adequate inspection of the arrangements of quarries, and the chains and whole apparatus are of inferior quality in too many instances.

We will proceed to sketch the outlines of an arrangement which we consider to present some advantages over that already described. The chain should be abolished altogether, and either a steel wire rope or a rail substituted. The rope would be little, if at all, more expensive than a chain, while it would be infinitely more trustworthy; less power, too, would suffice to raise the loads, as the wheels of the "horse" would have a comparatively smooth and uniform surface over which to travel. We believe a rail might be arranged made of round iron jointed much as a gas pipe is, the ends of the joint sockets being rounded on their outer edges to give freer passage to the wheels of the "horse." Instead of the "toggle" used with the chain, to prevent retrograde motion, a "clip" should be put on the rail (or rope) made of two pieces of iron hinged at one end, and with a coach screw at the other, each half being nearly semicircular in the center; this part would embrace the rail, and, if screwed up tightly, would prevent backward motion, or at the worst would act as a brake if the strain were too much for it. As to the catenary formed by a chain or rope, the rail would equally well assume that curve, as if of good iron its diameter need not exceed by more than one half that of the round iron in the chain links, and being without a weld, would be reliable to an extent such as the very best chain can never equal. This round iron rail arrangement would be far cheaper, too, than the chain.—*Mechanics' Magazine.*

Pyrometers.

A trustworthy means of determining with accuracy the high temperatures of furnaces, or any elevated temperature exceeding that of boiling mercury, has not as yet, perhaps, been successfully secured. The earliest pyrometer which actually came into use was that of Wedgewood, invented about 1780. The principle on which this invention was founded is the well-known property of clay to contract under the action of heat. In form, the pyrometer of Wedgewood was extremely simple. It consisted merely of a gage for measuring the dimensions of certain little clay cylinders before and after their subjection to the heat of the furnace. The test was in itself a very rude one, but the uncertainty of the indications of the instrument was increased by the fact, subsequently discovered that clay may contract under the influence of a comparatively low temperature, long continued, to as great a degree as under a higher or less duration.

It was proposed, at about the same time with the origination of Wedgewood's invention, to construct a thermometer for high temperatures on the plan of the mercurial thermometer, employing a fusible alloy instead of mercury, and a tube of clay enamel, or translucent porcelain, instead of glass. This was the conception of Achard, and it has a *prima facie* plausibility in its favor; but it is not known to have been reduced to practice. In fact, considering the liability of the porcelain to contract in the furnace—the property from which the pyrometer of Wedgewood derives all that it has of practical utility—the indications of the high-temperature thermometer here proposed would be liable to uncertainty in a very high degree. Several very distinguished physicists have endeavored to reach a more satisfactory solution of this difficult practical problem by availing themselves of the expansibility of air under high temperatures. These efforts have been to a certain degree successful; but the methods to which they have conducted depend for their accuracy upon the truth of the assumption, not yet fully established, that the expansibility of gases at the highest artificial temperatures follows the same law as at those at which this law has been experimentally verified.

One of the most promising methods of pyrometric measurement which has yet been proposed is the suggestion of Professor Edmond Becquerel, of Geneva, and is founded on the principles of thermo-electricity. In the Exposition of 1867, Mr. Ruhmkorff, of Paris, exhibits a thermo-electric pyrometer constructed under the direction of Professor Becquerel, which, in the experimental trials to which it has been subjected, has furnished indications remarkably consistent with each other; while it is free from complication of parts and apparently capable of being made practically available for all the uses for which such an instrument is needed. The thermo-electric combination employed by Mr. Becquerel is a single couple formed of two equal wires of platinum and palladium, each being one millimeter in diameter and two meters in length, united by one extremity in a junction formed by binding them firmly together with a fine platinum wire. The two elements, which are placed parallel to each other, are in contact to the extent of about one centimeter at the junction. In order to keep them separate for the rest of their length, the palladium wire is passed through a tube of porcelain; and this tube, with the two wires, is subsequently introduced into a larger tube of the same material, which last is to be exposed to the heat of the furnace. Both tubes are then filled with sand. The two wires are suitably connected at their outer extremities with the binding screws of a Weber's galvanometer, which indicates electric intensities with great exactness. A scale of temperatures related to the intensities of the developed currents has been prepared by Mr. Becquerel, by comparing the indications of an air pyrometer with those of the electric pyrometer when both are similarly exposed side by side. The divisions of this scale are equivalent to ten degrees Centigrade each.

It cannot yet be said, perhaps, of any form of pyrometer, unless of that of Wedgewood, which, as we have seen, is untrustworthy, and which at best indicates differences of temperature very imperfectly, that its use for practical purposes is entirely unattended with inconvenience; but the electric pyrometer of Mr. Becquerel seems to come as near to fulfilling this condition as any that has yet been suggested.—*Barnard's Report on the Industrial Arts.*

Prize Offered for a Machine to Separate Rheea or China Grass Fiber.

The Government of India, after communication with various agricultural and horticultural societies in India, and with persons interested in the subject, has arrived at the conclusion that the only real obstacle to the development of an extensive trade in the fiber of Rheea or China-grass, is the want of suitable machinery for separating the fiber and bark from the stem, and the fiber from the bark; the cost of effecting such separation by manual labor being great.

The requirements of the case appear to be some machinery or process capable of producing, with the aid of animal, water, or steam power, a tun of fiber of a quality which shall average in value not less than £50 per tun in the English market, at a total cost, all processes of manufacture and allowance for wear and tear included, of not more than £15 per tun. The said processes are to be understood to include all the operations performed, after the cutting and transport of the plant to the place of manufacture, to the completion of the manufacture of fiber of the quality above described. The machinery must be simple, strong, durable, and cheap; and should be suited for erection, at or near the plantations, as the refuse is very useful as manure for continued cultivation.

To stimulate the invention or adaptation of such machinery or process, the Government of India hereby offers a prize of £5,000 for the machine and process that best fulfills all the requirements.

Rewards of moderate amount will be given for really meritorious inventions, even though failing to meet entirely all the conditions named.

Arrangements will be made by the Government of India for the supply of carefully dried stems, and specimens of fiber separated from the bark, but subjected to no other process, to mechanical firms and others desirous of competing, on application to the Secretary to the Government of India in the Home Department.

All machinery, etc., must be brought by the competitors, at their own charge, to a locality which will be notified hereafter, probably in the north-west provinces of the Punjab, and there worked under the supervision of their own representatives for a sufficient time to enable the judges appointed by Government to determine whether all the conditions named have been complied with. The prize machine is to be transferred, if required, to Government at 5 per cent above cost price; the patent right in any such machine to be also transferred, if required, to Government, on the latter securing to the patentee a royalty of 5 per cent on the cost price of all machines manufactured under the patent during its currency.

