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THE NEW POST OFFICE, MELBOURNE, AUSTRALIA.

It is many years since the idea of a General Post office, suited to the requirements of a colony so progressive as Victoria, was first conceived. It is, after all, simply a question of time whether other institutions of as much importance as the General Post should not be completed in accordance with the original views of promoters.

The architect of this building is Mr. Wardell; its frontage in Bourke street is 130 feet, and that to Elizabeth street 316 feet. The stone used in the front of the building is freestone from Tasmania quarries, the greater portion being from Point Ventenat, Taylor's Bay, and the remainder from Spring Bay.

The principle entrance to the building is in Bourke street, leading to an arcade by a flight of steps to the mail branch department, from which access is gained to the offices of the general secretary, the inspector of country post offices, and the inspector of stamps. An arcade extends along the Bourke and Elizabeth street fronts of the building, affording general access to the receiving, delivery, and inquiry windows, registration, sale of stamps, and private letter boxes. At the north end of Elizabeth street the arcade affords access to a staircase on the first floor, where the money order office and the dead letter office are located, and forms the public approach to the accountant's department. On this floor are also the stationery store, clerks' offices, corridors, etc. The mail branch department occupies the whole of the ground floor, affording a clear space throughout, except where interrupted by the piers continued the whole length of the two street fronts.

On account of the inequality of street level a basement is formed, commencing at above 12 inches above the footpath in Little Bourke street, and standing 4 feet 6 inches above the foot path at the corner of Bourke and Elizabeth streets. The portions of basement exposed to view are of red granite, and finished with a rusticated capping, forming a sub-plinth t each pier, and filled in with moulded blue stone steps. These steps extend beyond the plinth, and form a continuous flight to the arcades. The arcades are 10 feet wide in the clear, divided by piers and molded cross ribs at each bay, and vaulted over with Roman groining in brick. The north front is of plain brickwork, and the basement throughout is of chiseled bluestone ashlar. The middle compartment is divided into centre and wings, the center being relieved by a screen of eight detached coupled columns of the Ionic order, terminating with balustrades above. The pedestals over the columns are to have statues or carved terminations. The walls to the center portion of the ground space form a central area carried up to the full hight of the building, and lighted from above, to be used as a sorting room, around which are placed successively the stamp, registration, and inquiry windows, and the newspaper and letter delivery, as well as private letter windows; these are on the south side, facing Bourke and Elizabeth streets. On the eastern or rear side of the building is the mails receiving room, entered from the right-of-way joining Bourke street with Little Bourke street. The inland and foreign despatch, with outside approach is on the western side, and the letter carriers' room is on the north side. By this arrangement, supervision is obtained by the superintendent in the sorting room over the whole of this department. Washing rooms and water closets are provided on each floor. The basement, on the rear side of the building, is appropriated for storerooms, etc.

The architecture is of Ionic and Doric orders, superimposed after the Italian manner. The angles of the building and the main central compartment of the long Elizabeth street front break forward beyond the general face, and form in the complete design, angle towers to both street fronts. The main central compartment and angle tower abutting on both streets is carried up another story with the Corinthian order. The angle tower is surmounted by a turret of octagonal form with clock dials on four sides. The two remaining angle towers are of less elevation, and are simply terminated with a balustrade and attic. Each front between the towers and central compartment in Elizabeth street is finished with a balustrade. The upper story consists of pilastered arched headed windows, with balconettes continuing the line of pedestal to the upper order, the impost to the window being continued. Engaged coupled columns mark each bay, and the towers are relieved with pilasters and columns, with detached shafts on each face extending to the three orders, the cornices breaking round. The columns with detached shafts are fluted, and the windows to the central compartment and towers have fluted Ionic columns. In the wings to the central compartment arched heads are omitted, and the spaces above are filled with sunk panels and carved festoons. The angle tower connecting the arcades to the two streets is domed in brick. The hight of the lower order from the level of the basement is 21 feet 6 inches, and the upper order, including pedestal and parapet, 30 feet 6 inches. The hight of the angle tower abutting on Bourke and Elizabeth streets is 98 feet above the footway. The central compartment is 92 feet 6 inches to the top of the masonry. The remaining parts are 60 feet high. The roofs are of wrought iron, and covered part with slate and part lead. On the third floor, an attic room is provided, for storage and extra office accommodation, as well as living rooms for messengers. A space is set apart on the basement for heating the mail branch department with hot water.

THE NEW POST OFFICE, MELBOURNE, AUSTRALIA.

In the Black Sea, says the *Builder*, there are no tides, but the level of the water along the shore is considerably influenced by the action of the wind. Near the mouth of the Danube it varies from eighteen inches below the mean sea level, when the wind is from the west or off the land, to two feet above that level when the wind is landward or from the east.

A TRAIN recently ran 132 miles in two hours and fifty minutes, on the Pennsylvania Railroad, recovering fifty minutes of lost time.

EXPERIENCES OF A BUREAU OFFICER.

[Extract from a speech of Hon. S. S. Fisher, late Commissioner of Patents.]

Of direct bribes there are few tendered, and, I apprehend, so few accepted, that this method, considered as a mode of influencing the minds of officials in the Patent Office, may as well be laid out of the consideration of ordinary applicants. It is not uncommon to find outsiders trading on the strength of the supposed corruption of officials or of Congressmen; but I think, as a rule, money paid for the purpose of influencing either rarely goes beyond the pockets of the self appointed agent. One of the examiners once brought me a fifty dollar bill, which had been left on his table in an envelope, which also contained a request for a private interview. At my suggestion he wrote declining the interview, and notifying the gentleman that he could have his money by applying to the Commissioner. A day or two afterwards a tall and sheepish looking individual appeared and demanded the fifty dollars. He was required to give a receipt in due form for the money; and, I think, will hardly care to repeat the experiment. A meaner trick was the practice of paying a young man in the office a debt long due to his widowed mother, by a check, payable at a point so distant that it was supposed that it could not be collected until the young man had acted in the case submitted to him. The young gentleman, who is a thoroughly upright man, called my attention to the case, and all proceedings were suspended by order until the check was heard from. It was returned dishonor d. There were no funds in the bank, but the scamp was caught. His case was still in abeyance, and rather than risk the action of a man upon it, whom he had just attempted to swindle, he paid the debt in full in good currency.

I believe the officers of the Patent Office to be, as a class, thoroughly honest, efficient, and capable. Some of them who have been long in office have become a little set in their ways and somewhat restive under criticism, and not unfrequently their resulting obstinacy seems to the mind of an applicant, under the fostering suggestion of his solicitor, to be dictated by some corrupt motive of opposition. Nearly every inventor fears his shadow. Every pillar in the Patent Office is a lurking thief waiting to filch his invention. He thinks the Commissioner, the examiners, even the very laborers and messenger boys, must know what a fortune there is in his new invention, and that the study of their lives is now to steal it from him. It may be well to remember that the officers who examine 20,000 applications in a single year are as likely to become *blasés* on the subject of new inventions as the ladies who open 500 epistles per day in the Dead-letter Office are said to become upon the subject of love-letters. The most persistent and troublesome form in which it was attempted to commit the Commissioner to improper official acts, was in the constant attempt to force him into conversation about cases which had been argued but not decided. This practice had unfortunately been permitted under one of the previous administrations, until it was impossible to say when the argument closed, and after oral discussion in the presence of each other, the remaining aim of the parties until the day of decision was to catch the Commissioner alone and to pour into his ear an argument to which opponents were to have no opportunity to reply. It is believed that this evil is now effectually suppressed.

The system of making appropriations for the departments struck me as objectionable. Now, as early as October in each year, every head of a bureau makes his estimates of the number of clerks and the amount of money necessary to carry on operations for the fiscal year beginning on the following July—nine months. In making these estimates, if honest, he is guided by his experience of the past, and his forecast of the future. When Congress meets, his estimates go before the Committee on Appropriations. Here they run the gauntlet of all the would-be economists. Then they pass the ordeal of all the gentlemen who happen to be unfriendly to the bureau, or especially to its head. It will be remembered that one gentleman, in urging an incompetent friend upon me for office, reminded me that he was a member of the Committee on Appropriations. This reminder, under such circumstances, was equivalent to a threat. No one cares to call on the head of the department or bureau for explanation, but each man slashes according to his fancy. Sometimes, what has escaped the committee is decimated by some clerk. The appropriations for the Patent Office were once cut down by apparently striking out arbitrarily every tenth or twelfth line. Curious to understand it, I called upon the committee. No one knew anything about it, or had any objection to the appropriations that had been stricken out. Presently it appeared that the clerk of the committee had exercised *his* supervising care over our estimates by making these erasures, and when the motive was looked for, it was found in the fact that he had unsuccessfully attempted to procure the appointment of a friend in the Patent Office during the preceding summer. A parallel case was found in the rejection at one time at the Treasury Department of an entire quarter's accounts of the Patent Office. The objections were not well founded, and the accounts were subsequently passed. The cause of the temporary annoyance was found in a clerk in the Auditor's Office, whose daughter had been discharged from the Patent Office, and who had informed us that he could, if he would, do us much harm.

It will be seen from these sketches how the present system vitiates and corrupts every department of our system of government. The time spent by government officials in making and listening to applications for office, amounts to fully one-third of the business day. The strife and bitter feelings engendered are sufficient to destroy all proper intercourse between the executive departments and the representatives of the people. The evils of the system are not confined to Washington. They are to be found to a greater or less degree in every State capitol, in every Congressional district. This incubus must be thrown off, or, like the "old man of the sea," it will strangle us. We must have better public servants, selected for their education and capacity, and retained in service as long as their experience is valuable and their bodily powers are intact. The President, by the legislation of the last session, imperfect as it is, has a great opportunity to inaugurate a purer and better system than the country has yet seen. Let him do this, and however politicians may bluster and scold, the sober sense of the people will respond, "Well done, thou good and faithful servant."

The Great Rice-fields at the South.

A Southern correspondent of the *Syracuse Courier* writes of the rice lands:

"There is a belt of land stretching from Virginia down the coast to the Gulf of Mexico, and most of the distance it lies low, very little above the level of the ocean, and some of it is covered with water by every high tide. The greater portion of this land may properly be called swamp land—not altogether given up to the domain of the water, but always damp, and too wet for any grain except rice. It is not every swamp or wet piece of land that is fit for the cultivation of rice. The alluvial swamps lying along the banks of rivers, having a deep soil, composed of decayed vegetables, is best fitted for the purpose, but it must be so located that it can be overflowed at high tide, or it is useless for the purpose. The lands must also be protected from the salt water, and from the rapid currents occasioned by freshets. South Carolina is the great rice State, more being cultivated than in all the United States beside. The rivers flowing down from the table land of the interior reach this low land, and force themselves to the sea, spreading and forming a broad deep channel. There is volume of water sufficient, so that the tide will cause it to set back for many miles. Along many of these ravines, the land is as level as the sea, and it can be flooded at pleasure. Gates are constructed through artificial embankments along the banks of the river, and when the tide is high the water is let in, and the land flooded and the gates closed. When it becomes necessary to draw the water off, the gates are opened at low tide. Some of these fields are very large and interesting when being prepared for a crop, and are very beautiful when the rice comes up through the water and shows its needle-like spears. These fields must have a secure embankment along the river, and must be thoroughly draine l by artificial channels, so as to take the water entirely away when necessary. In large fields some of the channels have capacity enough to float a flat bottomed boat, which is used to convey the harvest to the place of storage.

"The land is plowed in winter, and in the first warm days of spring is flooded. The preparation of the ground commences in March. The ground is made as mellow as a garden. The seed is sown in trenches about fifteen inches apart. It requires about three bushels of seed to an acre. The seed is tightly covered with the soil, and the water let in, to remain about a week, by which time the grain sprouts, when the water is drawn off; but when the grain is a few inches above the ground, it is again flooded for four or five days, and then drawn off, and the grain is then allowed to grow for four or five weeks, when it is cultivated and the ground thoroughly stirred; and then the water is let on, and it is flooded for a few days, and then gradually drawn down and again cultivated; and after the second cultivation the water is again let on to remain till the crop matures, which takes about two months, when the water is drawn off, and it is harvested very much as we harvest buckwheat. The crop in a favorable season is a profitable one. The grain is threshed and cleaned in mill. It is frequently sent to market before the hulls are removed. There are extensive mills at Liverpool and New York for hulling the rice, and they enable the dealer to put it on the market fresh and white. There are mills at Savannah and Charleston, where the rice is hulled for the local market. The best hulling machines cost from $15,000 to $18,000, and have very intricate machinery. The rice, before being hulled, is called poddy. T e machine takes off the hulls and assorts the grain. After the hulls are removed, it is moved out on inclined screens, which are fine at first, and all the small and broken rice passes through, and then a little coarser, and the rice called 'middling rice' drops through, and last the 'Prince rice.' The latter quality is passed through another screen, which is called polishing, and in that process is swept clean and bright. Rice is cultivated in all the warm countries of the world, and is used for food by more people than any other cereal except wheat. It is cultivated very extensively in the East Indies; and along the coast, where the lands are marshy, it is the only crop raised. It is a staple crop in Africa, the south of Europe, North and South America. Ceylon produces a large quantity in excess of consumption. There are several varieties, some of which grow on dry land, but the Carolina or water-rice, as it is called, is as fine as any in the world. It grows very rapidly, and is often six feet high. When it is sufficiently high to cover and hide the water, it presents a beautiful sight."

Modern Vandalism.

Paris, now the Niobe of cities, has had many of her glories and monuments of her genius destroyed by the rude chances of war; but the unreasoning savagery of the Communists, in deliberately violating the shrines of art and the temples of science, has never been paralleled in the history of the world. There no political or party zeal such as inflames the liberal against the memory of the Empire, no fanatical hatred such as incites the republican to destroy the very symbols of monarchy, can be pleaded in justification. The wilful destruction of libraries, works of art, and models and specimens illustrating all the sciences, which have so long maintained the renown of Paris as a home for all that is best and greatest in art, science, and civilization, is the most unaccountable exhibition of wickedness of modern times. It is a war upon the very knowledge and intelligence that distinguishes man from brute, a deliberate attack on the mind of man and on the works thereof. Surely crime never did more dastardly and more unworthy deeds than the recent acts of violence upon the museums, libraries, and art galleries of Paris.

One of the most intrinsically valuable and most interesting of all the places ravaged was the *chateau* of Arceuil, which has been plundered and its valuable contents wantonly destroyed. A collection, made by the great Laplace, to whose descendant the castle belongs, of rare books, souvenirs, and works of art, has been devastated and scattered to the winds. The author's original manuscript of *La Mécanique Céleste*, that wonderful production of the greatest of modern astronomers, was thrown into the little stream, the Bièvre, which runs by the *chateau;* but the invaluable relic was subsequently recovered. The sacking of the house of Laplace, and the ruin of the relics of his great genius and labors, was accomplished by a horde of ruffians from the neighboring district of Mouffetard.

Advantages of Printing Telegraph Instruments.

"Printers have the advantage of other systems in the reduced liability to errors. In transmitting and receiving dispatches with lines of the conductivity indicated, there can be but one chance for mistakes, and there is less liability to error than in transcribing from one paper to another. The message must be received and printed exactly as it is sent. If an error occurs, it is of course the fault of the transmitter and not of the receiver. Another decided advantage is that they can be worked much more rapidly than any other system, and as soon as the message is complete, it is ready to go to the delivery clerk, to be enveloped and sent to its destination. Working printers is not as exhausting to the operators as other systems, as, when the line and instruments are in proper order, the receiving operator has only to see that the messages agree with the checks. On main circuits, where a large amount of business is to be done, these advantages are of great importance.

Another advantage in employing printing telegraph instruments is the fact that they are always popular with the public, who prefer to receive their despatches in that shape. Other things being equal, printing lines have always had a decided popularity with the public over other systems. With proper lines and insulation, good operators, and such instruments as can now be manufactured, we believe that in ten hours' steady work the printers will do from one half to two thirds more work than any other system now in use in this country."

[We fully concur with the *Telegrapher* in the above estimate of the advantages of the telegraph printing instruments. We wonder that large and flourishing companies like the Western Union do not more extensively employ them. We have seen them worked at the Western Union establishment in this city, both in sending and receiving despatches, when they certainly surpassed the ordinary instruments in rapidity and correctness. Sending messages by key and receiving by sound is a very simple and convenient method, to be sure; but the blunders that are often committed, especially with names, are fearful to contemplate. Then the chirography of many telegraphers is difficult to decipher, having more resemblance to fly tracks or Aztec hieroglyphics than to civilized writing.

The public likes the plain printed style of messages much the best. It would be a popular move on the part of the companies to use the printing instruments exclusively.—Eds.

Car Wheels and Axles.

In an action recently tried in England against a railroad company, it was testified that experience has shown that, by tapping, defects can be detected in the wheels but not in the axles, but that the only way to find out whether an axle is sound or not, is to break it. The plan adopted is to break several specimens taken at random from a lot of axles, in order to find out whether the iron is good. If the test be satisfactory, the rest of the axles are taken on trust. The breaking of railway axles very seldom occurs. In the case before the court, which was an action for damages against the railroad company, arising from injuries caused by the breaking of an axle, it was proved that this particular axle had been in use for eighteen years, and that after it broke a fracture extending around it to the depth of half an inch was discovered. This was the case in the axle which broke recently upon the Maine Central Railway at Freeport.

Extraordinary Positions for Birds' Nests.

The following is vouched for by several English papers: A white-throated wren recently built its nest in the letter-box of the Duke of Rutland's gamekeeper at the Links, near Newmarket, and produced six young ones. During its incubation, the old bird took no notice of the intrusion of the of the persons who went for the letters night and morning. A short distance from this remarkable nest is one built by a lark under the metals on the line of railway between Newmarket and Dullingham. The bird is sitting upon four eggs, and takes no notice of the thirty trains which pass over the line daily.

Learning and Understanding.—"How is it, my dear," inquired a schoolmistress of a little girl, how is it that you do not understand this simple thing?" "I do not know, indeed," she answered with a perplexed look, but I sometimes think I've so many things to learn that I have no time to understand."

[For the Scientific American.]

A CHAPTER ON AMERICAN GEOLOGY.

BY CHARLES MORRIS, OF PHILADELPHIA.

In the western corner of the State of Nebraska is a locality fearfully inhospitable to the husbandman, an extensive region untouched by pre-emption claims, and forcing the team of the emigrant, who would seek yet further westward more fertile lands, to wind far and slowly through labyrinthine defiles ere he can pass its difficult barrier.

Yet, though treeless and barren, seldom visited by the kindly waters of the skies, and undimmed by the cabin smoke of the settler, these *Mauvaises Terres*, or "Bad Lands," as they are appropriately named, are to the geologist a true land of promise, no other locality in our country yielding so strange an array of fossil remains.

This region is a veritable mirage to the traveler whose adventurous foot leads him so far into the prairies of the great West. From afar there seem to rise the towers and temples of a mighty city, lifting their fair proportions high into the cloudless air, vast columns as of the capital of some unknown empire of the West. As he approaches, these pinnacles and towers lose their harmonious proportions, and the city sinks into a grand ruin, uplifted in mighty disarray above the level surface of the prairie.

But now, with every step, the mirage fades, and the unlucky Barmecide stops at last before a lofty deposit of hardened clay and marl, through which ages of rain and the slow appetite of running streams have cut, in every direction, cañons, winding in labyrinthine defiles through the *Mauvaises Terres*, rugged passes for the wheels of the dauntless emigrant bound "Westward, Ho!"

Here was, in ancient times, a great fresh water lake, which for ages dropped to its bottom the earthy deposits brought in by the present White river and other streams, till in time the lake was extinguished under its silt of marl, sand, and clay, which has since been uplifted into the elevated and water-worn ruin above described.

The Bad Lands comprise an area of about 100,000 square miles, the lake they represent having covered the most of Western Nebraska, with an area of some 150,000 square miles. From the source of the White River to what is technically known as the Forks, the surface is, geologically, tertiary, having been laid in that grand third age, of the building of the earth, which has yielded in all parts of the globe such marvellous animal remains. Thence to where it merges in the muddy Missouri, it runs through cretaceous beds, strata agreeing in age with those white chalk and green sand deposits of Europe, which are noted as mausoleums of the gigantic sea lizards of the old oceans, whose exhumed bones have been more the marvel and delight of *savans* than aught beside that the earth has yielded, to the chisel and hammer of the indefatigable rock delver.

At some distance from this stream is another, called the Niobrara, running through similar deposits, the tertiary beds stretching from river to river. South of the Niobrara to the Platte river is a second strange region known as the Sand Hills. Here an extensive area is covered with conical hills of sand, constantly shifting before the wind, and frequently scooped out at their summits into incipient craters. This sandy region is not, however, destitute of vegetation, as it forms a favorite grazing range of the buffalo and antelope.

While the waters were slowly filling up these lowlands with the mud denuded from upland regions, leaves of trees and bones of animals dropped or drifted into the lakes and marshes, and, buried in the mud of the bottom, have been preserved intact to our time. Modern naturalists do not ask much. Give them a well defined leaf and they will reconstruct the tree, give them the bones of a skull and they will rebuild an extinct animal. Even this is frequently denied them, a single tooth being sometimes the basis of an animal reconstruction. Fortunately the teeth, the most durable of animal bones, are also the most significant, being full of evidence of the character, race, and food proclivities of their owners.

In the Bad Lands are found the remains of two distinct animal communities, as described by Dr. Leidy, in Dr. Owen's "Geological Report of the North West." While the lowest bed was being deposited, the lake was probably a great marsh, in which wallowed numerous hippopotami of at least two distinct species. But the distinguishing creature of this period was a huge thick skinned animal, named, from his great size, the *Titanotherium*, or Titanic animal. At the period of the second deposits, there roamed the prairies great herds of an ancient species of hog, partly carnivorous, yet chewing the cud like modern ruminating animals. Of this *Oreodon*, as it has been named, were several species, of one of which Dr. Leidy has found remains of more than 700 individuals.

