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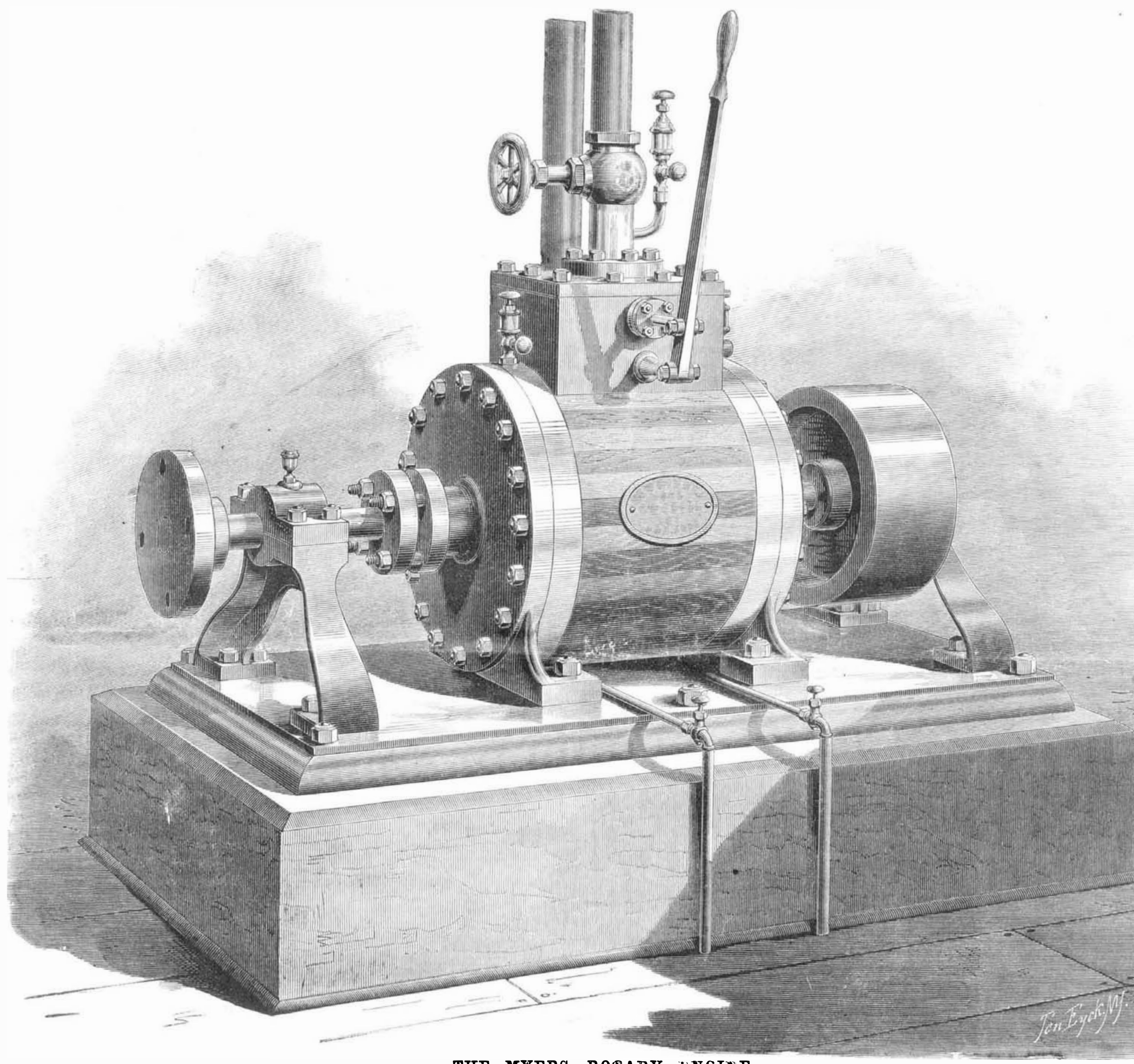

THE MYERS ROTARY ENGINE.

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To fail has been far more frequently the fortune of inventors of rotary engines, than to succeed. So frequently, indeed, and from so various causes has this been the case, that most engineers adhere to the opinion that with the reciprocating engine the rotary can never enter into successful competition, much less prove a formidable rival.

The question of to what extent the machine we are about to describe can cope with the rotative engine of corresponding power in economical use of steam alone, we leave to future consideration in connection with the records of tests soon to be instituted. In this article, we desire to direct attention to the mechanical construction as probably the simplest arrangement ever devised for the rotary engine.

A perspective view of the engine is shown in Fig. 1. From Fig. 2 it will be seen that the cylinder is divided by a diaphragm, A, and that the shaft, B, passes directly through. Each of the two compartments of the cylinder contains the working parts of a separate engine; and as both are exactly alike, the longitudinal section, Fig. 3, may answer for either. C is the piston, one end of which is made to encircle the shaft, while the other terminates in flukes, forming a broad surface which bears against the inner periphery of the casing. The piston also passes through a cylindrical oscillating guide, D, which is secured in the ring, E. The ring is not attached to the shaft, no power whatever is transmitted through it, and it simply serves as a guide and to give capacity to the cylinder. It is held in place by resting in one annular groove in the diaphragm and in another in the cylinder head, so that, as seen in Fig. 2, when the cylinder head is in place, the three edges of the piston take against the diaphragm, the head, and, as above noted, the inner periphery.

Fig. 2

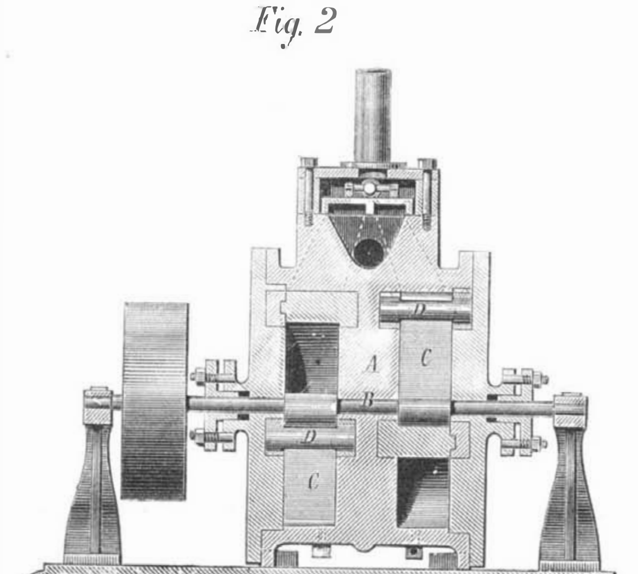
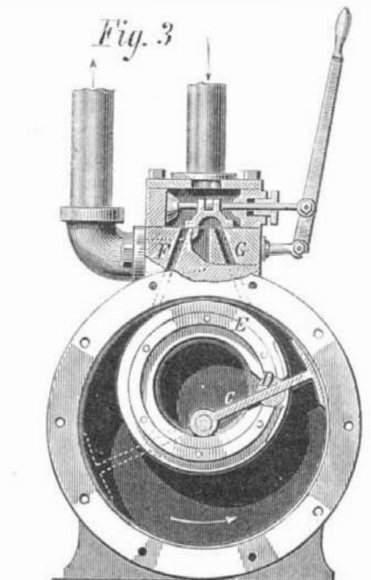


Fig. 3



The ring is disposed eccentrically to the shaft; and as, at its highest point, it is in contact with the cylinder between the ports, F and G, it forms a constant abutment for the steam. The latter, entering between this abutment and the piston, acts directly upon the piston, which, being merely a lever arm as regards the shaft, of course turns the same, traveling in the direction of the arrow. In passing the abutment part of the ring, the flukes fit into a recess, so that the contact between the abutment and cylinder is always maintained. The reversing gear, by which steam is admitted to either port by means of a common D valve, is operated by the hand lever shown.

The most important points in the rotary engine are no clearance and tight joints which, while avoiding friction, are slow to wear. An English contemporary, speaking of the sliding abutment plan, and allowing the abutment to have the same velocity as the piston, says that, in an engine 9 feet 8 inches in diameter, having 86 square inches of piston surface and making 60 revolutions, such an abutment could not completely close until the piston had moved four inches away from it. This four inches represents clearance, which is waste, for in rotaries there is no compression.

In the Myers mechanism, there is no clearance. The abutment is always closed; the instant the piston clears the port, steam enters and immediately exerts its useful effect, and there are no springs, cams, valves, or other devices, save the simple three working parts, to produce this highly important result.

The packing difficulty is a stumbling block for an immense number of rotary engines. In the present machine, the broad bearing surfaces are of metal, face to face. There is no packing at all inside the cylinder, and it only exists in the stuffing boxes about the shaft. So far as the development of friction in the engine is concerned, it might be supposed that the steam, pressing against the broad flukes of the piston, would force the same into too close contact with the cylinder, bending the shaft. Such is evidently not the case, for the steam must enter between the piston and cylinder, so balancing the former at every point, except during the instant it passes the exhaust port, exactly, in fact, as the ordinary slide valve is balanced. Friction and wear are thus prevented. Finally the aggregate friction of the various parts of this machine, as compared with that of the parts of a reciprocating engine (the piston, the rod, the gibs, the crank pin, etc.), is, as is apparent from the very fewness of the working portions, the less.

The operation of the Myers engine is perfectly noiseless; there is no pound or clack whatever, and the 50 horse power machine at the Fair runs and reverses instantly under half a pound pressure of compressed air or steam. The arrangement of pistons, as shown in Fig. 2, forms really a double engine, the pistons being 180° apart, thus ensuring even motion, while it suggests the possibility of any number of engines and pistons being thus combined.

The particular form of engine represented in our engravings, through its prompt reversing and capability of holding the load, is especially adapted as a hoister for mines, elevators, and like uses. It is besides well suited for the working of steering gear, or the driving of propellers in vessels. As it is remarkably compact, occupying a minimum of floor space, it will doubtless prove valuable in establishments where economy of room is an object; and in instances in which, for example, it is desirable to attach a circular saw directly to the shaft.

A word may be added with reference to economy of steam, to point out that the tendency of the pressure within the cylinder is to force the abutment up and so obviate leakage. If the other leakage about the piston edges is prevented, there seems no valid reason why the engine should not be as economical as a reciprocating machine at full stroke. All that is necessary to provide for expansion is to arrange a cut-off at the reversing valve. Of this, however, more hereafter. For the present, we dismiss the subject with the opinion that the engine is of unquestionable merit; and if future tests prove this probable economy of steam, we can predict for it a well deserved success. The inventor is Mr. Edward Myers, and further information regarding the machine may be obtained by addressing the Myers Engine Company, No. 6 Cortlandt street, New York city.

Breathing through the Mouth.

A fact which cannot be too frequently impressed on the mind, says the *Science of Health*, is "that the pernicious habit of breathing through the mouth while sleeping or waking is very hurtful. There are many persons who sleep with the mouth open, and do not know it. They may go to sleep with it closed, and awake with it closed; but if the mouth is dry and parched on waking, it is a sign that it has been open during sleep. Snoring is another sure sign. This habit should be overcome. At all times, except when eating, drinking, or speaking, keep the mouth firmly closed, and breathe through the nostrils, and retire with a firm determination to conquer. The nostrils are the proper breathing apparatus—not the mouth. A man may inhale poisonous gases through the mouth without being aware of it, but not through the nose."

The editor should, in this connection, have directed the attention of his readers to the patent anti-snoring device illustrated in these columns some time ago. By its use, the above troubles are all obviated.

Crystalization of Tin.

A fine crystalization of tin is obtained as follows: A platinum capsule is covered with an outer coating of paraffin or wax, leaving the bottom only uncovered. This capsule is set upon a plate of amalgamated zinc in a porcelain capsule. The platinum is then filled completely full of a dilute and not too acid solution of chloride of tin, while the porcelain is filled with water acidulated with $\frac{1}{20}$ of hydrochloric acid, so that its surface comes in contact with the surface of the liquid in the platinum. A feeble electric current is set up, which reduces the salt of tin. The crystals formed after a few days are well developed. They are washed with water and dried quickly.

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NEW YORK, SATURDAY, NOVEMBER 14, 1874.

Contents:

(Illustrated articles are marked with an asterisk.)

RAPID TRANSIT IN THE CITY OF NEW YORK.

We recently called attention to the appointment of a special committee of the American Society of Civil Engineers, to receive, consider, and report upon the best plans for providing rapid transit in this city. The Committee have held several meetings, and examined a variety of plans; but only a few new ones have been presented.

Mr. Davis proposes a cheap elevated single track railway, of narrow gage, like that used in some of the mining districts of England. Mr. Nolan has a two story iron bridge railway. Mr. De Puy's plan is an iron framework placed over the street, with sidewalk for passengers and railway in the middle. Mr. McGonegal would have an arch of iron over the street, with tracks within the arch. Peter Cooper suggests an elevated railway with endless propelling rope and cars. Mr. Speer presented his chain of flat cars, with little houses and chairs set thereon, forming what he terms a traveling sidewalk. Mr. Schuyler exhibited his canal railway, through private property, estimating the cost at eight to ten millions of dollars from City Hall to Harlem, eight miles. Mr. Church advocated an arcade railway, four tracks, to cost a million and a half per mile. Mr. Gardner urged his elevated railway along the rivers, with warehouses. Our readers are familiar with most of these plans, as they have heretofore been illustrated and described in the SCIENTIFIC AMERICAN.

The Committee, we understand, are not pledged to any particular plan, but are so convinced of the paramount necessity of having some sort of rapid transit road immediately built, that they will recommend a hard times railway, one of the economical plans, believing that the cheaper it is in first cost the more quickly it will be erected.

In the meantime, while the many inventors are planning and the Committee considering, it is gratifying to know that rapid transit in this great city is making real progress. The magnificent line of solid and substantial underground railways on Fourth avenue, between the Grand Central Depot, 42nd street, and Harlem river, 4½ miles, authorized by the State Legislature of 1872, is now almost completed, and will open for traffic in January next. The continuation of these tracks down town to the southern limit of the city, at the Battery, 4½ miles, by the Broadway Underground Railway Company, was finally authorized by the Legislature, May 10, 1874; and although but a brief time has elapsed, it is believed that the construction will soon begin. These great works, having a total of 8¾ miles in length, built in the strongest manner, under the direct supervision of the most eminent engineers, will form a rapid transit railway of which the citizens of New York may well be proud. Our engineers will do well to lend all possible influence in favor of their early completion. Over these tracks, passengers may be safely conveyed, at high velocity and for low fares. Nothing about these roads will be experimental or uncertain. Their capacity for traffic will be enormous; they will in all respects be adequate, convenient, and satisfactory to the public.

We commence on another page a series of articles descriptive in detail of the Harlem section of the Underground Railway, from which our readers will gain some idea of the magnitude and importance of the work. As the most recent specimen of American railway engineering, the plans are worthy of study, and will undoubtedly command the attention of civil engineers everywhere. Our articles will not only embrace sectional views and dimensions of the tunnels, viaducts, open cuts, and bridges, but will also exhibit the construction of the underground passenger stations and other peculiar features. These papers will possess special interest and value, owing to the many different forms of construction that are involved along the line of the work.

HINTS TO INVENTORS AND CAPITALISTS.

As a general rule, the man who makes an important invention has not the necessary capital to manufacture and place it in the market; hence he is obliged to seek assistance from others, giving up some part of his invention in return for the means of development which was furnished to him. Indeed, many valuable inventions are abandoned before being fully perfected, on account of the poverty of the inventors. It is eminently fitting that capital should lend its aid to intelligence, in cases of this kind, since the original outlay will be more than returned when the public appreciate the value of the new idea. It is not true, however, that every new idea is a good one, and a useless or imperfect invention forms one of the best devourers of money that can well be imagined. There are many capitalists who are ready and anxious to furnish means for the advancement of new projects, if assured they will be useful and profitable; but they have been deceived so often by schemes that promised well, that it is difficult to induce them to listen favorably to anything that is presented. It would seem, then, that there should be some middle ground upon which inventors and capitalists could meet, making and receiving propositions by means of a third party who is well versed in business matters and also fully acquainted with technical details. The capitalist, for instance, although a good business man, generally has not the experience and the technical knowledge necessary to enable him to form a thorough opinion in regard to the value of a mechanical device or process. The inventor, even allowing that he is fully acquainted with all the matters to which his invention relates, can hardly be considered the most suitable person to expatiate upon its merits. There is a trait in human nature that causes most men to have a pretty good opinion of their own ideas, and our readers must have noticed that the inventor of the most worthless article is apt to consider it of as much value to the world as anything that can be desired. In listening to the enthusiastic talk of the inventor, one is apt to be carried away by his remarks, unless he is thoroughly acquainted with the subject. Many inventors, however, before approaching a capitalist, carry their designs to experts and obtain opinions from them. But even with a score of such recommendations, the capitalist will not be safe in investing money to develope a design. Many experts are not as careful as they should be in giving opinions on inventions, and no one, however honest and capable he may be, can assert positively, without a trial, that a new machine will be successful. He can frequently discover fatal defects by simple inspection, but he cannot safely assert that none exist. A little incident, which lately occurred, will illustrate these points more fully. A mechanic had invented a new cut-off, which he asserted would save at least 25 per cent of the fuel, on being attached to any engine that had a plain slide valve. Like many other inventors, he had exhausted his means in obtaining his patent and building one machine; but it had been examined by several engineers, who thought very favorably of it, and expressed these favorable opinions in writing, so he considered that it would not be difficult to obtain what money he needed. After interviewing a few capitalists, he met one who seemed quite favorably impressed. The latter, however, rather distrusting his own judgment in a matter with which he was so little acquainted, sent the inventor to an expert, promising to accept his report as final. The expert was a man who was accustomed to dealing with such matters, and was moreover rather cautious in expressing an opinion in cases in which he could readily discover facts. So he addressed the inventor, somewhat after this manner: "My friend, you say that you have a cut-off which will save 25 per cent of the fuel, and you have also letters from a number of well known engineers, in which they state that they believe the invention will effect this saving. If it really does, it is a valuable device, and I shall not hesitate to recommend the gentleman, who sent you to me, to invest his money. I will propose a plan to you, by which the matter can be definitely settled. There is a plain slide valve engine, near here, that has been running for nearly twelve months, and a careful record has been kept of the coal consumed and the power developed each day. Attach your cut-off to this engine, and let the record be taken for a month."