One year from February 10th, 1870, will be allowed for the preparation of the machines, and their transport to the locality named for the competition, and the trials will then be made, and the decisions of the judges announced. If no invention of sufficient merit is received in the above-named period to obtain the prize offered, the Government will continue to allow machines to be tendered for trial till the end of two years from the same date, after which, or on the award of the prize, the offers herein made will be withdrawn.

By order of the Governor General in Council,

E. C. BAYLEY,
Secretary to the Government of India,
Fort William, Calcutta.

WILL IT PAY TO BUILD THE DARIEN CANAL.—In our recent editorial under the above title, an error crept in which obscured our meaning. Instead of saying "If we condense the Erie Canal one tenth in length *without altering its cubic contents,*" we were made to say the same with the italicized words omitted. Printers will readily see how such errors as this sometimes escape notice; but as the general reader might be misled, we make this correction. Instead of saying it would make a canal 36·3 miles long, 400 *feet wide at the top,* 280 *feet wide at the bottom,* and forty feet deep, we should have said *forty feet* wide at top and twenty-eight feet wide at the bottom.

PATENT OFFICE DECISIONS.

In the matter of the application of David Stuart and Lewis Bridge for letters patent for a design for a cooking stove.—The applicants on November 3, 1868, patented the arrangement of ovens and flue in a cook stove having a peculiar external conformation. On February 5, 1870, they filed an application for a design, substantially identical with that shown in their patent of 1868.

Upon this state of facts the Examiner asks:

1st. Should the application be rejected on the patent?

2d. If so, can the patentees reissue in two divisions, one of which shall be for the design?

3d. If, so, what fees are required?

Section 11 of the act of March 2, 1861, provides that the new design, etc., shall not be "known or used by others before his, her, or their invention, or production thereof, and prior to the time of his, her, or their application for a patent therefor," etc.

It will be observed that no provision is made for use or sale of the invention prior to the application, as in the case of other inventions; and the reason of the distinction is found in the fact that as designs relate to form and shape only, no time is required for experiment before application. At all events, the language of the statute is plain. The design must not have been known or used by others prior to the application of the inventors. It is obvious that, if the design be described in a prior patent, granted either to himself or others, it is known to others within the meaning of the law. The present application must therefore be rejected upon the former patent.

The second question is, whether the original patent can be surrendered and reissued in two divisions, one of which shall be for the design.

Patents for designs may be granted for three and one half, seven, and fourteen years, at the election of the applicant, made at the time of application. Patents for other inventions are granted for seventeen years.

The patent granted to applicant in November, 1868, was of the latter kind, and was granted for seventeen years.

It is provided by section 13, of the act of 1836, that upon applications for reissue it shall be lawful for the commissioner, etc., to cause a new patent to be issued to the said inventor for the same invention, for the residue of the period, then unexpired, for which the original patent was granted.

This language is explicit, and it is obvious, that, under this section, any reissue of this patent, or any division of such reissue, must be granted "for the residue of the period then unexpired for which the original patent was granted;" that is, for the residue of seventeen years. But no patent for a design can be granted for seventeen years, or for the residue of an unexpired period of seventeen years; and this fact seems decisive of the question.

The result is, that an invention of a design, if shown in a patent for a mechanical invention is lost, and cannot be included in a subsequent application and patent for a design.

(Signed) SAMUEL S. FISHER, Commissioner.
February 23, 1870.

In the matter of the application of Israel C. Mayo, for letters patent for a design for a transparent shield.—The applicant makes application for a patent for a design. He pays ten dollars into the Treasury, and adds to his petition the following proviso: "Should the Commissioner be willing to allow a patent on this application, the undersigned wishes to pay into the Treasury the further sum of twenty dollars and have such patent granted for fourteen instead of three and a half years."

Section 11 of the act of March 2, 1861, provides that upon application for a patent for a design "the Commissioner on due proceedings had, may grant a patent therefor, as in the case now of application for a patent, for the term of three and one half years, or for the term of seven years, or for the term of fourteen years, as the said applicant may elect in his application: provided that the fee to be paid in such application shall be for the term of three years and six months, ten dollars; for seven years, fifteen dollars; and for fourteen years, thirty dollars.

This language contemplates an election to be made by the applicant, at the time of his application, of the term for which he desires his patent to issue, and the payment of a fee corresponding to that election. It does not contemplate the contingency of an application for one term and the payment of one fee, and a subsequent election, at the time of issue, of another term, and the payment of another fee. The words are, "elect in his application." The choice is to be made there, and not elsewhere or otherwise, and being made, must be final.

I can see that the practice proposed might be desirable and might result in the granting of design patents for a longer period, and the receipt of a larger revenue; but I have no power to alter the plain language of the statute, or to extend the time of election beyond the time of making the application for any purpose.

In the present case the applicant has paid a fee of ten dollars. His patent, if granted, can issue only for three and a half years.

(Signed) SAMUEL S. FISHER, Commissioner.
February 23, 1870.

U. S. Patent Office.

How to Obtain Letters Patent FOR NEW INVENTIONS.

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The model should be neatly made, of any suitable materials, strongly fastened, without glue, and neatly painted. The name of the inventor should be engraved or painted upon it. When the invention consists of an improvement upon some other machine, a full working model of the whole machine will not be necessary. But the model must be sufficiently perfect to show with clearness the nature and operation of the improvement.

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is made into the patentability of an invention by personal search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiners of long experience.

Inventors who employ us are not required to incur the cost of a preliminary examination. But it is advised in doubtful cases.

COST OF APPLICATIONS.

When the model is received, and first Government fee paid, the drawings and specification are carefully prepared and forwarded to the applicant for his signature and oath, at which time the agency fee is called for. This fee is generally not over $25. The cases are exceptionally complex if a higher fee than $25 is called for, and, upon the return of the papers, they are filed at the Patent Office to await Official examination. If the case should be rejected for any cause, or objections made to a claim, the reasons are inquired into and communicated to the applicant, with sketches and explanations of the references; and should it appear that the reasons given are insufficient, the claims are prosecuted immediately, and the rejection set aside, and usually

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Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

PATENTS CAN BE EXTENDED.

All patents issued prior to 1861, and now in force, may be extended for a period of seven years upon the presentation of proper testimony. The extended term of a patent is frequently of much greater value than the first term; but an application for an extension, to be successful, must be carefully prepared. MUNN & CO. have had a large experience in obtaining extensions, and are prepared to give reliable advice.

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Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24th, and Nov. 20, 1869. 64 Nassau st., New York.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

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For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

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Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

Perforated Zinc and Sheet Iron for separators, smut machines grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 500-tun iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Caveats are desirable if an inventor is not fully prepared to apply for a patent. A Caveat affords protection for one year against the issue of a patent to another for the same invention. Patent Office fee on filing a Caveat, $10. Agency charge for preparing and filing the documents from $10 to $12. Address MUNN & CO., 37 Park Row, New York.