Three species of hyæna inhabited these plains, together with a tiger, with sabre like teeth. Fierce conflicts took place between these beasts, the marks of which still remain in their fossil skulls. In one hyena skull were found two wounds on each side the nose, while near by was another skull whose canine teeth exactly fitted the apertures.

Besides these creatures, no longer found on American soil, there existed two species of rhinoceros, supposed, unlike their African representative, to have been hornless. A gigantic weasel, an immense turtle, and numerous other strange creatures, lived and multiplied here, long before these lands had deserved their sobriquet of "Bad." Great has been the change from the occupation of this region by animals no longer found anywhere on the continent, by a vast lake, and umbrageous forests, to its present treeless and lifeless condition.

But these are not all the organic marvels of the region. The more modern beds of the Niobrara yield an entirely different series of animals, of which more than thirty species have been examined, all new to science. A vast period of time must have elapsed between these two formations, for an extensive series of animals to utterly die out, and a new and distinct series to take its place.

In this new commonwealth lived a species of that American elephant, known as the Mastodon; much smaller, however, than that which afterwards existed. But this dwarf is balanced by a giant, or, as Dr. Leidy has appropriately named it, The Emperor of the Elephants (*Elephas Imperator*). This massive brute was one third larger than any other elephant known, living or fossil, yet to attest his imperial dignity there only remain a few scattered bones.

There lived here, also, native representatives of that sand loving creature which modern legislators have of late sought to re-introduce to his old range on the Western plains. No less than four species of camels roamed here, unburdened and unridden. Besides these there was a rhinoceros, resembling that now living in India, two species of deer, an animal like the mountain sheep, a ruminant hog resembling the oreodon, a porcupine, a small beaver, four species of wolves, two animals of the cat tribe, and various others.

Another animal has been introduced by man into this country without any idea that it had ever previously trodden the soil of America. When Darwin discovered the bones of a fossil horse in South America, it was an unexpected revelation to science. But in this region of the Niobrara, no less than twelve distinct species of the horse have been found, ranging in size from that of the Newfoundland dog to that of the largest horse, thus seeming to prove this the true native land of the charger. Though all these animals have long since departed from the earth, their genera are still represented in most cases, but strangely enough most of these representatives are now only found in Asia and Africa.

In the cretaceous deposits are found leaves much more modern in character than those of the European chalk beds. For the flora of the European chalk is no longer represented on that continent, and its family relations connect it with Indo-Australian instead of modern European plants. It had thence become a maxim that the cretaceous period was entirely unrepresented in modern plants. But these American beds have quite overthrown this idea, yielding plants that closely conform to those now living. These plants are related to those found in European tertiary beds, showing that America was far ahead of Europe in its organic development, and has far better claims to the title of the Old World.

Testing Lubricating Oils---Invention wanted.

In an editorial upon this subject, the *National Oil Journal* remarks: Some practical and inexpensive method of testing the quality and relative value of different kinds of lubricating oils, is a standing want on the part of large oil consumers.

We know that some of our best railway managers comprehend the importance of this matter, and are anxious that some method should be devised which will secure them against the contingencies we have indicated. The Great Western railway company of Canada is the only one, so far as we are aware, that has undertaken a practical solution of the question At their machine shop, in the city of Hamilton, they have erected a very simple yet thoroughly practical machine for the purpose of testing lubricating oils. It consists of an ordinary car axle arranged to run in ordinary journal boxes. The axle is run by belts from a stationary engine at a uniform rate of speed, and under a pressure of 2½ tons to each journal—equivalent to ten tons to a car. The packing and all the other conditions of the test are made to correspond as nearly as possible to those of a car in motion on the road. A thermometer is so arranged as to indicate the exact temperature, and during a trial all the conditions of the test are recorded in what is called the test book. No oils are purchased nor allowed to be put on the road without being first tested by this machine.

It may not be inappropriate to give in this connection a brief description of a machine for a similar purpose, but of more elaborate construction, built a few years ago by the authorities at the Brooklyn Navy Yard. In this case the tests were designed to be analagous to the requirements for the main bearings of screw steamers. For this purpose a shaft with journals 9 inches in diameter was fitted to revolve in appropriate brasses. The upper brasses, instead of being secured by the usual caps, were weighted by a system of levers so arranged that the pressure could be graduated at pleasure and accurately measured. By running at a uniform rate of speed, with a counter attached to each shaft and a thermometer in each one of the upper brasses, they were able to keep an exact record of all the conditions of the tests. In operating the machine the pressure on the journals was gradually increased until the maximum that could be sustained without increasing the temperature above 116° Fahrenheit was ascertained. This maximum pressure, other conditions being equal, was taken as an index of the relative merits of the oils tested. It was found that by applying winter sperm oil at the rate of one half gallon in 25 hours, the journals would just stand a pressure of 9,400 pounds without increasing the temperature. Under the same conditions summer sperm was reported as standing a pressure of 11,164 pounds, and lard 8,000 pounds. The best grades of petroleum lubricators stood from 8,000 to 9,000, while the various inferior mixtures and compounds were represented by greatly reduced figures. It appears that the operators conducted all their experiments with uniform quantity of oil and a graduated pressure. We think they would have rendered their report far more valuable if they had varied the test, and added a table of results in running with a uniform pressure, and the quantity of oil graduated to the apparent requirements of the journals. A purchasing agent, with a machine of this kind adapted to this use, would be able not only to guard against annoyance and damage from inferior goods, but would be able to determine with far greater accuracy than at present, the relative value of the different grades of lubricators in the market. He could go to work intelligently to find the true economic mean between high and low priced oils, and could determine for himself the quality and cost of oil adapted to his use. The Brooklyn machine complete cost but $412. We presume that one possessing all its advantages and adapted to railway purposes might be constructed for nearly or quite one half the money. But in our opinion they would be cheap at double or three times that sum, provided they could not be obtained for less. Will not some one possessed with a spirit of invention, go to work and construct and put on the market a portable machine which will meet all the requirements of the case?

The Art of Employing Time.

Adam Smith has shown, beyond all possibility of cavil, that a great many more pins can be made if the process is divided among eighteen trades, than if each workman is obliged to make every pin from beginning to end himself. S , too, a naturalist, who spends year after year in the observation of red ants, will be likely to learn far more of their nature and habits than could ever be known without making them the objects of special study. There is a story told of a learned German professor who had given his whole life to the study of the Greek article, and who on his deathbed, warned his son to learn from his example, and not to fritter away his time in trying to master too extensive a subject; for he himself had failed in that way, whereas he might have accomplished something if had confined his labors to the dative case. Now it is no mean thing to accomplish something, and there is a deep delight in knowing that a thing done has been done well. Perhaps one is happier if, by dint of patient grubbing for a lifetime, he finally gets to the bottom of one thing, than he would be if, like a swallow skimming over a thousand meadows, he had been merely sipping the manifold sweets of nature, even though he should have sipped of them all.

We would not speak too positively on this point for it is so easy to be wrong. But in so far as we may speak, we will declare our conviction that there is a higher ideal than exclusive devotion to a single end, and that more happiness and the best social results are attainable by an harmonious development of all our faculties, intellectual, moral, and æsthetic. We believe that a state of society is desirable, and we hope it is attainable, in which even the pointer of pins or the lowliest of workers will, in addition to his routine of work (for we do not expect or desire to see division of labor discarded), find both time and inclination to extend his thought over other fields. We feel that no man should, if he can help it, allow himself to be so absorbed in a single pursuit as to find no pleasure elsewhere, and thus dwarf the greater part of his nature. There is a joy in work, it is true, if work be performed with heart and strength; but there are innumerable other joys of nature, which present themselves at unexpected moments in unexpected ways, and must be grasped at once or they are gone forever.—*Exchange and Review.*

The Stevens Institute of Technology.

The late Edwin A Stevens, of Hoboken, N. J., a gentleman of rare intelligence and great wealth, provided by his will, among other benevolent dispositions of his property, for the establishment at Hoboken of a large and splendid institution of learning. He desired that it should be furnished with every possible appliance capable of affording assistance in thorough instruction in the sciences, that the fees for tuition should be moderate, and its usefulness thus widely extended.

Up to the present time the trustees have received from his estate the munificent sum of seven hundred and fifty thousand dollars. They have just completed a noble building in Hoboken, opposite New York, and it is stocked with perhaps the finest collection of scientific apparatus ever brought together.

The Stevens Institute of Technology opens its first session on the 20th of September next, with the following scale of tuition fees: Residents of New Jersey, $75 per annum; to others, $150.

The faculty, as will be seen from the advertisement in another column, embraces the names of some of our best and most eminent scientific instructors; Prof. Henry Morton, of Philadelphia, is the President, and under his enterprising and judicious lead the Stevens Institute will undoubtedly take a high rank.

Cheap Postage in England.

New and still cheaper rates of postage went into operation in England, August 1st. Letters and parcels of all sorts, closed or open, without any distinctions, are charged as follows:

Not exceeding 1 oz.			2 cents.
Above	1 oz.	but not exceeding 2 oz.	3 "
"	2 oz.	" " 4 "	4 "
"	4 oz.	" " 6 "	5 "
"	6 oz.	" " 8 "	6 "
"	8 oz.	" " 10 "	7 "
"	10 oz.	" " 12 "	8 "

12 ounces is the limit of weight for letters.

In this country, our rate for letter postage continues to be 3 cents for each half ounce, or six cents an ounce, which is just three times higher than the new English rate for an ounce, and nine times more than the English rate for twelve ounces.

We think our Government might take a lesson from England in the matter of cheap letter postage. But for parcels of certain kinds, our rates are less than the British charges.

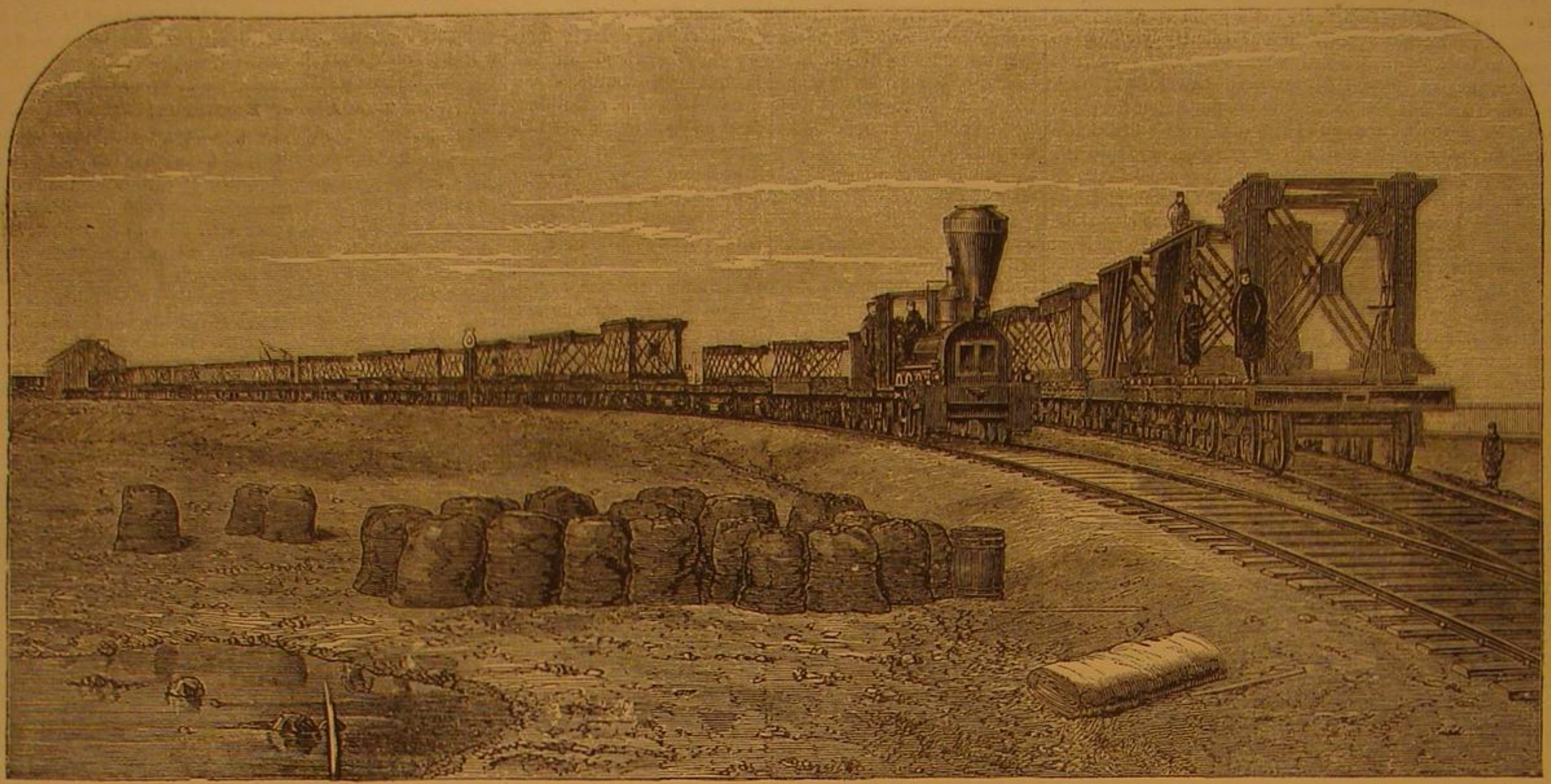
WROUGHT IRON BRIDGES FOR THE NICOLAI RAILWAY OF RUSSIA.

The largest of these bridges is that which carries the railway across the river Msta, and which consists of nine spans of 199 feet 6 inches each, center to center of piers; its total length, including abutments, is 1927 feet, 6 inches. Two spans of this bridge were destroyed by fire towards the close of 1869, but were reconstructed, and the through traffic was restored in the early part of 1870. The superstructure carries a roadway 31 feet 6 inches wide, and is formed of three lines of mber lattice girders 21 feet deep throughout their length, and they cross the river at a clear height of 101 feet 6 inches above the ordinary water level. The piers of the bridge are partly of timber and partly of brickwork and masonry. The bridge was constructed in 1849 from the designs of Major George W. Whistler, of the United States engineers, who was the engineer of the Nicolai railway. The Msta bridge is interesting as illustrating the class of bridges on this railway, which are gradually being superseded by iron structures, and which, sooner or later, will itself be replaced by one of a more permanent character.

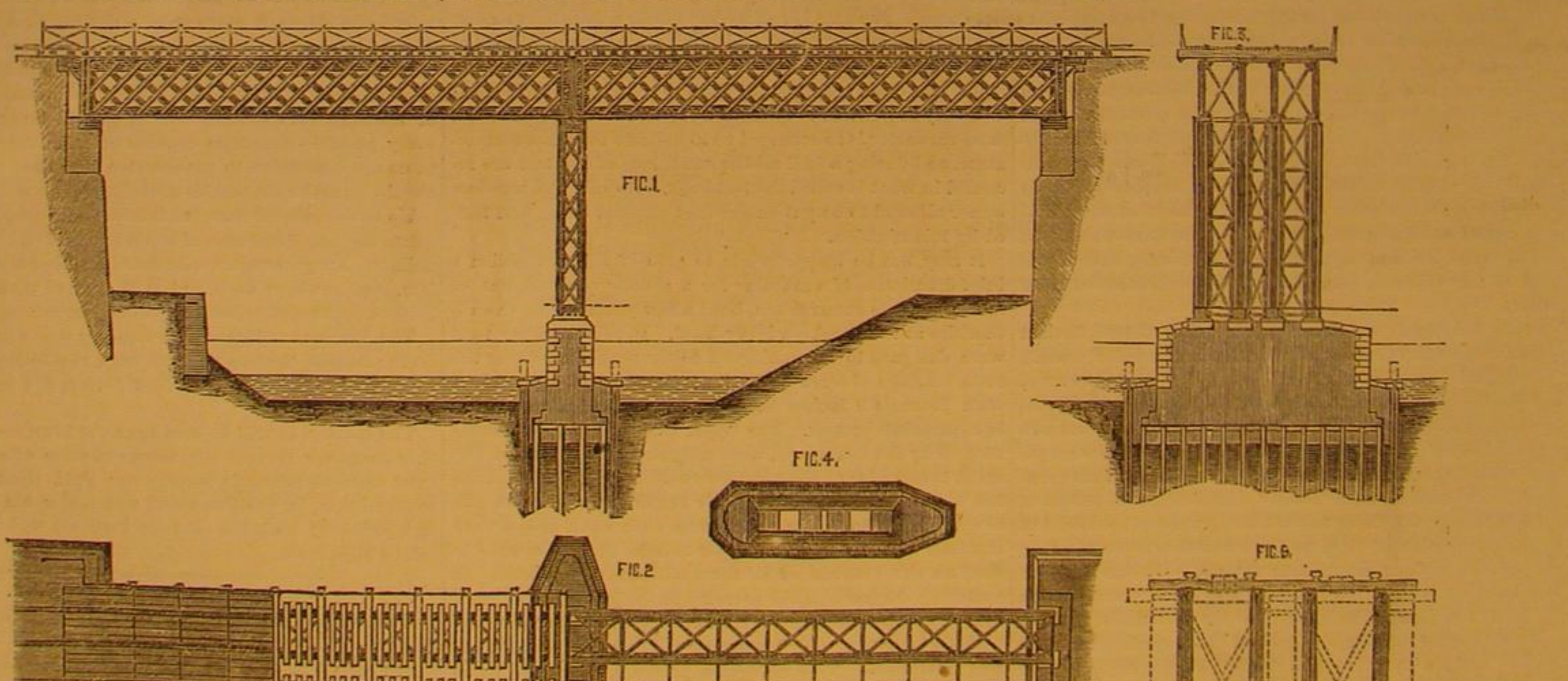
It was this liability to destruction, both from fire and decay which formed an inherent element of danger in these bridges, that led to a determination several years since to replace them all by iron structures. The partial destruction of the Msta bridge probably hastened the conclusions on this point, for shortly after the accident it was decided to reconstruct all the other bridges, and tenders were invited from various European engineering firms for that purpose. Eventually Messrs. Andrew Handyside and Co., of Derby and London, obtained the contract for the supply and erection of seventeen of the bridges, with spans varying in width from 60 to 90 ft.

The designs for these bridges were supplied by the Russian engineers, and they are all more or less copies of each other. We have illustrated herewith one of these bridges, for a double span, made from a working drawing by Messrs. Handyside & Co. In the engraving Fig. 1 is an elevation, Fig. 2 a plan, Fig. 3 a vertical tranverse section through the girders near the pier, and Fig. 4 a plan of the pier of the bridge, Fig. 5 being a transverse section or diagram showing the wooden structure, and it is illustrative of the method of building the new bridge into the old one. The total width of the opening is 143 feet, each girder—which is of the ordinary lattice type —being 74 feet in length, and 9 feet 2 inches in depth. The girders are riveted together over the centre of the pier, the ends resting on masonry abutments. There are four girders in each bridge, which are braced together in pairs by diagonal bracing, the two pairs being connected by tranverse tie bars, as seen from the plan of the bridge. The roadway is carried on the top of the girders upon transverse timbers, on which a longitudinal timber decking is laid, the width between the handrails being 24 feet. The piers consist of four built up wrought iron columns, square in plan, and which may be compared to box girders placed on end. The necessity for using wrought iron in these piers, as indeed in the whole of the superstructure, arises from the circumstance that cast iron is an objectionable material for the purpose on, account of the extreme degree of cold to which it would be subject in a Russian winter. These columns are 30 feet high, and rest on a pier formed of masonry with a brick core, 16 feet high, and resting on 2 feet of concrete laid on piling. The height from bed of the river to the underside of the girders is 42 feet. The piers are built with cutwaters on the side facing the current as a protection against the floating ice, the dimensions of the piers being at their bases 37 feet 4½ inches long by 11 feet 6 inches wide.

The method of construction adopted by Messrs. Handyside was as follows: The ironwork was sent from England ready for riveting up, which was done at the St. Petersburgh end of the Nicolai Railway. A large space of ground adjoining the railway was granted them for a building yard, and there they established constructing sheds and appliances, a number of sidings being laid down for the work. Arrived at St. Petersburgh, the girders were built up on railway wagons—of which they had more than one hundred in use—in sections suited to the length of the wagons, which themselves were long, being carried on a pair of bogie frames. It is this point in the work of construction that the engraving represents, and which shows the building yard of Messrs. Handyside & Co., with the railway wagons on which the girders are being built up ready for removal down the line. As the work was finished, the wagons carried it to the site where it was to be used, the level nature of the railway, its freedom from sharp curves, and the absence of overhead bridges, rendering the line peculiarly suitable for this arrangement. Arrived at their destination, the trucks on one line of rails, and carrying one pair of girders, were run on to the bridge, and the girders lifted from off them by special tackle sent out from England. The wagons were then run back, and the girders were lowered into their required position, each girder coming almost directly in line of the rails as previously laid. By this arrangement, the traffic was only stopped on one line of rails at a time during reconstruction, the second pair of girders not being laid until the traffic could be carried on over the first pair. The timber of the old structure was then removed, the platform made good, and the bridge was again ready for traffic on both lines, the interruption of which was thus only partial and then of comparatively short duration.



METHOD OF CONSTRUCTING THE NICOLAI RAILWAY BRIDGES AT ST. PETERSBURGH, RUSSIA.