The attachment was made; and for several days, as the coal account did not seem to diminish, the inventor kept making slight alterations when the machinery was stopped, but without any apparent benefit. After two weeks his fa miliar face was no longer seen around the premises; and when the month had elapsed, the apparatus was removed and is still on storage, waiting for a claimant.

Many more such examples could be cited, and there are few consulting engineers who have not met with a number of such cases in their experience. But the trial to which this cut-off was subjected was made in the interest of no one, being intended simply to determine the truth in regard to its value.

CHLOROFORM DANGERS.

The death of another patient in the dental chair, while under the influence of chloroform, again attracts public attention to the dangers attending the use of that anæsthetic. This latest accident occurred in Boston, and the opinion of the physicians points to the fact that the lungs of the deceased were affected by consumption, and hence unable to throw off the influence of the volatile spirit. However, the jury impaneled at the coroner's inquest ignore in their verdict the previous condition of the patient, and, while asserting that the death was due directly to the inhalation of the chloroform, add that, owing to our present lack of knowledge regarding the same, its use as an anæsthetic is utterly unjustifiable. They also recommend legislative enactments to prevent its administration.

The distressing effects of sulphuric ether, upon a large class of patients, more especially those of extreme nervous temperament, have been the cause of the preference given to chloroform by many physicians. It is argued that the latter anæsthetic is not dangerous so long as the inhaler's heart is not affected, and that its more speedy action in producing insensibility is eminently advantageous in many surgical operations. But these claims in its favor, it must be conceded, are greatly outweighed by the consideration that, while there are repeated instances of death being the direct sequel of the administration of chloroform, there is no record of ether ever having produced fatal results.

It does not appear needed, however, that legislation should interfere to check the use of chloroform, since the growing tendency of the medical profession is in favor of pure ether as a substitute, or else a mixture of chloroform, ether, and alcohol, which, we understand, produces good results without causing the dangerous depressing effect of the chloroform or the nausea of ether. The employment of nitrous oxide in dental surgery is also greatly extending; and since it is both a harmless as well as an agreeable anæsthetic, it possesses peculiar advantages in connection with the rapid operation of removing teeth, or, in fact, with almost any case in which a minute or two of time is ample for the purpose.

As regards the proper treatment of patients who fall into a dangerous syncope while under the influence of chloroform, there is some difference of opinion among physicians. The most recent mode of procedure (which the eminent French surgeon, Dr. Nélaton, not long since deceased, as well as Dr. Sims, of this city, both state to be very efficacious, having in six different instances saved the patient's life) is as follows (we extract it from the *Tribune*). These surgeons had come to the conclusion that death from the inhalation of chloroform was immediately caused by a want of proper determination of blood to the brain. "The want of this stimulant to the brain's action rapidly led to the suspension of other vital organs of the economy. When, therefore, M. Nélaton's patient, upon whom he was operating, suddenly ceased to breathe, he caused his legs and body to be elevated, the head hanging downward. The blood, by specific gravity, tended to the brain. Artificial respiration was kept up, and after a time the patient again began to breathe of his own volition. He was laid back upon the table, and the operation was about to be continued, when it was noticed that he had again ceased to breathe. The same process was gone through with, and again the patient was resuscitated. A third, and even fourth, time he relapsed into the state that would have been death, and each time his breathing was restored by this process. The fifth time he relapsed, the effects of the anæsthetic had almost passed off; and, while the patient was suspended in the air, head downward, and when artificial respiration had just ceased, with the returning regular breathing he asked M Nélaton why they were holding him in that extraordinary position. The operation was finished without further administration of the anæsthetic, and it resulted successfully. In the other cases the patients were resuscitated, the medical men having charge of them testify, by the same process. These cases are considered enough to demonstrate, with a reasonable degree of certainty, the proper treatment to be followed in cases of syncope and approaching death, from the inhalation of chloroform."

MASTERS AND MEN.

Great captains have not always been those best able to plan brilliant campaigns or best able to make the most of the varying vicissitudes of war. But whether great in strategy or not, they have always been men who could get the best work out of their followers: captains whose presence was inspiration, whose commands were prophetic of victory because certain to be carried out.

"Who ever saw such tactics?" grumbled the veterans of Italy, when the young Corsican knocked their enemies right and left with his handful of men, winning victories not so much because of his audacity and military genius, as because his soldiers could be depended on to do what they were sent to do. Then, as afterward, the great secret of his success lay in the unbounded personal devotion he inspired in those by whom his victories were won, a devotion which he took great pains to justify, by honoring faithful service to the utmost.

The great captains of industry have ever been of like disposition. They have succeeded, not because they excelled their rivals as marketmen or financiers, but because they could get more and better work, and trustier service in every way, from the men they employed. The best work wins, other things being equal. This is one of the great lessons so strikingly enforced in Parton's lecture on "Kings of Business," a lecture crammed with illustrations of successful enterprise, drawn very largely from direct study of the operations of American business kings.

At the Cambria Iron Works, where 7,000 men are employed making iron and rails, the President of the company was asked the secret of such a great development of business. The reply was: "We have no secret. *We always try to beat our last batch of rails.*" This persistent endeavor to excel, not others only but themselves, is the master key to the success of many.

Another lesson is that the surest way to turn out uniformly good work is to employ good men and treat them well. Said the manager above quoted, the other day: "We find that the more we do for our men, the better they do for us." In this Saxon sentence, the experience of hundreds of business kings is crystalized. Justice wins justice. The rudest workman will do more honest work gladly for the man who does the fair thing for him and his family, than the hardest driver can get by other means. The wisest selfishness is just if not generous: a lesson which small men never learn.

The country is full of illustrations. We have in mind two establishments of the same sort, within cannon shot of each other, which may stand as types of the extremes of management in this respect.

Half a century or so ago, a sterling business king became controller of a new establishment for mining and manufacturing purposes. The country was new, rough, and unattractive; yet a thriving village soon sprang up, with stores, churches, schools, and all the other accompaniments of a well-to-do and self-respecting community. The men employed were carefully selected, well paid, and fairly treated. The works were eminently successful; their various products soon won an honorable name, not only throughout this country, but abroad; and the brand of the establishment was a guaranty that every article was what it should be.

The king died. The heirs were of the meanly selfish sort, caring only for their immediate income, and taking no interest in the works save to get out of them all that they could with the least trouble to themselves. They lived at a distance, and regarded their employees merely as parts of a great machinery. What they were or how they lived, they did not care. The management of the works was committed to agents, subject to the minutest control from headquarters. Naturally, meanness could command only mean tools, and the character of the directors was soon stamped upon everything connected with the works. Merit ceased to be regarded. The good men whose honest work had contributed to the success of the father soon drifted away, to be replaced by men of lower grade, themselves to be displaced by those yet lower. The strongest claim for service was irretrievable indebtedness to the company, or pliability at the polls, in gratifying the petty political ambition of the managers. Irregular working, strikes, breakdowns, and other business drawbacks became common; and after some years of decadence, the once thriving business collapsed in utter failure. Meantime, the exodus of the honest and saving had depleted the village of all that had made it worth living in. The school degenerated, the church became the playhouse of window-breaking boys, the stores were closed or turned to groggeries, and a low-lived rabble made life miserable in the place of a once respectable community. As this town went down, the adjoining village rose. The owners of the works, round which the village clustered, lived among those they employed, and sought to surround themselves with the best men they could get. Still more: they sought to make their workmen better for being in their employment. Thrift was encouraged, and the unthrifty systematically weeded out. The men were made to understand that they were expected to be better off at the end of each year than at the beginning. Not to be so, accidents excepted, was to hazard their continued employment. Yet the unfortunate, the sick, and the bereaved were looked after with a kindliness that could not be misinterpreted. The wives of the partners—genuine ladies—made it their business to know and visit the women folk of all the employees, winning their confidence and esteem by sisterly service in times of trouble, and aiding them at all times by judicious counsel, or, if need be, with more substantial help.

It is needless to describe the development of a village where the ruling influence bears steadily toward good government, good schools, good society, sobriety, and universal thrift. Floods destroyed and fires laid waste now and again, but help was always ready for the deserving; and though surrounded by colonies of rude miners, colliers, and the like, and largely composed of men of rough employments, the village became and remains a worthy representative of our best manufacturing towns.

It is needless, also, to describe the prosperity of the business by which and for which the town exists. In employments of such a nature that the indifferent or evil-disposed can destroy or waste in five minutes more than he can earn in a day, the advantage of careful, honest, trustworthy, and interested help is enormous. By dealing justly with their men, the rising company gained while their meaner rivals lost, and won a handsome fortune and the lasting esteem of their men whom they had helped to competence and comfortable homes; while the others were hated for the poverty they engendered in their descent from wealth to merited bankruptcy.

That men have been mean, hard, grasping, and ungenerous to their help, and yet have amassed wealth is undeniable, just as generals have won victories with mutinous soldiers; but these cases are relatively rare, and the success so won is not only precarious, but liable to most unexpected reverses. Our great manufacturing establishments have not been built up by such management. As Parton tersely puts it:

"Traverse the world over, search the history of our race in all times; and wherever you find a man truly superior to his fellows, a natural king of men, born to command, you will find him attentive to the interests, and to the feelings, and to the dignity of those who execute his will. If he is not man enough to be so from good feeling, he is man of business enough to do it from policy. If there is any one here who snubs persons dependent upon him, begrudges them their just compensation, cares nothing for their interests or their honor, that man is not naturally a master; he is one by accident only: he belongs, by birth or breeding, or both, to the class of the defeated and the servile. He is merely a beggar on horseback, and perhaps stole the horse."

THE DEVELOPMENT OF SUBTERRANEAN HEAT.

A gentleman engaged in the mining of lead, a Mr. Ewing, of Joplin City, Mo., has written for an explanation of some curious phenomena which have recently occurred in his vicinity. They took place in sinking the shaft of a lead mine. The shaft had been sunk 96 feet, and a drift, located about 16 feet above the bottom of the shaft, had been driven about 40 feet. At the time the work was going on, nothing unusual was experienced; but a short while after, the temperature of that portion of the drift situated about two thirds the distance from its opening into the shaft, along a space of 15 feet, began to augment. It finally rose to 102° Fah., while the temperature at the mouth of the drift and in the body of the mine remained at 60°. The miners, on attempting to cut another drift through that portion of the earth which thus increased in temperature, at right angles to the former, were compelled to stop work on account of the oppressive heat. "In one minute's time after entering the warm space, a person will sweat freely. No bad effects are felt, the lamps burning as freely as on top, and the air being good. In the heated portion of the drift, its walls are covered in spots with a substance in appearance like mold from dampness. It proves, on closer examination, to be a greasy or waxy substance, which at a lower temperature becomes as solid as clay, and resembles tallow and beeswax mixed together. It dissolves readily in water, and dyes cloth yellow."

At the time of receiving the specimens which accompanied the letter, they were quite hard, though friable, and appeared like a hardened, unctuous, greenish-yellow clay. It was evident, from the fact that a change had taken place after the earth in the drift had been exposed to the atmosphere, that we ought to find the results of this change by an analysis of the substance, and thence be able to infer the original bodies out of which it had been formed. It proved to consist of: Silica and clay, 9·499; sesquioxide of iron, 25·170; protoxide of iron, 0·438; sulphuric acid, 31·640; water, 33·030. Total, 99,777, which were probably combined as: Silica and clay, 9·499; protosulphate of iron, 0·918; hydrated persulphate of iron, 72·960; hydrated sesquioxide of iron, 5·880; water, 10·520. Total, 99·777.

These analyses reveal, in a very striking manner, the cause of the remarkable liberation of heat. A large amount of pyrites has existed finely disseminated throughout the earth. On exposure to air and moisture, it has absorbed both with great rapidity. We have no determination at hand, giving the number of thermal units equivalent to the oxidation of one pound of iron pyrites, and the subsequent conversion of the protoxide and sesquioxide of iron into hydrated sulphates; but it must be a large number, as shown by the great elevation of temperature. Although we are not aware of such a phenomenon as this having occurred in sinking a shaft in lead mining, yet similar occurrences are common in coal mines, and have produced many serious accidents. In the great piles of "slack" heaped up around the mouths of the pits of the Lehigh & Wilkesbarre Coal Company, many small pieces of sulphur can be found, produced by sublimation from the decomposing pyrites. It is said that on sinking a pail of water into one of these slack heaps, the water may be made to boil, and cook an egg. The heat thus developed, operating upon the finely divided carbon of pyritous bituminous shales, may at times reach to the hight of rapid combustion.

The subject is one full of interest, and of high importance, as affording one explanation of volcanic action, and of the occurrence of sulphur deposits in connection with these phenomena. It is stated by Lyell that, when moistened iron filings and sulphur are buried in the ground, in the course of a few hours the temperature rises, the ground is swollen by expansion, and finally flames arise, or there is an explosion. By the hypothesis of similar chemical actions on a great scale, certain geologists have endeavored to account for all earthquake and volcanic disturbances. A. R. L.

WE are gratified by receiving a large number of letters, from subscribers to the SCIENTIFIC AMERICAN, approving of the folding, cutting, and pasting of the paper. These features add to the expense of publication; but we believe that our old patrons will influence enough new subscribers to compensate for the extra cost.

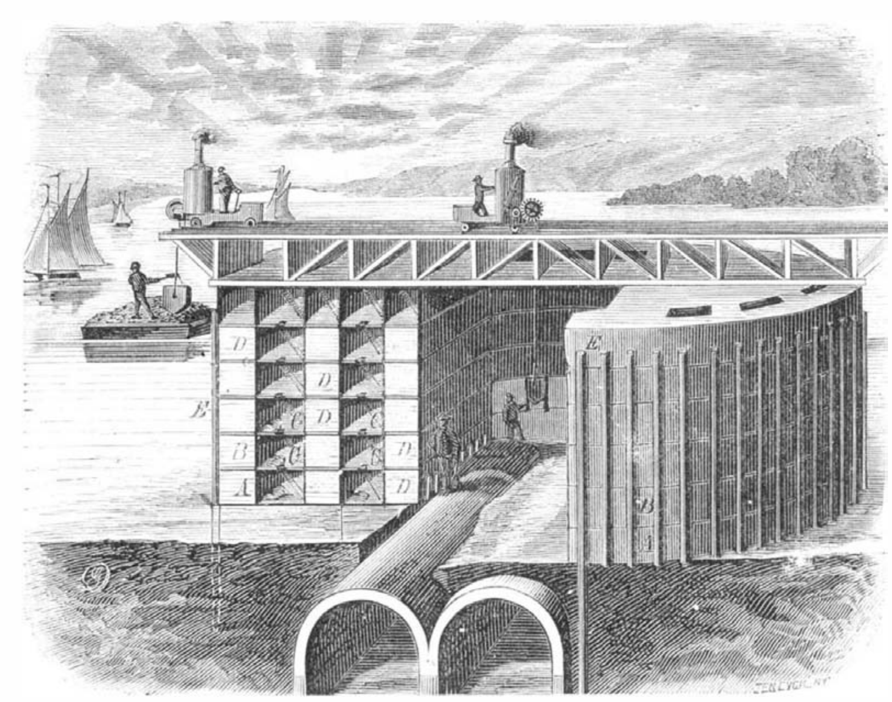
THE consumption of coal per train mile on the London and South Western Railway shows an average of only 28·0 pounds, against fully 45 pounds on the eight other principal British lines.

NOVEL PLAN FOR BUILDING SUBMARINE STRUCTURES.

Mr. Jerome Wenmaekers, a Belgian engineer, is the inventor of a new plan for the construction of quays, tunnels, and similar submarine structures, which appears to us to present many meritorious and valuable advantages. The invention has been patented September 8, 1874, through the Scientific American Patent Agency; and from Mr. Wenmaeker's drawings, we have prepared the annexed engraving, which will render the proposed construction readily understood.

A number of caissons are built either in segment or in circular form, but providing for a large opening or shaft in the center when several are superposed. The material is iron, with iron partitions, some of the subdivisions formed by the latter being used to hold ballast, while others are employed for machinery, storage, etc. Each caisson, after being built, is slung to a strong arched structure which extends between two boats, and is thus transported to the place at which the submarine excavation, for a tunnel, for example, is to be begun, or rather to meet a short commencement of the tunnel which is run from the shore in the ordinary manner.