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Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisemets at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

P. S. R., of Ga.—The velocity of water issuing from a pipe is that of a heavy body falling through space, reduced by the retarded motion of friction. What the actual retardation of that friction is can only be determined by experiment. Many experiments have been made on this subject, perhaps those as reliable as any others are published in Eytelwein's "Handbuch und der Hydraulik," by which it appears that, if we call the velocity in feet per second v, the diameter of the pipe in feet d, the head of water in feet h,

$$v=50\sqrt{\frac{dh}{l+50d}}$$

l being the length of the pipe in feet. Or, to translate this formula into common language, multiply the diameter of the pipe in feet into the head of water in feet, and divide the product by the length of the pipe in feet, plus fifty times the diameter in feet. Fifty times the square root of the quotient will be the velocity in feet per second sufficiently near for practical purposes, in a pipe without bends.

M. M., of Pa.—When fresh milk has a bad odor, you may be sure there is a cause for it, which a little patience will reveal. Cows are much more sensitive creatures, and their milk is much more easily affected than most people imagine. Even the odor from carrion inhaled by the cow, will taint her milk very unpleasantly. In one instance a farmer lost $1,000 in consequence of the rejection of his milk during a single season, on account of its bad odor, for which he was unable to account. He finally discovered that it was caused by the decaying body of a dead horse in the pasture where his cows fed. The mere breathing of the carrion odor by the cows tainted the milk. This shows how important it is that pastures, streams, the air of stables, and everything connected with the cow, should be pure and clean if we want good milk.

R. O., of Me.—Your application of the turbine principle to the construction of a rotary steam engine is by no means new, and is worthless. It has all the defects of ordinary rotary steam engines, with comparatively few of the advantages of other rotary steam motors. There are radical defects in this entire class of machines, which will probably render them always uneconomical converters of steam pressure into work.

R. P. G., of Vt.—The elongation of a steel wire by tension within the limits of its elasticity, is in proportion to the tension. This is true of all elastic rods. The law does not apply, however, to tensions which will produce a permanent elongation, and this may be accomplished by too great duration of the tension by a weight, which, acting but temporarily, would not be heavy enough to produce permanent set.

P. D. W., of Tenn.—The great problem in bridge construction is to secure greatest strength and rigidity with equalized strain at all points, and the least possible weight in the structure. Neither of these things have been accomplished in your device, and there is nothing novel or patentable about it.

E. F. R., of Mass.—There is no way that we know of whereby you can dissolve rubber sponge, and when it hardens have it resume its spongy consistence. We advise you to communicate with H. E. Towle, 176 Broadway, New York, who may be able to set you on the right track.

D. B. S., of Mass.—The cement you allude to is undoubtedly made nearly like the old recipe, 16 parts gutta percha, 4 parts India-rubber, 2 parts common caulkers' pitch, 1 part linseed oil. The ingredients are melted together, and used hot. It will unite leather or rubber.

L. M., of Va.—The first use of copper plates at the ends of telegraph wires, in [making the earth] circuit, is attributed to Herr Steinheil, of Munich, Bavaria, who is said to have adopted this plan as early as 1837.

D. L. T., of Miss.—No method of operating the ordinary blacksmiths' bellows can give a perfectly uniform blast. In this respect the bellows is a far inferior instrument to the fan-blower.

R. H., of Wis.—The center of a magnet is neutral, manifesting neither attraction nor repulsion. Your electro-motor will work: not a doubt of it.

E. S. N., of Pa.—We think the best way to mark figures on an engineer's brass tape is to stamp them on with small steel dies.

M. C. D., of Mass.—You are wrong. The reflecting telescope made by the Earl of Rosse is the largest ever constructed.

C. C., of D. C.—We do not deem it prudent to publish your statement of how U. S. Securities may be counterfeited.

J. C., of Pa., wishes some expert to tell him how he can stop cracks in gas retorts, so as to render them fit for use.

J. M. F., of N. Y.—You will find a rule for placing and shape of bridge walls on page 146, current volume.

B. L. H., of Mo.—The mineral you send is sulphuret of lead.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

COMBINED SEEDER AND HAY TEDDER.—Jonas House, Howard, N. Y.—This invention consists in the combination of a seeder, of peculiar construction, with a tedder for spreading hay, in such manner that one set of wheels may operate both devices, either separately or in conjunction, as may be desired.

GAGING INSTRUMENT.—Eli S. Prime, Baltimore, Md.—This invention consists in the combination of a gage rod a "variety" scale, and a bung slide in such a manner as to enable the operator to accurately ascertain the contents of a cask without performing any mental computation.

STEAM PRESSURE GAGE AND DETECTOR.—Elijah Clark, Louisville, Ky.—This invention has for its main object to prevent engineers from raising the pressure of steam upon their boilers beyond a certain fixed limit.

MODE OF STORING POWER.—Henry F. C. Krumme, Ridgeway, Pa.—This invention consists in an apparatus for enabling a railroad train, when drawn by a pneumatic engine, to bring itself to a halt by the resistance afforded to pumps connected with the driving or other wheels of its locomotive, and employed in condensing atmospheric air into the main tank, by which process brakes are rendered unnecessary, and power is stored up for drawing the train when it is set in motion again.

WASHING MACHINE.—John O. Kopas, Washington, D. C.—This invention consists in the combination of a wringer with a washing machine, when the latter is provided with a reciprocating rubber that slides in a weighted vertical sash, by means of which the rubber is pressed downward upon the inclined washboard or upon the garments inserted between the rubber and washboard, and when the wringer and rubber are operated from the same shaft.

Dropper for Harvesters.—N. S. Ketchum, Marshalltown, Iowa.—This nvention has for its object to furnish an improved dropper for attachment to such harvesters as are provided with an endless apron, carrier, or elevator, for removing the cut grain from the cutter platform.

Coupling for Connecting the Inlet Pipe to the Retort Cover of a Gas Machine.—John Butler, New York city.—This invention has for its object to furnish an improved coupling for connecting the inlet pipe to the retort cover of a gas machine, which shall be so constructed as to allow the pipe and cover to be readily disconnected when desired for convenience in detaching the said retort cover.

Hot-Blast Furnace.—A. Burtenshaw, Hope Furnace, Ohio.—The object of this invention is to provide a more durable construction and improved arrangement of what are known as ring hot-blast furnaces. It is also designed to provide an arrangement, whereby repairs may be more easily made, and old and worn-out rings may be removed. The invention also comprises an air-heating chest and throat of improved construction.

Railway Brake.—D. P. Lefevre and ;L. Philippe Dorré, France.—This invention refers to a new or improved system of self-acting railway brake, operated by the buffers.

Hulling Machine.—David Kahnweiler, New York city.—This invention consists in the arrangement and adjustment of the knives of the cylinder of a machine for hulling cotton seed and for other purposes, and in the formation of the cylinder and concave, and the parts connected therewith.