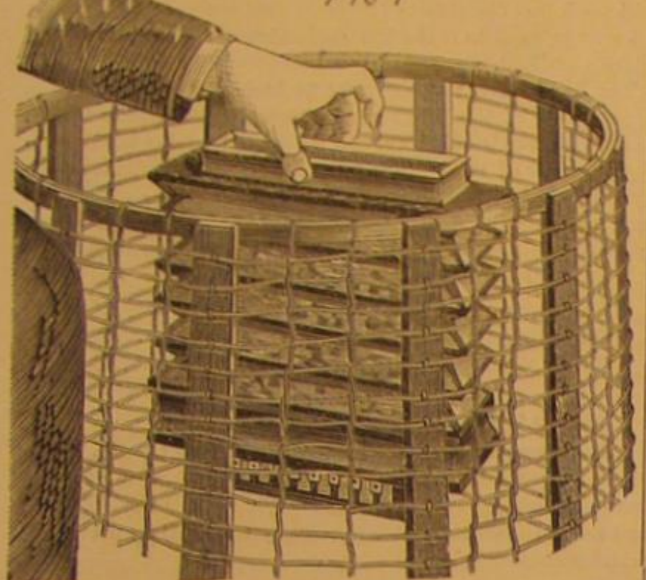
WROUGHT IRON BRIDGE FOR THE NICOLAI RAILWAY.

EXPERIMENTAL INVESTIGATION OF A NEW FORCE.

[By William Crookes, F. R. S., &c., to the Quarterly Journal of Science.]

Twelve months ago, in this journal, I wrote an article, in which, after expressing in the most emphatic manner my belief in the occurrence, under certain circumstances, of phenomena inexplicable by any known natural laws, I indicated several tests which men of science had a right to demand before giving credence to the genuineness of these phenomena. Among the tests pointed out were, that a "delicately poised balance should be moved under test conditions;" and that some exhibition of power equivalent to so many foot pounds, hould be "manifested in his laboratory, where the experimentalist could weigh, measure, and submit it to proper tests." I said, too, that I could not promise to enter fully

FIC 1



nto this subject, owing to the difficulties of obtaining opportunities, and the numerous failures attending the inquiry; moreover, that "the persons, in whose presence these phenomena take place, are few in number, and opportunities for experimenting with previously arranged apparatus are rarer still."

Opportunities having since offered for pursuing the investigation, I have gladly availed myself of them for applying to these phenomena careful scientific testing experiments, and I have thus arrived at certain definite results which I think it right should be published. These experiments appear conclusively to establish the existence of a new force, in some unknown manner connected with the human organization, which, for convenience, may be called the Psychic Force.

Of all the persons endowed with a powerful development of this Psychic Force, and who have been termed "mediums," upon quite another theory of its origin, Mr. Daniel Dunglas Home is the most remarkable, and it is mainly owing to the many opportunities I have had of carrying on my investigations in his presence that I am enabled to affirm so conclusively th e existence of this force. Ths experiments I have tried have been very numerous, but owing to our imperfect knowledge of the conditions which favor or oppose the manifestations of this force, to the apparently capricious manner in which it is exerted, and in the fact that Mr. Home himself is subject to unaccountable ebbs and flows of the force, it has but seldom happened that a result obtained on one occasion could be subsequently confirmed and tested with apparatus specially contrived for the purpose.

Among the remarkable phenomena which occur under Mr Home's influence, the most striking, as well as the most easily tested with scientific accuracy, are—(1) the alteration in the weight of bodies, and (2) the *playing of* tunes upon musical instruments (generally an accordion, for convenience *of* portability) without direct human intervention, under conditions *rendering* contact or connection with the keys impossible. Not until I had witnessed these *facts some* half a dozen times, and scrutinized them with all the critical acumen I possess, did I become convinced *of their* objective reality. Still, desiring to place the matter beyond the shadow of a doubt, I invited Mr. Home on several occasions to come to my own house, where, in the presence of a few scientific inquirers, these phenomena *could* be submitted to crucial experiments.

The meetings took place in *the* evening, in a large room lighted by gas. The apparatus prepared for the purpose of testing the movements of the accordion, consisted of a cage, formed of two wooden hoops, respectively 1 foot 10 inches and 2 feet diameter, connected *together* by 12 narrow laths, each 1 foot 10 inches long, so as to form a drum shaped frame, open at the top and bottom; round *this* 50 yards of insulated copper wire were wound in 24 rounds, each being rather less than an inch from its neighbor. *These horizontal* strands of *wire were then netted* together firmly with string, so as to form meshes rather less than 2 inches long by *1* inch high. The height of this cage was *such* that it would just slip under my dining table, but be too close to the top to *allow of* the hand being introduced into *the* interior, or to admit of a foot being pushed underneath it. In another *room* were two Grove's cells, wires being led from *them* into the dining room, *for connection* if desirable with the wire *surrounding* the cage.

The accordion was a new one, having been purchased for these experiments at Wheatstone's, in Conduit street. Mr. Home had neither handled nor seen the instrument before the commencement of the test experiments.

In another part of the room an apparatus was fitted up for experimenting on the alteration of the weight of a body. It consisted of a mahogany board, 36 inches long by 9½ inches wide and 1 inch thick. At each end a strip of mahogany 1½ inches wide was screwed on, forming feet. One end of the board rested on a firm table, whilst the other end was supported by a spring balance hanging from a substantial tripod stand. The balance was fitted with a self-registering index, in such a manner that it would record the maximum weight indicated by the pointer. The apparatus was adjusted so that the mahogany board was horizontal, its foot resting flat on the support. In this position its weight was 3lbs., as marked by the pointer of the balance.

Before Mr. Home entered the room, the apparatus had been arranged in position, and he had not even had the object of some of it explained before sitting down. It may, perhaps, be worth while to add, for the purpose of anticipating some critical remarks which are likely to be made, that in the afternoon I called for Mr. Home at his apartments, and when there he suggested that as he had to change his dress, perhaps I should not object to continue our conversation in his bedroom. I am, therefore, enabled to state positively that no machinery, apparatus, or contrivance of any sort was secreted about his person.

The investigators present on the test occasion were an eminent *physician*, high in the ranks of the Royal Society, whom I will call Dr. A. B.; a well-known Serjeant at Law, whom I will call Serjeant C. D.; my brother; and my chemical assistant.

Mr. Home sat in a low easy chair at the side of the table. Close in front, under the table, was the aforesaid cage, one of his legs being on each side of it. I sat close to him on his left, and another observer sat close on his right, the rest of the party being seated at convenient distances round the table.

For the greater part of the evening, particularly when anything of importance was going forward, the observers on each side of Mr. Home kept their feet respectively on his feet, so as to be able to detect his least movement. The temperature of the room varied from 68° to 70° F.

Mr. Home took the accordion between the thumb and middle finger of one hand at the opposite end to the keys (see wood cut, Fig. 1), (to save repetition this will be subsequently called "in the usual manner.") Having previously opened the bass key myself, and the cage being drawn from under the table so as just to allow the accordion to be passed in keys downwards, it was pushed back as close as Mr. Home's arm would permit, but without hiding his hand from those next to him (see Fig. 2). Very soon the accordion was seen by those on each sides to be waving about in a omewhat curious manner; then sounds came from it, and finally several notes were played in succession. Whilst this was going on, my assistant got under the table, and reported that the accordion was expanding and contracting; at *the same* time it was seen that Mr. Home's hand which held it was quite still, his other hand resting on the *table*.

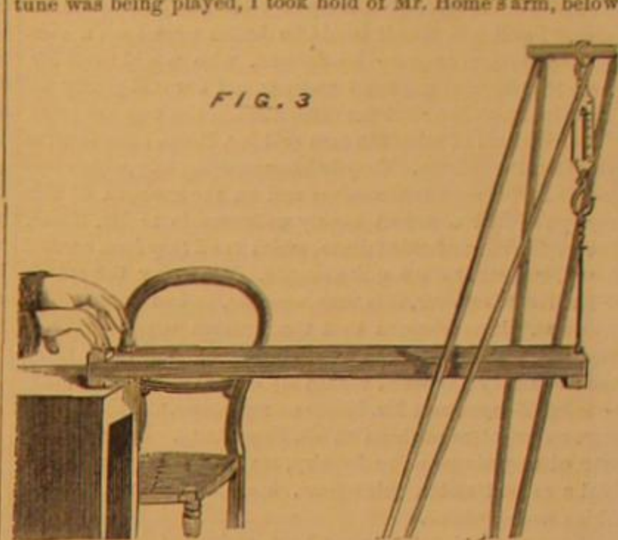
Presently the accordion was seen by those on either side of Mr. Home to move about, oscillating and going round and round the cage, and playing at the same time. Dr. A. B. now looked under *the table*, and said that Mr. Home's hand appeared quite still while the accordion was moving about emitting distinct *sounds*.

Mr. Home still holding the accordion in the usual manner in the cage, his *feet being held* by those next him, and his other hand resting on the table, we heard distinct and separate notes sounded in *succession*, and then a simple air was played. As such a *result* could only have been produced by the various keys of the instrument *being* acted upon in harmonious succession, this was considered by those present to be a crucial experiment. But the sequel was *still more striking, for* Mr. Home then actually let go the accordion, removed his hand quite out *of* the cage, and placed it in the hand *of* the person next *to him, the* instrument then continuing to play while no one was touching it.

I was now desirous of trying what would be the effect of passing the battery current round the insulated wire of the cage, and my assistant accordingly made the connection with the wires from the two Grove's cells. Mr. Home again held the instrument inside the cage in the same manner as before, when it immediately sounded and moved about vigorously. But whether the *electric current* passing round the cage assisted the manifestation of *force* inside, it is impossible to say.

The accordion was now again taken without any visible touch *from* Mr. Home's hand, which he removed *from* it entirely; I and two of the others present not only seeing his released hand, but the accordion also floating about with no visible support inside the cage. This was *repeated* a second time, after a short interval. Mr. Home presently reinserted his hand in the cage and again took hold *of* the accordion. It then commenced to play, at *first* chords and *runs*, and afterwards a well-known sweet and plaintive melody, which it executed perfectly in a very beautiful manner. Whilst this tune was being played, I took hold of Mr. Home's arm, below

F/G. 3



the elbow, and gently slid my hand down it until I touched the top of the accordion. He was not moving a muscle. His other hand was on the table, visible to all, and his feet were under the feet of those next to him.

Having met with such striking results in the experiments with the accordion in the cage, we turned to the balance apparatus already described. Mr. Home placed the tips of his fingers lightly on the extreme end of the mahogany board which was resting on the support, while Dr. A. B. and myself sat one on each side of it, watching for any effect which might be produced. Almost immediately the pointer of the balance was seen to descend. After a few seconds it rose again. This movement was repeated several times, as if by successive waves of the Psychic force. The end of the board was observed to *oscillate* slowly up and down during the time.

F/G. 2

Mr. Home now of his own accord took a small hand bell and a little card match box, which happened to be near, and placed one under each hand, to satisfy us, as he said, that he was not producing the downward pressure (see Fig. 3). The very slow oscillation of the spring balance became more marked, and Dr. A. B., on watching the index, said that he saw it descend to 6½ lbs. The normal weight of the board as so suspended being 3 lbs., the additional downward pull was therefore 3½ lbs. On looking immediately afterwards at the automatic register, we saw that the index had at one time descended as low as 9 lbs., showing a maximum pull of 6 lbs.

In order to see whether it was possible to produce much effect on the spring balance by pressure at the place where Mr. Home's fingers had been, I stepped upon the table and stood on one foot at the end of the board. Dr. A. B., who was observing the index of the balance, said that the whole weight of my body, (140 lbs.) so applied, only sunk the index 1½ or 2 lbs. when I jerked up and down. Mr. Home had been sitting in a low easy-chair, and could not, therefore, had he tried his utmost, have exerted any material influence on these results. I need scarcely add that his feet as well as his hands were closely watched by all in the room.

This experiment to me appears, if possible, more striking than the one with the accordion. As will be seen on referring to the cut (Fig. 3), the board was arranged perfectly horizontally, and it was particularly noticed that Mr. Home's fingers were not at any time advanced more than 1½ inches from the extreme end, as *shown* by a pencil mark, which, with Dr. A. B.'s acquiescence, I made at the time. Now, the wooden foot being also 1½ inches wide, and resting flat on the table, it is evident that no amount of pressure exerted within this space of 1½ inches could produce any action on the balance. Again, it is also evident that when the end furthest from Mr. Home sank, the *board* would turn on the further edge of this foot as on a fulcrum. The arrangement was consequently that of a see-saw, 36 inches in length, the fulcrum being 1½ inches from one end; were he, therefore, to have exerted a downward *pressure*, it would have been in opposition to the force which was causing the other end of the board to move down.

The slight downward pressure shown by the balance when I stood on the board was owing probably *to* my *foot* extending beyond *this fulcrum*.

I have now given a plain unvarnished statement of the facts from copious notes written at the time the occurrences were taking place, and copied out in full immediately after. Indeed, it would be fatal to the object I have in view—that of urging the scientific investigation of these phenomena—were I to exaggerate ever so little; for although to my readers Dr. A. B. is at present represented by incorporeal initials, to me the letters represent a power in the scientific world that would certainly convict me if I were to prove an untrustworthy narrator.

I confess I am surprised and pained at the timidity or apathy shown by scientific men in reference to this subject. Some little time ago, when an opportunity was first presented to me of examining into the subject, I invited the co-operation of some scientific friends in systematic investigation; but I soon found out that to obtain a scientific committee for the investigation of this class of facts was out of the question, and that I must be content to rely on my own endeavors aided by the co-operation from time to time of the few scientific and learned friends who were willing to join in the inquiry. I still feel that it would be better were such a committee of known men to be formed, who would meet Mr. Home in a fair and unbiased manner, and I would gladly assist in its formation; but the difficulties in the way are great.

A committee of scientific men met Mr. Home some months ago at St. Petersburg. They had one meeting only, which was attended with negative results; and on the strength of this they published a report highly unfavorable to Mr. Home. The explanation of this failure, *which is all they have accused him of*, appears to me quite simple. Whatever the nature of Mr. Home's power, it is very variable, and at times entirely absent. It is obvious that the Russian experiment was tried when this force was at a minimum. The same thing has frequently happened within my own experience. A party of scientific men met Mr. Home at my house, and the results were as negative as those at St. Petersburg. Instead, however, of throwing up the inquiry, we patiently repeated the trial a second and a third time, when we met with results which were positive.

These conclusions have not been arrived at hastily or on insufficient evidence. Although space will allow only the publication of the details of one trial, it must be clearly understood that for some time past I have been making similar experiments and with like results. The meeting on the occasion here described was for the purpose of confirming previous observations by the application of crucial tests, with carefully arranged apparatus, and in the presence of irreproachable witnesses.

Respecting the causes of these phenomena, the nature of the force to which, to avoid periphrasis, I have ventured to give the name of "Psychic," and the correlation existing between that and the other forces of Nature, it would be wrong to hazard the most vague hypothesis. Indeed, in inquiries connected so intimately with rare physiological and psychological conditions, it is the duty of the inquirer to abstain altogether from framing theories until he has accumulated a sufficient number of facts to form a substantial basis upon which to reason. In the presence of strange phenomena as yet unexplored and unexplained, following each other in such rapid succession, I confess it is difficult to avoid clothing their record in language of a sensational character. But to be successful, an inquiry of this kind must be undertaken by the philosopher without prejudice and without sentiment. Romantic and superstitious ideas should be entirely banished, and the steps of his investigation should be guided by intellect as cold and passionless as the instrument he uses. Having once satisfied himself that he is on the track of a new truth, that single object should animate him to pursue it, without regarding whether the facts which occur before his eyes are "naturally possible or impossible."

Experimental Investigation of the New Force.---Letters from Prof. Huggins and Edwd. Wm. Cox.

Upper Tulse-hill, S. W., June 9, 1871.

DEAR MR. CROOKES:—Your proof appears to me to contain a correct statement of what took place in my presence at your house. My position at the table did not permit me to be a witness to the withdrawal of Mr. Home's hand from the accordion, but such was stated to be the case at the time by yourself, and by the person sitting on the other side of Mr. Home.

The experiments appear to me to show the importance of further investigation, but I wish it to be understood that I express no opinion as to the cause of the phenomena that took place. Yours very truly, WILLIAM HUGGINS.

Wm. Crookes, Esq., F.R.S.

36 Russell Square, June 8, 1871.

MY DEAR SIR:—Having been present, for the purpose of scrutiny, at the trial of the experiments reported in the *Quarterly Journal of Science*, I readily bear my testimony to the perfect accuracy of your description of them, and to the care and caution with which the various crucial tests were applied.

The results appear to me conclusively to establish the important fact that there is a force proceeding from the nerve system capable of imparting motion and weight to solid bodies within the sphere of its influence.

I noticed that the force was exhibited in tremulous pulsations, and not in the form of steady continuous pressure, the indicator moving and falling incessantly throughout the experiment. This fact seems to me of great significance, as tending to confirm the opinion that assigns its source to the nerve organization, and it goes far to establish Dr. Richardson's important discovery of a nerve atmosphere of various intensity enveloping the human structure.

Your experiments completely confirm the conclusion at which the Investigation Committee of the Dialectical Society arrives, after more than forty meetings for trial and test.

Allow me to add that I can find no evidence even tending to prove that this force is other than a force proceeding from, or directly dependent upon, the human organization, and therefore, like all other forces of nature, wholly within the province of that strictly scientific investigation to which you have been the first to subject it.

Psychology is a branch of science as yet almost entirely unexplored, and to the neglect of it is probably to be attributed the seemingly strange fact that the existence of this nerve force should have so long remained untested, unexamined, and almost unrecognized.

Now that it is proved by mechanical tests to be a fact in nature (and if a fact, it is impossible to exaggerate its importance to physiology and the light it must throw upon the obscure laws of life, of mind, and the science of medicine) it cannot fail to command the immediate and most earnest examination and discussion by physiologists and by all who take an interest in that knowledge of "man," which has been truly termed "the noblest study of mankind." To avoid the appearance of any foregone conclusion, I would recommend the adoption of some appropriate name, and I venture to suggest that the force be termed the Psychic force; the persons in whom it is manifested, Psychics; and the science relating to it, Psychism, as being a branch of Psychology.

Permit me also to propose the early formation of a Psychological society, purposely for the promotion of the study by means of experiment, papers, and discussion, of that hitherto neglected science. I am, etc., EDWD. WM. COX.

To W. Crookes, Esq., F.R.S.

Correspondence.

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

Constructing Cone Pulleys.

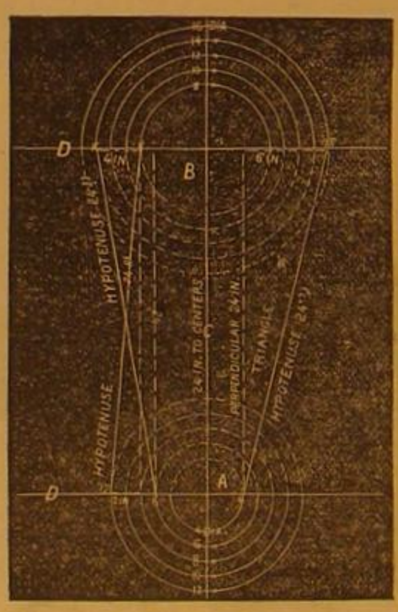
To the Editor of the Scientific American:

Thinking that G. L. D., of Pa., has misunderstood H. G. L.'s problem (in No. 1, July 1), which is to construct a pair of cone pulleys so that the belt will fit equally tight on all the steps, I venture to give a rule, only, however, an approximate one.

I send, that I may be more fully understood, a diagram, which is purposely an extreme case, to show all the errors there may be in it. I will give my method somewhat in detail.

Procure a draft board of sufficient length to draw the cones full size and the full distance they are to be apart when put up, as cones can be made to match at only one distance.

Referring to the diagram, draw cone, A, as wanted when finished (I have marked five pulleys, 4, 6, 8, 10 and 12 inches as their diameters); and cone, B, with the same difference



(between pulleys) that there is on cone, A, but different in diameters, which are 8, 10, 12, 14, 16 inches, respectively.

Draw the line, C, joining the centers of cones 24 inches distant; also, lines, D, at right angles to line, C.

Now, as cone, A, is finished, as wanted, all the correcting must be done on cone, B; and as there is a 10 inch on each, and so they will require no changing, we will consider them correct, because the belt runs parallel with the center line and round half of each pulley, establishing the length of belt, which is twice the distance the centers of cones are apart, and an amount equal to the circumference of a ten inch pulley. Thus:

Distance to center line, 24×2	48·00
Circumference of 10 inch pulley	31·41
Entire length of belt	79·41

I will now make the correction for 12 inches on A and 8 inches on B, which are a little different.

The line joining the 12 inch and 8 inch pulleys makes a triangle, base 2 inches; perpendicular 24 inches; hypotenuse 24 $\frac{8}{100}$; but the reducing the diameter of the 8 inch pulley increased the angle, while the other decreased the angle, and so a different fraction must be used. Multiply the fraction $\frac{8}{100}$ by 4 and ÷ by 3, and we get the fraction $\frac{10}{100}$. Reducing the 8 inch pulley by this fraction, we have 7 $\frac{90}{100}$ for the diameter; this changes the triangle, and we have for short side 2 $\frac{5}{100}$, long side 24, and hypotenuse 24 $\frac{9}{100}$.

And we have for this second measurement:

Half diameter of 7 $\frac{90}{100}$ inch pulley	12·40
Half diameter of 12 inch pulley	18·84
Twice the hypotenuse, 24 $\frac{9}{100}$	48·18
	79·42

This is the $\frac{1}{100}$ of an inch longer than the belt for the 10 inch pulleys; and the greatest error is in the 4 inch pulley and 16 inch pulley, the error being $\frac{15}{100}$, or about ⅙ of an inch. Now, to apply this in practice, draw the pulleys full size and full distance apart, on a draft board; get the distance correctly on straight edge from center to center of cones. Finish up one cone as desired, or as drawn on draft board; now try your straight edge on the hypotenuse, and the amount the hypotenuse is longer than the distance from centers is the amount the pulley must be reduced in diameter, unless the reducing the diameter increases the hypotenuse; in such a case the amount the hypotenuse is greater than a straight line, *b*, must be multiplied by 4 and divided by 3, and the diameter of pulley reduced by the product.