The ballast compartments of the first caisson, A, whether it be composed of several segments or one piece—are loaded, and the tier lowered a short distance below the water surface. Then a second caisson, B, is brought up, placed on top of the first, the whole is allowed to become submerged, and a third tier is added, and so the work progresses until a huge coffer dam is formed, rubber joints at the sections of which render it thoroughly watertight. By opening suitable valves, water is admitted to the ballast compartments, C, and also to water chambers, D, pumping engines being used for the purpose if needed. By this means it is claimed that a resistance is imparted to the entire structure sufficient to insure its standing against storms or heavy currents.


WENMAEKER'S SUBMARINE BUILDING.

For the purpose of preventing the washing off of the bed of the body of water below the dam, a double series of piles, E, guided in staples, is driven around the circumference. The water in the center of the structure is then pumped out, and the earth is excavated in the space exposed. After a quay or tunnel section equal to the inner length of the dam is completed, the water is pumped out of the compartments, the piles are drawn, and the whole structure, which then floats, is towed to another point, where the work is continued in connection with that already done.

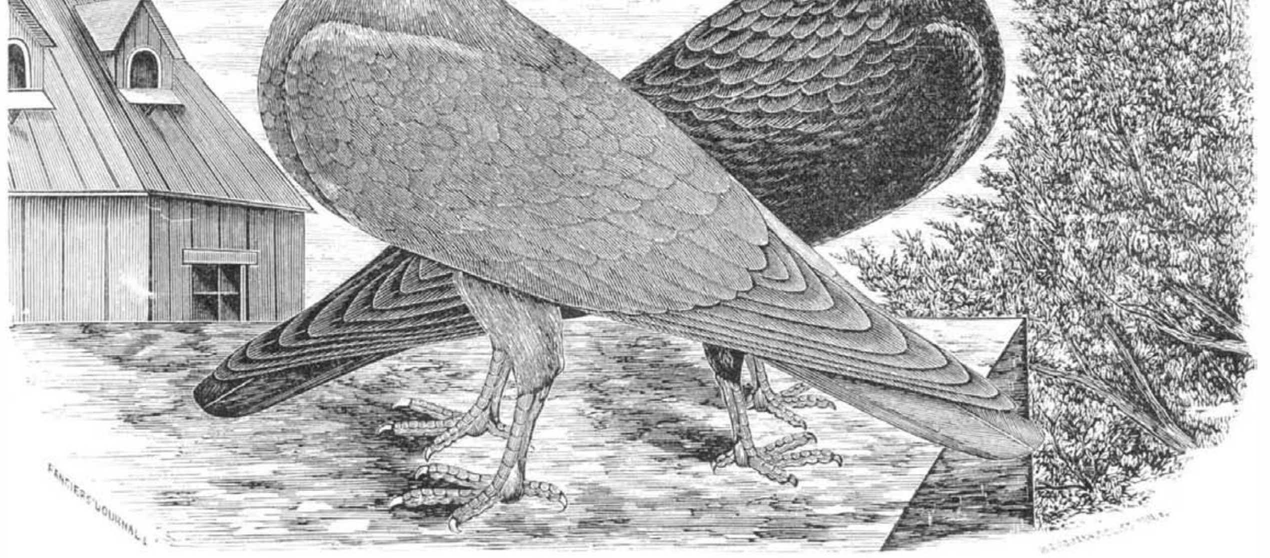
The building of quays is accomplished by not completing the circle of the dam, but leaving an open space which is filled by the masonry, so that the structure keeps moving further into the water as additional length is given to the quay. The invention does not apparently involve so great an expense as many systems which have been devised for similar purposes, while it has the important advantage of capability of being repeatedly used, as the sections maintain their entirety and are not difficult to transport wherever needed.

CARRIER PIGEONS.

The large numbers of carrier pigeons used during the Franco-Prussian war, for the transmission of despatches, and their more recent proposed employment for carrying messages during a transatlantic balloon voyage, have been the means of exciting a wider public interest in in these curious birds than has existed for many years past. In Holland and France, the breed is carefully guarded, and in all the European countries fine specimens of the birds find ready buyers. Prussia has a pigeon communication between her capital city and the fortresses of Metz and Strasbourg. In Paris many of the daily journals receive news of events transpiring in the Legislative Assembly, at Versailles, through the carrier pigeons, in preference to using the telegraph. The birds traverse the distance in from fifteen to twenty minutes, and the intelligence thus reaches the newspaper offices much more quickly than would be the case were the despatches obliged to wait their turn for transmission by the telegraph operators, or otherwise delayed by official formalities.

The long employment of the pigeons as news carriers has been the means of proving conclusively that no instinct guides them back to their cotes. On foggy days they will not attempt to return, nor during the night, except at times when there is a clear atmosphere and a full moon. When released, the bird flies upward and then circles around until it sees certain features of the landscape which it recognizes as being adjacent to its home. These it has learned to know during short flights which it is allowed to make during the training period; and therefore the instant the surroundings of its abode, often extending over a radius of several miles, meet the pigeon's eye, it at once travels with wonderful velocity in their direction. It is said that, when a bird fails to remember any portion of the landscape beneath it, it will fly for some miles without any reference to course, and then circle about again, and this will be repeated until a familiar object is caught sight of; or else the bird becomes exhausted, gives up the search, and never returns.

The accompanying engraving, from the *Fancier's Journal* (a most excellent paper of its class, published in Philadelphia), represents a pair of carrier pigeons, imported from England by Mr. John Yewdall, of the latter city, at a cost of $225. They are probably the finest birds in the country. Fine pigeons like these, are able to travel about 36 miles per hour.


CARRIER PIGEONS.

Telegraphic Cables.

It is evident that a new invention, in connection with the manufacturing of telegraph cables, is needed, and a good opportunity for the exercise of ingenuity in this line now exists. *Engineering* says that portions of a cable laid in 1860, between France and Algiers, were dredged up in 1871 in 400 fathoms off Minorca, and the outer covering of steel and hemp, similar to the Atlantic cable, found to be completely destroyed, so that the piece would only bear a few fathoms of its own weight. This was on a soft muddy bottom. The Falmouth and Gibraltar, laid in 1870 and repaired this year, was found chafed through at a depth of 1,000 fathoms. The Direct Spanish cable failed suddenly in the Bay of Biscay, and was found for a mile to be swallowed up in the ground in a depth of 1,300 fathoms, as if by volcanic action, the bottom being stiff blue clay.

If there is any part of the Atlantic crossed by the Atlantic cables having the same species of bottom as that where the Algiers cable of 1860 was dredged up, there would be a certainty of the cable decaying to such an extent that, if lying also over a ridge, it would eventually break. Nor does it seem so entirely improbable that volcanic action or movements of the ground, similar to that which undoubtedly occurred in the Bay of Biscay and also in the Persian Gulf, may occur on some portions of the route. The question of the *teredo* also arises. Cables in the Mediterranean have been found attacked by these insects at great depths; but in these cases probably from the cables thus examined not having been submerged long enough, the boring was only slightly into the surface. In shallow water, cables have been found with holes bored through the gutta percha down to the copper wire, thus entirely destroying the insulation.

Thus a piece of cable laid in Kurrachee harbor was found bored down to the copper, the insect having got in in places where the outer protecting wires were a little open; more recently, too, the cables in the Irish Channel have been found attacked. Two wires in the Dublin and Holyhead cable, laid in 1871, have just been found thus injured, and are rendered useless. This cable has each of its outer sheathing wires covered with a coating of tape, and thus the actual iron wires do not touch each other, so that the insect is able to pass between them. The Atlantic pattern of cable is still more open to the attack of the insect, as the outer steel wires, being each covered with a thick coating of Manilla hemp, are separated from one another by more than their own diameter. We have no experience yet of this insect having attacked an Atlantic cable; and should this ever occur, the pattern of all future Atlantic cables will have to be entirely revised. The pattern of the cables used on the principal lines in the Mediterranean and on the Direct Spanish, where the steel wires touch each other, would be a much safer one in localities where the attacks of this insect are to be feared.

But should the danger be found to extend to the Atlantic, it is doubtful whether the insulation of such important lines should depend even on the certainty of the outer wires touching one another throughout. In the case of the Wexford cable, where the outer covering consisted of iron wires, supposed to touch throughout, the insect has found out places where they are a little open, and has thus been enabled to insinuate itself, destroying the insulation by boring through the gutta percha. It is evident that, in these localities, at least a more certain protector than the iron wires is required. Some four years ago, Mr. F. C. Webb devised the application of a thin steel armor to the insulated wire, but it has never yet received any practical application. Something of this sort must, however, be adopted wherever the attacks of the *teredo* have to be resisted.

Wet Boots.

What an amount of discomfort wet boots entail, and how well we all recall the painful efforts we have now and then made to draw on a pair of hard-baked ones which were put by the fire overnight to dry! Once on, they are a sort of modern stocks, destructive of all comfort, and entirely demoralizing to the temper. The following plan, it is said, will do away with this discomfort:

When the boots are taken off, fill them quite full with dry oats. This grain has a great fondness for damp, and will rapidly absorb the least vestige of it from the wet leather. As it quickly and completely takes up the moisture, it swells and fills the boot with a tightly fitting last, keeping its form good, and drying the leather without hardening it. In the morning, shake out the oats and hang them in a bag near the fire to dry, ready for the next wet night; draw on the boots, and go happily and comfortably about the day's work.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

In London the Underground Railway system has been in operation for eleven years, and so great has been its success, so fully does it meet the requirements of the population, that every year adds to its extension. Opened in 1863 with a section of 4½ miles, from Bishop's Road to Farringdon street, it has been constantly extended, until now it has a length of about 13 miles; while new extensions, costing some twelve millions of dollars, are this year in progress of construction. Many millions of passengers are annually conveyed over these underground tracks, which extend beneath the streets in all directions, uniting the principal centers of trade, intersecting all the great railway lines, and, by their marvelous capacity for traffic, facilitating the enormous transactions of daily business, for which London is so renowned.

It is gratifying to know that this system, so thoroughly tried by long experience, so certain and fruitful in promoting municipal life and prosperity, is about to be inaugurated here in New York. For many years it has been urgently needed, but it is only within a very recent period that the construction was actually begun. The Underground Railway in New York is projected to run from the Harlem river, on the north, down through the heart of the city, under Fourth avenue and Broadway, to the Battery, 8¾ miles. It will, in course of time, naturally have other extensions, among the most obvious of which are tunnels under the North and East rivers, to Jersey City and Brooklyn.

Before entering upon the details of this new railway, we would call the attention of our readers to the remarkably advantageous natural position of New York city, for the purposes of business and commerce, and to the location of some of the other great and interesting engineering works besides the Underground Railway, which are now going on in our midst. Referring to the diagram, Fig. 1, it will be seen that New York city occupies a narrow tongue of land, surrounded on both sides by deep rivers, with illimitable dock room, and a magnificent land-locked bay, more than sufficient to accommodate the commerce of the world. At the Narrows, the gateway to the Lower Bay and the ocean, some of the most massive fortifications are in progress, and the shores on either side, for long distances, bristle with lines of fifteen inch cannon in readiness for defence. The bay and ocean prospects from the hights at the Narrows are superb, and are not surpassed even by the far-famed views of the Bay of Naples. At the left stand the shores of New Jersey, where the Erie, the Pennsylvania, the New Jersey Central, and other great railways from the North, South, and West concentrate. The traffic is at present all conveyed over the river by ferry boats. The freight cars are run upon the decks of great barges, and towed across by tugs, a most convenient, quick, and economical method.

The new docks, which are to surround the water fronts of New York, are now in course of construction, and embrace engineering works of great magnitude. The docks are to consist of iron, granite, and artificial stone, and will involve expenses to the amount of a hundred millions or more of dollars.

On the right is seen the position of the great suspension bridge between Brooklyn and New York, built at the joint expense of the two cities, and expected to cost from fifteen to twenty millions of dollars. This will be the largest suspension bridge in the world, the clear span between the towers being 1,600 feet. The towers are now approaching completion

Further up the East River, the Hell Gate Rocks are specified. Here it is that the important work of tunneling the bed of the East river is now going on, for the purpose of removing its rocky bottom, which impedes navigation. The general plan of the work is to honeycomb the rocks with tunnels, then fill them with nitro-glycerin and explode the mass, thus deepening the river. This work, costing an immense sum, has been in progress for three years past, but no time has been fixed for the grand final explosion. Still further north runs the Harlem river, over which various fine bridges, and underneath its bottom various tunnels, at the extremities of our city avenues, are soon to be constructed, to accommodate the wants of a fast-increasing population.

In the middle of the city lies Central Park, which, with its lands, roads, and architectural structures, has, so far, cost the city over eight millions of dollars. Along the banks of the North River, above the Central Park, but communicating therewith by noble drives and avenues, new parks have been laid out, in addition to which there are over thirty miles of pleasure roads and avenues, Museums of Art, of Natural History, Zöological Gardens, and other public establishments, projected and in progress. Taken altogether, there are few places where so many important improvements are going on as in New York, and there can be no question but that in due time it will become one of the most attractive cities in the world.

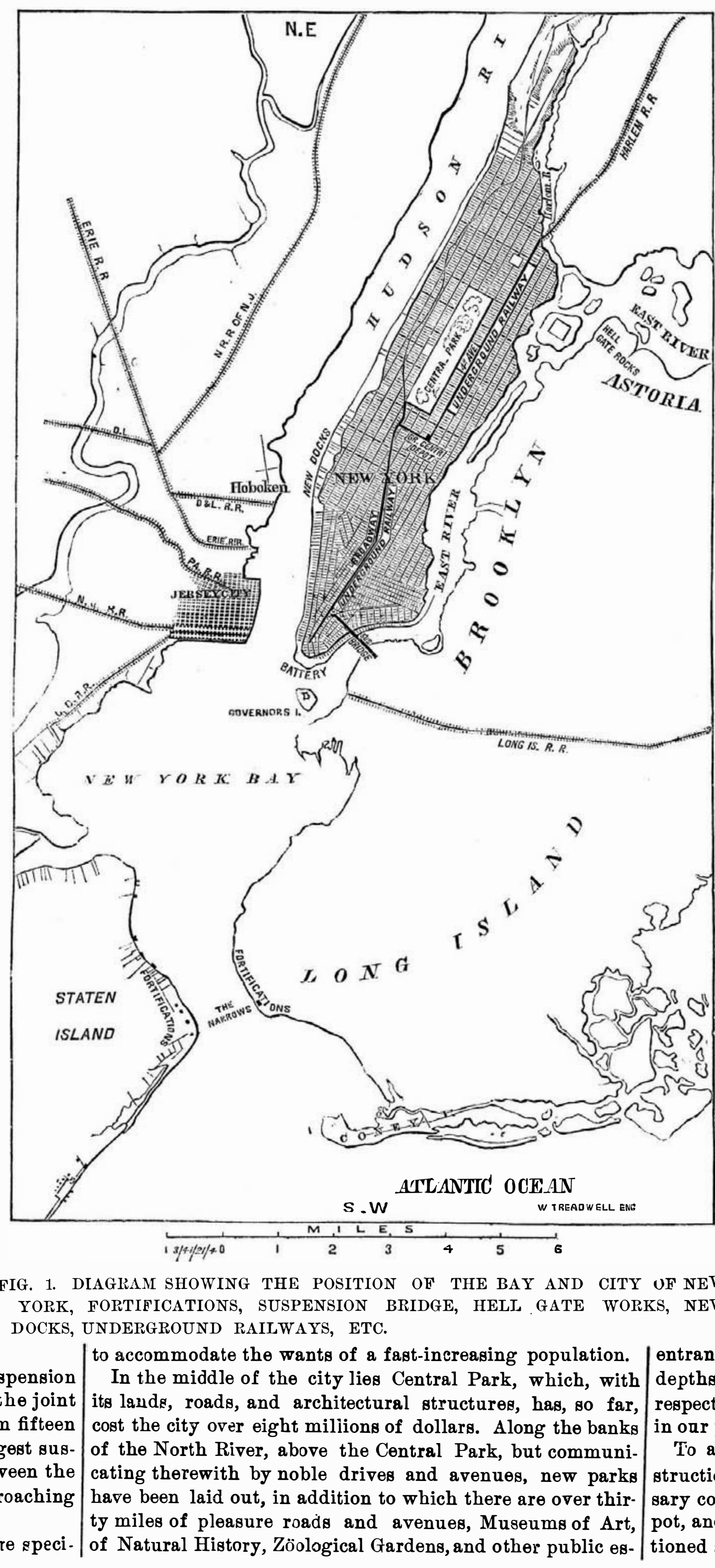


FIG. 1. DIAGRAM SHOWING THE POSITION OF THE BAY AND CITY OF NEW YORK, FORTIFICATIONS, SUSPENSION BRIDGE, HELL GATE WORKS, NEW DOCKS, UNDERGROUND RAILWAYS, ETC.

Turn we now to a consideration of one of our latest and best city improvements—the underground railway system, the objective of which is the Grand Central Depot, which is located at the junction of 42d street and Fourth avenue. This is the great railway center of the city. Here terminate or begin the tracks of the New York Central and Hudson River Railways, which, with their connections, reach to the far South and West, extending even to the shores of the Pacific Ocean, and receiving direct tribute from all parts of the country, save the immediate Southern seaboard regions. Here also center the tracks of the Harlem Railway, which reach northerly to Canada, and of the New York, New Haven, and Hartford Railway, extending easterly to Boston, Maine, New Brunswick, and Northeast Canada.