Bed Bottom.—Joseph Sperry, Charleston, Ill.—This invention relates to a new and useful improvement in bed bottoms, whereby they are made more durable and useful than slat bed bottoms have hitherto been, and it consists in a double slat bottom, made without metallic or rubber springs, and entirely of wood, save the necessary screws for fastening the parts together.

Boat Detaching Apparatus.—N. C. Reynolds, Ellsworth, Me.—This invention relates to a new and useful improvement in a device or apparatus for simultaneously detaching the ends of a boat from a davit tackle, and it consists in operating a detaching lever hook at the bow and at the stern of a boat by means of a lever and connecting rod.

Machine for Picking Cranberries.—J. P. Prickett, Medford, N. J.—This invention relates to a new and useful improvement in a machine for picking or gathering cranberries, whereby that slow and tedious operation (usually performed by hand) is performed by machinery.

King Bolt for Carriages.—William Clark, Johnsonville, N. Y.—The object of this invention is to provide a king bolt attachment to the axles of wheeled vehicles, whereby the horizontal as well as vertical oscillations of the axles are permitted without the use of a fifth wheel or other complicated apparatus.

Mold for Cornices.—Michael Meany, John McGinnis, and Wm. Cunningham, Brooklyn, N. Y.—This invention relates to a new device for forming plaster cornices in rooms, halls, etc., and has for its object to produce a device which is adjustable to any angle of corners, and which will complete a molding and perfect it to the corner.

Stump and Rock Lifter.—Silas Smith, West Stockholm, N. Y.—This invention relates to improvements in machines for raising rocks, stumps, and other heavy bodies, and consists in an improved arrangement of shear frame, chain driver, and drum operating apparatus on a truck.

Combined Collar and Hames.—W. O'Brien and H. Wentworth, Omaha, Neb.—This invention relates to improvements in the construction and arrangement of collars and hames in one structure. The invention consists in an improved, simple, and cheap construction of the stocks or parts which serve the function of the hames, and the base for the padding and lining of wood, with metal mountings at the end, of peculiar construction, to form the joints. It also consists in an improved mannner of connecting the leather linings and facings.

Coffeepot.—John P. Williams, Mobile, Ala.—This invention relates to improvements in coffeepots, and consists in an arrangement with the exterior vessel of ordinary construction, of an inner coffee holder, from which the water of the outer vessel may be so separated that it may be kept in a boiling condition, while that in the coffee holder is in a fit state for use, the boiling water being forced into the coffee holder only when there is sufficient steam in the outer vessel to convey it through a tube extending from below the steam surface to the coffee holder, at the top, from which it may be poured for use, while the water boils in the said exterior vessel.

Reversible Feed for Sewing Machines.—J. J. Hirschbuhl, Louisville, Ky.—This invention relates to improvements in reversible feed apparatus for sewing machines, applicable to the Weed, and other like machines, and consists in the attachment to the feed bar, of an arm, projecting below the feed-operating shaft, and in attaching a rocker arm to the said shaft for working the feed, by connection with this arm, at the side of the said shaft, opposite the rocker arm now used to give the direct feed, so that a reverse motion will be imparted to the feed bar by connecting these arms, and disconnecting the others. The invention, also, consists in arranging the feed shaft, to slide longitudinally for shifting the connection of the said rocker arms with their respective bars.

Chimney Top.—D. S. Robinson, Pittsburgh, Pa.—This invention relates to a new chimney top, which will be acted upon by the wind in such a manner as to always leave a free passage for the escape of smoke; and it consists in a novel manner of suspending a V-shaped swinging hood, and in a novel construction of chimney cap.

Method of Measuring and Shaping Corsets.—Miss Mollie Williams, Camden, Ohio.—This invention relates to a new method of measuring and shaping the pieces of cloth required for a well-fitting corset, with the aid of but four measurements, and it consists in the use of three tools or implements, whose edges are so shaped that they will, after the requisite measments have been produced, give curves to the several pieces.

Washing Machine.—M. Ingalls, Muscatine, Iowa.—This invention has has for its object to furnish a simple, cheap, convenient, and effective washing machine, by means of which the washing may be quickly and conveniently done, and in such a way as not to injure the most delicate fabric, the washing being done by forcing the boiling suds through the clothes.

Apparatus for Separating the Seed from Fruit Pulp.—R. H. Mayo Paris, Texas.—This invention has for its object to furnish a simple, convenient, and effective machine for separating the seed from the Bois-de-Arc, or Osage Orange, and other apples, where the seed is required to be separated uninjured, for planting or other purposes.

Cotton-seed Planter, etc.—Wm. W. Croom, Gainesville, Ala.—This invention has for its object to furnish an improved machine for planting and fertilizing cotton seed, which shall be so constructed and arranged as to drop the seed regularly and uniformly, and not in clumps, and which may be easily adjusted for planting Indian corn, sorghum, peas, etc., doing its work accurately and well in either capacity.

Wagon Brake.—Michael Powell, Umatilla, Oregon.—This invention has for its object to furnish an improved brake, more particularly designed for trail wagons, but which shall be equally applicable to other wagons, and which shall be strong, durable, easily made, conveniently operated, and which will not bounce off the wheels when in use.

Neck Yoke.—Joseph King and Charles S. Gould, Janesville, Wis.—This invention relates to improvements in neck yokes for horses, and consists in an arrangement of sliding ferrules, or sleeves, for supporting the rings by which they are suspended from the neck straps, to admit the horses to move towards or from each other, as the condition of the road requires. It also consists in a novel arrangement of means for connecting the said sliding rings, to cause them to move in unison.

Fruit Funnel.—Thomas Scantlin, Evansville, Ind.—This invention has for its object to provide a funnel to be used in filling fruit cans and jar with fruit, which will rest on the jars and cans fairly, without projecting inward so far as to interfere with filling them to the top. The invention consists in providing a short and broad funnel for wide-mouthed cans or jars, with a horizontal flange a short distance above the bottom, whereby he said funnel will rest fairly on the tops of the cans, and will admit of use with cans or jars having openings of different sizes.

Whip and Rein-Holding Attachment.—J. R. Finney, Youngstown, Ohio.—This invention relates to improvements in whip and rein-holding apparatus for carriages, designed to provide a simple and convenient combined attachment, so arranged as to be simply and readily attached to the dash-board, and that the socket or whip-holder will form a part of the rein-holder; also, so arranged that the whip-holder may be readily detached for the substitution of another when required, and to adapt it for more durable service in holding the whip.

Hay and Cotton Press.—J. S. Duffy, Battle Ground, Ind.—This invention relates to improvements in presses for hay, cotton, and other similar articles, designed to provide an arrangement whereby a sufficient amount of power may be applied by hand, and in a short space of time, and so arranged that the applied power will increase as the bale becomes more compact.

Adjustable Shears.—James Booth, Worcester, Mass.—This invention relates to improvements in adjusting apparatus for book-binders' and other shears for cutting broad sheets, and consists in the application in the axis in the hollow hub of the movable shear arm, of an adjusting center block, on which it is suspended by center pins, and against which set screws tapped through the hub work, in a manner to adjust the hub and shear arm.