You will perceive that it makes no difference whether there are pulleys of the same size on each or not, the rule will work just the same.

I now proceed to make the correction for the 4 inch and 16 inch pulleys.

The line joining the circles at 14 inch and 16 inch is the hypotenuse of the right angle triangle, with base 6 inch and perpendicular 24 inch, and hypotenuse 24 $\frac{73}{100}$. Reduce the diameter of the 16 inch pulley by $\frac{73}{100}$, the amount the hypotenuse is longer than the perpendicular, and the 16 inch pulley will be 15 $\frac{27}{100}$ inch, and the short side of the triangle is 5 $\frac{64}{100}$, long side 24 inch, hypotenuse, 24 $\frac{65}{100}$.

This second measurement is thus stated:

Half circumference 15 $\frac{27}{100}$ inch pulley	23·98
Half circumference 4 inch pulley	6·28
Twice the hypotenuse, 24 $\frac{65}{100}$	49·30
Length of belt, nearly	79·56

But it may be noticed that the belt would strike the 16 inch pulley before reaching the center line, bending the belt out considerably; and in such a case, if we call the $\frac{73}{100}$, $\frac{74}{100}$, and make the calculation accordingly we shall be nearer correct. This would be:

Hypotenuse, 24 $\frac{57}{100}$ × 2	49·14
Half circumference large pulley	23·93
Half circumference small pulley	6·28
	79·35

The next I will correct are the 6 inch and 14 inch pulleys. The line joining 6 and 14 makes the triangle 4 inch and 24 inch, hypotenuse 24 $\frac{33}{100}$. This is the first measurement. Now reduce the 14 inch pulley $\frac{33}{100}$, the amount by which the hypotenuse is longer than the perpendicular. Now we have for the 14 inch pulley 13 $\frac{67}{100}$ diameter, and the short side of the triangle, 3 $\frac{84}{100}$; long side, 24, and hypotenuse, 24 $\frac{30}{100}$. This is the second measurement, and may be thus expressed:

Half circumference of 13 $\frac{67}{100}$ inch pulley	21·47
Half circumference 6 inch pulley	9·42
Twice the hypotenuse, 24 $\frac{30}{100}$	48·60
Length of belt for this pair	79·49

La Grange, Ind. J. TURLEY.

The Paine Electro Magnetic Engine---Curious Revelations by a Practical Man.

To the Editor of the Scientific American:

In forming an opinion of the Paine motor, several points should be considered, and compared with one another. These are, the construction and appearance of the motor, its operation, its surroundings, the fizzle of engines modeled after it, and Mr. Paine's variegated statements.

The general appearance of this motor is that of a fan blower some 2½ feet in diameter. The cast iron shell or frame supports five stationary magnets, with their poles pointing towards the center. Corresponding to the fans of a blower are six rotary magnets, with their poles pointing outward. There is a system of circuits running around the frame to which the rotating magnets are fastened—one circuit for each magnet. The shell hides something like half of both sets of magnets—the half including the poles. The base is also cast iron, evidently a shell, without so much as a pin hole through which one may look, and this base sits flat on the floor. In the same building is machinery run by steam.

The battery consists of 4 cells, about 8 inches high—zinc in dilute sulphuric acid, and carbon in chromic acid.

Mr. Paine holds that "the world knows nothing of the mechanical equivalent of zinc under combustion in a battery;" that "the forces developed by the action of a single Bunsen cell, if utilized and converted into power, would drive the largest ship afloat."

Here he recognizes an immense force as resident in a galvanic battery. Before setting his engine in mot on the day I saw it, Mr. Paine explained its construction and operation, claiming success mainly on the ground of the utilization of the electric current, but 10 or 15 minutes afterwards he upset this statement by declaring that the force which ran his engine did not come from the battery; that the battery was a mere percussion torch or match, which *touched off some other power!*

Mr. Paine's explanation of the increased speed of his motor while performing hard work does not bear inspection. If, as he says, a reduced speed affords the magnets more time to charge and spring towards each other, then, of course, a greater velocity must give them less time to charge and let them spring back, again lessening their power; so this continual struggle to accelerate and retard should result in an apparently uniform motion.

On the occasion above mentioned, this engine made six revolutions per second, which put the revolving magnets into circuit 30 times a second and the stationary ones 36 times. Now, when we remember that the much smaller and quicker telegraph magnets can no more than half charge six times per second, it is difficult to believe that those in this engine acquire, in the 70th part of a second, a power so enormous as to spring the stout cast iron frame.

I saw one freak in the Paine motor which seems explicable only on the theory that the battery "touches off some other power." Four cells of battery would start the engine very suddenly, and run it with 2½ or 3 horse power, but it stubbornly refused to move by the current from 3 cells, even when started by hand, though the galvanometer in circuit and the spark at the commutator showed the proper amount of current. The connection was several times shifted from 3 to cells, and *vice versâ*, with this uniform result. Ohm's law (which is a law as conclusively demonstrated as any that can be named) declares this force to be illegitimate.

Shortly after this freak, 4 cells failed to move the engine, though the battery was still good. I did not remain until the trouble was remedied, but I was afterwards informed by a person pecuniarily interested that Mr. Paine found defective insulation in some of the connecting wires so that the current was diverted from the magnets. This explanation might be accepted if it were not for that quiet little tell-tale, the spark at the commutator, as the engine was turned by hand. This spark is produced principally by the current induced by the discharge of the magnets. Now, as this spark was not diminished by the trouble in question, it proves conclusively that the same magnetic forces were in operation, and that the current went its usual route. It is rather an unfortunate coincidence that Mr. Paine had occasion to leave the room for a few minutes just after the engine gave out.

Last winter several enterprising gentlemen in New York and vicinity made such arrangements with Mr. Paine that if he could have come to time, a score or more of successful Paine motors would, ere this, have proved to the world what no man ever can on paper. These gentlemen, or some of them, required other proof than what they witnessed in Newark, so Mr. Paine promised to take his engine over to New York and let it run the machinery in the manufactory of one of these gentlemen, but he afterwards refused to do so. Then it was agreed that one of these engines should be constructed in New York, Mr. Paine promising that if there was any difficulty in making it a success he would come over and right it. Two small motors were then made—one with 9 magnets, the other with 11. No particular mention will be made of the former, because the latter gave the best results. The magnets in this were about 3 inches long, and averaged about 1 inch in width. I think they were wound with No. 23 wire, but am not positive now.

This engine was very carefully constructed and adjusted, and exhaustive experiments were made with it. The greatest speed attained by the use of 6 eight inch cells of bichromate battery was 10 revolutions per second. On the shaft of the rotary magnets was a smooth 2¼ inch pulley. By holding the blade of a penknife on the pulley, as if grinding, the speed was easily reduced from 10 revolutions per second to zero; yet Mr. Paine has admitted that engine to be correct!

Then the same parties constructed another motor, a trifle larger than the one exhibited in Newark. The magnets in this (6 rotary and 5 fixed) were wound with No. 16 wire. The greatest speed made by it was 110 revolutions per minute on the current from eight 8 inch cells of bichromate battery. The power of this engine was but a little greater than that of the small one, as a penknife held on the pulley would almost stop it. The Newark engine ran on 4 similar cells, and the current from them was reduced at least one half by the galvanometer in circuit, so we have this comparison; the Newark engine was 3 horse power on 2 cells, while the duplicate, using 8 cells, furnished just about enough power to grind a razor.

Mr. Paine was advised of the result, but he did not come to the rescue as promised. He did, however, send a substitute, with information that the magnets must be made of a certain size given, that required by the English patent (which was held to be a correct guide), and that of the magnets in the Newark engine being all at variance with one another. The mention of these inconsistencies to the substitute, cornered him; so, heaving a sigh, he departed, and Mr. Paine turned his attention to other parties.

After having put these gentlemen to the trouble and expense of building three engines, after having claimed that his English patent was a perfect guide, and having admitted that one of the engines built by them was correct, Mr. Paine then said he had given no clue to his success, and had not intended to; that the world was not yet prepared for the revelation; that it was so simple they would laugh when they learned what it was.

Six months ago the Paine motor was a perfect success. Now, according to the apologist, Mr. Sims, Mr. Paine merely hopes to succeed, and that, instead of laughing at the simplicity of his invention, he is "baffled" by it!

When will Mr. Paine and his associates learn that they cannot conceal themselves by thrusting their heads into a bush? J. E. SMITH.

Easton, Pa.

Formation of Gold Nuggets.

To the Editor of the Scientific American:

Mr. C. Wilkinson, of Australia, announces, to the Royal Society of Victoria, some experiments instituted by him, which Mr. Daintree assumes will account for the formation of gold nuggets.

Mr. W. Skey has also communicated to the Wellington Philosophical Society of New Zealand, a number of experiments upon the same subject. Having no desire to detract in any way from the merits of the labor of those gentlemen, it must be remembered that others have contributed much knowledge on the same subject.

The discovery of laws which regulate chemical energy is the result of pure experimental inquiry, and is often the result of the combined labors of many illustrious men. For the benefit of those who are likely to pursue that subject, it will be necessary to call the attention to some facts that have come under my own observation.

It will be seen that Mr. Wilkinson conducts his experiments by using a solution of gold undergoing decomposition by contact with organic matter. Gold is deposited upon itself. He also observes that some of the other metals and their sulphides act as a nucleus for gold thus reduced. Mr. W. Skey, pursuing the same subject, is surprised to find that the same effect takes place without the intervention of organic matter, the proto-salts and the sulphides effecting a direct reduction.

The question here arises, what new ideas have been advanced by the experiments above reported?

Depositing gold upon itself, as on other metals, is certainly no new feature. Chemistry has long been aware of such actions, their electro-negative qualities, and their behaviour among themselves. Mr. Skey is surprised to find gold deposited upon cubes of galena, and many of the sulphides. If Mr. Skey had pursued the matter a little further, he would have found that it was not necessary that it should be a metal, or its combination with sulphur, to form a nucleus to determine a deposit of gold. He would have found that graphite and many other substances act in the same manner. Again, he ought not to have been surprised to find gold depositing from its solution, in presence of a powerful deoxidizer. Such chemical actions have been long known, and are daily verified in the chemical arts. Brown iron ore and quartz appear to be unsuitable material to recover a deposit of gold.

It is evident that if gold had been deposited from its solutions, Nature must have employed other means to effect its purpose than the one chosen by our experimentalist, since gold is found disseminated and deposited upon quartz and the brown iron ore.

The question as to the formation of gold nuggets is a difficult one, and should be discussed with caution.

J. TUNBRIDGE.

Newark, N. J.

A Scientific Paradox.

To the Editor of the Scientific American:

It is held by some writers, that iron expands in passing from the molten to the solid state.

If this were true, it would account for the fact that cold iron will float in molten iron, by the difference in specific gravity.

But as a matter of fact, we find that it floats not on account but in spite of the difference; for we find that patterns for iron castings are made by the shrink rule, which is longer than the standard measure, by a little more than one per cent., while the castings made from such patterns correspond with the standard measure.

Other proofs in abundance might be cited, but the whole case is included in this, which demonstrates, too clearly to admit of question, that iron contracts in cooling, like other metals, and does not expand at all, as the books say; for the pattern is of the very magnitude of the molten iron in which the cold iron of the casting will float.

Various lame attempts have been made to patch up a reconciliation of the facts, by supposing an expansion and a subsequent greater contraction; but no proof is required to convince a rational mind that the only terms admissible in the computation, are the respective specific gravities of the hot and cold iron at the moment when the phenomenon takes place; and they cannot but be proportionate to the magnitude of the pattern and its casting. But even if the change of magnitude were in the right direction, it could only account for a part of the buoyancy of the cold iron, leaving a remainder quite as hard to account for as the whole; for the proportional part of the cold iron which rises above the surface is much greater than any change of its magnitude caused by heat.

Any person may find all the facts which I have stated fully confirmed, and a good many more added to them, by visiting a foundery at casting time; and if he will carefully weigh the facts as they are, and give a rational solution of the paradox, he will enjoy the satisfaction, I think, of having made an original contribution to scientific knowledge. S. H. W.

Deep River, Conn.

Use of Air Blasts in the Arts.

To the Editor of the Scientific American:

Will you permit the correction of some remarks (in your paper of July 29, page 72, entitled "Application of Air Blasts in the Arts"), which are apt to mislead your readers into the error that connects access of air to alcoholic liquids with acetic acidification?

The process of air treatment of R. d'Heureuse, of New York, to which you allude, secures a rapid, perfect, and safe alcoholic fermentation, free from acidification, at the temperature most suitable for that process; and, at the same time, a removal of the albuminous matter, which, if retained, impairs the taste, and produces future disturbances, in wine and other beverages.

It is not assumed that a few hours would accomplish this object in wine making; but less than one hour's vigorous blast, previous to, and occasional very brief and gentle admission of the air during, the fermentation, finishes this process in from 5 to 10 days, to make the wine ready for bottling, shipping, or consumption within from 1 to 3 months.

It has indeed been proved, that wine made by judicious air treatment has invariably less acid than wine from the same must, made in the usual most careful manner ("Annals of Oenology," vol. i., pp. 218, 428; vol. ii., p. 188; and *Journal of Applied Chemistry*, March and April, 1871).

The recent researches of many distinguished European investigators throw much light upon this subject. Dr. M. Reess found that the alcoholic fermentation is due solely to the presence of a distinct class of fungi (species of moving air *ces*), and to no others, and that liberal supply of *Saccharomy-* vastly promotes their growth, while all other kinds of fungi, present in the fluid, are thereby suppressed; and that an alcoholic fermentation by air treatment is for this reason perfectly healthy, very energetic and rapid; and all putrefying or souring disturbances, incident to the usual mode of fermentation, as the results of injurious fungi, are prevented.

A few hours vigorous blast into organic juices or liquids at a temperature above 140° Fah., removes the albuminous parts, with suppression of fermentation. Articles in your valuable paper of June 17, August 7 and 14, 1869, and February 25, 1871, are explanatory of this action, and mention the advantages of this method for sugar making and refining, for the purification of drinking water from injurious organic matter, etc. The fact has also been established, that vegetable acids are neutralized (not formed) by vigorous blasts of air, or other gases, into the liquids that contain them, and particularly at a temperature of 160° and upwards, with the simultaneous removal of the albuminous parts. This action makes the process of superior value in sugar making and other businesses, where the greatest losses, by the usual modes of working, are due to souring and fermentation.

The real conditions productive of acetic acidification are still somewhat misunderstood by the general public. The same particles of (diluted) alcoholic liquids exposed in thin strata to a lengthy contact with air, for instance, by spreading over the rough surfaces of wood, shavings, etc., or the surface of a quiescent fluid, increased by scums, floating matter, or fungi, exposed to the contact, are subject to acetic acidification, which is prevented by currents of air through the bulk of the fluid. A powerful continued blast of air through such liquid, even where souring has already been induced, only carries off the acetic acid and the alcohol. According to the testimony of hundreds of wine makers that used air treatment, no acetic acidification was induced by the same. CHEMICUS.

New York city.

Electro-Motors.---Mr. Paine's Answer to Mr. J. E. Smith.

To the Editor of the Scientific American:

Mr. Smith must not assume that I have said that a magnet of the dimensions specified in my article, when actuated by the specified battery, acquires its *maximum* of attraction in the $\frac{1}{120}$ of a second of time. My words are: "It will acquire a *lifting power of fifty pounds* in the $\frac{1}{120}$ of a second;" and this statement is not predicated of any theoretic data, but of practical manipulation. Mr. Smith's reference to experiments in the *Telegraph* office is peculiarly unfortunate for the force of his argument, inasmuch as the electrical pulsations are made through *long circuits*.

I protest against these men of straw that my opponents set up, and then, so satisfactorily to themselves, demolish. My article in your journal of August 5th is a full answer to the rest of Mr. Smith's statements, as far as they relate to the question at issue. And I desire Mr. Smith and all others to bear in mind that I am not discussing my motor nor any of its qualities; but in a plain practical manner proving that the books and schools know nothing whatever of the mechanical equivalent of zinc when under combustion in a battery. H. M. PAINE.

NOTE.—Mr. Smith proposes, in a future communication, to relate his "experience in experimenting with three others, modeled after it," meaning, after my motor. I beg to say that unless Mr. Smith has had access to the secret archives of the Patent Office, he has not the knowledge required to produce a model of my motor.—H. M. P.

New Mechanical Movement.

To the Editor of the Scientific American:

The crossed link, converting circular into rectilinear movement, or, certainly, the reverse, converting rectilinear into circular movement by means of crossed links, is not so new as you and our patent authorities seem to have determined. Seven or eight and twenty years ago there existed in the *Sun* printing vaults, corner of Nassau and Fulton streets, a steam engine, placed there for temporary use only, called the "Grasshopper," because of a fancied resemblance to that well known insect. The peculiarity of this engine was this very principle of crossed links, and I now attribute its disappearance from the market to the death of its builder—a man of very limited means, but of much ingenuity.

A still more complete exemplification of the principle came under my observation at Paris some five or six years ago. It was in use in a confectionery establishment in the Rue Vivienne, not far from the Bourse, in a steam engine of some three horse power, the daintiness of whose construction was almost marvelous.

Mr. Russell's application of it to the pump, as described and illustrated in the SCIENTIFIC AMERICAN of July 29, 1871, is, however, the first application of it which I have observed in hand implements, and is an extremely ingenious one. B.

THE Weed Sewing Machine Company have leased the entire works of the Sharpe's Rifle Company, at Hartford, for five years, and will soon increase their daily manufacturing capacity from 150 to 200 machines.

The First Locomotive Works in America.

Scribner's Monthly for July, in describing Philadelphia and its industries, gives the following account of Baldwin's locomotive works:

The Baldwin Locomotive Works on Broad street have a national reputation. Founded in 1831, they have grown to colossal proportions, and employ 1,800 men. It takes 1,800 men one day to complete, set up, and make ready for service a single locomotive. Thus these works could turn out 300 engines a year; in fact, in twelve months, ending last October, they actually sent off 267, which, one after another, went dashing over the country. Although Mr. Baldwin, the founder, is dead, the works still bear his name, for they are the creation of his inventive genius and indomitable perseverance.

Previous to the spring of 1831, only two locomotives had been built in this country, and those at the National foundery of West Point. In that spring Mr. Baldwin made a miniature engine, with two cars, capable of seating four persons, and placed it on a track laid in Peale's Museum, where it was surrounded by curious crowds. The next year he received an order from the Germantown Railroad Company for the construction of a locomotive for their road. Although but a single American mechanic had succeeded in building one of any use, he boldly undertook it. At the time there was not a blacksmith in the city that could weld a bar of iron more than an inch and a quarter thick, and no one thought of attempting to weld a tire five inches wide and an inch and a half thick. The only machine for boring out a cylinder was a chisel fastened in the end of a stick, to which a crank was fitted and turned by hand. He had no proper tools, no patterns, no models, but, confidently relying on his genius and resolution, he went to work, and in six months had it finished and placed on the road. Crowds gathered along the line to see this self moving monster drag a train of cars after it. It was a great success. Soon after there appeared in the city papers the following notice:

"NOTICE.—The engine (built by Mr. Baldwin) with a train of cars will run daily (commencing this day) when the weather is fair . . When the weather is not fair, the horses will draw the cars the four trips."

It is not yet forty years since this extraordinary notice appeared in the press of a city into which, now, a dozen railroads run, along which dozens of locomotives thunder.

It is singular how the simplest contrivances are often overlooked, while those requiring the most consummate skill are wrought out. Here was a man who could, almost without tools, from his own ingenious brain construct a locomotive, and yet the simple remedy of a "sand box," to keep the wheels from slipping never occurred to him. The principle he doubtless had seen applied a score of times to keep the human foot from slipping on the ice, but he never thought of adapting it to this case, and so in wet weather the locomotive was stabled and the horses turned out, and *vice versâ* in fair weather.

From that time the reputation of the works was established, until now it is doubtful if they have their equal in the world. A stroll through them awakens novel and often sublime emotions. Amid the din and clatter and thunder of machinery and ponderous hammers, the law of order is seen to prevail over all. Each part is made in a separate building or room, and one sees only a pile of rivets here, boilers there heaps of smoke stacks, and a confused collection of wheels and tires that resemble chaos. But at a given word these detached bones of the monster move from diverse points to a common center—the erecting shop—each to find its appropriate place in the body that is to be formed. As part is fitted to part, everything is found adapted accurately to that which it is to join, and rapidly the ponderous thing takes form and swells into huge proportions. When completed, men take hold of the drivers, and roll them once or twice backward and forward, to see that all is clear. Steam is then turned on, and the drivers are sent whirling at a speed that would carry a train thirty miles an hour. Then the inspector advances, and, like a skillful doctor when he examines a patient, lays his hand on the pulse of the engine. The fingers now press the piston rod, and now the connecting arms, drivers, and cylinder heads, to see if there be any jar or disturbance. If there is none, the engine is declared fit for use, and is lowered down upon the rails and rolled out by the side of the railroad, ready to be sent to its point of destination.

Railway Cars for Narrow Gages.