The Grand Central Depot building is an immense structure, the largest of the kind in this country. Its length is 690 feet, breadth 240 feet, hight from railway grade to center of glass roof, 109 feet 7 inches. This depot, together with the adjoining car sheds, engine houses, freight depots, and coal yards, covers an area, in round numbers, of 830,900 square feet, or a little over nineteen acres.

The existing northerly section of underground railway extends from the entrance of the Grand Central Depot, on 45th street, northerly, under the surface of Fourth avenue, to the Harlem river, at 133d street, a distance of 4¼ miles, where the track rises to and crosses a fine railway bridge over that stream. This portion is now almost finished, and is expected to be opened for traffic in January. The southerly portion, known as the Broadway Underground Railway, from the Grand Central Depot to the Battery, was finally authorized by the Legislature, in May, 1874, and will be pushed as soon as the financial requisites, now in progress, are settled.

The northerly portion has been built by the Harlem Railway Company, under the supervision of a State engineer commission, consisting of Alfred W. Craven, C.E., Allan Campbell, C. E., the Engineer of the Department of Public Works, and the Engineer of the New York and Harlem Railway. The commission appointed to supervise the construction of the southerly portion, under Broadway, consists of George S. Green, C.E., Allan Campbell, C. E., and James P. Kirkwood, C. E. On the completion of these two sections, the city of New York will possess a magnificent continuous line of fast railway tracks, 8¾ miles long, through its center, over which passenger and freight trains of every class may travel from Harlem to the Battery at the highest speed, and at the cheapest rates, without disturbance of inhabitants.

The Underground Railway commences, as we have stated, at the north front of the Grand Central Depot, and here, for a short distance, the tracks for the accommodation of the cross street traffic are spanned by bridges, the first of which, at 45th street, is placed directly in front of the entrance of the depot. See engraving, Fig. 2. The gradients, depths, character of works, and position of the road bed, in respect to the surface or grade of Fourth avenue, are given in our profile diagram, Fig. 3.

To a very great extent, the work now in course of construction, on Fourth avenue, must be regarded as the necessary consequence of the building of the Grand Central Depot, and the centering of the great railways we have mentioned at one terminus. The authority for the work was

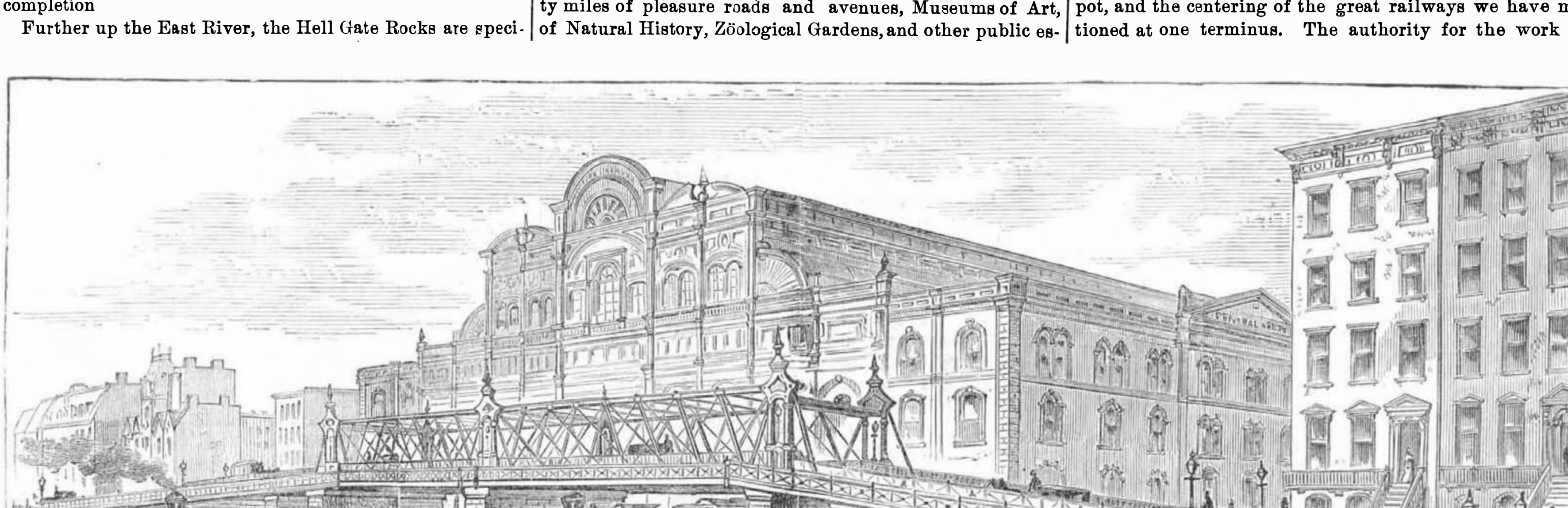


Fig. 2.—THE UNDERGROUND RAILWAY IN NEW YORK, THE FIRST BRIDGE AND GRAND CENTRAL DEPOT, 45TH STREET.

passed by the State Legislature on the 14th of May, 1872. By the provisions of the act, the New York and Harlem Railway Company is directed to construct open cuts, bridges, tunnels, and a viaduct, at certain specified places, to lay temporary tracks, and alter the grade of the cross streets wherever necessary; the gas, water, and sewer pipes are ordered to be removed by the corporations owning them, and the Mayor and Aldermen of the city forbidden to obstruct, and authorized to adopt and facilitate, the work; the total expense of which is to be borne in equal proportions by the city and the railway company; that sustained by the city to be raised by a tax on real and personal property. A Board of Engineers was also created, who should have entire control and charge of the work, receiving, in return for their services, $8 for every day employed. In accordance with the requirements of the act, a Board of Engineers was appointed consisting of Alfred W. Craven, Allan Campbell, the Engineer of the Department of Public Works, Edward H. Tracy, and the Engineer of the Harlem Railway Company, the late Isaac C. Buckhout.

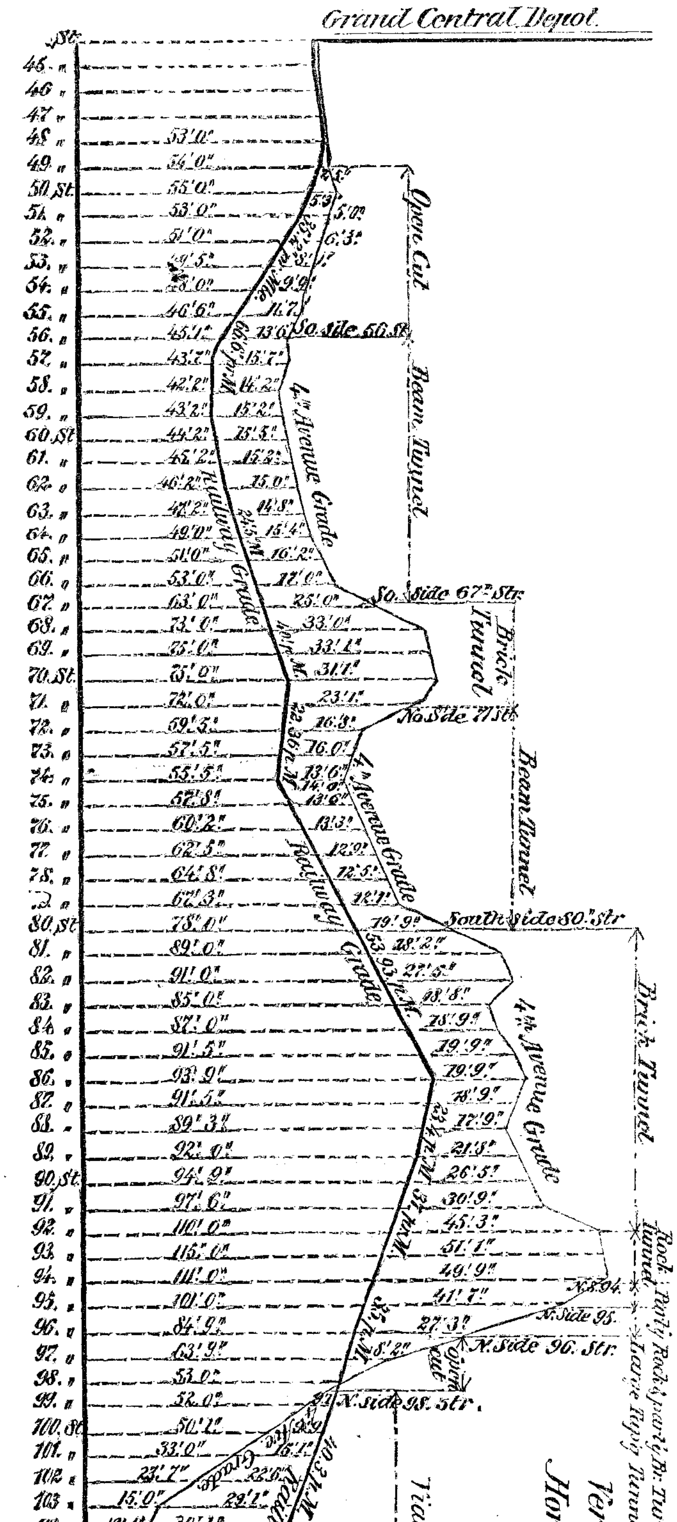


Fig. 3.—THE UNDERGROUND RAILWAY IN NEW YORK. PROFILE OF THE SECTION FROM 45TH STREET TO HARLEM RIVER. DISTANCE 4 1-4 MILES.

Estimates, plans, and specifications were prepared and bids opened for the work in the same year. Of all the bids offered, that of Messrs. Dillon, Clyde & Co. was selected, this firm contracting to do the work in the manner required for the sum of $6,395,070, or $285 per running foot, which was proportioned as follows:

Earth excavation and embankment	$579,000
Rock excavation in open cut	701,000
" " " tunnels	255,000
Retaining walls	1,013,000
Parapet walls	100,000
Foundation walls	238,400
Granite coping	134,700
Plank used in foundation	70,000
Piling used in foundation	182,200
Concrete	23,800
Removal of sewer, water, and gas pipe	300,200
Drain pipe	6,800
Ballasting	57,000
Brickwork in arches, etc	708,500
Blue stone	34,300
Bridge from 79th street, exclusive of parapet, coping, excavation, and drain pipe	334,100
Iron bridges and approaches	388,000
Wrought iron	498,500
Cast iron	23,500
Iron railing	79,200
Felting	36,500
Temporary track	50,000
10 per cent for contingencies	581,370
Total	$6,395,070

Late in the fall of 1872, ground was broken and the work commenced by the contractors and their sub-contractors, under the supervision of the Board of Engineers already mentioned, with Mr. I. C. Buckhout, of the Harlem Railway Company, as Superintending Engineer, Mr. W. L Dearborn, C.E., as Resident Engineer, Mr. F. S. Curtis, C. E., Principal Assistant, and a corps of four Division Assistants, Messrs. Geo. S. Baxter, C E., S. F. Dayo, C.E., Savene Lee, C. E., and Milford Berrian, C.E. The names of the sub-contractors will be mentioned in connection with the work done by them.

We will briefly give the general plan of the work, and then pass to a detailed description of its parts, premising that, for the drawings which we publish and for much valuable information, we are indebted to the courtesy of Mr. F. S. Curtis, the principal assistant resident engineer, and to Mr. Horan, the chief of the drafting department.

In plan, the work consists of a four track railway, reaching from 42d street to the Harlem river, a distance of four and a quarter miles, and, with the exception of that portion passing over the viaduct on the Harlem flats, everywhere sunken below the level of the street, and covered in with tunneling over as large a part of the distance as the grade of the road and the grade of the avenue will admit. On that portion of the line which is covered with tunnels, three kinds of tunneling have been used, depending upon the character of the ground and the difference between road grade and avenue grade. Thus wherever sufficient headway could be obtained, arched brick tunnels are used; wherever the headway was too small to admit of an arched tunnel, a flat top beam tunnel is used; and where the headway was too small to permit the use of the beam tunnel, open cuts, spanned at the street crossings by iron plate girder bridges, sixty feet in width, were of necessity resorted to. The third kind of tunnel referred to is the rock tunnel at 92d street. The reason for the use of these three kinds of tunneling will, perhaps, appear more evident by a glance at the accompanying profile, Fig. 3, which, being so greatly reduced, will throw into bold relief the various grades used on the railroad and the avenue, and the difference between them, and will afford a good idea of the various species of work involved. It will there be noticed that the grade of the road begins to fall gradually from 45th to 48th streets, and that from this point to 57th street it increases rapidly, falling in this space 25 feet, 66·6 feet in the mile, which is the heaviest grade on the road. From 57th to 59th streets the grade runs level, then rises to 70th street through a hight of 15 feet and 9 inches, is again level to 71st street, falls between 71st and 73d streets 2 feet 4 inches, or 22·36 feet in the mile; is once more level to 74th street; rises 32·5 feet, or 53 9 in the mile, to 86th street, at which point begins the long descending grade which crosses the viaduct and extends to 129th street, falling in the distance 69·8 feet, after which begins the up grade, which reaches the street level at 133d street and Harlem Bridge.

At 56th street the railway grade is 13·6 feet below avenue grade; and at this point, the headway not being sufficient for an arched brick tunnel, a beam tunnel commences and extends to point 24 feet 9½ inches south of the south side of 67th street. Here the railway is 25 feet below the street; and the ground rising rapidly, a headway is obtained sufficient for an arched tunnel, which extends to a point 29 feet 2 inches north of the north side of 71st street, where the beam tunnels again begin and reach to 27 feet 7½ inches south of the south side of 80th street, where the ground commences to rise rapidly and the brick tunnels once more appear, ending at the beginning of the rock tunnel at 92d street. This tunnel is about 550 feet long and is followed by the partly rock and partly brick tunnels, which end at a point 31 feet 6 inches north of the north side of 95th street, and from this point to north side of 96th street extends a tapering tunnel formed by three tunnels passing into one. At 96th street the difference of grade is about 27 feet; and from this point, the land falls so rapidly to the Harlem flats that at 97th street the difference of grades is but 8 feet 2 inches, and consequently from this point to 98th street extends an open cut, ending at the south end of the viaduct, which reaches thence to the middle of the block between 115th and 116th streets, or a little over 717 feet short of a mile. [We shall continue the subject in our next and future numbers with various illustrations of the works.]

Correspondence.

The Crystalization of Carbon.

To the Editor of the Scientific American:

You refer, on page 247 of your current volume, to a new idea of making artificial diamonds by crystalizing carbon. It strikes me that the almost constant co-occurrence of native platinum or gold with diamonds is not merely fortuitous, and these metals may have something to do with the crystalization of carbon. It is a sufficiently proved fact that, at very high temperatures, chemical affinity is much modified, and perhaps disappears; the same modification may be a result of high pressure. Undoubtedly, in former geological ages, the atmospheric pressure was much higher than it is now, as is proved by the fact that liquid carbonic acid is enclosed in rock crystals. But a great pressure is also produced by a high column of water; and this may be one of the circumstances under which carbon is now crystalizing in the form of diamonds.

Let some one try a series of experiments, in which chloride of platinum, Pt Cl_2, or gold may act under the highest possible pressure on a suitable hydrocarburet (containing a maximum of carbon and a minimum of hydrogen), and see if such a decomposition as the following is possible:

$$2C_n\ H_m + mPt\ Cl_2 = 2mH\ Cl + mPt + 2nC,$$

in being greater than m, whereby Pt would fall down as a regulus, and C would crystalize as diamond.

If this be Nature's process of forming diamonds, the muriatic acid is of course washed away and deposited elsewhere in muriates; while the native metal and the diamonds are retained in the place of formation or carried along by the mechanical action of water. The highest pressure may be obtained by compressing water at a temperature of over 39·2° Fah., if only a material can be found for a vessel that can endure this pressure. It being desirable that the walls of the vessel are translucent, perhaps rock crystal or fluorspar could be used. But as the hydrocarburet is lighter than water, some means must be found to hold it, close to the bottom of the vessel (perhaps by means of a bladder, through which exosmosis takes place), in contact with the solution of chloride of platinum. Perhaps some liquid other than water may be desirable; but it must be lighter than the hydrocarburet, and not affect either the latter or the solution of platinum.

There is another series of experiments: It is generally known that air dissolved in water contains more oxygen than atmospheric air. Now, ozone is a modification of oxygen, produced, probably, by a denser formation of the atoms. The oxygen of the air in the water is probably turned into ozone by a high pressure, which would decompose the hydrocarburet by taking away the hydrogen and leaving the carbon, which would crystalize in the liquid. This process may have taken place where no platinum is found associated with diamonds. According to my opinion, it is worth trying whether one of these processes, or perhaps both combined, will have the result, so long sought for, of crystalizing carbon before our eyes.

W. THIESE.

Rochester, N. Y.

Professor Tyndall and the Buddhist Philosopher.

To the Editor of the Scientific American:

In your issue of October 3, page 208 of your current volume, under the caption "Candle Flames and Streaks of Cloud," you quote the Buddhist philosopher: "It cannot be said that he (Buddha) is here or there; but we can point him out by the discourses he delivered. In these, he lives;" and you add: "Science has no further word to offer."