Leather Rolling Machine.—J. G. Curtis, Emporium, Pa.—This invention relates to improvements in leather rolling machines, and consists in the combination with the roller, arranged on the lower end of the pendant vibrating beam, and the concave bed commonly used, of a springing or movable support for the said bed, and one or more pairs of rocker arms, with eccentric segmental bases, and a reciprocating rod, or bar, arranged between the ends of these arms opposite the said bases, one of which bears under the movable bed and the other on a permanent bed below, so that it moves the said arms on their eccentric bases, to and fro in a way to raise or lower the concave rolling bed, relatively to the roller. The movement of the said rod or bar being effected by a crank arm, rock shaft, and foot treadle, or lever, whereby the operator may govern the amount of pressure brought to bear upon the leather, by using his foot, leaving the hands free to handle the leather at the same time.

Mill Pick Handle.—F. Bellinger, Lockport, N. Y.—This invention relates to improvements in handles for mill picks, and consists in a handle composed of two parts of metal divided longitudinally, connected at the end to be taken in the hands, and at a short distance from the other end; the two parts at the latter end are made capable of springing between the latter connection and the ends, which are fitted to pass through an eye in the pick, and to be wedged against the side walls of the eye by a long steel or other metal wedge, running through the handle from end to end, in grooves in the two parts of the handle, which form a central hole when the said two parts are connected together.

Medical Compound.—Philester Lee and Lemue Matthews, Lebanon, Oregon.—This invention relates to a new and useful medical compound for use as a purgative and tonic.

APPLICATIONS FOR EXTENSION OF PATENTS.

Mode of Attaching Pads to Saddle Trees.—James Ives, Mount Carmel, Conn., has applied for an extension of the above patent. Day of hearing May 25, 1870.

Non-elastic Bands for Bales of Cotton and Other Fibrous Materials.—Mary Ann McComb, Memphis, Tenn., administratrix of David McComb, deceased, has petitioned for an extension of the above patent. Day of hearing June 1, 1870.

Machine for Paring Apples.—Horatio Keyes, Terre Haute, Ind., has applied for an extension of the above patent. Day of hearing June 1, 1870.

Cartridge.—Edward Maynard, Washington, D. C. has petitioned for an extension of the above patent. Day of hearing June 1, 1870.

Shoemakers' Edge Plane.—Isaac A. Dunham, North Bridgewater, Mass., has petitioned for the extension of the above patent. Day of hearing June 8, 1870.

Safety Hatches for Warehouses.—Wm. H. Thompson, Boston, Mass., and Eustis P. Morgan, Biddeford, Maine, has applied for an extension of the above patent. Day of hearing June 8, 1870.

Metallic Hook for Labels.—Samuel B. Fay, New York city, has petitioned for an extension of the above patent. Day of hearing June 15, 1870.

Fruit Box.—Jabez W. Hayes, Newark, N. J., has applied for an extension of the above patent. Day of hearing July 27, 1870.

Buckle for Wearing Apparel.—Edward Parker Plymouth, Conn., has petitioned for an extension of the above patent. Day of hearing August 17, 1870.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING March 29, 1870.

Reported Officially for the Scientific American.