An esteemed correspondent at Portland, Me., sends a communication, in which we find the following practical suggestion:

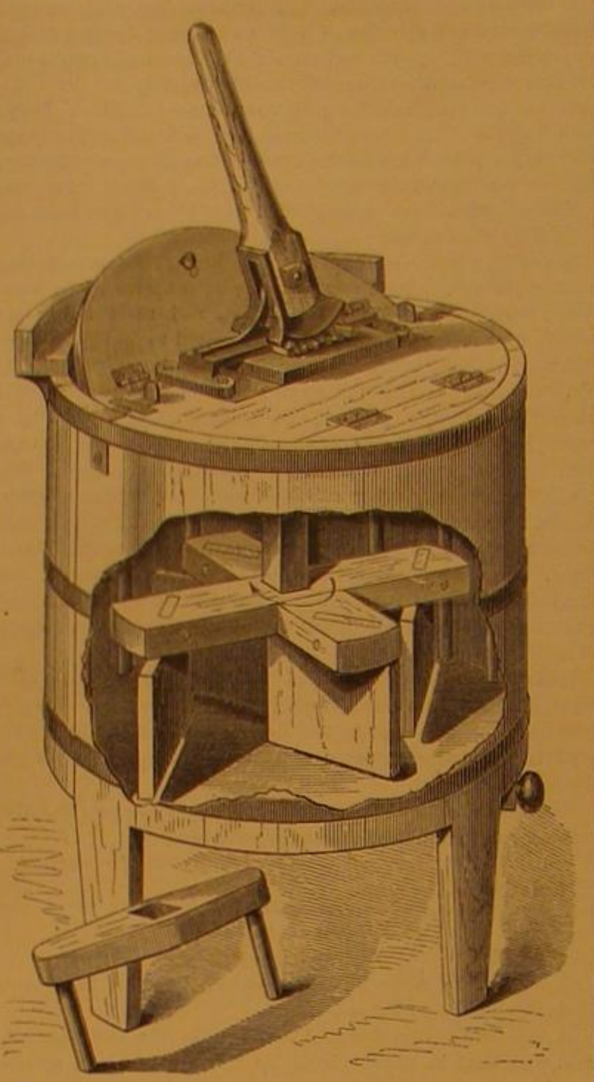
Each trunk railroad to be provided with platform cars of its own gage, on to which the bodies of through cars could be run. The termini of the railroads would need appliances for the transfer of the movable bodies, and by this means, all freight cars would practically become through cars.

The shifting of passenger traffic at places where there are breaks of gage is a matter of slight importance: but the baggage and freight have always been causes of trouble and delay. The plan of our correspondent seems likely, if put in practice, to reduce the chaos of some of the large depots and junctions to system, order, and simplicity.

TO CLEAN BRASS.—Rub the surface of the metal with rotten stone and sweet oil, then rub off with a piece of cotton flannel and polish with soft leather. A solution of oxalic acid rubbed over tarnished brass soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whitening and soft leather. A mixture of muriatic acid and alum dissolved in water, imparts a golden color to brass articles that are steeped in it for a few seconds.

MECHANICAL MOVEMENT FOR CHURNS, WASHING MACHINES, ETC.

Our engraving illustrates a new application of a mechanical movement to the agitation of cream in churns, or suds in washing machines, and also a peculiar form of vertical adjustable rotary dasher, to be used for the agitation of cream. A cross head, with vertical pins, is substituted for the cream dasher when it is desired to use the machine as a washing machine.



The dasher is formed as shown, with obliquely adjusted paddles upon the arms, the inclination of the paddles causing them to react with the outward currents caused by centrifugal force, to throw the cream violently against vertical ribs attached to the inner side of the tub.

When clothes are to be washed, the crossbar with vertical pins is used, and is so constructed that it can be readily substituted for the dasher.

The mechanical movement is not shown in the engraving, but it may be described as being a series of reciprocating cams, acting upon a rotary cam keyed to the vertical shaft of the dasher. The reciprocating arms are fixed to a plate which slides in guides attached to the cover, and receives its motion from an oscillating lever attached to a toothed sector, which sector meshes into a rack on the reciprocating cam plate. The inventor claims that this makes a cheap and effective machine, easily cleaned, and very convenient to use for either washing or churning.

Patented through the Scientific American Patent Agency, May 2, 1871, by John J. Kimball, of Naperville, Ill., whom address for further information.

PAGET'S GIPSY WINCH.

Experiments have been recently made at the International Exhibition on a new form of gipsy winch, the invention of

Fig. 1

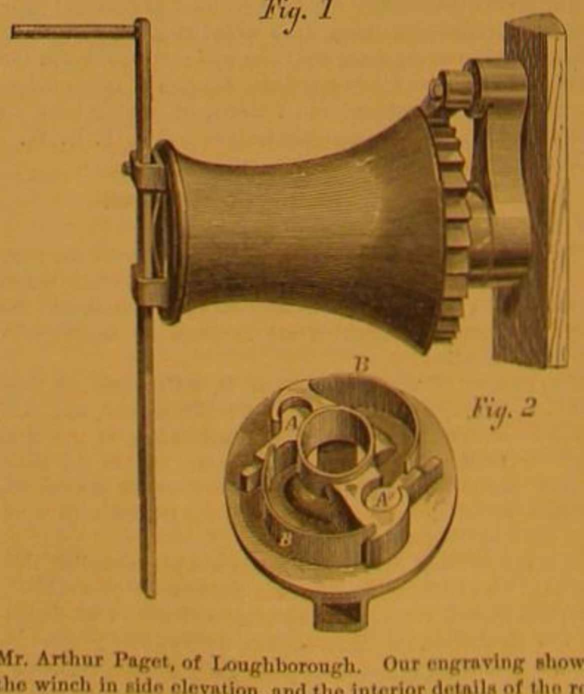


Fig. 2

Mr. Arthur Paget, of Loughborough. Our engraving shows the winch in side elevation, and the interior details of the reverse ratchet. The apparatus consists of a hollow barrel rotating freely on its axis, and to its larger end is affixed the usual ratchet wheel and pawl. The handle of the winch is attached by stirrups to a cap revolving on the axis. This cap is provided with a pair of pawls, A, which, by means of springs, B, are forced against ratchet teeth in the interior of the small end of the barrel. By this means two motions can be applied to the winch, the ordinary rotary method of working the handle, and a reciprocating motion in which the handle is worked up and down in a similar manner to a pump. In the ordinary rotary motion the ratchet movement of the cap is not utilised; but when the maximum power of the apparatus is required the pumping motion is adopted, and the men at the handle are enabled to work to just those positions and distances at which their power is most effective. It will be seen that the handle can be lengthened at will, and different degrees of leverage obtained, as may be found requisite, the radius of the handle being readily altered from 10 inches up to 20 inches, and, by means of adjustable levers, beyond. The apparatus is made self lubricating, the barrel containing a supply of oil sufficient to last an ordinary voyage. In the experiments alluded to, the apparatus being worked by one man with the rotary motion, a strain was put upon a rope of 1¼ cwt., when the radius of handle was 10 inches, and of 3 cwt., when the handle was lengthened to 20 inches. When, however, the handle was worked with the pumping or reciprocating movement, a 20 inch leverage of handle gave the enormous increase of strain of 15 cwt., exactly five times the power obtained with the ordinary rotary motion. The winch with which these experiments were made is only about 4¼ in. in diameter at its smaller end.

ENGRAVINGS OF INVENTIONS AND MACHNERY.

During the forthcoming Exhibition of the Amerian Institute in this city, commencing in September, we shal publish a variety of engravings, illustrative of the machnery and improvements there to be exhibited. To those of our readers who desire to have special illustrations prepared for the occasion, we would say, send us your orders as early as possible, so that we can have the engravings executed in good time, thus avoiding delays in publication and overcrowding of our columns.

Upon this subject of engravings, we will remark that our practice of publishing illustrations of new inventions, while it affords interest to every reader, is also of great advantage to the parties immediately concerned. The paramount object of every patentee or manufacturer is to place the merits of his goods or improvements conspicuously before the public; and one of the most effective methods of doing this is by well executed engravings. Good pictorial illustrations impress the eye, arrest the attention, and impart special interest to the subject. The regular edition of the SCIENTIFIC AMERICAN is now between 35,000 and 40,000 copies per week, and it therefore forms an unrivalled medium for the introduction of improvements. The entire expense for the production by us of an engraving, including its publication, is usually much less than the cost of printing an equal number of ordinary circulars.

A VALUABLE BOOK.

We have just issued a new and enlarged edition of our little book upon the Patent Laws, which contains the new Census of 1870 complete, showing the population, by counties, of all the States and Territories of the United States, giving also the areas; and the population of all cities having over 10,000 inhabitants. The book also contains the United States Patent Laws in full, with official rules for proceedings before the Patent Office; instructions how to obtain Patents, both at home and abroad, the costs thereof, etc. Suggestions and advice upon selling Patents are also given, with the forms for assignments. Directions for securing Design Patents, Trade Mark Patents, Copyrights, etc., are likewise given, together with a variety of useful tables and other valuable information, with diagrams of mechanical movements, illustration of the condensing steam engine, etc. About 175 diagrams in all are presented. The book contains 120 pages, and is neatly bound in board covers. Price, only 25 cents. A more valuable compendium for so small a price, has, we think, never before been published. To be had at the SCIENTIFIC AMERICAN office.

WHEATSTONE'S AUTOMATIC INSTRUMENT.—This instrument, which is now being extensively employed in the Postal Telegraph Stations, consists of two parts. By one part, which is called a puncher or perforator, the signals representing the messages are punched out on a ribbon of paper. The punched ribbon is then passed through the other part, which is called the transmitter, which transmits the signals automatically and with unerring accuracy to the other end of the line. The transmitter can work up to 180 words per minute; but the punching, which is done by hand, rarely exceeds a rate of forty words per minute. In order therefore, to get the full value out of the instrument, by equalizing the speed of the punchers and writers with that of the transmitters, it is necessary to employ several punchers and writers to every transmitter, to punch the messages in batches, by several hands, and to divide the received ribbon among several writers.

SOUTHWESTERN EXPOSITION COMPANY OF NEW ORLEANS, LA.—This company has been recently organized, under State laws, for the purpose of establishing a permanent exhibition of machinery, furniture, household goods of all kinds, textile fabrics, ornamental articles, etc. Goods exhibited will be for sale, and the public will be admitted free. Manufacturers and others taking space, in the large and commodious iron building belonging to the company, are promised the advantages of widespread publicity. Further particulars will be found in our advertising columns.

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Contents:

(Illustrated articles are marked with an asterisk.)

DR. CROOKES ON PSYCHIC FORCE.

If we mistake not, the article published on another page from the London *Quarterly Journal of Science*, containing engravings illustrative of experiments made by Dr. Crookes, with what he styles "psychic force," will attract attention. The high source from which the article is taken, and to which it was contributed by a man long known as a scientist, whose reputation as such is too valuable to himself to be rashly risked, commands more than the usual respect accorded to extraordinary statements.

The existence of a force in the animal organism which may as well be called "psychic" as otherwise, has long been admitted by both the scientific and unscientific. This force underlies all forms of muscular motion, and as yet has never been proved identical with any other known force. That this force could move inanimate objects external to the body without the intervention of muscular energy has been hitherto denied *in toto*. Yet from time immemorial there have been recorded instances wherein bodies appeared to move at the will of witches, miracle performers, spiritual mediums, jugglers, etc., without any apparent material medium between the will and the objects moved. It would be foreign to our purpose to enumerate any of these alleged occurrences; the accounts of them are accessible to our readers in any large library, and are not wanting in the Bible itself. Dr. Crookes has, however, proved, he thinks, that there is a force—whether identical with that which govern muscular motion or not, he does not pretend to say—which does not only move bodies without muscular intervention, but systematically and intelligently, an instance of which he gives—that of an accordion playing an air in a pleasing and accurate manner, without being actuated by visible hands.

That Dr. Crookes does not wilfully mistate, his past record, as well as his present standing, testifies. His life having been spent in making scientific experiments, in criticising the experiments of others, and in familiarizing himself with scientific methods, it seems almost as hard to believe he was duped as to believe he would deliberately falsify on such a matter. But many an honest and careful observer has been deceived by the subtle tricks of legerdemain to which, it must be confessed, most of the so called spiritual performances bear resemblance.

Among the persons present during Dr. Crookes' experiments was a no less brilliant *savant* than Dr. William Huggins, the celebrated astronomer, and Edward William Cox, the well known London lawyer. Both these gentlemen have publicly endorsed, by letters over their own signatures, which we publish elsewhere, the extreme accuracy of Dr. Crookes' account of the events which transpired at the sitting, though Mr. Huggins reserves his opinion as to the cause. Mr. Cox, however, concurs with Dr. Crookes in assigning the movements to a psychic force, which may, it seems, be subjected to the scientific touchstone, the balance, and hence is within the proper sphere of physical investigation.

We are glad these investigations are thus initiated. Heretofore, when anything out of the common way has occurred, a solution has been found by a certain class of minds, in the belief that spirits of the dead revisit the earth and manifest their presence by out-of-the-way performances, etc. If the existence of psychic force be now accepted as proved, it will give the spirits a chance to rest; their services will no longer be required.

These experiments, performed through the presence of the celebrated spiritual medium, Daniel Dunglas Home, are no more remarkable than those exhibited in this country by other mediums we could name, and which we have frequently witnessed. It is their subjection to strict scientific scrutiny that renders them noticeable at this time.

THE LATE GENERAL RODMAN.

In the bright galaxy of American inventors who, by their creative genius, have shed luster upon their country's name, there are few who, for originality of thought, and wide expansion of views, are worthy of a more honorable place than the late General Rodman. There are in the records of his life, which has just been brought to a premature close, passages which are worthy of consideration by his fellow inventors, for their encouragement and imitation.

Thomas J. Rodman was born in Salem, Ind., July 30, 1815, and, like most of the youth of the West at that day, his early advantages for education were limited. Until he was nearly twenty-one years of age, he was engaged in tilling the soil of his father's farm. By his own exertion he obtained an appointment as cadet at West Point, and by close attention to his studies, the importance of which was thoroughly impressed upon him, on July 1, 1841, he was graduated seventh in a class of fifty-two members. He was at once commissioned as brevet second lieutenant in the Ordnance department, and assigned to duty at the arsenal near Pittsburgh, Pa. Here he became familiar with the practical details of the operations carried on in the shops, and developed an unusual mechanical turn of mind as well as taste for such pursuits.

A few years later he was placed on duty at the Fort Pitt foundery, to superintend the manufacture of large guns there being made for the army; and while engaged in the performance of this duty, he was led to make a thorough investigation into the various strains to which a gun is subjected in firing; and he was convinced that our cast iron guns were made on a wrong principle. His first invention was a compound gun formed of a wire wrapped around an iron core, but this was given up, and his improved method of casting iron guns followed soon after.

He made every effort to induce the Government to undertake to make guns in this way, but the officers of rank and influence did not appreciate the merits of the invention, and declined to take any steps to test its value. Despairing of ever seeing his improvement tried by the Government, he was given permission to try private enterprise, securing to the parties the exclusive right to make guns in that way, should it prove valuable. It took fourteen years to prove, to the satisfaction of the authorities, the superiority of this mode of casting guns; no less than eight pairs of guns were made and tested; in every case the hollow cast gun, after General Rodman's plan, proving the better gun. Most inventors know something of the difficulty of overcoming early prejudices, in introducing something new and different from that in common use. In 1860, General Rodman undertook to make a fifteen-inch gun, weighing 50,000 lbs., and throwing a 450 lb. ball. This was a great step in advance—the largest guns then in use being eleven-inch, weighing 15,700 lbs. The trial of this gun was entirely successful, and in 1864, a twenty-inch gun was cast, weighing 116,000 lbs., and throwing a solid shot, weighing 1,080 lbs., over four miles.

By the use of this mode of casting, larger guns were made possible than had ever been conceived of for the use of iron solid shot; and the monster artillery has proved itself formidable to an extent little thought of when first undertaken.

General Rodman's improvement in the exterior model of guns was the result of an elaborate discussion of the strain to which they are subjected, he having deduced a mathematical formula giving the tendency to rupture at all points of the bore.

This is the most complete analysis of the different strains to which guns are subjected anywhere to be found, in any language.

The location of the trunnions so that the gun shall be balanced on them, was a novel idea, opposed to all preconceived opinions on the subject, and at first deemed absurd and ridiculous.

Attempts have been made at different times to measure the pressure exerted by gunpowder, but in all cases the quantity of powder experimented upon was extremely small. It had never been attempted by any one to measure the strain on a gun from firing eight or ten pounds of powder. This information being most desirable, General Rodman proposed for its determination his pressure piston, which has proved so satisfactory, at least as a comparative test of the pressure of different charges, that it has been generally adopted by the European nations, and is of the greatest value in trials of powders, and different charges of powder.

The invention of General Rodman, which is deemed his greatest, and will prove most useful to all nations, is his improvement in powder for heavy guns; the establishment of the principle, in the first place, that the powder must be adapted to the gun in which it is to be used; and, in the next place, proposing a new and improved form of powder for heavy guns. Previous to his experiments on powder, there was but one kind used in common for all cannon, irrespective of size or length, and little or no attention was paid to the density. He showed that, as the charge and length of bore increased, so must the size of the grain. For very large guns, he proposed a cake powder with small cylindrical holes parallel to each other running through it. The trials with this have proved most satisfactory, and it has been adopted by both the Russian and the Prussian governments, under the name of "prismatic powder." By its use, we are enabled to give a higher velocity to the projectile without increasing the strain upon the gun, and thereby rendering it practicable to use larger guns than could otherwise have been done. The importance of doing this, for the defense of our harbors and sea coast towns, cannot be too highly appreciated, and the necessity for it has been rendered greater of late years by the great advance made in armor-clad vessels.

The English Government for a long time ignored this improvement in powder for heavy guns, but has recently woken up to its importance, and now extols it under the name of "pebble powder."

General Rodman never took out a patent for this invention, as it could only be of use to nations, and not to individuals; and notwithstanding its acknowledged value, as shown by its adoption by most of the nations, he has never received any compensation for its use or any acknowledgment of his services in proposing it.

At the different arsenals where he served, General Rodman has left evidence of his inventive faculty, in numerous improvements in machinery and implements used in the military service.

His inventions were mostly confined to those articles to which his attention was necessarily attracted in the course of his professional duties, and it is on this account that his reputation as an inventor is not better known beyond the limits of the army. He took out but few patents, and most of his inventions have brought him in no pecuniary return. His patent for casting guns, which the Government could have had for nothing, or could have purchased for a moderate compensation after its merits had been thoroughly proved, paid him, during the war, when large guns were in great demand, a handsome fortune. The wrapped metal cartridge for small arms, of which he was the partial inventor, long before it was taken up by Captain Boxer for the English musket, also brought him a fair return.

The simple habits and tastes of his early years remained with him through life. Prudence, carefulness, a sound judgment, originality of conception, widely extended grasp of thought, and conscientious discharge of duty, were his marked characteristics.

Laborious preparation for his work, and unremitting attention to it, without due relaxation, rest, and, recreation, undermined by degrees a constitution, which, strong by nature, and strengthened by early physical training, might have, by proper care, attained at least its three score and ten years.

Like that of many of the active, laborious men of this restless age, his work, which was creditable alike to himself, his profession, and his native country, was brought at an early age (fifty-six) to a premature close.

The results of his labors, upon which our judgment of his merits as an inventor must be based, will, when fully known, duly considered and impartially weighed, establish what is claimed for him, a just title to be ranked high among the most distinguished of American inventors.

GOLD AND SILVER WASTE.

We have before denounced the system of piratical and unscientific mining, which has characterized the search for precious metals in this country ever since the discovery of gold in California. The skimming of the surface, working it only so long as it would pay by the rude processes of the early miners, has at last given place to far more systematic working of quartz lodes. But even under the improved methods now employed, there is probably no more precarious business of legitimate character now prosecuted, than gold or silver mining. The working of a lode of a certain degree of richness is prosecuted till a streak is struck that will not pay; and in the hope that it will pay better ultimately, money is sunk, until better luck or final bankruptcy is reached—too often the latter.

It can, and has been, shown that the waste still existing in the methods of extracting precious metals, would itself be a paying profit, could it be turned into the pockets of the mining companies, instead of running out of the sluices. This waste is so large that its mere statement would stagger belief were it not asserted upon unquestionable authority.

Mr. Almarin B. Paul communicates to the *Scientific Press* the results of tests, made by him with the tailings of many quartz mills in California, which go to show that the loss is from *fifty to sixty* per cent of the entire quantity of metal contained in the ores. It seems incredible that with the great attention that has been given to mining and metallurgy, and the large mass of information, now possessed, bearing upon these industries, such a waste should exist; but here are Mr. Paul's figures as evidence:

"I made a test of 50 pounds of tailings for a party who took them a mile below his mill, and the return was 55 per cent of what was his average working. I also made a test of three fourths of a tun, and the result showed the loss in the mill working to be 63 per cent. I could write every column of your paper full of tests corroborative of the fact of the enormous loss in the milling of our gold ores. But these given should be as convincing as more; and I hope enough so, as to waken a desire for investigation at least. From what attention I have given the subject in actual labor, as well as collecting all the data attainable from others, I know that the loss, as a whole, is fully 50 per cent, and, in the majority of mills, all of 60 per cent of what the ore contains."

Preceding what we have quoted, Mr. Paul gives the results of a great number of tests, showing a varying wastage of from twenty per cent up to the percentage above given. One mill was running out, in tailings, about $340 per diem. Two mills were together wasting $84,960 per annum. Mr. Paul says:

"California, in twenty-one years, has produced over $800,000,000, and wasted $1,000,000,000 more! For the wastage in 'sluicing' is greater than that in quartz mining. The Sacramento river in ages to come, and when it shall be upheaved as was the Sierra Nevada, will gladden the heart of some straggling miner with an auriferous stratum, the wealth of which will throw all histories of Potosis, Comstocks, and Del Reys combined, into the shade.