Both the ancient philosopher and the modern professor have erred in making the destiny of man analogous to the transmutation of the correlated forces, heat, light, elec tricity, motion. There is another law which Science cannot disregard. Life, whether vegetable or animal, does not necessarily become "extinguished as the flame." It becomes latent in the seed. It is there ready to resume its normal law of growth whenever the proper conditions are presented. It would be in accordance with strict deduction, from observed facts in the vegetable, to expect that the animal also, when planted, would return to its renewed form. This expectation is constantly disappointed as to the lower animals and generally as to man. But another series of facts must be also weighed by Science. A large part of our race has always expected a continued existence; and this expectation has been confirmed by human testimony to the rising from the dead of a certain Man who also raised others from the dead; and after thus proving his right to know, He declared that all others would eventually be raised to life again, having been planted (as it were) in the ground. Science must of necessity inquire: 1. Whether the facts of this resurrection and this assertion of a competent witness are duly proved according to the rules of evidence. 2. Whether the statement that growth may be resumed, after cessation for a great length of time, accords with this law of latency as found in plants. Science cannot concern with this as a matter of faith; but it cannot disregard facts duly proved by credible and competent witnesses. Taking up the subject in this line of hard logic, we believe it is to be shown beyond reasonable doubt that the destiny of man is not to melt into the "infinite azure," nor "to be extinguished as the flame," but to live again and to participate again in the affairs of this world. The mode of his return to life and the manner in which he will participate in the future world's affairs are not subjects for discussion here. A belief in the resurrection of a material and organized body leads one very far from the orthodoxy of the churches; but it brings the ascertained facts of Science and the literal words of Scripture into an harmony that does not seem to have been suspected by the scientists or the doctrinaires. E. X.

Lunar Acceleration.

To the Editor of the Scientific American:

There are good reasons why astronomers do not accept the theory of the above named phenomenon, published by your correspondent, Mr. John Hepburn, on page 260 of your current volume.

It has not yet been demonstrated that the sun's orbit is anything like a circle or an ellipse; but there is every reason to believe that his orbit is of a more complicated character, that it is without any period, and is not confined to any one plane. It is believed, also, that his motion is comparatively so slow that the change of direction of his course in 25,800 years amounts only to a small fraction of a degree. Unless your correspondent can prove the fallacy of our fundamental theories of dynamics, he dare not maintain that the sun is rotating in a circular orbit without a central body whose attraction is many times greater than the resultant of all attractions from the rest of the so called fixed stars. Without the sun's orbit be in the ecliptic, and of a circular or elliptic form, it is as absurd to speak of a retrograde motion as it is to speak of an above and below, of a before and behind, of a right or left hand side of the Universe.

There is no doubt but the travel of the terrestrial poles and the precession of the equinoxes have a common cause. If we depict the travel of either pole, as observed on a stellar globe, we find that for any one time both poles occupy directly opposite positions, and that the phenomenon can be produced by no other motion than a gyration of the earth's axis, of which the precession of the equinoxes is a necessary sequence. This being an established fact, I am unable to see what the alleged retrograde motion of the sun has to do with the explanation.

The period for a complete revolution of the recession of the eclipses is somewhat less than 19 years, and that of the precession of the equinoxes about 25,800 years, which is apparently not quite the same rate, as your correspondent states. Evidently the two phenomena have not a common cause, though they are results of the same principle, and have long ago been satisfactorily explained and experimentally demonstrated by the gyroscope.

Your correspondent subsequently takes refuge in a hypothetical and rather exorbitant increase of the motion of the sun, which no astronomer can take for granted on this ground only. Next he confounds increased with increasing motion. A rotation that makes 31° for 30°, 62° for 60°, and 93° for 90° is simply increased, not accelerated, as it would be if it would make 31° for 30°, 64° for 60°, 99° for 90°, according to the laws of accelerated motion. Lastly, he commits the mistake of referring the angle he found to the diurnal, instead of the annual, rotation of the earth. If he makes his calculations in accordance with the laws of dynamics, he will find no agreement whatever between his theory and the observations of astronomers.

I am afraid that the question is still open.

Philadelphia, Pa. HUGO BILGRAM.

The Potato Bug.

To the Editor of the Scientific American:

Several paragraphs in relation to the potato fly (*cantharis vittata*) have appeared in the SCIENTIFIC AMERICAN, and are now going the rounds of the press. It is strange that an insect well known to the medical profession for the last nineteen years, and which but twenty years ago amounted, in extensive districts of this country, to almost a scourge, should now have become so great a stranger. Under the head of "Potato Flies," the United States Dispensatory says (I quote from the ninth edition, page 171):

"Within the limits of the United States are several species of *cantharis*, which have been employed as substitutes for the *c. vesicatoria*, and found to be equally efficient. Of these, only the *c. vittata* has been adopted as officinal. * *

* The potato fly is rather smaller than the *c. vesicatoria*, which it resembles in shape. Its length is about six lines. The head is of a light red color, with dark spots upon the top; the feelers are black; the elytra or wing cases are black, with a yellow longitudinal stripe in the center, and with a yellow margin; the thorax is also black, with three yellow lines; and the abdomen and legs, which have the same color, are covered with a cinereous down. It inhabits chiefly the potato plant, and makes its appearance about the end of July or the beginning of August, in some seasons in great abundance. It is found on the plant in the morning and evening, but during the heat of the day descends into the soil. The insects are collected by shaking them from the plant into hot water, and are afterwards carefully dried in the sun. They are natives of the Middle and Southern States. * * If the potato fly has been found more speedy in its effects than the *cantharis* of Spain, the result is, perhaps, attributable to the greater freshness of the former. It may be applied to the same purposes, treated in the same manner, and given in the same doses as the foreign insect."

Black River Falls, Wis. E. S. WICKLIN.

Aniline Black Dyes.

To the Editor of the Scientific American:

Of late years the importance of aniline black to calico printers and dyers has steadily increased, and I think it may be of some interest to your readers, among whom you must have many printers of fabrics, to know something of the best methods of printing it and the *rationale* of the process.

Aniline black is produced upon cloth by the application of a mixture of a salt of aniline with a chlorate (usually chlorate of potassa) and generally a little sulphide of copper. Now the great causes of trouble in the process are the following:

I. Injury to the doctors (scrapers) and rollers by crystals of chlorate of potash.

II. Weakening of the cloth by the action of the acid.

III. The great difficulty of getting a steam color.

The first of these difficulties is avoided by the French printers by using chlorate of baryta instead of potassa, and in England by the use (in some works) of chlorate of soda, a very much more soluble chlorate than that of potassa, and one which can be procured perhaps as cheaply. The two last difficulties are insurmountable or nearly so, and it has been proposed to use an acetate of aniline instead of the chlorhydrate; but I have found by experiment that acetanilide is formed, which gives no black color with oxidizers.

By carefully aging in very damp rooms, the second difficulty may be surmounted; but the third, the production of a sufficiently cheap aniline black to steam without tendering the cloth is not yet a solved question. M. B. C. G.

Boston, Mass.

Cribbing in Horses.

To the Editor of the Scientific American:

Noticing an article and illustration in your valuable paper sometime ago, on the subject of cribbing in horses, I send the following plan of eradicating the habit:

Cribbing is caused in the first place by some foreign substance being pressed between the teeth, or by the front teeth growing too close together, thus causing pain. The horse, to avoid this, instinctively pulls at any hard substance, thus spreading the points of the teeth, and by that means affording temporary relief. To remedy this fault, it is only necessary to saw between the teeth with a very thin saw; this relieves the teeth of all side pressure, and effectually ends the trouble. The gulping of wind and the gurgling in the throat are effects that will cease with the removal of the cause.

Elmira, Ohio D. COOK.

Improvement in Gas Retorts.

To the Editor of the Scientific American:

I have a wrinkle to impart to those of the gas fraternity who use clay retorts. It is well known that clay retorts, when first fired up, are very open and porous, causing considerable loss in the yield of gas; and the same thing happens when they become coated with carbon on the inside and have been recently burned out. If those who use such retorts will, when they are new, coat them (both in and outside) with a solution of silicate of soda, of the consistence of ordinary sirup, the difficulty will be entirely removed. It is hardly necessary to add that the coating should be done before setting, and allowed to dry thoroughly.

Frankfort, Ky. M. L. JONES.

[For the Scientific American.]

CRUCIBLES.

The excellence of a crucible depends on the ready expansion and contraction of the ingredients of which it is made. The best crucibles are composed of the following compositions, which are of two kinds, namely, with and without plumbago.

WITHOUT PLUMBAGO.

Three parts by measure of the Stourbridge best crucible clay, two parts cement, consisting of old used-up fire bricks, and one part hard coke. These ingredients must be ground and sifted through a one eighth inch mesh sieve; the sieve must not be finer, otherwise the pot will crack. This composition must be mixed with sufficient clean cold water, trodden with the bare foot to the consistency of stiff dough, and allowed to stand for three or four days well covered with damp cloths, to admit of its sweating and the particles of clay becoming thoroughly matured. It is then ready for use, and must be blocked by hand on a machine. Dr. Ure, in his "Arts and Manufactures," gives drawings and methods of working the machine.

Owing to the coarseness of this composition, the pot cannot well be thrown on the potter's wheel; and in no instance can it be made by pressing.

The crucible must not be burnt in a kiln, but merely highly and thoroughly dried before being placed in the furnace for use. For brass and copper melting, it will stand one good hard day's work; but care must be taken to replace the pot again in the furnace after the metal has been poured. If the pot be not allowed to go cold, it will last for several days. It will, with the greatest safety, stand one melting of wrought iron. The cost, when made on the steel manufacturer's own premises, is about forty cents per pot, each pot holding from 100 to 120 pounds of metal.

HESSIAN CRUCIBLES.

Good Hessian crucibles are composed of two parts of the best German crucible clay and five parts pure fine quartz sand. This composition must be sifted through a one eighth inch mesh sieve; it is then tempered and trodden with the bare foot, as before described. When ready for use, it is pressed into different sizes of crucibles, which, when thoroughly dry, are placed in the kiln or furnace and burnt hard.

ANOTHER COMPOSITION.

Two parts best Stourbridge crucible clay, three parts cement; sift through a one eighth inch sieve. Temper as before described and block by hand on the machine. When thoroughly dry, it is placed in the kiln and burnt hard. These crucibles are principally used for melting gold and silver, and also for dry analysis.

The best and most perfect fire clay for crucible making is nearly always found in the pavement of coal. Some of the Pittsburgh fire clays, and those found to exist in the pavements of some of the Pennsylvania coal mines, are excellent fire clays. But the various compositions cannot be described, as they are as numerous as the different kinds of clays.

WITH PLUMBAGO.

The Birmingham soft tough pot consists of two parts of the best Stourbridge crucible clay, three parts plumbago, and one part cement, consisting of old used-up crucibles ground and sifted through a one eighth inch mesh sieve.

ANOTHER COMPOSITION.

Four parts of the best Stourbridge crucible clay, three parts plumbago, two parts hard coke, and one part cement, consisting of old pots ground and sifted as before. Where old pots cannot be had, the above composition must be burnt hard, ground, and sifted. The scales or chippings of the insides of gas retorts are far superior to the best common hard coke. But where scales and chippings cannot be had, hard coke is the best substitute. All the ingredients of this composition must be sifted through a one eighth inch sieve (but not finer), tempered, and made as before described. When thoroughly dry, it is placed in the kiln and annealed, but not burnt hard. This composition makes a pot (for melting the hardest metal) which cannot be melted at any pitch of heat, nor can it be cracked with the most sudden heating and cooling. It is regularly known to stand fourteen and sixteen meltings of iron, even wrought iron. I have often made it to stand more than that.

Any steel manufacturer can make the pot on his own premises at a cost of $1 20 or thereabouts, the pot holding from 100 to 120 pounds of metal. J. D.

Houston, Texas.

Utilization of Silk Rags.

According to *Les Mondes*, one of the wealthiest English velvet manufacturers, Mr. Lister, worked his way to success by years of patient labor in search of a way to utilize silk rags. He began by buying up all such waste at less than a cent a pound; and up to the year 1864, he had expended the immense sum of $1,312,500 in fruitless efforts to find a process. Nothing daunted, Mr. Lister continued his experiments; and within the past ten years, he has discovered a way of making the refuse into fine velvet. He carries on this industry at Manningham, Eng., in an establishment which employs not merely 4,000 workmen, but 283 travelers in all parts of the globe, whose sole business is to buy the silk waste. The factory is said to have cost nearly $3,000,000.

The practice of patenting imitations of articles of standard excellence is growing in favor at the Patent Office. A patent lately granted is for producing an imitation of Russian sheet iron. This is done by hammering the sheet between anvils and hammers that have indented surfaces, so as to give the sheet a mottled appearance. Another patent is for an imitation Swiss window shade, in which the lace work is imitated by stencils.

JOHN LAIRD, M. P.—The death of Mr. John Laird of Birkenhead, Eng., occurred on the morning of Thursday, October 29. He was the son of William Laird, of Greenock, Scotland, and was educated the Royal Institution, Liverpool. He was well known as an enterprizing and successful ship builder. We shall probably publish a portrait of him next week.

SULPHATE OF COPPER OPTICS.—If we receive the solar light reflected by a large crystal of sulphate of copper upon a sheet of platinum or tin plate, placed at a small distance from the crystal, the sheet assumes the color of metallic copper upon the part which receives the reflected light.

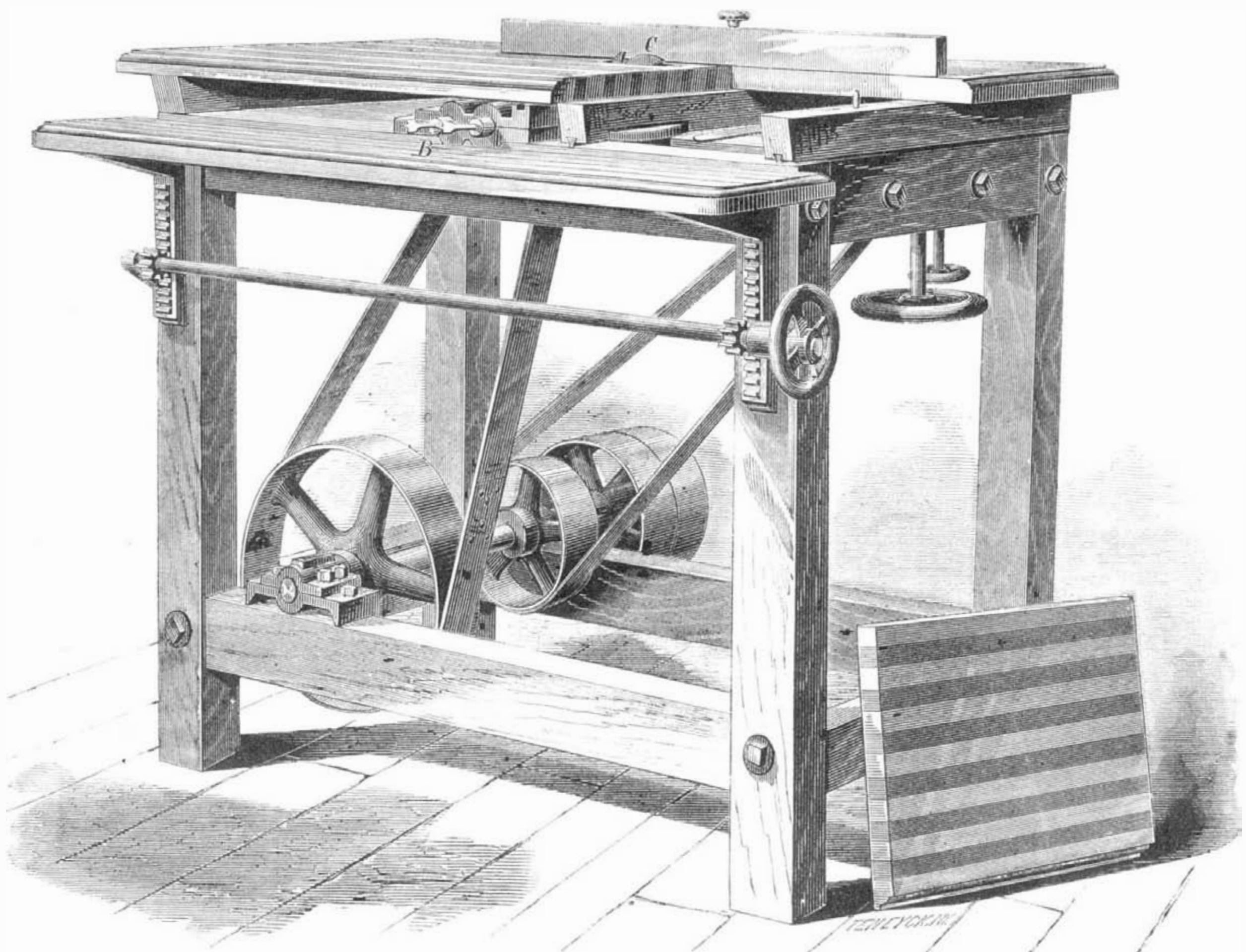
IMPROVED SASH BORING AND GROOVING MACHINE.

We illustrate herewith a machine for boring and grooving sashes, which allows the operator to prepare the work ready for the cord at one handling and without changing his position, the entire job being performed in a space a foot square. It is claimed that the apparatus saves three fourths of the labor necessitated by the ordinary process.

Two mandrels are driven by the belt, A, and carry the pair of bits shown at B, for boring the holes. The groove is made by the saw, C, attached to one of the mandrels. In front of the saw a single mandrel sets and serves to bore through from the groove to provide for the reception of the cord.