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101,204.—Elevated Railway.—John M. Abbott, Hillsdale, Mich.
101,205.—Anti-Friction Carriage Axle.—Alonzo Allcott, Haverhill, Mass.
101,206.—Cotton Seed Planter.—John P. Allen, Dawson, Ga.
101,207.—Screw and Screw Driver.—Allen S. Apgar, New York city, assignor to himself and Isaac Arnold, Jr., Haddam, Mass.
101,208.—Carriage Wheel Hub.—William J. Arrington, Jefferson county, Ga.
101,209.—Knife.—N. E. Babcock and G. D. Goodsell, Rockford, Ill.
101,210.—Hinge Machine. — Joseph H. Baird, Oakville, Conn.
101,211.—Suspender.—Thomas W. Bartholomew, New York city.
101,212.—Hasp for Trunks, etc.—S. T. Barton, and John W. Affron, New Orleans, La. Antedated March 29, 1870.
101,213.—Apparatus for Tanning Leather.—O W. Bean and W. B. Rowland, Tecumseh, Mich.
101,214.—Pick Handle.—Franklin Bellinger, Lockport, N.Y.
101,215.—Vapor Burner.—David Berkey, Huntington, Ind.
101,216.—Cultivator.—Charles Bird, Ackley, Iowa.
101,217.—Mode of Cushioning Steam Pistons.—George F. Blake, Boston, Mass.
101,218.—Machine for Picking and Dusting Wool.—M. Bliss, Ioala, Mich.
101,219.—Bracket Hanger.—Charles E. Bliven, Toledo, Ohio.
101,220.—Shears.—James Booth, Worcester, Mass.
101,221.—Turbine Water Wheel.—Clark Boyd, Andover, N. Y.
101,222.—Apparatus for Photographic Prints.—Warren S. Burgess and G. A. Lenzi, Norristown, Pa.
101,223.—Hot-Blast Furnace.—A. Burtenshaw, Hope Furnace, Ohio.
101,224.—Coupling for Connecting the Inlet-Pipe to the Retort of a Gas Machine.—John Butler, New York city.
101,225.—Steam Boiler Feeder.—J. M. Case, Worthington, Ohio.
101,226.—Washing Machine.—Geo. R. Chandler, Detroit, Mich.
101,227.—King Bolt for Carriage.—William Clark, Johnsonville, N. Y.
101,228.—Machine for Nicking Screws.—N. S. Clement, Northampton, Mass.
101,229.—Saw Gage.—Wm. Clemson, Middletown, N. Y.
101,230.—Machine for Bending Rake Teeth.—Columbus Coleman, Allegheny City, Pa.
101,231.—Cotton Picker. — Robert F. Cooke, Brooklyn, N. Y.
101,232.—Cotton Seed Planter, etc.—William W. Croom, Gainsville, Ala.
101,233.—Steam Generator.—Hugh E. Curry, Louisville, Ky.
101,234.—Rolling Machine for Leather.—John G. Curtis, Emporium, Pa.
101,235.—Knife Guard.—G. K. Dearborn, Pawtucket, assignor to Timothy Earle, Smithfield, R. I.
101,236.—Broiler.—D. W. Denham and Wm. K. Tillotson, Detroit, Mich.
101,237.—Trunk.—Heinrich Doerr, Milwaukee, Wis.
101,238.—Fastening for Cutter Heads, Pulleys, etc.—John Du Bois and Edwin Beugler, Williamsport, Pa.
101,239.—Cotton and Hay Press.—John S. Duffy, Battle Ground, Ind.
101,240.—Wheeled Cultivator.—S. H. Dwight and W. B. Chambers, Decatur, Ill.
101,241.—Material for Chair Seats.—A. N. Elliott, Barre, Mass.
101,242.—Apparatus for Setting up Barrels.—Wm. B Elliott, Corning, N. Y.
101,243.—Tanning.—Elihu England, Mossy Creek, Tenn.
101,244.—Culinary Vessel.—Charles Estabrooks, Calais, Me.
101,245.—Safe.—John Farrel and Jacob Weimer, New York city.
101,246.—Harvester Rake.—Joel Farrington, Corry, Pa.
101,247.—Whip Socket and Rein Holder.—J. R. Finney, Youngstown, Ohio.
101,248.—Preventing the Incrustation of Steam Boilers.—J. T. Fisher (assignor to James B. Clow), Pittsburgh, Pa.
101,249.—Lathe for Squaring Nuts, etc.—James Flower, Detroit, Mich.
101,250.—Converting Articles made of Iron into Steel. Hiram C. Folsom, Bangor, Me.
101,251.—Bit Stock.—D. P. Foster, Waltham, Mass.
101,252.—Horse-Collar Pad Press.—J. Fraser, Dowagiac, Mich.
101,253.—Manufacture of Artificial Stone.—Aaron H Frear, Chicago, Ill.
101,254.—Printing Press.—Merritt Gally (assignor to Allen Carpenter), Rochester, N. Y.
101,255.—Water Wheel.—James E. Gillespie and H. B. Weaver, Hartford, Conn.
101,256.—Plow.—J. S. Godfrey, Leslie, Mich., assignor to himself and S. M. Loveridge, Pittsburgh, Pa.
101,257.—Cotton Seed and Corn Planter.—J. B. Godwin, Williamston, N. C.
101,258.—Saw.—G. B. Goodnow, Detroit, Mich.
101,259.—Wheel for Railway Car.—Jeremiah D. Green Troy, N. Y.
101,260.—Bait Mill for Fishermen.—Silvanus Hamblin Taunton, Mass.
101,261.—Pump.—Everett C. Hammond, Oswego, N. Y.
101,262.—Copying Press.—William H. Hawkins, Cleveland, Ohio.
101,263.—Manufacture of Iron and Steel.—James Henderson, New York city.
101,264.—Tinning and Galvanizing Wire.—E. H. Hill, Worcester, Mass.
101,265.—Sewing Machine.—Jos. I. Hirschbuhl, Louisville Ky.
101,266.—Combined Seeder and Hay Tedder.—Jonas House, Howard, N. Y.
101,267.—Spring Bed.—Liverus Hull, Charlestown, assignor to Tucker Manufacturing Company, Boston, Mass.
101,268.—Combination Asbestos Filling for Fire-Proof Safes and other Structures.—Theodore Hyatt, New York city.
101,269.—Washing Machine.—Moses Ingalls, Muscatine, Iowa.
101,270.—Wood Pavement.—S. H. Ingersoll, New York city.
101,271.—Hulling Machine.—David Kahnweiler, New York city.
101,272.—Tuck Creasing Attachment for Sewing Machine.—James F. Kellogg, North Bridgewater, Mass.
101,273.—Harvester Dropper.—N. S. Ketchum, Marshalltown, Iowa.
101,274.—Neck Yoke.—Joseph King and C. S. Gould, Janesville, Wis.
101,275.—Wrapper for Seeds, etc.—Royal G. Kinner, Penn Yann, N. Y.
101,276.—Machine for Felting Hat Bodies.—James Kirk, Samuel Shelmerdine, and Cephas Froggatt, Stockport, Great Britain.
101,277.—Washing Machine.—John O. Kopas, Washington, D. C.
101,278.—Ratchet Drill.—Joseph Laubser, Milwaukee, Wis.
101,279.—Medical Compound.—Philester Lee and Lemuel Matthews, Lebanon, Oregon.
101,280.—Railway Car Brake.—Desire P. Lefevre and Louis Philippe Dorré, France.
101,281.—Stirrer and Egg Beater.—Charles Lehmann Hartford, Conn.
101,282.—Current Water-Wheel.—Wm. Lightfoot, Hamilton county, Tenn., administrator of John S. Lightfoot, deceased.
101,283.—Bleaching Dark Soap and "Foots."—Oscar Loew (assignor to J. M. Pendleton), New York city.
101,284.—Method of Bleaching and Refining Oils.—Oscar Loew (assignor to J. M. Pendleton), New York city.
101,285.—Window Guard against Flies and Mosquitoes.—E. S. Logg, Central Falls, R. I.
101,286.—Paper Collar.—Ed. Elisha Mack, Albany, N. Y
101,287.—Feed-Water Heater for Locomotives.—I. P Magoon, St. Johnsbury, Vt.
101,288.—Apparatus for Defecating Cane Juice.—C. K. Marshall, New Orleans, La. Antedated March 16, 1870.
101,289.—Apparatus for Separating the Seed from Fruit Pulp.—Robert H. Mayo, Paris, Texas.
101,290.—Stone Drill.—Wm. D. McClure, Constitution, Ohio.
101,291.—Manufacture of Cast Steel.—Hugh McDonald, Pittsburgh, Pa.
101,292.—Sewing Machine.—Wm. S. Mead, New York city. Antedated March 17, 1870.
101,293.—Cornice Mold.—Michael Meany, John McGinnis, and William Cunningham, Brooklyn, N. Y.
101,294.—Press and Strainer Combined.—W. D. Medbery, Bangor, Wis.
101,295.—Children's Carriage.—George H. Mellen, New York city.
101,296.—Fireplace Grate.—E. D. Merrick, New Brighton, Pa.
101,297.—Bayonet.—Anson Mills, United States Army.
101,298.—Sleigh Bench.—Edward Milner, Marquette, Mich.
101,299.—Machine for Folding Paper Bags.—Calvin J Moffatt, Brooklyn, N. Y.
101,300.—Saw Mill.—Charles D. Moore, Gilmanton, N. H.
101,301.—Washing Machine.—D. F. Neikirk and John J Koch, Republic, Ohio.