"To remedy the evil, more care must be taken. The fact is, we are too much of a rushing, reckless people; we have not got sobered down yet; and I don't know as we ever will. It's rush, rush, and make too little solid, permanent, profitable headway. We have oceans of wealth surrounding us, and ought to be the most opulent, refined, and wealthy on earth—the loadstone for God's creation. But how is it, and why is it, that we are not?"

We recently gave a notice of a process, originated in Australia, in which mercury, mixed with sugar, to a state of intimate subdivision was employed instead of the mercury by itself, in the extraction of gold, and we believe scientific men are now fully awake to the importance of any process which shall largely reduce—not to say wholly prevent—the enormous—we had well nigh said, shameful waste of which we have spoken. It is, we believe, within the resources of chemistry and mechanics to accomplish this desired result, and it is perhaps not too much to say that its non-accomplishment is a standing disgrace to technical science.

WILL GUNPOWDER EXPLODE IN A VACUUM?

We had the pleasure, in 1862, in company with Dr. Doremus, of visiting the workshop of the celebrated instrument maker and ingenious experimenter, Bianchi, in Paris; and, among other pieces of apparatus, were shown a contrivance for experimenting upon gunpowder and fulminates in vacuum. The results arrived at by Bianchi were very unexpected and curious; and although they were partly described at the time, we deem them worthy of recapitulation for purposes of information and discussion at the present moment, when the question is likely to come before the courts for adjudication. We need not stop to describe the apparatus there first exhibited to us, as it has since been pictured in some of our text books, and can be procured of dealers in chemical wares, but we will pass to the chief results obtained at the time by experiment.

Rifle, blasting, and cannon powder, either in grains or compressed to cakes, when suddenly heated to a temperature of 2000° Cent., in a large vacuum receiver, burned up quietly and much more slowly than in the air. There was no explosion, and the products of the combustion were different from those obtained from powder under pressure. When the powder was put into a pistol barrel, and the pistol inclosed in the exhausted receiver, and the heat applied as before, the combustion of the powder took place nearly as rapidly as it would in the open air. The partial confinement in the bore of the pistol, although no wad was used, gave this experiment a different character from the other. The behavior of gun cotton in the vacuum was, if possible, still more curious. It burned up slowly from the side on which it was ignited, and in a dark room gave off no light whatsoever. The absence of all appearance of illumination attending this experiment is a phenomenon well worthy the closer investigation of physicists. The experiments were further varied by firing gunpowder in nitrogen, carbonic acid, and other gases, which are not supporters of combustion, with very nearly the same results as were obtained from the combustion of the powder in the open air. The experiments performed by Bianchi were similar to those which Professor Joseph Henry, of the Smithsonian Institution, has been in the habit of exhibiting to army officers for years. He relates that some of the artillery officers preferred to accept his word for it rather than to stand by and see a teacupfull of gunpowder fired by an electric spark under the bell jar of his air pump. It required considerable nerve and unbounded faith in the Professor, to induce any one to witness such an experiment.

During the recent siege of Paris, the researches of Bianchi were turned to practical account, and we have seen it stated that the effectiveness of shells was greatly increased by pumping in considerable quantities of oxygen gas under pressure. The manner of conducting the operation and the details of results have not been published, but there seems to be no doubt that greater execution was attained in this way. Professor Jillson, of Pittsburgh, Pa., has tried numerous experiments with a gun from which the air could be removed, and oxygen or any other gas introduced. In each case, the amount of powder and the weight of the ball was the same; the target was also made of the same material, and the gun placed the same distance from it. When the powder was surrounded by air, the ball penetrated the target to the depth of 2·15 inches; and the same result was obtained when the air was pumped out and the powder was in a vacuum.

Carbonic acid did not materially change the result; and with oxygen gas, the penetration of the target was actually diminished. These results do not necessarily vary from Bianchi's experiments, as the conditions under which they were obtained were so different. It is, however, difficult to explain the diminution of effect where oxygen gas was brought into play, and there is evidently need of more information on this subject.

The use of ball cartridge was very different from the quiet burning up of powder in an open receiver. Bianchi found that even the slight confinement in the bore of the pistol modified the phenomena of combustion.

The effect of firing gunpowder in closed chambers was recently explained by Captain Noble, at a lecture at the Royal Institution, an account of which we gave, on page 297, Vol. XXIV., and need not repeat here. In each cylinder had been placed platinum wire and foil of different degrees of thickness. These had disappeared, and he was unable to say in what chemical state they were until the residues had been examined. It is to be hoped that the analyses of these residues will soon be published, as there is much diversity of opinion as to their probable constitution.

We have had occasion, during the last ten years, to publish numerous experiments upon the explosive force of powder, and the gases produced by its decomposition under pressure, but the literature on the discharge of powders and fulminates in vacuum is quite small, and the testimony is somewhat conflicting. The belief generally entertained appears to be that gunpowder will not explode in vacuum, and that, as in the case of gun cotton, the phenomenon of light is wanting when the air is exhausted.

NEW APPLICATION OF THE OXYHYDROGEN LIGHT TO THE SEPARATION OF METALS, BY TESSIE DU MOTAY, OF PARIS, FRANCE.

This new process, recently devised and patented, is especially applied to the metallurgy of copper. The usual treatment of copper has had until now for its object the extraction of the metal of a certain class of ores, where it is found combined with sulphur, arsenic, antimony, tin, lead, iron, etc. etc. The new method referred to first smelts the metal with a flux of silicates; metallic silicates are formed, in which the sulphur and arsenic are eliminated and replaced by silicic acid.

These metallic silicates are then further treated in a blast furnace, and submitted to the reducing property of incandescent charcoal; the metallic oxides are reduced in a metallic state and fused, and thus collected in ingots.

The ingot thus obtained is composed of a variety of metals from which the copper has to be separated; this object is attained by smelting these ingots in a reverberatory furnace in the presence of atmospheric air, which oxidizes all the metals except the copper; it is by this process of cupellation that M. Tessie du Motay utilizes the slowly oxidizing property of the oxyhydrogen flame, in order to facilitate the separation of the copper; he directs the flame, obtained by burning a mixture of common street gas and oxygen gas, on to the fused mass. The combustion of this gaseous mixture furnishes a certain amount of carbonic acid and oxide of carbon, as well as a small proportion of water; it is this water, claims the inventor, which, at the high temperature to which it is submitted, has the property of oxidizing rapidly all the metals except the copper and lead. The fused metal obtained is then pure copper, if the original ingot contained no lead; and is composed of an alloy of copper and lead, if the ingot contained these two metals.

In this latter case, a subsequent operation must take place, and the metal must be once more smelted and submitted to the oxidation of a current of air furnished by a blower.

The slow oxidation of the oxyhydrogen flame, proposed by M. du Motay, for the separation of the copper, is likely to render good service to metallurgy, as the production of oxygen gas has become in his hands a cheap and accessible process.

NARROW GAGE RAILWAYS.

This subject appears to be "nuts," not only to the engineering publications of the period, but to the dailies and weeklies devoted to matters and things in general. What is said today we find repeated tomorrow, and the next day new changes are rung on the same old tune. So far as we can see, nothing new upon the subject has been advanced in six months, and really the discussion is becoming monotonous.

That nothing new is said is not surprising, as, in fact, there is nothing new to say. The financial results of some of these roads are good and encouraging, and the example set by the Festinoig railway, in Wales, is being followed with greater or less success in other parts of the world; that is about the sum and substance, yet many of our cotemporaries persist in treating the matter as a grave engineering question, to be debated *ad libitum, ad nauseam*, instead of a thing settled and foregone. No one at all posted in engineering progress can fail to see that the narrow gages are just the thing needed in certain localities, and under particular circumstances, and that they are to be extensively used in the future.

Narrow gage railways are, however, not a new idea. They have been used in coal mines, in excavating works, etc., for a long time, and their practicability for passenger traffic, as well as for freight, has been fully demonstrated for two years.

The question of financial policy is one which must be decided for individual cases. There are no general grounds upon which it can be elaborately discussed, and one may read column after column of much that has been written about it without obtaining a single new idea. We submit that the papers interested in the construction of railways for their own localities, may properly discuss the propriety of adopting a particular gage for their proposed roads, but the endless reiteration indulged in by technical journals upon this thread bare topic is becoming flat and unprofitable.

THE WESTFIELD EXPLOSION.

The story of the explosion of the boiler of the steam ferry boat *Westfield*, plying between Staten Island and New York, has been conveyed to every corner of the land. As yet the coroner's inquest is not completed, and the evidence scarcely warrants an opinion as to the cause of the dreadful disaster. It is, however, revealed that the boiler was old and patched, that steam pressure was carried above that authorized by the license, and that the engineer was away from his post at the time of the explosion, and had been so at least five minutes, the pressure being twenty-seven pounds when he left it—two pounds above licenced maximum. How much the pressure rose during his absence is not known; but that it was enough to rend the boiler, to precipitate a large number of persons into eternity, and grievously burn and maim still more, is certain. There may have been negligence on the part of the inspector; that there was culpable neglect on the part of the company and its employés is sure. A patched boiler is not necessarily an unsafe one, but patched principles are always unsafe. And it is because of looseness in the administration of law, and the want of enforced regard to the public welfare on the part of railway and steamboat companies, that the waters of New York Bay were filled with dead and wounded on the last Sunday in July, 1871.

HOW SCIENTIFIC MEN WORK.

In an article published in the *American Exchange and Review*, under the above heading, we find the following paragraph:

"It is said that when an eminent foreign *savant* once called on Dr. Wollaston, desiring to be shown over his laboratories, in which science had been enriched by so many important discoveries, the doctor led him into a little study, pointed to a table on which was an old tea tray containing a few watch glasses, test papers, a small balance, and a blowpipe, and said: 'There is all the laboratory I have.' Now, how was this possible? How could this meager apparatus, which a school boy would find insufficient, serve to suggest and establish some of the highest and most fundamental truths of chemistry? Does not the explanation at once suggest itself that the true field in which the leader of scientific thought works is his own mind? A great man uses the things which he sees, to suggest to him ideal existences; and in his capacity of creating such as are consistent with all the known facts of the universe, his fame and distinction are grounded. Nothing could be farther from the truth than to suppose that science accords with Mr. Gradgrind's demand for 'facts, facts, nothing but facts.' On the contrary, Prof. Tyndall long ago defined science as 'the art of seeing the invisible,' and in a recent brilliant lecture has happily shown that its progress depends largely on the fullest possible use of the imagination."

Now, it may or may not be true that Dr. Wollaston made all his great discoveries with a few watch glasses, a small balance, and a blowpipe. It, however, sounds like the story of George Washington and the hatchet, which was originated by that constitutionally unveracious clergyman, Weems, and who was author of many other pretty stories of great men, equally unreliable. But it is not with the story that we quarrel so much as with the moral drawn from it. "The capacity of a man to create ideal existences such as are consistent with all the known facts of the universe, is what gives him fame and distinction." In other words, speculation, pure and simple, is put before patient investigation, and he is declared the great man who can speculate most ingeniously, rather than the one who sits down patiently to search for new facts.

Thus Newton, for his hypothesis of a force of gravity, should, according to this essayist, take higher rank than for his demonstration that bodies attract each other directly as their masses, and inversely as the squares of the distances between their centers of gravity. Laplace for his nebular theory should receive a meed of glory far greater than for his mathematical researches.

It is true that Tyndall has, in his forcible, figurative way, defined science as "the art of seeing the invisible." But the invisible may be fact as well as the visible. Surely this most hard headed of all our modern thinkers did not mean invisible nothings; and though a free use of the imagination is essential to the scientist, it is that kind of imagination that calls up and groups facts that is of use, not the imagination that enables men to construct theories that have no basis in fact.

The true scientific thinker makes use of hypothesis precisely as the mathematician makes use of an imaginary quantity in an equation, not as a reality, but as a help to the ascertaining of realities. If the hypothesis prove by subsequent investigations to be truth, then, and then only, does he accept it as true. That a hypothesis accounts for known facts, or is consistent with them, only renders it highly probable that the supposition is correct. And when Tyndall says the evidence of the existence of a luminiferous ether is conclusive, he does not talk of this ether as a thing supposed to be, but something proved to be, by *facts*.

The essayist whose false teaching we are striving to correct, makes the error of confounding just inference with hypothesis. A conclusion logically inferred from known facts is very different from a theory devised to correspond with facts.

Neither do scientific men work with poor tools, as this author would have us infer. They seek for the utmost refinement in instruments and processes. It is false teaching to promulgate the doctrine that a man can, with a few pipe bowls and rude appliances, proceed with great chemical investigations, or do good work as an astronomical observer, with spectacle glasses arranged on a board. That one man in a thousand succeeds in doing something worthy with inferior apparatus, only proves his superiority, not that the means are sufficient. The investigations of Wollaston were such as required no better apparatus than he used, or he would never have made his discoveries.

It seems to us that it is about time to put a stop to the trite twaddle about genius working in ways and through means that men of ordinary intelligence cannot comprehend. The true scientific method is to guess at nothing, and proving all things, to hold fast to that which is good.

ARTIFICIAL LEATHER.—UTILIZATION OF LEATHER SCRAPS AND CUTTINGS.

We have been greatly interested in the examination of specimens of artificial leather, made from leather scraps and cuttings, forwarded to us for examination by Mr. P. J. McKenzie Oerting, of Pensacola, Florida, who has the control of the patent right for this country.

It is almost superfluous to say anything in regard to the great value of a cheap and good process for the utilization of leather waste. This waste represents millions of dollars annually. A process that could reproduce a texture of these cuttings, only half as good as the original leather, would be one of national importance, and would at once establish a new industry. The process by which the specimens above referred to are made, is, however, claimed to make uniformly an artificial leather even superior to ordinary tanned sole leather.

Examination of these specimens reveals the following facts: It is much harder than ordinary leather, and does not yield to hammering or compression nearly as much. It is very flexible and elastic. Thin shavings of it possess as great tensile strength as shavings of equal thickness of common oak tanned leather. It is nearly, if not quite, impervious to water. It cuts smoothly and easily in working. With regard to its durability under wear, we have no doubt it would wear longer than sole leather, provided it does not decompose by exposure. We have no means of determining this latter point, but we are assured that it does not decompose or change under the ordinary circumstances of wear to which leather is exposed in its various uses.

It is claimed that the leather thus made is equally good for soles or belting; and our tests as to its tensile strength, flexibility, and elasticity certainly go to corroborate the claim.

A really good method for making artificial leather of scraps has, as our readers are well aware, long been sought; but heretofore nothing has been obtained that combined all the essential properties of good leather. The method under consideration was first brought out in Copenhagen, Denmark, and has been patented both in Europe and America. The ingredients employed and their proportions are as follows: For first quality, one pound caoutchouc for each three and a quarter pounds leather pulp. For other qualities, the proportion of leather pulp is increased variously up to six pounds for one pound of caoutchouc. The caoutchouc is dissolved in benzine or other solvents, and, when sufficiently dissolved, aqua ammonia is added in the same proportion as that of the rubber, and the mass is thoroughly stirred until it assumes a grayish white color. The leather pulp is then added, and the whole is kneaded into a plastic homogeneous dough of uniform consistency, which can be pressed or molded into any required form, or rolled into sheets, as may be required.

The ammonia is claimed to act upon the animal glue in the cuttings, restoring to it its original vitality, which it has lost to a great degree in the process of tanning.

The following are some of the properties and uses of this remarkable substance, as claimed by Mr. Oerting in his letter accompanying the specimens:

"Its waterproof quality makes it especially valuable for pump leather, as well for cold as hot water, and also for harness, as even a continued exposure to all kinds of weather has no effect on it, occasioning neither rot nor crack. It can be made endless, or of any length, width, and thickness required, and of perfect uniformity as to wear, which is generally well known to be impossible with leather belts made of shorter pieces of different hides, and of unequal wearing capacity. It will stand any amount of heat and friction, as well as the most intense cold, will stretch less than any other belting, and can be changed from one pulley to another with ease and rapidity. It is very strong and substantial in the edge, and will stand a great amount of ill use without suffering any injury, and through its combined properties will supply a desideratum much needed. By suitable machinery for molding, or forming the material in its doughy state into hose, fire buckets, etc., for which purpose it is especially adapted on account of its flexibility, impenetrability by water, and its capacity to withstand any amount of hardship, as well as extreme heat or cold, it will certainly make the best as also the cheapest material yet produced for such purposes."

By a different mixture and proportion of the ingredients, a matting for floor covering is made, which, on account of its cheapness, its waterproof properties, and its capacity to keep rooms protected from cold and dampness, makes, it is claimed, an unequaled article for covering offices, passage ways of public buildings, etc., which will withstand an immense amount of wear, and can very easily be cleaned.

We are informed by Mr. Oerting that the cost of the materials employed in its manufacture amounts to about $11\frac{1}{4}$, $13\frac{3}{4}$, $16\frac{1}{2}$, and 19 cents per pound for the different qualities, besides from twelve to fourteen ounces of scrap leather, which prices, calculated after the present rates of the raw ingredients, would be reduced at least ten to fifteen per cent by a direct importation in larger quantities.

The entire right for the United States, or State rights for this invention will be sold. For samples or further information, address Mr. Oerting as above.

Mr. Oerting will be happy to furnish specimens to persons interested in such matters, and would like to correspond with parties who wish to engage in the manufacture.

TO CLEAR MUDDY WATER.—A little dissolved alum is very effective in clearing muddy water. If thrown into a tub of soap suds, the soap, curdled and accompanied by the mud particles, sinks to the bottom, leaving the water above clear and pure. In times of scarcity of water, this may be used again for washing clothes.

RE-AGENT TO DETECT NITRIC ACID.

The proposed re-agent is the sulphate of aniline; it detects, with the most minute accuracy, the least traces of nitric acid. In order to obtain the desired result, the *modus operandi* is as follows: Place in a watch glass about 1 cubic centimeter of pure and concentrated sulphuric acid at a density of 1·84; then pour, drop by drop, half a cubic centimeter of a solution of sulphate of aniline, prepared by mixing 10 drops of commercial aniline with 50 cubic centimeters of diluted sulphuric acid. A glass rod is then dipped in the liquid to be tested, and it is then introduced in the watch glass and stirred in a circular way; from time to time the experimenter should blow slowly on the agitated liquid; if the liquid thus stirred contains traces of nitric acid, circular lines of a deep red are soon visible, coloring the whole liquid to a pink. On adding a very small quantity of nitric acid to the mixture, the liquid becomes of a carmine color; the addition of a single drop of very diluted nitric acid renders the liquid a deep red, and afterwards a dead red. This simple process can be applied to the detection of nitric acid in the commercial sulphuric acid. I have thus been able to detect nitric acid in water from wells; and generally this acid is to be found in rain water after a storm.

Hypoazotic or hyponitric acid produces also the same re-action; morever, when only traces of hyponitric acid are detected, the distinction can easily be made by the use of starch and iodide of potassium, acidulated by sulphuric acid.

OZONIZED ETHER.

Ozonized ether has attracted much attention abroad, and we proceed to explain the way it is prepared. It is peroxide of hydrogen in solution in ether. The first idea of this mixture belongs to Mr. Richardson; in experimenting on the action of the peroxide of hydrogen on a number of various organic and inorganic substances, it came into his mind to add to ether a strong solution of peroxide of hydrogen. He was rather astonished in passing a large portion of this substance into ether to find that, after decantation, the ether retained a strong flavor of the peroxide of hydrogen used; and the ether treated by oxide of manganese disengaged a large amount of oxygen; he also noticed that, after a certain time, the oxygen was still retained. The addition of a small quantity of alcohol to the ether facilitates the absorption of the peroxide of hydrogen by the ether.

The combination remains permanent, as some peroxide of ether, having been shipped to Australia and back, had suffered no alteration. This compound constitutes, without doubt, a very strong agent, and will most probably take the place of one of the most important remedies. The peroxide of hydrogen has been used for changing the color of the human hair into that light butter color which was *à la mode* in Europe lately; and it has also been used as a disinfectant of hospitals: its action is very rapid, and does not overload the atmosphere with moisture, and does not irritate the respiratory organs; but it has an inconvenience, it cannot be used near a fire or a light. The remedy for this objection is to use it by means of a glass tube for the evaporation in an atomizer.

EDITORIAL SUMMARY.

TYRRELL'S LABELLING MACHINE.—In our last volume we published an engraving of this ingenious invention, and we are pleased to hear that it is having an extensive introduction. It is applicable for use in labeling every description of round boxes, cans, etc. The latter are fed into a hopper, from which they pass, one by one, in regular procession, the labels being pasted and pressed upon the boxes as they pass, without any hand work whatever; in fact, the machine appears as if endowed with intelligence, for it picks up the labels one at a time, pastes them, and sticks them upon the boxes or cans. Besides the important saving in manual labor which the machine effects, the work done is executed in a neat and superior manner. The invention is now in practical use in some of our largest canning establishments, and operates with the most complete success. Recently patented in this country and Europe. Further information may be obtained by addressing the inventor, Mr. Edward Tyrrell, No. 281 Plymouth St., Brooklyn, N. Y.

We would call the especial attention of parties desiring to engage in an established and successful business, to the advertisement of the Eclipse Machine Works at Hamilton, O. The firm consists of Messrs. Owens, Lane, Dyer & Co. Some of the partners, having made all the money they want, are about to retire; and a half share in the business is about to be sold. The reputation of the concern is first class.

A NEW fire alarm cable, weighing four tons, constructed of the heaviest armor and strong enough to hold any vessel so that it cannot be broken, has been succesfully laid to East Boston. It contains five conductors, two of which are used for the fire alarm, and there are two extra. One will be used for the police telegraph.