The machine is constructed of maple or ash, and is put together with joint bolts. The top is made of walnut and ash strips, 1½ inches square and glued up. The countershaft and the mandrels—the latter of cast steel—run in the best Babbitt metal. Two groovers and sash and blind bits, complete, are furnished, together with a ten inch circular saw, which adapts the machine for all ordinary light sawing, in addition to its capability of boring blinds, grooving shutters, rabbeting doors, etc. The detached piece, shown leaning against the frame on the right, serves to fill up the space on top of the apparatus when it is used as a common saw table The floor space occupied is two feet wide by three and a half feet in length.

For further particulars address the manufacturers, Messrs. J. H. Blaisdell & Co., 405 Commerce street, Philadelphia, Pa.



BLAISDELL'S SASH BORING AND GROOVING MACHINE

IMPROVED SURFACE BLOW-OFF.

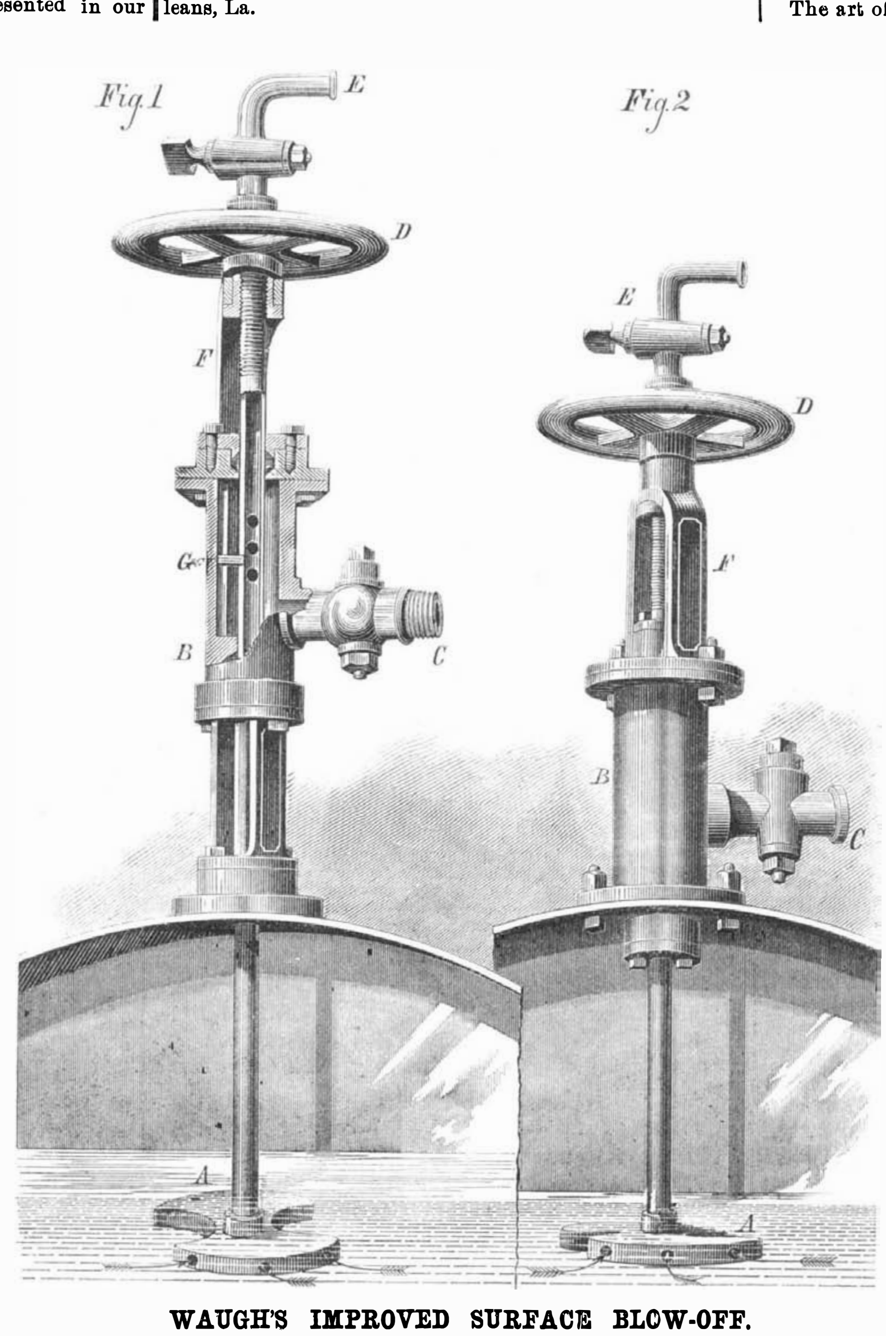
By using the novel surface blow-off represented in our illustrations, it is claimed, the engineer is enabled to tell exactly how much water is in his boiler, whether scum and foreign substances are or are not being forced out, and, in case of the water being lost, he is provided with a means of readily finding it to the last moment of safety.

The engravings represent the invention in section, Fig. 1, and also give an exterior view, Fig. 2, the latter figure differing from the former, however, in that the stuffing box, which surrounds the tube attached to the float or skimmer, A, is arranged inside instead of outside the boiler shell, and also in some readily perceived details of construction. The device is placed on top of the generator, as shown. The skimmer is a hollow flat box provided with side openings for the admission of the surface water. The tube by which it is suspended extends upward through a chamber, B, and is there perforated so that the water may enter said chamber and escape through the blow-off cock, C. The tube continues on upward, passing through suitable stuffing boxes, and terminates in a screw and wheel, D, surmounted by a test cock, E. As shown in Fig. 2, the wheel and screw is supported in a nut on the standards, F, above the chamber, B. The object is to allow of adjusting the skimmer to any hight above or below the water level, as desired. The test cock, by ejecting when opened either steam or water, according to the position of the skimmer, indicates the location of the latter and, of course, the water level in the boiler. The main tube is made of sufficient length to allow for the entire range of water level, so that the skimmer may be shifted up or down, as required by the hight of water, without interrupting the flow.

At G, on the main tube, Fig. 1, a stud is provided, which enters a groove in the side of the chamber, B. This serves to prevent the main tube from turning by the nut above.

The inventor states that by this device the scum which rises to the surface of the water may be so thoroughly expelled that a boiler thus provided, and running without cleaning for a period four or five times longer than other generators unprovided, will still keep cleaner than the latter. He also informs us that he has practically tested the invention upon the boilers of a sugar plantation in Cuba, of which he is the engineer, with excellent success. The apparatus is especially adapted for marine boilers, particularly those upon steamers which make long voyages. It can be arranged so as to be operated from any part of the vessel.

Patented through the Scientific American Patent Agency, September 1, 1874. For further particulars address the inventor, Mr. Robert Waugh, Ingenio San Joaquin, Pedroso, Isle de Cuba, or John M. Wiemann, Box 2,524, New Orleans, La.



WAUGH'S IMPROVED SURFACE BLOW-OFF.

Railroad Fire Engines.

The Central Pacific Railroad Company employ no less than than four fire trains on the mountain route across the Sierra. The first is stationed at Blue Cañon, the second at Emigrant Gap, third at the Summit, and the fourth at Truckee. Each train consists of a locomotive and three or four water cars. These cars are about the same length as an ordinary freight car, and formed of two inch plank; they are very strongly put together, as nearly watertight as possible, and elevated above the track about four feet. Each car will hold 3,000 gallons of water, or not far from 100 barrels—equal in weight to 24,000 pounds. The locomotives are arranged with powerful pumps that throw a steady stream, and do equally as good work as the best steam fire engines used in any of the large cities. Leather hose three inches in diameter is used, which, when not in use, is wound upon a large reel mounted on one car of each train. These trains are kept in constant readiness to proceed with all possible speed to the locality of the fire, upon the first alarm. All of the 25 miles of shedding between Emigrant Gap and Truckee is thoroughly deluged with water once a week. In sprinkling the sheds, the pipe man stands on the pilot in front of the engine, which moves slowly along at the rate of two miles an hour. In this work five men are sufficient to manage a train. Since the introduction of the fire alarm telegraph, with 32 different stations between Emigrant Gap and Truckee, the danger of any very disastrous conflagration in the sheds is nearly or quite obviated.

New Chiming Machine.

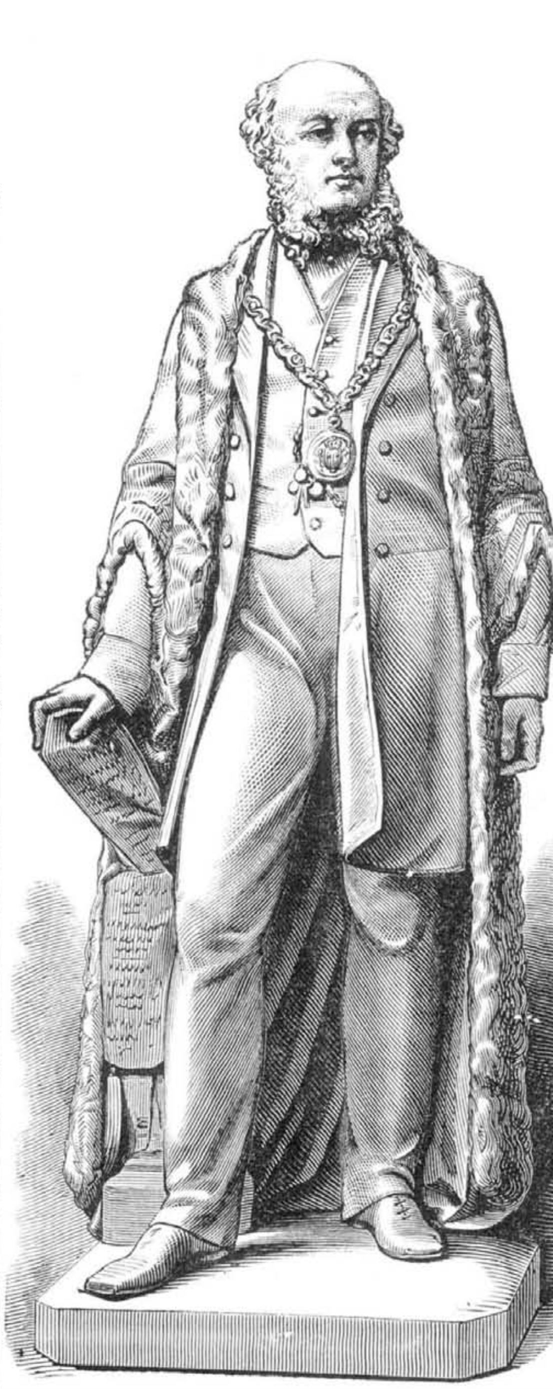
The art of constructing carillons, or machines for playing tunes on peals of bells, is being much practised in Europe. *Iron* says: The new carillon or chiming machine which has been fixed in the parish church, Leek, by Messrs. Gillett and Bland, of Croydon, England, was lately opened. The carillon machine is fixed in the same chamber as the clock, to which it is connected by means of a lever. On being slightly pulled, the lever dislodges a pin, which instantly sets the machine in motion, and the tune commences playing. It is constructed to play fourteen tunes on eight bells, the tenor weighing one tun, and the whole peal about 4½ tuns. This apparatus is on an entirely new system. The motive power is obtained by weights of about half a tun each, which are suspended from an iron barrel by a steel line. At one end of this barrel is a wheel running in gear with a pinion, driving a spindle, upon which are fixed twenty cam wheels, kept constantly revolving, ready to do the heavy work of lifting the hammers the instant they are released by the musical barrel, which is also kept revolving by a series of wheels similar to a musical box. The levers arranged at the top of the machine are,at the musical barrel end, connected with the hammers above (by means of wire lines and cranks) and the key frame in front of the barrel; and directly the ends of the lever are released by the small brass pins pricked upon the musical board, the other ends of the levers, with the points of the arms attached to them, fall upon the revolving lifting cams and are instantly raised into the striking position and locked by the key frame at the other end, so that the two actions of releasing the hammers by the musical barrel and again lifting by the cams are perfectly simultaneous, and therefore very rapid passages in the music can be played. It will give some idea of the slight tension required for letting off the heavy hammers and the remarkable effectiveness of the mechanism when we state that the musical barrel is made of hard wood, only ten inches in diameter, studded with brass pins one eighth of an inch square; and the whole machine does not occupy more than a quarter of the space that the old one did.

BARROW-IN-FURNESS (ENGLAND) AND ITS FOUNDER.

The rapid rise of Barrow-in-Furness, on the east coast of Lancashire, England, from a little fishing village to a port, a commercial and manufacturing town, and the center of an iron-making district of enormous wealth and prosperity, has been already described on page 22 of our volume XXX. Barrow has recently been the scene of the annual meeting of the Iron and Steel Institute; and it is seen that, even since our recent account of its industries, many important extensions and improvements have been made.

The iron business at Barrow has undoubtedly been called into existence by Mr. Bessemer's renowned invention, for which the Cumberland hematite ores are especially adapted. The wealth of two mighty landowners has been brought into the trade, but the brain and soul of the enterprize (for its various manufactures must be looked upon as one) has been James Ramsden, the manager of the local railroad, who projected the Barrow Steel Company, enlisted the necessary capital in the cause till its works became the largest Bessemer refinery in the world, constructed the docks, brought the jute manufactory into operation to employ the females of the ironworkers' families, and remained, throughout, the central figure of the busy scene. More than two years ago, Mr. Ramsden became Sir James, the Queen having knighted him in recognition of his services to manufacturing industry. He became Mayor of Barrow; and during his year of office, his fellow townsmen commissioned an eminent sculptor to execute a statue of him, in his robes of state. The statue (of which we publish an excellent representation) is of bronze, and is 11 feet high. At the same time, a portrait of the same gentleman was hung in the town hall.

One of the most flourishing enterprizes at Barrow is the yard of the Barrow Iron Shipbuilding Company. The works are arranged for the construction of fifteen vessels at one time, and a large graving dock is completed. Two thousand men are employed here, and the full force of the works will number seven thousand. An ocean steamship company is already incorporated, and six steamers of 4,000 tuns each are being built for it; five more of similar size for the East Indian trade, are contracted for by the company. The extent of the shipbuilding works and yards, and their proximity to the ocean and to the railroads, are well shown in the excellent engraving (from the London *Graphic*) published herewith.

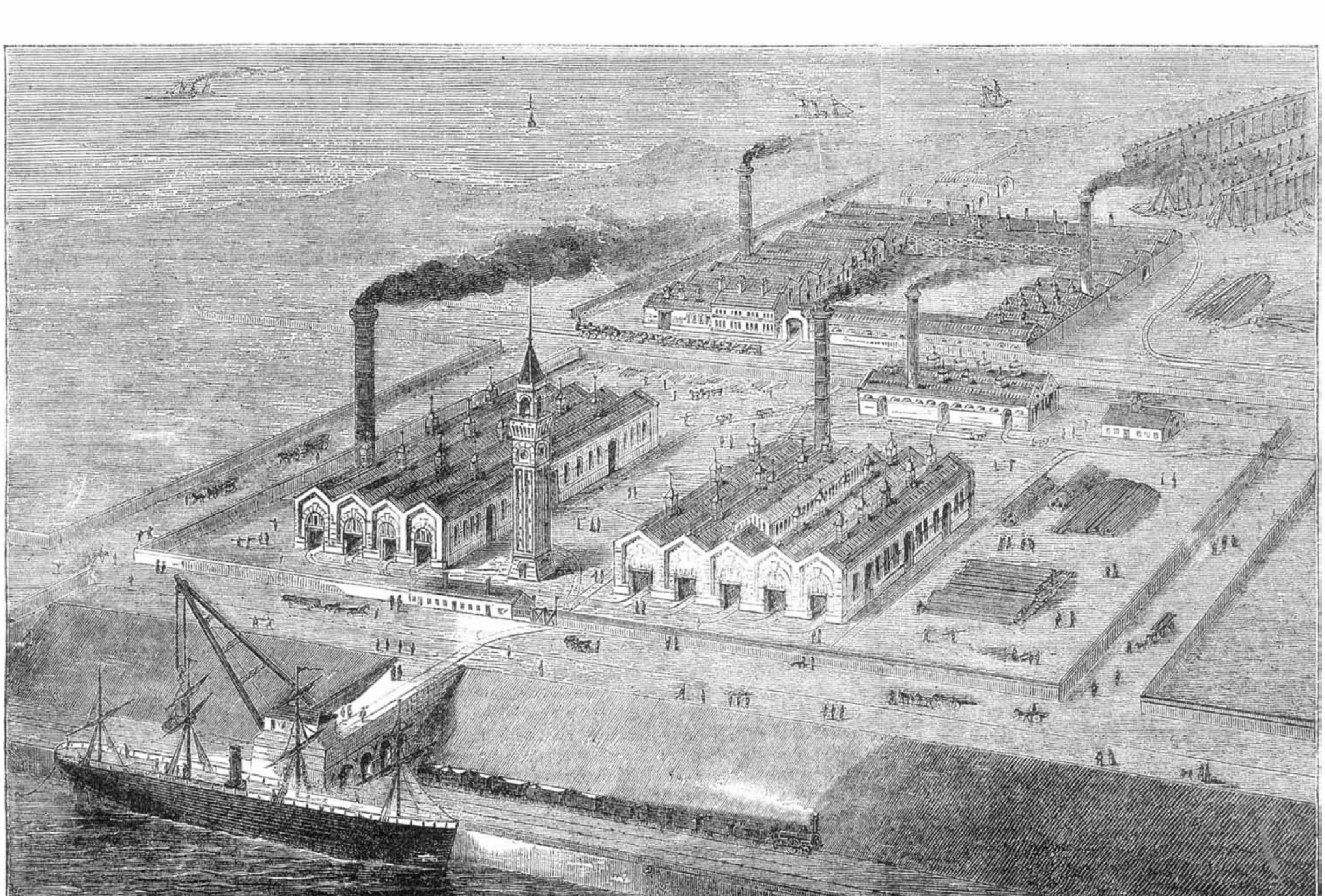


STATUE OF SIR JAMES RAMSDEN.