101,302.—Tie Bar for Holding Bent Wood.—Joel G. Niccum, Indianapolis, Ind.
101,303.—Collar and Hames.—Wm. O'Brien and Harry Wentworth, Omaha, Nebraska.
101,304.—Pump.—M. S. Orton (assignor to Zimri Pond), Galesburg, Ill.
101,305.—Medical Compound.—Heinrich C. S. Otto, New York city.
101,306.—Rotary Hydro-Pneumatic Pump.—H. M. Paine, Newark, N. J. Antedated Feb. 23, 1870.
101,307.—Attachment for Brush.—Samuel Pearson, Cincinnati, Ohio.
101,308.—Wagon Brake.—Michael Powell, Umatilla, Oregon.
101,309.—Gage Rod.—Eli S. Prime, Baltimore, Md.
101,310.—Velocipede.—F. L. Purroy, New York city. Antedated March 16, 1870.
101,311.—Railway Gate.—Robert Ramsay and Charles Stafford, New Wilmington, Pa.
101,312.—Boat-Detaching Apparatus.—Nathaniel C. Reynolds, Ellsworth, Me.
101,313.—Chimney Top.—David S. Robinson, Pittsburgh, Pa.
101,314.—Composition Roofing.—B. D. Sanders, Wellsburg, West Va.
101,315.—Machine for Compressing Wood Tenons.—B. D. Sanders, Wellsburg, West Va.
101,316.—Stove Drum.—Thomas Scantlin, Evansville, Ind.
101,317.—Pessary.—Caspar Schmitt, St. Louis, Mo.
101,318.—Mold for Casting Solder, etc.—Abraham Schoenberg, New York city.
101,319.—Process of Obtaining Acetic Acid from Wood.—Theodore Schwartz, New York city.
100,320.—Treating Wood to Obtain Useful Products.—Theodore Schwartz, New York city.
101,321.—Washing Machine.—Anna M. Smith, Pittsburgh, Pa.
101,322.—Bolt for Safety Stove for Cars.—C. J. Smith, Norfolk, Va.
101,323.—Water Meter.—George W. Smith, Norwich, Conn.
101,324.—Grain Separator.—Myron H. Smith, Lawton, Mich.
101,325.—Lubricating Compound.—Jacob H. Smyser, Pittsburgh, Pa.
101,326.—Bed Bottom.—Joseph Sperry, Charleston, Ill.
101,327.—Bed Frame.—Samuel Springer, Chicago, Ill.
101,328.—Caster for Sewing Machines.—J. M. Veasey, Denver, Colorado Territory.
101,329.—Oval Turning Tool.—J. L. Warren, assignor to George Hargreaves and Samuel Hargreaves), Detroit, Mich.
101,330.—Device for Tightening Carriage Tires.—J. B. West, Geneseo, N. Y.
101,331.—Apparatus for Tanning Hides.—R. T. White (assignor to himself and F. W. Perry), Winchester, Mass.
101,332.—Brush.—J. L. Whiting, Boston, Mass.
101,333.—Hand-Setting Calendar.—Charles H. Wight, Baltimore, Md. Antedated January 18, 1870.
101,334.—Steam Water Elevator.—J. C. Wightman, Newton, assignor to T. P. Proctor, trustee, West Roxbury, Mass.
101,335.—Washing Machine.—Caleb Williams, Newark, N. J.
101,336.—Coffeepot.—J. P. Williams, Mobile, Ala.
101,337.—Device for Measuring, Laying out, and Forming Corsets.—Mollie Williams, Campden, Ohio.
101,338.—Mowing Machine.—T. H. Witherby, Worcester, Mass.
101,339.—Shearing and Punching Machine.—T. H. Witherby, Worcester, Mass.
101,340.—Liniment for Burns, Scalds, etc.—Louis Wolff, Chicago, Ill.
101,341.—Base-Burning Fireplace Stove.—W. E. Wood, Baltimore, Md.
101,342.—Seeder and Cultivator Combined.—Nelson E. Allen, Trenton, and Israel B. Record, James Rood, and Jasper Hayden, Beaver Dam, Wis.
101,343.—Saw Mill.—Emanuel Andrews, Williamsport, Pa.
101,344.—Pencil Case.—W. N. Bartholomew, Newton Center, Mass., assignor to Joseph Reckendorfer, New York city.
101,345.—Bearing for the Table Rolls of Fourdrinier Paper Machines.—G. S. Barton, Worcester, Mass., assignor to Rice, Barton & Fales' Machine and Iron Co.
101,346.—Wood Pavement.—Albert Betteley, Boston, Mass.
101,347.—Water and Gas Meter.—N. L. Blanchard, Spuyten Duyvil, N. Y. Antedated March 24, 1870.
101,348.—Exhausting Apparatus for Gas Works.—S. R. Brick, Philadelphia, Pa.
101,349.—Corn Planter.—Truman Brockway, Chatsworth, Ill.
101,350.—Harrow.—J. G. Burcham, Noblesville, Ind.
101,351.—Fence.—Timothy Coffield, Natrona, Pa.
101,352.—Rivet.—H. E. Copeley, Brooklyn, N. Y.
101,353.—Apparatus for Keeping Pure the Air in the Manufacture of Fertilizers.—J. E. Cox, Cincinnati, Ohio.
101,354.—Machinery for Making Paper Boxes.—C. O. Crosby, New Haven, Conn.
101,355.—Lock.—C. E. Dickerman, Boston, Mass.
101,356.—Machine for Shearing Metal.—Ellis Doty and H. Richardson (assignor to Doty Manufacturing Company), Janesville, Wis.
101,357.—Oven.—McCann Dunn, Bloomington, Ill. Antedated March 19, 1870.
101,358.—Plumbago Press.—John C. Ford, Cambridgeport, Mass., assignor to W. A. Ives, New Haven, Conn.
101,359.—Water Closet Valve.—C. T. Forrest, San Francisco, Cal.
101,360.—Shoe Fastening.—Wm. H. Fortney and Wm. E. Sheaffer, Middletown, Pa.
101,361.—Broiler.—Ann L. H. Graham, Chester, Pa.
101,362.—Permutation Lock.—Henry Gross, Tiffin, Ohio.
101,363.—Cover for Sewing Machines.—Thomas Hall, Brooklyn, N. Y.
101,364.—Still for Hydrocarbons.—S. A. Hill and C. F. Thumm, Oil City, assignors to themselves and Oliver P. Scaife, Pittsburgh, Pa. Antedated January 18, 1870.
101,365.—Still for Hydrocarbons.—S. A. Hill and C. F. Thumm, Oil City, assignors to themselves and O. P. Scaife, Pittsburgh, Pa. Antedated January 2, 1870.
101,366.—Machine for Threading Bolts.—Merrit Hine (assignor to C. Cowles & Co.), New Haven, Conn.
101,367.—Hoisting Machine.—George Johnson, Cincinnati, Ohio.
101,368.—Base-Burning Stove.—William J. Keep, Troy, N. Y.
101,369.—Extension Gas-Fixture.—Henry Kruger, New York city.
101,370.—Carriage Axle.—G. A. Lloyd, San Francisco, Cal., assignor to himself and Anthony Rosenfield.
101,371.—Double Pincers.—William L. Maund, Milan, Texas.
101,372.—Electro-Magnetic Enunciator.—W. N. McInnis, Northumberland, Pa.
101,373.—Preserving Vegetables, Fruits, etc.—D. M. Mefferd, Norwalk, Ohio.
101,374.—Carpet Tack.—T. A. Mitchell (assignor to himself and Daniel Breed), Washington, D. C.
101,375.—Heating Stove.—Jas. Moore, Ergeneth, Ireland.
101,376.—Bed Bottom.—Moses Morehouse, Boscobel, Wis.
101,377.—Easel.—George Munger and J. W. Schermerhorn, New York city.
101,378.—Turbine Water Wheel.—J. B. Park, North Platte, Nebraska.
101,379.—Screw Piling.—C. H. Parker, Boston, Mass.
101,380.—Convertible Plow and Cultivator.—C. L. Reid, Louisville, Ky.
101,381.—Cigar Box.—Matthew Richardson, Brooklyn, N. Y.
101,382.—Projectile for Toy Pistol.—Charles Robinson, Boston, Mass.
101,383.—Traveling Cap.—James F. Sargent, Tunbridge, Vt.
101,384.—Mode of Lubricating Axles.—Enoch Sawyer, Hollow Square, Ala.
101,385.—Base-burning Fireplace Stove.—S. B. Sexton, Baltimore, Md.
101,386.—Gag Runner and Buckle.—Severin Siebold (assignor to himself and P. Burns), Syracuse, N. Y.
101,387.—Terret Lining.—Severin Siebold (assignor to himself and P. Burns), Syracuse, N. Y.
101,388.—Distillation.—H. B. Sinks, Cincinnati, Ohio.
101,389.—Casting Ingots in Groups.—F. J. Slade, Trenton, N. J.
101,390.—Graduated Rule and Pattern for Tailors.—W. E. Smith, Chicago, Ill.
101,391.—Padlock.—Daniel Snell, Little Falls, N. Y.
101,392.—Cooling Air and Liquors.—D. E. Somes, Washington, D. C.
101,393.—Fire Escape.—Joseph Steger, New York city.
101,394.—Packing Journals and other Parts of Machinery.—C. A. Stevens, New York city.
101,395.—Steam Plow.—A. L. Taveau, Chaptico, Md.
101,396.—Trowel.—Alpheus Walker, Worcester, Mass.
101,397.—Sawing Machine.—Charles G. Wells, Collinsville, Conn.
101,398.—Watch.—C. V. Woerd, Waltham, Mass.
101,399.—Boot and Shoe Heel.—Joseph Woodley, Quebec, Canada.
101,400.—Brush-handle Attachment.—R. Wyatt, Brooklyn, N. Y. Antedated March 19, 1870.
101,401.—Anti-Friction Journal.—Pierce W. Yarrell, Littleton, N. C.
101,402.—Water Wheel.—Pierce W. Yarrell, Littleton, N. C.
101,403.—Hose Coupling.—Charles H. Cushman, Alexandria, Va.
101,404.—Automatic Fire Extinguisher for Use on Railroad Cars, etc.—H. C. Stewart and R. T. Bradley, Cincinnati, Ohio. Antedated March 5, 1870.
101,405.—Ice House.—William Veite and John Fagan, Pittsburgh, Pa.
101,406.—Process of Preparing Paper for Roofing and Similar Purposes.—C. H. Smith, Baltimore, Md.
101,407.—Elevator.—H. C. Stouffer, Salem, Ohio.
101,408.—Washing Machine.—William H. Roach, Harrisville, Ohio.