METEORIC IRON FROM VIRGINIA.—Professor Mallet, in the *American Journal of Science and Art*, gives the following analysis of a meteoric mass found in Virginia, near Staunton: Iron, 88·706; nickel, 10·163; cobalt, ·396; copper, ·003; tin, 00·2; manganese, trace; phosphorus, ·341; sulphur, ·019; chlorine, ·003; carbon, ·172; silica, ·067. Total, 99·872.

THE Iron Works Company at Fall River are now building seventy-four large boilers. Seventy-two of these are for the new Durfee, Granite and Stafford Mills. They are the common cylinder boiler, and are each 50 feet long by $2\frac{1}{2}$ feet diameter. Some fifty men are now employed on these boilers.

FUNGUS THE CAUSE OF WHOOPING-COUGH.—Dr. Letzerich the American pathologist, has recently made a series of experiments with a form of fungoid growth which he believes to be the cause of the very tronblesome disease, whooping-cough. The spores found in the expectorated mucus, causing the irritation and coughing, were allowed to vegetate into large masses, and small portions were then introduced into young rabbits by an opening in the windpipe. The wounds thus made soon healed, but the animal became affected with a violent cough. Several animals thus diseased were killed and the air passages in each were found to contain very large quantities of similar fungus. These observations, so important to the advocates of the germ theory, have not as yet, been confirmed by other investigators in the same field.

THE enterprising and well known thread manufacturers, Messrs. J. and J. Clark, Paisley, are about to build another large factory for manufacturing thread and sewing cotton. Between the two wings of which it will consist, there will be the engine house, which will be furnished with compound beam engines of 1,200 indicated horse power, being the largest in use for manufacturing purposes in Scotland. The fly wheel alone will weigh not less than 55 tons, and in order to make a proper foundation for this gigantic machinery 10,000 cubic feet of stone will be required. Messrs. Musgrove and Sons, Bolton, are the contractors for the engines and boilers.

AMONG THE INVENTIONS shown in the International Exhibition now open in London, is an ordinary sewing machine from France, the peculiarity of which is that it is driven by a clockwork arrangement, which is wound up in the usual way. Fixed on the apparatus, which is enclosed in a case beneath the machine itself, is a set of vanes, which can be adjusted to work at any angle, so that the speed of the machine is regulated by the greater or less resistance which they offer to the air. They form, in fact, the governor of the machine. The application is ingenious, and will of course save much time and labor, but its price is high, so that there are only two classes of the rich that will patronize it, namely, the delicate and the lazy.

IN his important work on "Mechanics," the late Dr. Whewell, Master of Trinity College, Cambridge, wrote unconsciously the following verse: "There is no force, however great, can stretch a cord, however fine, into a horizontal line that shall be accurately straight."

NEW BOOKS AND PUBLICATIONS.

A GENERAL TREATISE ON THE MANUFACTURE OF VINEGAR, THEORETICAL AND PRACTICAL. Comprising the Chemical Principles involved in the Preparation of Acetic Acid and its Derivatives, and the Practical Details of the various Methods of Preparing Vinegar by the Slow and Quick Processes, with Alcohol, Wine, Grain, Malt, Cider, Molasses, Beets, etc., as well as the Fabrication of Pyroligneous Acid, Wood Vinegar, etc., etc. Together with their Applications, and a Treatise on Acetometry. By H. Dussauce, sometime of the Laboratories of the French Government, Author of "A General Treatise on the Manufacture of Soap," "A Complete Treatise on Tanning, Currying, and Leather Dressing," etc., etc. With Illustrations. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. London: Sampson Low, Son & Marston, Crown Buildings, 188 Fleet street. Price, by mail, free of postage, $5·00.

The works of Professor Dussauce rank deservedly high as industrial publications. Their best feature is profuseness in the treatment of practical details. The present work is no exception in this respect. The work is probably the most complete treatise on the subject of vinegar manufacture now extant. It should be in the hands of every brewer, distiller, and manuefacturer; for though it treats more especially of vinegar making, the departments devoted to malting and cognate subjects are valuable in all these branches of business.

THE COOLIE—HIS RIGHTS AND WRONGS. By the author of "Ginx's Baby." Author's Edition. New York: George Routledge & Sons, 416 Broome street.

The author of "Ginx's Baby," no doubt stimulated by the unusual success of that incisive little book, has published a work of more serious tone and higher aim. This book discusses the labor question, in the West Indies and elsewhere, with especial regard to the immigration now going on from from China and India. The state of the West Indies, and the suitability of those islands for homes for the Mongolian and other Eastern races are fully discussed, as well as the agencies in the East for enlisting emigrants. The same questions, with regard to importation of laborers in o British Guiana are also well and ably treated. The work is thorough and exhaustive, and shows the author to be a man of intelligence and observation, who has traveled, seen, and thought much. He dates from the "Temple, London," and thus gives the first clue to the personality of the writer of "Ginx's Baby."

A PRACTICAL TREATISE ON THE PREPARATION, COMBINATION, AND APPLICATION OF CALCAREOUS AND HYDRAULIC LIMES AND CEMENTS. Compiled and Arranged from the Best Authorities, and from the Practical Experience of the Compiler during a long professional career. To which are added many useful Recipes for various Scientific, Mercantile, and Domestic Purposes. By James G Austin, Architect, New York; John Wiley & Son, 15 Astor Place.

This is one of those universally useful books which may be read with profit by almost any one.

SUPPLEMENT AND INDEX TO "THE LATHE AND ITS USES." New York: John Wiley & Son, 15 Astor Place.

An important addendum to a work issued by the above named firm in 1868. It is published in pamphlet form, and contains a description of the manufacture of the celebrated Tunbridge ware.

TABLES OF WEIGHTS, MEASURES, COINS, ETC., OF THE UNITED STATES AND ENGLAND, with their Equivalents in the French Decimal System. Arranged by T. Egglestón, Professor of Mineralogy and Metallurgy, Columbia College. New York: John Wiley & Son.

A handy little manual.

TRAVELERS' RAILWAY GUIDE.

This work, published under the auspices of the National General Ticket Agents' Association, and edited by Edward Vernon, is probably the best work of its kind now issued. It is published by the National Railway Publication Company, 237 Dock street, Philadelphia, Pa., and can be procured of news dealers.

THE flying frog is an animal, of the existence of which comparatively few people are aware; yet Mr. A. R. Wallace, during his travels in the Malay Archipelago, found one on the island of Borneo—an island so vast in size that the whole of Great Britain, if set down in the middle of it, would be surrounded on all sides by a sea of forests. This frog was a large tree-frog, with very long toes, fully webbed to their very extremity, so that when expanded, they offered a surface much larger than the body of the animal itself. He was seen to come down from a high tree, through the air, in a slanting direction, as if flying.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

Is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller, if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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A re-issue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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Lord's Boiler Powder is only 15 cts. per pound by the bbl., and guaranteed to remove any scale that forms in steam boilers. Our Circular, with terms and references, will satisfy all. Geo. W. Lord, 107 W. Girard ave., Philadelphia, Pa.

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For Hydraulic Jacks, Punches, or Presses, write for circular to E. Lyon, 470 Grand st., New York.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

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Send your address to Howard & Co., No. 865 Broadway, New York, and by return mail you will receive their Descriptive Price List of Waltham Watches. All prices reduced since February 1st.

Dealers in mill machinery, please send address to S. H. Soule, Binghamton, N. Y.

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See advertisement of new Machinist's tool on last page.

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M'fr's of Steel, Builders' Hardware, &c., secure rights to make the iron and steel work in the Reversible Sash Illustrated in SCI. AMER'N, July 22, 1871. Guides to be rolled steel. A big trade, and rights low.

M'fr's or importers of Corrugated Iron or Steel Wire, send address to W. P. Nelson, 618 N. Main St., St. Louis, Mo. Want the wire for keys to reversible sash illustrated in SCIENTIFIC AMERICAN, July 22, 1871.

Wanted—A good Chucking Lathe, 14 in. swing, for ¼ to 2 in. holes. Send price and description to Lock Box 129, Woonsocket, R. I.

Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth st., Brooklyn, manufacture Presses and Dies. Send for Catalogue.

Wanted—One new or second-hand Woodward's Planing and Tonguing and Grooving Machine, in good order. Address H. G. Hall Fayetteville, N. C.

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.

A Chemist wants a place at $800 the first year. Address Charles E. Avery, 19 Chester Park, Boston.

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For Sale—14 H.P. Engine and Boiler, used 90 days. Machinery to sink an artesian well. J. C. Burruss, Carrollton, Ill.

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Bailey's Star Hydrant, best and cheapest in the world. All plumbers send for a circular to G. C. Bailey & Co., Pittsburgh, Pa.

For Sale—A Patent on Steam Mangle. Address P. Rundquist, 954 Sixth Avenue, New York City.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

The Baxter Steam Engine is manufactured by Colt's Arms Co., Hartford, Ct., and sold by the B. S. E. Co., 18 Park Place, New York.

Answers to Correspondents.

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 advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

FINISHING WALNUT WOOD.—Mix, with good whiting, such colors as will produce as near as possible the color of the wood to be filled. This mixture to be dry. Then give the wood a good coat of oil, and sprinkle the mixture over the work until it is pretty well covered; then with a soft rag or other soft substance, rub this in well. Wipe off all superfluous material. Let dry thoroughly and varnish. This mode is far superior to sizing.—J. B., JR.

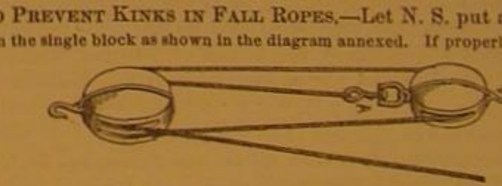
BELTS.—I have always found, in a long experience, that leather belting used with hair side to pulley will both last longer and accomplish more work than when used with flesh side to same. The fibre of hair side is more compact and solid than that of flesh side, and consequently more of its surface is constantly brought in contact with the particles of the pulley. What is lost by want of contact must be supplied by an extra strain on the band.—R. H. P., of Ohio.

MENDING PIPE.—If B. H. D. will take glycerin and add to it enough litharge to form a paste as thick as putty, and use while soft, he will undoubtedly mend his pipe so that it will stand both heat and water. W. J. B. of N. Y.

VARNISH.—Querist, B. F. B., page 43, current volume, wants thin varnish and one that will dry. Let him make it as follows: Pound up ten ounces of gum sandarac, four ounces of mastic, and half an ounce of camphor, adding three quarts of strong alcohol; the mass to be frequently stirred up, and finally put in a warm place until it settles. This varnish does not peel off, and therefore can be applied very thin.—H. W. G., of Mich.

MILL PICKS.—F. A. K., querist No. 3, page 43, wants a good receipt for tempering mill picks. I submit the following:—To six quarts of soft water, put in pulverized corrosive sublimate one ounce, and two handfuls of common salt. When dissolved it is ready for use. The first gives toughness to the steel, while the latter gives the hardness. Directions: Heat the picks to only a cherry red and plunge them in, and do not draw any temper. In working mill picks, be very careful not to overheat them, but work them at as low a heat as possible.—H. W. G., of Mich.

TO PREVENT KINKS IN FALL ROPES.—Let N. S. put a swivel in the single block as shown in the diagram annexed. If properly propor-



tional to the size of the block, so as to give as little friction as possible, he will find this attachment will remove all trouble from kinking.—P.K., of N. Y

SEALING FRUIT CANS.—If J. B. H. will use gum shellac instead of resin, he will have no more trouble.—B. P. G., of Mass.

W. B. S., of Pa.—Dry steam is steam which contains no water unconverted into steam.—P. K., of N. Y.

BELTS.—J. F. M. asks which is the best side, next to pulley, to run a leather belt. According to experiment, the comparative working per cent of grain or hair side is 31 per cent; flesh side 23 per cent. The grain side will therefore drive 34 per cent more than flesh side, to pulley, and will also last much longer.—B. P. G., of Mass.

BELTS.—In answer to J. E. G. According to my observation and experience, a running belt nearly vertical will run to the highest side, but belts running at from nearly an angle of 45° to horizontal, will run to the end of the pulley, where the shafts are nearest together, the pulleys in both cases being straight faced.—B. P. G., of Mass.

RESTORING BURNT STEEL.—I know of no compound for that purpose, that is as good as resin alone. To have in convenient form for use, melt the resin, then add sperm oil, to make a thin paste when cold. Stir in powdered charcoal enough to make a thick paste.—B. P. G., of Mass.

WASHING ETHER.—This operation is for the removal of alcohol, and may be done by agitating with twice the bulk of water, which will unite with the alcohol, forming a heavier stratum from which the ether may be poured off. The ether will absorb ten per cent of the water which can be removed by agitation with freshly burnt lime and subsequent distillation.—D. B., of N. Y.

J. E. G., of Pa.—When the horse power of a boiler is given, find the area of safety valve as follows: Multiply the square of the diameter of the cylinder of the engine, (supposed to be of the same horse power as the boiler), in inches, by the speed of the piston per minute, in feet, and divide the product by 375 times the pressure per square inch the boiler is designed to carry; the quotient is the proper area of valve port in square inches. Having thus ascertained the area and having fixed upon the length and dimensions of the lever, and distance of the fulcrum from the valve stem, multiply the weight of the lever, in pounds, by the distance from its center of gravity to the fulcrum, in inches, and divide the product by the distance from the center of the valve stem to the fulcrum, in inches; subtract this quotient from the pressure upon the valve, in pounds, and multiply the remainder by the distance from the center of the valve stem to the fulcrum, in inches, and divide the product by the length of the lever in inches, measured from the fulcrum to the point of suspension of the weight The quotient will be the weight required in pounds.

ELECTRIC LIGHT.—Not knowing the comparative value of electric lights produced by Grove's and Bunsen's cells, I cannot state exactly how large a number of the former would equal in effect a given number of the latter, but I should think twenty of Grove's would equal ten of Bunsen's. The points should be made of gas carbon, and connected directly with the poles of the battery. I know of no special difficulty in arranging them so as to produce a good light. There are electric lamps in market, but I know not where they can be obtained.—E. H. M., of Mass.

FINISHING WALNUT.—Let H. W. M., query 8, page 60, try, of equal parts, boiled linseed oil, Japan dryers, and spirits of turpentine, with wheat flour enough to make a thick paste. Rub down well before it dries. I have never found anything as good for ash and chestnut.—E. A. B.

COPPER SOLUTION.—Some time ago F. R. A. asked for a copper solution. E. C., of N. Y., answered on page 346, Vol. XXIV. I find the following works better either in single cell or separate battery. To every gallon of saturated solution of sulphate of copper, add 2½ ounces of strong sulphuric acid and ½ drachm white arsenic. If single cell, place a bag of sulphate in the solution just below the surface, to keep up the strength. E. M., of Mass.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

BORING AND TURNING CYLINDERS—G. W. P., J. H., and C. H. M.

THE TRADE WINDS—J. H.

MOISTURE IN THE ATMOSPHERE—W. H. H. H.

ELECTRO MOTOR—E. P.

CARDIFF GIANT—E. X.

Queries.

[We present herewith a series of inquiries embracing a variety o topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—COVERING BOAT BOTTOMS.—I would like to ask the following question of H. about his composition for boat bottoms: What coloring material would he use, instead of Rocky Mountain vermillion, to produce a blue color?—E. H. M.

2.—ELECTRIC LIGHT.—Is the reason known why more light is obtained from an electric lamp when the positive pole is at the top than when the negative is?—E. H. M.

3.—WATER FOR AQUARIUM.—I have just fitted up an aquarium, and wish to know if good, pure cistern water is injurious to gold or our native fish? Also, is good well water injurious? If not, how often should the water be changed?—G. W. G.

4.—SCREW CUTTING GEAR.—I am making a small lathe, and am not posted in the construction of screw cutting gear wheels. Wil some accommodating mechanic give me a clear and simple rule for that purpose?—GEAR WHEELS.

5.—FEEDING RABBITS.—Can one of your readers tell me, on what feed will young rabbits grow best, to get fat quickly? The rabbits are kept in a pen.—J. E. R.

6.—DEATH OF QUEEN BEES.—Will some apiarist tell me the reason why dead queens are found on the lighting board of strong stocks of bees about swarming time?—J. E. R.

7.—COMBUSTION IN BOILER FURNACE.—Can I. by introducing small jets of air into my furnace, under the boiler, improve combustion? If so, which is the best and cheapest mode?—A. H. G.

8.—CUT OFF.—My engine works full stroke. Can I, by substituting an eccentric of less throw, make it cut off shorter without altering anything else?—A. H. G.

9.—POLISHING WAX.—Can any of your readers give me a recipe for making a wax to be applied by a running belt, for finishing hickory handles, etc., that will retain its gloss?—T. McM.

10.—SEASONING LUMBER BY STEAM.—What is the process seasoning lumber by dry steam? What appliances are necessary in the process, besides the steam, and are they expensive? Can green pine be seasoned by the dry steam process in a few days, so that it will be suitable for the manufacture of bee hives?—G. T. W.

11.—LATENT HEAT OF DISSOCIATION.—Will Dr. Vander Weyde explain the theory of the latent heat of dissociation, of which he speaks, in your number of July 22d, as the true origin of the heat developed during combustion? I, and probably many others of your readers, am not acquainted with this theory, and he would do a favor to many by giving a full explanation of this new doctrine, for the previously entertained hypotheses are certainly very unsatisfactory.—E.

12.—BELLOWS FOR BLOWPIPE.—How can I construct a cheap and efficient bellows for a gas or spirit lamp, to be used for experimental purposes?—A. L.

13.—FRICTION OF WATER FLOWING THROUGH PIPES.—I want to deliver water through a pipe 5,000 feet long, and wish a simple rule for computing the friction. I wish to know how much larger I must make it, to deliver the same volume through this length, than if the length were only ten feet.—L. V. H.

14.—SULPHATE OF INDIGO.—Will any of your readers inform me how to make sulphate of indigo? I have dissolved indigo in sulphuric acid, and can only obtain a brown or purple solution. I have followed the directions in the text books on chemistry, and can obtain no other result.—J. T.

15.—SCALING SHEET STEEL.—I would like to find some simple way of removing the scale from the surface of sheet steel, otherwise than by grinding; say by the use of acid or a pickle. The article to be scaled is not over an inch square. Of course the process must leave a bright surace.—H. G.

16.—WASTE IN MELTING PIG IRON.—What percentage of waste is there in melting the following grades of iron, No. 1 pig, No. 2 pig, stove plate scrap, and ordinary mixed scrap? and what combination of the aforesaid grades is considered the most economical for ordinary foundery work, that is, mostly castings finished in casting?—C. C. S.

Recent American and Foreign Patents.

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

STRAW CARRIER FOR THRESHING MACHINES.—The carrier is run on end rollers in the usual manner, and driven by a belt which transmits power to one of the latter. The peculiar construction of the sides of the box constitutes a feature of the improvement. On the lower side of the apron or carrier, is a curved metallic plate, bent to correspond with the sag of the carrier, or apron, the object of which is to collect any grain which passes through the carrier; which grain will be swept downward by the carrier buckets, and delivered at the bottom of the apron. These buckets are strips of wood or metal, attached in such a way that they project at right angles rom the apron. When made of wood they are about a quarter of an inch thick, and project one and one fourth inches. The inventor is Otis Abell, of Witoka, Minn.

HARROW.—Joshua Center, of Mason City, Ill.—This is an improvement upon an invention, patented April 28, 1868, and consists in the combination of pair of handles and their supporting braces with the bars of the harrow.

FENDER FOR PLOWS.—Benjamin F. Neely, of Yorktown, Ind.—A curved fender bar is attached to the plow beam, passing backward and downward toward the share, where it terminates in a number of bars or fingers laterally adjustable so as to allow more or less earth to be thrown towards the plants, when used in cultivating crops planted in rows. The fender bar also plays up and down, so as to adjust itself to unevenness of surface.

STOVE LEG FASTENING.—James M. Corbin, of Liberty, Mo.—Across the base plate of the leg, is fitted a flat spring riveted at the middle. When the leg is inserted, this spring slides over stops cast upon the flanges on the bottom plate of the stove, which hold the leg in place. The leg cannot then be drawn out till the ends of the spring are raised above the stops.

FLAX BRAKE.—Mass Branch Southwick, of Mont St. Hillaire, Canada.—The inventor employs rollers having rigid cogs, with angular denticulated surfaces which intermesh and break the straw of flax, hemp, etc., when the latter is passed through between the revolving rollers.

SULKY HARROW.—Frederick P. L. Reimers, and Hans Asbahr, of Davenport, Iowa.—This is an arrangement of a rising and falling harrow with the frame of a two wheeled vehicle upon which the driver sits; the central bars of the harrow being caused to reciprocate through the action of shafts, cranks, and connecting rods actuated by bevel gearing from the wheels of the vehicle.

CULTIVATOR.—Newton J. Harris, of Meredosia, Ill.—This is a novel combination of a frame with plow beams in combination with a lever and a perforated bar for adjusting the plows. The plows may be also adjusted so as to work near to or far from the rows, as may be desired.

CORN HARVESTER.—John Crossland, of Spencer Grove, Iowa.—This machine consists of a frame on wheels, carrying a sickle or cutter, and spring bars to gather the corn together, as it is cut, and hold it on the frame till enough to form a "shock" has been collected. The horse travels on the right side of the center of the frame, the thills being pivoted to the right of the center, so that the horse travels between the rows when the cutter is brought into proper position. The driver sits on a seat upon the frame, and removes the shocks as they are gathered.

MEDICAL COMPOUND FOR LIVER AND OTHER DISEASES.—Cicero A. Simmons, of Waldo, Florida.—This compound is composed of a number of officinal drugs prepared in a peculiar manner, and, it is claimed, produces a healthy action upon the liver, stomach, and kidneys, and is a most valuable medicine in the treatment of all bilious affections.