The Early Days of Daguerrotyping.

The following amusing account of the early practice of taking sun pictures (from the pen of Mr. M. P. Simons, in Anthony's *Photographic Bulletin*) will doubtless bring to mind the similar experiences of some of our readers:

"I will give, as they occur to me, a few thoughts and incidents touching the early days of daguerreotyping. Whilst Daguerre was still in his laboratory working out his magic picture-making process, almost every mail from Paris brought over something of this mystery of mysteries, which was soon translated and studied out by the curious experimenters attracted by its novelty. No one after seeing the first of these smoke-like pictures could possibly have anticipated that Daguerre's process would ever reach the dignity of an art. The process was then, of course, still an undeveloped mystery; and then for some cause or other the published accounts of it received were not clear nor definite, and, as a matter of course, those who took hold of it in its early stage had a good deal to contend with, being obliged to fill in and work up a picture (so to speak) from indistinct outlines. Ah! those were the days of trials and many tryings of contingencies, of slow iodine, slow cameras, and consequently long sittings; when an artist might very easily have taken his dinner while his sitter was sweating out a picture in the sun. This, then, should have been called "long" as well as "high" art. Few were able to sit long to be "taken off" quietly, and fewer still could go through the mysterious operation without receiving a bunged eye or having some other feature knocked into a condition not the most flattering to be handed down as one's facsimile. But these long, tedious, distorting sittings are now past, thanks to sensitive bromine and the science of optics. Long before I ever thought of becoming an artist, I recollect hearing one day that some one in the city was making a very curious kind of likeness, described to me as being on looking glass or steel, and very true to life. My curiosity soon led me to the mystic establishment of Mr. Cornelius to see these marvelous mirrors of Nature. The first one I took in my hand to examine must have had an electric effect upon me. I was perfectly amazed, and for the time being completely entranced with their odd and novel appearance. I could not imagine how under, or rather how in, the sun they were made without hands or pencil. It seemed to me the very hight of jugglery, throwing likenesses from the face and catching them upon polished plates. It was a mystery then; how much less of a mystery is it now? A few years later, while I was preparing to go in to the art business myself, in connection with "Old Sol" as a silent partner to do the light work, Mr. Langenheim was busy fitting up for the same purpose his *atêlier* in the Philadelphia Exchange, which he did in good style for that early day. His fittings up, art appurtenances, and furniture were useful and comfortable. But the most important of all was that the lenses he used were the best that had yet made their appearance. Mr. Voigtlander, of Vienna, had just introduced his celebrated lens, and had constituted Mr. Langenheim, his brother-in-law, sole agent for this country. This gave Mr. L. quite a start and a decided advantage over his contemporaries. I at once saw that he was getting ahead of me fast, much faster than suited my youthful aspirations: so one day I took it into my head to make him a professional visit to ascertain if possible the cause of his great success, for up to that time I was not aware of there being any difference whatever in the quality of lenses. I supposed (as the most of our patrons did, and, it would seem, some do still) that the whole thing depended entirely upon the sun, ignoring skill and quality of tools as mere moonshine. I found Mr. L. quite busy making better pictures, and in much shorter sittings, with his quarter size Voigtlander than I was able to do with my half size Plumb. My second visit



THE WORKS OF THE BARROW-IN-FURNESS IRON SHIPBUILDING COMPANY.

to the rooms of Mr. L.; a few months later still, was on a dark, rainy afternoon. I found him this time without sitters, though as busy as ever in that mysterious "no admission room," finishing up his day's work and preparing for the next. This suited very well, as it gave me a fine opportunity to scrutinize more carefully his little lens, without being in anybody's way. There were quite a large number of these tubes and lenses of the different sizes, as they are usually gotten up, lying about on shelves and tables, waiting for lucky purchases. But the one Mr. L. himself used interested me the most of all; it was tube, lens, and camera box combined, done up in brass, and reminded one of a small telescope—the only one of this description I have ever seen—and although, as it appears, not a success, it was to my notion a perfect beauty from head to foot, and I fell dead in love with it at first sight. No child ever looked with more covetous eyes at toys in the shop windows than I did at this unique, brass-clad camera. The price of it was not extravagantly high either; yet I could only look at it, wishing all the while it were mine. I never in the whole course of my life felt so much the real want of the wherewithal as then, nor so effectually broke the tenth commandment. I left the Exchange that day with a heavy heart, though with a fixed determination to have without delay a Voigtlander lens, even if I had to sell my almost anything I possessed; and I went to work with renewed energy to that end, which was soon accomplished. Our business in those days did not fortunately lie altogether in making faces, but also (as you are aware) in teaching others how to make them, or how to spoil them (whichever is the most proper.) Of this sort of thing I already had my hands full, and it now steadily increased. I frequently have had under my own special care at one time six or eight young and old aspirants to high art, some rubbing or scratching away at plates, some polishing and coating, while others were sitting as patient models to those more advanced in the mysteries of the art. This state of things kept going on until I at length became quite alarmed, fearing that the art I had adopted as a profession would soon be teetotally ruined by too much competition, and in order to check it a little I advanced my terms for tuition. But this, strange to say, had the contrary effect. My valuable instructions, as it seemed, were appreciated according to the price I put upon them, for they flocked in upon me thicker and faster than ever (let those who think to increase their business by making cheap pictures take a hint from this). Here was a dilemma for me, and how to get out of it I did not know. I was afraid to raise my price again for fear it would have the same effect, and I had no room for any more. I often look back to those dark, foggy days of the art, when the teacher not infrequently was in turn taught by his pupil, and wonder how we made out so well as we did, for it was certainly "the blind leading the blind" over again. We stumbled and fumbled more over our dark experiments than we ever did in our dark room, and yet with our feeble assistance a great many managed to grope their way into the art, who in a little while made for themselves no ordinary name in the profession. But then there were also many others who promised much and performed but little. It was quite amusing to see the big worded signs that were so plentifully swung out about the city by these freshly made artists. I will here give a description of one which will answer for the most of them: "John Smith, artist, daguerreotyping taught, and improved apparatus for sale. N. B.—Likenesses taken in cloudy weather." This last was useless information for anybody who had ever seen John's pictures hanging at his door, for they were all more suggestive of clouds than of anything else. John was one of my promising young pupils. It had been but a few weeks since he had left the profession of dentistry to woo the sun, preferring drawing faces to drawing teeth. On some of these signs was the following liberal invitation: "Free exhibition; walk up"—but they didn't say how high up which I suppose was on account of their extreme modesty; they would rather that their patrons should find out for themselves how high their art was, though they should lose their breath in the effort of reaching it. These few casual incidents and recollections of the art, occurring under my own notice, and although not by any means a complete picture of the times, but only a sketch and, as the artists say, merely rubbed in with neutral colors, may still serve to give some little idea of the Daguerrean art and its pioneer profession, prior to the year 1842. At that period or thereabouts the art received a new value by the timely discovery of the gilding process, which gave to the daguerrotype a rich golden tinge, and, as we now well know, an unquestioned permanence, falsifying all prophecies to the contrary. This was an auspicious era in the daguerrotype art, and thenceforward it made greater advances than ever towards the perfection to which it ultimately attained. Between the years 1844 and '54 there were a great many most excellent daguerrotypes made—I think (I hope I may be excused for thinking so) that I made some few myself, and have only to refer to my early patrons to prove that I also got off many that were poor; I rather suspect that they were too Rembrandtish for the time. I often think of my first sitters with of pleasure and sorrow: sorrow that I was compelled to sit many of them so often to so little purpose (artistically speaking), and pleasure because they were such patient sitters, ever ready to make allowance for the many failures incident to this bewildering, soul-stirring process; and if such a thing were at all possible, I would gladly retake many of them, as a sort of conscience soother, not that their pictures were so far below the then average, but because the then average was so low. But alas! this cannot be. My old register reminds me that most of them are now, like the old camera I then used, laid by in the dust."

THE FRANKLIN INSTITUTE EXHIBITION.

No. I.

If the measure of the success of the approaching Centennial is at all to be gaged by that which has been achieved by the Exhibition now open in Philadelphia, the impossibility of its failure is assured. A single city, representing but a fractional part of the nation's manufacturing powers, has produced an exhibition of which the country at large may well be proud. The same has been done in a number of other cities throughout the country. Any single one of the most successful of them might fairly be taken as representative of the characteristic industries of our land. What then may we not fairly expect when the combined wealth of all sections of the country is collected in the huge exhibition grounds at Fairmount, and contrasted with the products of the entire civilized world?

On the 14th of September the Franklin Institute, having obtained the temporary occupancy of the immense building at Thirteenth and Market streets, formerly occupied as a freight depot by the Pennsylvania Railroad Company, opened an exhibition of arts, manufactures, and machinery. Notwithstanding the openly expressed fears of the timid, the energy and good sense of the managers succeeded in transforming the previously unsightly building into one of the most convenient and beautiful temporary exhibition halls ever occupied in the city. The full confidence which the managers had in its success was shown in the liberal expenditures that were incurred in order to make the buildings not only suitable for the Exhibition, but also beautiful and attractive to the visitors. At first the size of the building, covering, as it does, over two acres of ground, led to the belief among the less prudent that ample space could be obtained up to the time of opening. Too late, however, have they discovered their mistake. The applications came in so rapidly that soon all available room was appropriated, and at the present time over five hundred applications have been rejected for want of space.

Those who recollect the Exhibition building only as a freight depot would be surprised at the marvelous change that has been effected in so short a time. Entering at the main door on Market street, the visitor finds himself in a broad aisle, the roofing of which is gaily decorated with flags of all nations. The exhibits or gas fixtures and chandeliers, which occupy the two extremities of this aisle, add much to the general effect of the decoration. At night, when all two thousand odd lights are burning, the general effect is exceedingly fine. The entire right hand side of the building, occupying rather more than half its area, is devoted to the exhibition of machinery in motion. Two lines of shafting of $2\frac{7}{16}$ inches diameter supply the requisite power. One line is driven at the speed of 120, and the other at 240, revolutions per minute. The inconvenience often experienced at former exhibitions in regard to a want of uniformity of motion has been obviated by all the driving pulleys being supplied by the Institute. The steam power is furnished by the various boilers that are on exhibition, of which there are quite a number. At the extreme southeast corner of the Exhibition, a large leaden tank has been erected to hold the water for a full exhibit of steam and other pumps, which are all in active working. The left hand side of the building is devoted to the exhibition of household goods, philosophical instruments, drugs, dyestuffs, and chemicals, fine arts, printing establishments, sewing machines, carpets, fancy goods, mantels, carriages, and hosts of other articles. Steam heaters, stoves, and ranges occupy the extreme northeast corner of the building.

Having now obtained some idea of the ground plan of the building, we will now examine in detail some of the most interesting features of the Exhibition. As it will be impossible, in the necessarily restricted limits of a single letter, to describe all the exhibits, we will select here and there those which we believe will be the most interesting to the general run of our readers.

Beyond all doubt the feature of the Franklin Institute is the machinery. This fairly outstrips all other classes of exhibits. Nor should this occasion surprise. Not only is the Institute mainly designed for the promotion of the mechanic arts, but Philadelphia is unquestionably one of the centers of the country for the production of machinery and machine tools. In this way, then, has been produced the finest exhibition of machinery in motion ever shown in Philadelphia, perhaps in America.

The steam boilers are all placed on the ground floor, some dozen odd feet below the general level of the Exhibition floor. In the space thus appropriated are collected some of the most interesting features of the Exhibition. The Pennsylvania Diamond Drill Company have on exhibition one of the Leschot diamond-pointed steam drills. The drill of the one exhibited contains ten diamonds, and bores a two inch hole through marble at the rate of one foot in sixty seconds; through sandstone, at the rate of one foot in fifty-five seconds. The actual working of the drill always attracts crowds of the curious. The following important advantages are claimed for this drill over the ordinary steel drill, driven either by hand or steam power: The diamond drill, furnishing as it does a solid core of the rock penetrated, is of great value in prospecting mineral or other lands, since it brings up an actual section of the strata. In this way a far more accurate idea of the nature of the rock is obtained than when it is brought up either broken or pulverized, as in the ordinary methods. This feature gives the drill great advantages over all others for coal and mineral lands. The drill is also well adapted for the boring of artesian wells. The bore is round and true, and will admit of the introduction of a tube nearly as broad as the hole itself. A nine inch hole, 357 feet deep, has been successfully bored for the Wilkesbarre Coal Company, in the Empire mine.

THE HYDRAULIC BRAKE.

Nearly opposite the diamond drill is a large working model of the McBride hydraulic brake. Ordinary sized car wheels are run at a rapid rate by belting, and stopped at will by the application of the brake. The principal advantrges claimed are simplicity and hence diminished cost, and general efficacy, the brake being very powerful. The power is taken directly from the boiler. Under each car is placed a cast iron cylinder of suitable size, furnished with a piston, to the rod of which the brake levers are attached. To prevent the freezing of the water in the brake cylinders and pipes, mixtures of glycerin and water are employed, the relative proportions of the two being determined by the severity of the climate of the country through which the road runs. The cost of rendering the water non-freezing is comparatively slight, since but a small quantity of the glycerin is required: and when the pipes, etc., are once filled, no more is required except in case of accident or leakage. A peculiar feature of the brake is the almost instantaneous transmission of the power and its undiminished efficacy at the end of a long train. The very slight compressibility of water allows the same force to be applied to the last car of a long train as is applied directly to the car in connection with the engine. No other limit can be found to the number of cars the brake can thus stop, except the power of the locomotive to draw them. Since the power employed to work the brake is derived from the steam pressure against the water in the boiler, the locomotive boiler being tapped below the water line, the power is not actually less. During the operation of the brake, the gage does not indicate the loss of as much as half a pound of steam. We understand that the hydraulic brake is in successful operation on the West Chester road.

THE BOILERS.

In this portion of the Exhibition building, as we have already mentioned, are the boilers which furnish the steam for the various engines. Among a number of others we notice the following, namely: Shearman's improved upright tubular boiler, which claims as its distinctive features economy of fuel and space, cleanliness, convenience, safety, and cheapness. It claims to produce one horse power with twelve square feet of heating surface.

The well known Harrison steam generator is represented by a large boiler. The advantages of this form of generator, as our readers are probably aware, are security from destructive explosions and economy of fuel. A combination of cast iron hollow spheres, each eight inches outside diameter, and connected together by curved necks, with rebate machine-made joints, are held together with wrought iron bolts with caps at the ends. Each boiler is tested up to 300 pounds to the square inch by hydraulic pressure. The safety of the boiler is to be found in the number of joints that can give, in case the pressure of the steam becomes too great; while at the same time, the mode of connection of the hollow spheres of cast iron allows of great pressure without leakage. Experiments have been made in which a pressure of 850 pounds per square inch failed to rupture the boiler or start the joints. This boiler gets up steam quickly and can furnish superheated steam without the addition of extra apparatus. The number of small parts of which it is constructed offers great facilities for transportation and erection, no large opening being required for the introduction of the boilers. The largest can be put through an opening one foot square, when desired.

The Wiegand patent safety sectional steam generator also exhibits a large working boiler. The peculiar advantages it possesses are safety from dangerous explosions, economy of fuel, and a rapid generation of steam. The practical test for the efficiency of the boilers is to be found in the fact that they are now in use by a number of large manufacturing establishments throughout the country who know the requirements of a good steam generator, and who would not permit a poor instrument to remain in their works. With an hourly consumption of ten pounds of coal per square foot of grate surface, the area of which is 22 square feet, an hourly evaporation of 117·8 pounds of water is effected for every square foot of grate surface. The total evaporating power of one pound of coal equals 11·22 pounds of water. The Ætna grate bars are attached to this boiler, and apparently give general satisfaction. It is exhibited by Mosely & Metzgar.

The Keystone Portable Forge Company have an excellent display of portable and stationary forges, either for hand or power. They also exhibit their rotary positive pressure blowers, which they claim to be the most powerful blowers known. Lovegrove & Co. have a fine display of gages, etc.

THE STEAM HAMMERS.