REISSUES.

3,897.—Coal Stove.—H. G. Giles, Troy, N. Y., assignee, by mesne assignments, of Gilbert J. Kingsbury.—Patent No. 23,587, dated April 12, 1859; reissue 1,409, dated Feb. 17, 1863.
3,898.—Straw Cutter.—James Palmer, Brooklyn, N. Y., assignee, by mesne assignments, of D. J. Powers.—Patent No. 27,154, dated Feb. 14, 1860.
3,899.—Pump Piston.—New England Pump Manufacturing Company, Boston, Mass., Pacific Pump Manufacturing Company, San Francisco, Cal., Charles F. Mudge, Bridgeport, and Bridgeport Manufacturing Company, Bridgeport, Conn., assignees, by mesne assignments, of Nathan Stedman.—Patent No. 11,543, dated Feb. 9, 1861.
3,900.—Lamp.—C. A. Kleemann, Erfurt, Prussia.—Patent No. 37,867, dated March 10, 1863; reissue 2,098, dated Aug. 4, 1868.
3,901.—Knitting Machine.—The Pepper Knitting Machine Company, Boston, Mass., assignee, by mesne assignments, of John Pepper.—Patent No. 13,239, dated July 17, 1855; reissue 1,538, dated September 15, 1863; extended seven years.

DESIGNS.

3,941.—Bust.—Henry Berger, New York city.
3,942.—Folding Door Key.—Henry H. Elwell, South Norwalk, Conn.
3,943.—Trade Mark.—J. H. Gamhart, St. Louis, Mo.
3,944.—Trade Mark.—J. S. Kirk, Chicago, Ill.
3,945.—Stove Ornament.—Isaac Applin Sheppard, Philadelphia, Pa.
3,946.—Muff.—R. M. Seldis, New York city.

EXTENSIONS.

Cotton-seed Planter.—A. W. Washburn, Yazoo City, Miss. Letters Patent No. 14,529, dated March 25, 1856.
Machine for Cutting Loaf Sugar.—Adolph Brown and Felix Brown, New York city.—Letters Patent No. 14,490, dated March 25, 1856.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,189.—Substitute for Curled Hair.—M. W. Blanchard, Dutch Flat, Cal. November 3, 1869.
231.—Meter for Water and other Fluids.—J. F. de Navarro, New York city. January 25, 1870.
251.—Lawn Mower.—J. D. Frary, New Britain, Conn. January 28, 1870.
281.—Windmill.—Charles Mahler, San Francisco, Cal. January 31, 1870.
283.—Sewing Machine.—Grover & Baker, New York city. January 31, 1870.
303.—Electro-deposition of Nickel.—I. Adams, Jr., Boston, Mass. Feb. 2, 1870.
318.—Manufacturing Wrought Iron or Steel.—James Henderson, New York city. February 3, 1870.
319.—Friction Clutch.—F. A. Pratt and Samuel Colt, Hartford, Conn. February 3, 1870.
320.—Spring Bed Bottom.—R. Barker, S. A. Barker, and L. Fisher, Providence, R. I. February 3, 1870.
322.—Printing Presses.—Merritt Gally, Rochester, N. Y. February 3, 1870.
336.—Knitting Machine.—Henry von Hartz and Julius Feiss, Cleveland, Ohio. February 4, 1870.
362.—Mechanical Movement.—G. E. Harding, New York city. February 5, 1870.
372.—Marine and other Compasses.—R. C. Cutting, Liverpool, England and Amasa Mason, Boston, Mass. Feb. 9, 1870.
400.—Pitcher.—F. T. Ferguson, Boston, Mass. February 10, 1870.
426.—Rotary Digging Machinery.—O. C. Evans, ——, ——, U. S. Feb. 12, 1870.
434.—Combination Tool.—F. T. Ferguson, Boston, Mass. February 14, 1870.
500.—Machine for Molding, Rounding, etc., the Soles of Boots and Shoes.—A. Jeffers, Lynn, Mass. Feb. 18, 1870.

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