CARROUSEL.—Wilhelm Schneider, of Davenport, Iowa.—This invention relates to a new arrangement of "carrousel" or rotary pavilion used in public parks and other places of amusement, and has for its object to provide ample accommodation for occupants, a substantial mode of construction, and a convenient method of guiding it during motion. The invention consists in making the carrousel in two stories, and in providing a staircase within the central supporting frame to enable persons to reach the second story.

WHEELED VEHICLE.—This invention has for its object to provide means for reducing the draft of wheeled vehicles, and consequently lessening the wear and tear of the rolling gear and the fatigue of the draft animals. It consists in the application to the under side of a wagon or other vehicle of a pivoted frame carrying a grooved wheel which can be let down to run on a single rail and relieve the outer wheels from the main weight. The entire load is thereby more evenly balanced and transferred from a broad to a narrow base.—James F. Cass, of L. Original, Canada, is the inventor.

FIRE PLACE.—This invention provides a hollow fire-back for grates whereby a liberal supply of air will be carried from beneath the grate to the perforated back of the same, to furnish oxygen to the first products of combustion, and obtain a more perfect secondary combustion. The invention consists in the formation on the inner corners of the fire-back of lower air entrances, which are above the ash pan, and serve to convey air to the upper hollow perforated back of the fire place. These air entrances are produced by means of concave corners formed on the back above the square corners of its support, and do therefore not interfere with the grate nor take away any useful space behind the same. They extend down nearly, but not quite, to the ash pan, so that the latter may be of rectangular form. The invention consists, also, in forming projecting ears at the front upper corners of the fire back, which define the width of the throat to the flue and aid in keeping the tile in place. Joseph Hackett, of Louisville, Ky., is the inventor.

IMPROVEMENT IN SHIP BUILDING.—Edward M. Strange, of New York city.—This invention consists in a modeling of the submerged portion of the hulls of vessels on a circular or other equivalent form around the axial line of the center of displacement, the said circular or other form beginning amidship or thereabout, and tapering on fine lines to a point on each end, the object being that the lifting tendency of the water on the lower planes shall be neutralized by the impact on the upper planes of the said circular or other form, and the displacement caused to commence at the center of resistance, and operate in all directions, or nearly so, to avoid emersion, thereby causing the stationary and traveling load line to be the same, so that all the weight of ship and cargo will be wholly sustained by the water, and the engines relieved of any lifting tendency, and their whole power utilized for speed or displacement.

LIFTING MACHINE.—This is a new machine for lifting purposes, for testing the power of persons to lift heavy weights and developing the muscular system. It consists in a frame of two or more pairs of parallel bars pivoted near one end, and carrying heavy cylinders which may be easily rolled along the tops of the bars from one to another of the notches arranged along the upper edges of the bars at equal distances apart, and having the gravity indicated in pounds by figures at each notch, which, the weights resting therein, will represent when the frame is lifted at the fore end.—Cicero A. Simmons, of Waldo, Florida, is the inventor.

FEED APPARATUS FOR MILLSTONES.—Alvah Dewey, of Princeton, Ky.—This invention relates to improvements in the feed apparatus of millstones in which the upper and running stone is suspended on a tube by which it is rotated, and another tube, which does not revolve, is employed for conducting the grain down through the first to a short distance above the bed-stone; and it consists in the combination, with this conducting tube, of a disk or plate which is secured in the enlarged eye of the runner, and has for its office to spread the grain and facilitate its passage between the surfaces of the stones.

FENCE.—Samuel S. Porter, of Broad Ford, Pa.—Bed pieces rest upon the ground, in the top of whi h a "gain" is cut to receive the bottom ends of the posts. The posts of t e panels stand up in the gain of the bed piece in contact with each other, and are fastened together by a bolt. When the ground is undulating, the posts will separate at either top or bottom, and the bolt must be of a length to correspond. The braces are made to extend below the bed piece and enter the ground. Their upper ends are secured to the posts by the same bolt that holds the posts together. By removing the bolt the panels, as well as the braces and bed pieces, are left free, and may be removed without trouble, and in practice it is necessary to fasten the braces to the bed pieces in some manner. It is claimed that by the above construction and arrangement of parts a most durable and substantial fence is made, requiring very little labor either to construct and prepare the different parts or to put it down.

CORN-PLANTER.—James A. Knetzer, Fillmore, Ind.—This invention relates to an apparatus for planting corn by means of cans, for containing the seed, affixed to the side of a wheel, from which cans the corn is conducted in proper quantities through spouts to the deliveries at the perimeter of the wheel.

PLATE COATED SHINGLE AND COMPOUND FOR THE COATING.—Thomas J. Langley, East Cambridge, Mass.—This invention consists in a new compound for coating wooden shingles, whereby they are prevented from decaying, rendered fire and water proof, and caused to assume the appearance of slate shingles, without possessing their weight or brittleness, besides being produced at much less cost.

COMBINED STEAM AND WATER MOTOR.—John McGowan, Lebanon Church, Pa.—This invention has for its object to produce the revolution of a wheel by means of a jet of water thrown against the buckets of the wheel, the impulsion of the water being caused by the production of a vacuum within the case in which the wheel is enclosed, which vacuum the water rushes in to fill, and the vacuum being produced by the condensation, through contact with the water of steam which is injected into the case.

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117,499.—WASHING MACHINE.—J. H. Adams, Montana, Iowa.
117,500.—LAMP.—E. D. Ashe, Brompton, England.
117,501.—AWL.—Samuel Babbitt, Brazil, Ind.
117,502.—SEED PLANTER.—B. Baker, Hopkinton, Iowa.
117,503.—MOTION.—E. H. Bancroft, Syracuse, N. Y.
117,504.—MOTOR.—A. Barbarin, J. Albrecht, N. Orleans, La.
117,505.—MOTOR.—A. Barbarin, J. Albrecht, N. Orleans, La.
117,506.—HAT VENTILATOR.—S. Beatty, Norwalk, Conn.
117,507.—TREATMENT OF PIG IRON.—H. Bessemer, London, Eng.
117,508.—HORSESHOE.—A. T. Boon, D. M. Orsborn, G. Geer, Galesburg, Ill.
117,509.—CHAIR.—H. E. Braunfeld, Philadelphia, Pa.
117,510.—POWDER BOX.—B. F. Brown, Boston, Mass.
117,511.—LEAF TURNER.—A. W. Bush, M. McComb, St. Cloud, Min
117,512.—OIL CLOTH.—T. Carson, Brooklyn, N. Y.
117,513.—LATHE.—E. G. Chormann, Philadelphia, Pa.
117,514.—HARVESTER.—C. Clapp, Trumansburg, N. Y.
117,515.—SAD IRON HOLDER.—W. B. Coates, Philadelphia, Pa.
117,516.—HORSE POWER.—John F. Collins, Lodi, Miss.
117,517.—NUT LOCK.—J. M. Connel, Newark, Ohio.
117,518.—BATTLEDOOR.—M. Cregen, Chicago, Ill.
117,519.—GENERATOR.—Edwin Day, Rockford, Ill.
117,520.—WINDOW SHADE.—W. Devine, Philadelphia, Pa.
117,521.—FEED CUTTER.—C. R. Donner, Sonora, Cal.
117,522.—WATER WHEEL.—F. C. Doran, Benj. F. Sortman, Knightstown, Ind.
117,523.—DROP BOX.—John Dyson, Philadelphia, Pa.
117,524.—CULTIVATOR.—Daniel Edelman, Madison, Ind.
117,525.—PRUNING SHEARS.—C. H. Eggleston, Marshall, Mich.
117,526.—SEWING MACHINE.—J. V. D. Eldredge, Detroit, Mich.
117,527.—BOLT.—P. Eley, New York city.
117,528.—CARPET STRETCHER.—S. Elliott, Sonora, Cal.
117,529.—HANGING PICTURES.—A. A. Fielding, Boston, Mass.
117,530.—GLOVE FASTENER.—M. B. Foote, Northampton, Mass.
117,531.—GRAIN SPOUT.—John O. Frost, Candor, N. Y.
117,532.—STOVE.—S. J. Gold, Cornwall, Conn.
117,533.—LOOM.—R. B. Goodyear, Wilmington, Del.
117,534.—COAL HOISTER.—J. Green, New York city.
117,535.—ROLLING STOCK.—J. W. Grover, Westminster, Eng.
117,536.—BARREL HEAD.—A. Hanvey, Steubenville, Ohio.
117,537.—MEDICAL COMPOUND.—R. Hawkins, A. A. Hill Beallsville, Pa.
117,538.—MITER BOX.—G. E. Hedges, Ashland, Neb.
116,539.—BEEHIVE.—W. M. Henry, Leo, Ind.
117,540.—MORTAR MILL.—S. H. Hinsdell, Camillus, N. Y.
117,541.—HAY FORK.—Jacob Huy, Bakerstown, Pa.
117,542.—AUGER.—W. W. Jilz, Hamilton, Mo.
117,543.—CARPET BEATER.—T. Jordan, Brooklyn, and W. H. Jordan, New York city.
117,544.—OIL CAN.—M. S. Kavanagh, Detroit, Mich.
117,545.—GRAIN SEPARATOR.—E. L. Kelly, Reading, Mich.
117,546.—PIPE COUPLING.—F. Kibler, Baltimore, Md.
117,547.—CULTIVATOR.—H. P. Kynett, Lisbon, Iowa.
117,548.—GOVERNOR.—C. M. Langley, Lowell, Mass.
117,549.—STILL.—A. K. Lee, Galveston, Tex.
117,550.—TREMOLO.—John R. Lomas, New Haven, Conn.
117,551.—BRICK MACHINE.—W. H. and H. P. L. Machen, Jr., Toledo, Ohio.
117,552.—FIREARM.—J. Manton, Montreal, Canada.
117,553.—CAR SEAT.—M. M. Martin, Cochran, Ind.
117,554.—WASHING MACHINE.—J. Matthias, New York city.
117,555.—CHIMNEY.—S. M. McCord, Springfield, Ohio.
117,556.—SPINDLE.—A. Morton, Salmon Falls, N. H.
117,557.—SEWING MACHINE.—H. Moschcowitz, New York city.
117,558.—BEARING.—Eliza D. Murfey, New York city.
117,559.—TOY.—S. Patterson, Newark, N. J.
117,560.—HORSESHOE NAILS.—C. H. Perkins, Providence, R.I
117,561.—HAY TEDDER.—John G. Perry, Kingston, R. I.
117,562.—HAY TEDDER.—John G. Perry, Kingston, R. I.
117,563.—HOSE CLASP.—T. J. Pettit, Brooklyn, N. Y.
117,564.—BUTTON.—G. W. Phillips, Fresh Pond, N. Y.
117,565.—CHAIR AND BED.—J. F. Pitcher, Louisville, Ky.
117,566.—GRIPER.—T. J. Plunket, New York city.
117,567.—BORING MACHINE.—W. P. Powers, N. LaCrosse, Wis.
117,568.—DISH WASHER.—H. C. Robertson, E. Saginaw, Mich.
117,569.—GENERATOR.—H. M. and J. F. Rulon, Monmouth, Ill.
117,570.—VALVE GEAR.—H. See, Pottsville, Pa.
117,571.—BLOW OFF.—N. Sherman, Cincinnati, Ohio.
117,572.—REFRIGERATOR.—B. F. Smith, New Orleans, La.
117,573.—ROCK DRILL.—Hugo Sontag, Osnabrück, Germany
117,574.—PLOW.—P. H. Starke, Richmond, Va.
117,575.—ROUNDING LEATHER.—Le Roy A. Sweatt, San Francisco, Cal.
117,576.—BLAST FURNACE.—F. D. Taylor, Brady's Bend, Pa.
117,577.—CAN.—J. Taylor, Petroleum Centre, Pa.
117,578.—FLUTING MACHINE.—C. W. Thompson, Chicago, Ill.
117,579.—TELLURIAN.—Joseph Troll, Belleville, Ill.
117,580.—MOVEMENT CURE.—D. Wark, Montreal, Canada.
117,581.—LUBRICATOR.—H. S. Weaver, Irwin Station, Pa.
117,582.—TRIMMING JACK.—J. Webb, Jr., Portland, Me.
117,583.—HAIR DYE.—J. J. Wild, Bay city, Mich.
117,584.—HORSE SHOE NAIL.—H. A. Wills, Vergennes, Vt.
117,585.—HEATER.—W. E. Wood, Baltimore, Md.
117,586.—MOLDING MACHINE.—J. A. Woodbury, Boston, Mass.
117,587.—ORGAN.—G. W. Woodruff, Hartford, Conn.
117,588.—RIPPING TOOL.—J. O. Woods, New York city.
117,589.—SLICING CANDY, ETC.—J. P. Anderson, Phila., Pa.

117,590.—Pruning Shears.—G. W. Anesley, Marengo, Mich.
117,591.—Peat Wringer.—A. N. N. Aubin, Portland, Conn.
117,592.—Flat Iron.—A. Bachelder, Pelham, N. H.
117,593.—Hand Stamp.—E. H. Barney, Springfield, Mass.
117,594.—Auger Bit.—C. W. Beals, Greig, N. Y.
117,595.—Harrow.—J. Benson, Belle Plains, Iowa.
117,596.—Sewing Machine.—L. R. Blake, Fort Wayne, Ind.
117,597.—Bearing.—M. Briggs, Rochester, N. Y.
117,598.—Signal.—D. W. Brown, C. A. Campbell, Woodbridge, N. J.
117,599.—Car Seat.—C. S. Buck, J. Lovett, St. Louis, Mo.
117,600.—Cattle Guard.—C. Caton, Boyd's Mills, Ohio.
117,601.—Roofing.—C. W. Chaffee, Des Moines, Iowa.
117,602.—Gas Pipe Seal.—R. B. Chapman, Waltham, Mass.
117,603.—Washing Machine.—J. M. Clark, Lancaster, Pa.
117,604.—Sewing Machine.—A. F. Colby, Bath, Me.
117,605.—Roofing.—I. D. Cook, Normal, Ill.
117,606.—Waste Cock.—W. S. Cooper, Phila., Pa.
117,607.—Corn Sheller.—H. W. Cornell, Owego, N. Y.
117,608.—Plow.—S. A. Cummins, Vienna, N. J.
117,609.—Mallet.—J. B. Davids, New York city.
117,610.—Gas Retort.—D. Davison, New York city.
117,611.—Cutter.—W. S. Deeds, Baltimore, Md., J. P. Bradway, Phila., Pa.
117,612.—Quill for Silk.—I. Dimock, Boston, Mass.
117,613.—Generator.—S. W. Emery, E. P. Doyen, Portland, Me.
117,614.—Brush.—A. Fischer, New York city.
117,615.—Reamer.—W. Forker, Rockland, Pa.
117,616.—Loom.—J. G. Frick, Pottsville, Pa.
117,617.—Tea Kettle.—J. Gibson, Jr., Albany, N. Y.
117,618.—Ox-bow Pin.—I. Glover, Newtown, Conn.
117,619.—Dash Board.—H. I. Godwin, Windsor, N. C.
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117,712.—Cooler.—E. Wright, Philadelphia, Pa.
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117,714.—Coke.—W. McPheeters, C. Pearce, Harmony, Ind.
117,715.—Fanning Mill.—J. Goetz, West Bend, Wis.

REISSUES.

4,490.—Support.—W. Beers, Milan, Ohio.—Patent No. 115,016, dated May 23, 1871.
4,491.—Cartridge.—H. Berdan, New York city.—Patent No. 82,587, dated Sept. 29, 1868.
4,492.—Oil Tank.—J. Brundred, Oil City, Pa.—Prtent No. 110,953, dated Jan. 17, 1871.
4,493.—Signal Instrument.—T. S. Hall, West Meriden, Conn.—Patent No. 97,505, dated Dec. 7, 1869.
4,494.—Ventilator.—M. T. Hitchcock, Springfield, Mass.—Patent No. 74,534, dated Feb. 18, 1868; reissue No. 4,005, dated May 31, 1870.
4,495.—Fruit Dryer.—J. P. Miller, Somerville, N. J.—Patent No. 109,234, dated Nov. 15, 1870
4,496.—Firearm.—W. H. Morris, New York city, C. L. Brown, Sing Sing, N. Y.—Patent No. 26,919, dated Jan. 24, 1860.
4,497.—Washing Machine.—S. W. Palmer, C. Coventry, Auburn, N. Y.—Patent No. 40,330, dated Oct. 20, 1863.
4,498.—Stock Car.—A. Rank, H. King, and J. Sharp, Salem, Ohio.—Patent No. 111,873, dated Feb. 14, 1871.
4,499.—Grain Drill.—L. Wight, Whitewater, Wis.—Patent No. 112,663, dated March 14, 1871.
4,500.—Presser, etc.—A. S. Woodward, Brooklyn, N. Y.—Patent No. 110,945, dated Jan. 10, 1871.

DESIGNS.

5,146.—Steam Engine.—C. M. Farrar, Buffalo N. Y.
5,147.—Settee.—J. W. Fiske, New York city.
5,148.—Caster.—J. L. Haven, Cincinnati, Ohio.
5,149.—Floor Cloth.—J. Meyer, Newark, N. J.
5,150.—Medallion.—J. H. Miller, Philadelphia, Pa.
5,151.—Shoe Clasp.—G. Oldham, Youngstown, Ohio.
5,152 to 5,154.—Floor Cloth.—C. L. Pierpont, Salem, N. J.
5,155.—Sewing Machine Leg.—J. B. Secor, Chicago, Ill.
5,156.—Stoves.—N. S. Vedder, F. Ritchie, Troy, N. Y.
5,157.—Stove.—N. S. Vedder, F. Richie, Troy, N. Y.
5,158 to 5,162.—Stoves.—N. S. Vedder, Troy, and T. S. Heister, Lansingburgh, N. Y.
5,163.—Door Handle.—E. Wells, New Haven, Conn.

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412.—Whisky.—T. E. Moore, Shawhan, Ky.
413.—Picture Frame, etc.—M. J. Rice, Boston, Mass.
414.—Sewing Machine.—Domestic Sewing Machine Co., Norwalk, Ohio.
415.—Jewelry.—J. P. Turner, Birmingham, England.

EXTENSIONS.

Sawing Mill.—W. M. Ferry, Grand Haven, Mich.—Letters Patent No. 17,829, dated July 21, 1857; reissue No. 542, dated April 6, 1858.
Retort Cover.—J. R. Floyd, New York city.—Letters Patent No. 17,854, dated July 21, 1857.
Bridge.—G. H. Hulskamp, New York city.—Letters Patent No. 17,888, dated July 21, 1857.
Seaming Sheet Metal Roofs.—J. B. Prouty, Cincinnati, Ohio.—Letters Patent No. 17,874, dated July 28, 1857; reissue No. 889, dated Jan. 24, 1860.
Capstan.—C. Perley, New York city.—Letters Patent No. 17,940, dated August 4, 1857; reissue No. 1,345, dated Oct. 7, 1862.
Factitious Ivory.—W. M. Welling, New York city.—Letters Patent No. 17,949, dated August 4, 1857.

APPLICATIONS FOR EXTENSION OF PATENTS.

Metallic Screw Cap for Jars, etc.—John K. Chase, New York city, has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

Printing Machine.—Samuel W. Francis, Newport, R. I., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

Making Iron Spoons.—G. I. Mix, Yalesville, Conn., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

Pile for Rolling Beams.—John Griffin, Phœnixville, Pa., has petitioned for an extension of the above patent. Day of hearing, November 15, 1871.

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Cancer Cure.—F. Baker, New York city.
Condenser.—W. Wright, New York city.
Cuspadore.—E. A. Heath, New York city.
Knitting Machine.—G. W. Howe and D. M. Sommerville, Cleveland, O.
Paper Pulp, etc.—W. Anderson, Philadelphia, Pa.
Pavement, etc.—A. McKinley, New York city.
Printing Machine.—R. M. Hoe, New York city.
Sewing Machine.—C. H. Willcox, C. Carleton, New York city.
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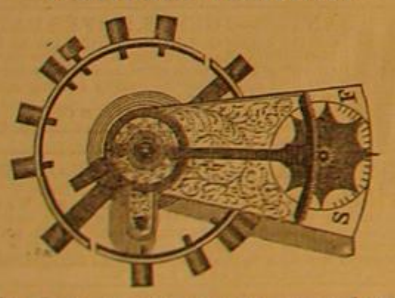

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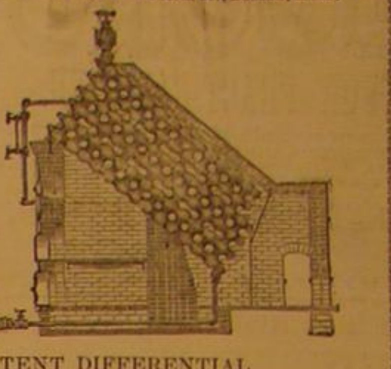

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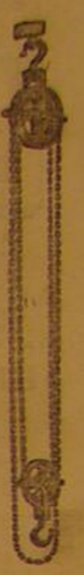

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ALL DRUGGISTS AND PRESCRIPTION Clerks in the City of New York are hereby respectfully notified that the Board duly appointed in accordance with chapter 202 of the laws of 1871 of this State, will meet for the purpose of conducting examinations, Daily, between the hours of 10 A. M. and 3 P. M., at their office, No. 72 Union Place.
Druggists will be examined first, and notified in alphabetical order. Due notice will be afterwards given to prescription clerks.
The subjects for examination will be chemistry, poisons and their antidotes, practical pharmacy and officinal botany, materia medica, prescriptions, and the adulterations of drugs. The office will be open daily 10 A. M. to 3 P. M.
R. OGDEN DOREMUS, M. D., *President.*
WILLIAM GRAHAM,
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C. M. O'LEARY, M. D., *Commissioners.*
LOUIS G. BRANDA, *Secretary.*
New York, July 20, 1871.

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