Quite a lively effect is produced in the basement by the working of the steam hammers, one exhibited by W. Bement & Son, and the other by Wm. Sellers & Co. The latter is peculiarly light and graceful in appearance, when its power is taken into consideration. It is the old "Morrison steam hammer," with a number of improvements which the Messrs. Sellers have since added. The hammer is formed of a long bar of wrought iron to which the piston is welded, forming, in fact, a part of the piston itself. No side guides are employed, the bar being guided by the top and bottom cylinder heads only. The advantage thus gained is apparent. The entire space below the cylinder is free, and the workmen is enabled to handle his work more effectually than when two of the sides are occupied. At the same time the hammer head and die are more effectually guided and the frames subjected to a less severe strain. An improvement has been made in the shape of the hammer head and the mode of its attachment. By increasing the sectional area of the piston rod toward the hammer head, the greatest mass of the metal is brought nearest the point of impact, and a much greater efficiency is thus given to the blow. Again, the hammer head, instead of forming a continuous piece with the piston, is now attached to the lower cylindrical end of the hammer bar by a circular taper key, thas preventing the breaking of the bar by concussion. A modification of the ports of the steam chest allows the use of a supplemental valve which throttles the exhaust steam below the piston, but does not affect that above it. In this way the hammer is enabled to strike quick, light blows for finishing, since, the exhaust above the piston being unaffected, the hammer can rise as quickly as before; but in coming down, its force may be regulated by the cushion of steam on which it descends. This compressed steam reexpands on the up stroke, and thus effects an economy of the steam power. We have seen one of these 300 pound steam hammers drive a pin in a beam by a dozen or more blows. In this instrument the workman has as perfect control of the rapidity, force, and character of the blow as if he were enabled to actually wield the hammer in his hand, and control it directly by his will.

Recent American and Foreign Patents.

Improved Invalid Bedstead.

Henry Bull, Newport, R. I.—This bed bottom is provided with rollers, and adapted to be slid on and off rails which are hinged to the bedstead at one end, and may be lowered at the other by a windlass or other suitable means. On said bed bottom are hinged pieces and a fixed apertured seat piece, so that, when extended, the said hinged pieces form part of the floor, and when otherwise adjusted one of them drops down, and the others are elevated and connected by hooks to adapt them to support the patient.

Improved Friction Brake.

Elisha C. Sanders, Westerly, R. I.—This invention consists of a friction clamp, of two independent parts, one of which is stationary and has contrivances whereby the other part is fastened to it, so as to hold the drum against being turned by the strain to which it is subject. The other fastening device is so contrived that by the revolving of a tappet against it the pressure is relaxed so as to let the drum turn a little. The pressure is varied by a screw and a spring, so as to subject the drum to more or less resistance; and the tappet wheel employed for relaxing the pressure will become fast or slow, and otherwise varied to suit the requirements of the case. The invention is especially intended to be employed as a let-off attachment for looms, in which case the relaxing holder will be raised once for each beat of the loom by the tappet wheel.

Improved Pegging Awl.

Michael Fichter and John P. Dexheimer, Lawrenceburgh, Ind.—The handle is made hollow from its upper end nearly to its lower end. It has a square hole extending from said cavity to its lower end, into which the shaft stem or holder fits. The lower end of the shaft is split, to form jaws to receive the shank of the awl, which jaws are drawn together to clamp the said shanks by a nut made with a polygonal flange to receive the wrench. When the nut is screwed on the awl, neither can move up or down or turn in its holder.

Improved Hay Press.

William H. Penniston, Fox, Mo.—This is an improved device for operating the beater in beater presses so as to make it prompt in its action, and so as to diminish the amount of slack rope when the beater falls, and thus lessen the distance the horse has travel to again raise the said beater, and consequently to lessen the time required to complete the bale.

Improved Nut Lock.

Clark Hutchinson, Tonica, Ill.—This is an improvement in means for preventing the turning of nuts on screw bolts; and it consists in cutting the screw thread transversely and tying a wire around the bolt at that place. By means of a channel the wire is prevented from working upward, while it securely locks the nut.

Improved Spring Bed Bottom.

Henry Whiteside, Jr., Ottawa, Canada.—This is an improved bed bottom frame, formed of parallel side bars and transverse bottom slats arranged in a lower plane. The means of support and connection between them consist of blocks and bolts. The blocks serve to keep said slats and bars equidistantly separated and support the latter on the former, the slats resting on the cleats of the side rails of the bedstead when the bed bottom is in use.

Improved Cross Head for Locomotives.

William A. Alexander, Mobile, Ala.—This invention consists in the arrangement of a detachable wrist pin placed into side recesses of the cross head, and fastened suitably thereto. It consists further in arranging the jaws of the crosshead at a certain angle or inclination to the horizontal axis of the same, and placing thereon adjustable slotted wedge pieces for setting the top and bottom plates squarely thereon, and securing them by means of screw bolts.

Improved Billiard Table Leveler.

George C. Brotherton, San Quentin, Cal.—This invention consists of legs, separated into two parts near the top, and connected by dowel pins and an adjusting screw, all so contrived that the screw may be readily turned by a pin introduced into holes in the head through a slot in the side of the leg. The slot may be covered by a pivoted or sliding panel or other piece of ornamental work. The head of the screw is fitted into a metal cap, fixed in the top part, and a metal nut for the screw is fitted into the lower part of the leg.

Improved Gin Saw Filing Machine.

Wiley J. Johnson, Hernando, Miss.—In this machine there is a triangular file head, having three holes for files at unequal distances apart, and arranged to shift around on the stock. The stock race is pivoted centrally and in line with the crank shaft, so that it may be turned to any angle.

Improved Spike Extractor.

William Devine, Brownsville, Tex.—A gripe or grapple is formed of hinged jaws which are connected to a tube which is swiveled to the hoisting or jack screw. By turning the jack screw, the tube and grapple will be raised vertically, thereby drawing the spike.

Improved Razor.

Ferdinand Erdmanski, Hiawatha, Kan.—This is a detachable blade which is inserted into the supporting back part of the razor. It is fastened therein by its hinged top half, which is secured by a suitable slide piece on the lower or main part. The steady position of the razor blade is secured by means of pins of the main part of the supporting frame, passing through symmetrically arranged holes of the blade into recesses of the hinged part.

Improved Grist Alarm.

Joseph H. Curtis, Chariton, Iowa.—This invention provides, for the conducting spouts, hoppers, and other parts of the mill, an automatic alarm, which is operated by the pressure of the grain, flour, or bran on the valve part, indicating, by the ringing of a bell, the interruption of the supply. When the supply of grain, flour, etc., is steadily kept up in the spouts, hoppers, etc., the pressure on the valve will carry the clapper away from the bell, and prevent thereby the ringing of the same; but as soon as the pressure is discontinued, the rotating shaft will strike the bell stem and give the alarm, so that the miller has ample time to supply the spout before the burrs run empty or other parts of the mill machinery are stopped.

Improved Link Motion.

John Sandall, Jr., Charlottetown, Can.—This link is formed in two parts each part being connected with an eccentric, and both parts communicating with a central eccentric, by the rod of which the two parts are made to operate as though hinged together.

Improved Ironing Table.

William O. Donnell, Pittsburgh, Pa.—This ironing board is adapted to be attached to a vertical wall and supported in a horizontal position by means of a hinged brace.

Improved Nut Lock.

James U. Fisher and Hiram W. Fisher, Penn Station, Pa.—The locking plate has a reduced part which is bent up at the end. Said part is inserted into a groove in the bolt from the upper side of the nut, and its lower end is turned up on the under side of the same. The lower side of the nut has a circular rabbet, which receives the end of the hook plate where it is subject to no friction in turning the nut; then the nut is turned home, and the part of the plate is bent over and on the edge of the nut, thus effectually locking the device.

Improved Paneling Machine.

William Cobban and Charles H. Smith, Bloomer, Wis.—This invention consists of a carriage adapted to hold the boards on which panels are to be raised, so as to present them sidewise and endwise to a pair of rotating panel-raising tools. A clamp is provided, which both holds the boards in place and springs them out of wind, so that they will be dressed exactly alike on both sides all around the edges.

Improved Ornamental Chain for Necklaces, etc.

Saintemme Diolot, New York city.—This invention consists in a chain constructed of alternating closed rings and opening spring links, the latter being made of two separate links, soldered to each other at one side, so that the free ends of both links join by their spring action at opposite sides into socket-shaped connecting ends. The closed links are then readily inserted.

Improved Clothes Line Fastener.

Joseph Hill, Wabash, Ind.—This invention consists in making a clothes line fastener of a flanged plate having a projection, a lock piece having a diagonal slot, and a bolt having an oblong head. This construction enables it to be attached to, and detached from, a fence, paling, or wall with great facility, while it allows the line to be secured and quickly made fast.

Improved Wagon Seat.

Stephen G. Peabody, Champaign, Ill.—This invention relates to providing a wagon seat with an improved attachment for connecting it to, and supporting it upon, the wagon body.

Improved Bouquet Holder.

John Boyd, New York city.—This is a small ornamental receptacle, pressure of the lid of which on the stem of the bouquet retains the same firmly in the holder, while it admits of the instant removal and replacing by releasing the lid. The cavity of the holder may be employed, if desired, for taking up a small quantity of water, by which the flowers may be kept fresh for a longer period of time.

Improved Adjustable Picture Frame Suspender.

Albert Gorrell and Robert J. McClure, Holmesville, Ohio.—Wires or strips of woods are attached to the back of the frame, so as to allow adjusting rings to slide freely thereon. At the lower ends of the wires are used eyes, to which the ends of the suspending cord are attached before being passed through the rings. As the latter slide readily up or down, the points of suspension are thus readily and very quickly adjusted up or down the back.

Improved Storage Box for Firemen's Implements.

Thomas A. Colgan, Brooklyn, N. Y.—This invention consists of storage boxes for containing firemen's implements, located in convenient positions throughout the fire districts, and sunk in the sidewalk or roadway. The boxes have a corrugated or roughened top, and are provided with hooks, brackets, or slings for the reception of axes, pikes, and the like. The contrivances for locking them are such as to be readily opened with a hydrant wrench.

Improved Cone Sawing Machine.

Junius Harris, Titusville, Pa.—This invention consists of a cone saw in the form of a tapered tube, with teeth on the large end. The tube is slitted along one side from end to end, to allow it to expand and contract, and near the large end is fitted between a cone on the shaft for turning the saw and a corresponding collar, which is secured to the cone by a screw passing through the slit. At the other end, it is connected to a sliding collar on the shaft, provided with a lever, by which the saw is shoved forward along the cone and collar to the work, and expanded and drawn back and contracted suitably for sawing bungs and other conical articles. The invention also consists of a table top for holding the work to the saw, contrived with a hinge joint and a foot treadle for working it, so as to press the work up to the centering point in the end of the shaft over which the saw works, to hold the work at the beginning, and to drop down to discharge the sawn pieces.

Improved Suspension Truss Bridge.

Jacob B. Bausman, Minneapolis, Min.—The cables are made of wire, and semi-cylindrical in form. The chords are each of two sections of [iron, placed parallel with each other, and confined together by a covering plate. The truss posts are confined to the chords, and are connected to the foot blocks by dowels, as are also the transverse stay pieces. The cables pass through the foot blocks, and are connected at each end with swivel or socket yokes, which connect them with the anchor bars. The side diagonal braces fit into lozenge-shaped recesses in the bottom of the foot blocks, or slip over projections at the same points. The transverse diagonal braces are held in place by the dowels of struts. The posts and strut bars are made of star iron, which form gives them remarkable strength, stiffness, and durability. With the exception of the tension bars at each end, the cables are continuous throughout each span. Owing to the manner in which the lower connections are made with the foot blocks, the trusses can be adjusted from the roadway, and the structure can be erected, when the same may be desirable, without employing substantial scaffolding, as is usual in the erection of bridges, the use of screw bolts being confined to points which are easily accessible.

Improved Rockers for Cradles, etc.

Phineas R. Strong, Colchester, Conn.—This invention consists of cradle rockers with additional pieces pivoted to them in such a manner that they produce, when folded to form extensions of the rockers, a cradle, while a standing crib is obtained by turning them in upright position as extensions to the standards or feet.

Improved Steam Trap.

Josiah Anoney, Mamaroneck, N. Y.—The feed water vessel is provided with a tube, passing centrally therethrough, having slots and a valve, which shuts off the steam that enters an enlargement through the live steam inlet. A float surrounds the tube, and, sliding thereon, lifts a valve rod. As usual, the float rises with the inlet of water, unseats the valve, and admits steam, which forces the water to the boiler. As the water falls, the valve closes and water rushes in. By interposing the tube between the valve rod and the float, the said rod can always move with perfect freedom, and without receiving any interference from the float.

Improved Adjustable Knife for Cutting Hat Boxes.

William Marx, New York city.—This is an improved knife for cutting out hat boxes, so constructed as to enable a number of boxes to be cut at one operation, and which may be readily adjusted to cut larger or smaller boxes, as may be required. The knife is adjusted for cutting different sized boxes by detaching end knives and replacing them with longer or shorter ones. The shorter end knives have a wedge-shaped plate attached to their outer side to bring them into proper position to give the box the proper flare, and make the bottom of the proper size.

Improved Burial Case Fastener.

William S. Wood, Newtown, N. Y.—This invention is to provide means for holding burial cases fast in their boxes when they are packed and being transported or stored, and it consists of a bracket of wood and metal, made in any form so that it will hold the case by entering screw holes on the sides or ends of the case, which are made for fastening the body of the case together.

Improved Method of Protecting Crops from the Chinch Bug.

Leman H. Faunce, Montrose, Ill.—A ditch, about a foot deep, is made around the field in which the crop is growing, or in which the bugs have been hatched, by plowing two or three furrows in the same place, and then drawing a small log along the ditch until the dirt is reduced to fine dust In the bottom, a rod, more or less, apart, are set small tin cans, made with funnel-shaped tops. The cans are sunk in the bottom of the ditch until their tops are a little below the surface of the ground. The bugs, in seeking to enter or leave the field, pass into the ditch; and being unable to ascend the other side of the ditch readily they begin, after a time, to pass longitudinally along it, and fall into the cans. The latter, at convenient times, are taken up, and the bugs are emptied into hot water and destroyed

Improved Operating Car Brake.

William C. Shearer, Savannah, Ga.—This invention consists in augmenting the friction of brake shoes, and thus facilitating the braking of a train of cars by combining with the ordinary rock shaft a long arm whose bifurcations have end pulleys, over which and a pair of pendent fixed pulleys passes a chain that connects the rear car with a spirally grooved winding drum on the tender.

Improved Sewing Machine Case.

William Salisbury, Wheeling, W. Va.—This invention relates to a mode of constructing the box and table of a sewing machine so that the cover of box may be conveniently applied as an extension to the table, and so that the drawers or apartments may be easily attached together or detached for convenience.

Improved Hand Car.

Montgomery Crossman, Marshall, Mich.—Hitherto the levers of hand cars have been connected by means of suitable rods, with a double crank axle. The attendant disadvantages of such arrangement are avoided in this invention, which consists in the construction and arrangement of parts, more particularly in connecting the levers with a single wrist pin on a toothed wheel, which is fixed on a short shaft arranged in a plane above and in rear of the driving axle of the cars; also in the means for shifting the power from one axle pinion to another, and thus varying the speed.

Improved Asphalt Pavement.

Edwin E. Glaskin, Boston, Mass.—This invention consists in forming a new material, for roofing, paving, and other like purposes, from an asphaltic dolomite as a base. The process consists in treating said base by first subjecting it to the action of heat, then adding naphtha or oxydized petroleum, and albertite coal and sesquioxide of iron. The final step consists in adding a fresh quantity of the basic material, to wit, the dolomite.

Improved Seed Planter.

Charles Franksih, Abilene, Kansas.—This invention is an improvement in the class of corn and dropping devices adapted for attachment to the beams of an ordinary turning or furrowing plow. The improvement relates, first, to the means of attachment of the coulter or pilot wheel and seed-dropping devices to the plow beam; secondly, to the construction and arrangement of parts for adjustment of the wiper for the revolving seed cylinder; thirdly, to the adaptation of parts for removal of said cylinder from its case and from the shaft of the revolving pilot wheel.

Improved Door Check.

Daniel Gundelfinger, Jefferson City, Mo.—This invention relates to means whereby the knobs of doors may be prevented from striking the paper, paint, or wall of a room, and may be secured in a position that will not allow the door to be swung back by a draft of air or accidental force. The invention consists in placing a spring catch on the door, which receives the end of a notched arm projecting from the wall, said arm being adapted to fold, and being provided with its own lock.

Improved Bale Tie.

John Colley, New Orleans, La.—This invention consists of a notched plate fastened to one end of the hoop permanently. It receives the hook of the other end in its notch, and has a bolt for fastening said hooked end which swings around into the hook on a pivot, and then slides lengthwise a little on a rivet. The end is notched to engage the rivet, and the hole for the pivot on which the bolt swings is slotted to allow the bolt to slide. The two rivets are headed down, so as to hold the bolt fast.

Improvement in Folding Tables, Beds, etc.

John N. Valley, New York city.—This invention relates to that class of tables which, for convenience and portability, are intended to fold up when not in use and be laid away in a small space, and is a new and improved arrangement which may equally as well be applied to either a table, bed, lapboard, stand, or any other similar article of furniture. It consists in the arrangement of the legs, which are attached by means of metallic straps to transverse pieces under the table, and folding inwardly, said sets of legs being braced and locked in position by a hinged brace attached to a longitudinal board under the table by similar metallic straps.

Improved Washing Machine.

James B. Farrar, Carbonton, N. C.—This invention relates to certain improvements in washing machines. It consists of a bench or table having at one end a transverse opening in which are disposed two spring-seated and vertically adjustable rubbers connected with back plates which are detachably fastened to the bench or table. The clothes are fed from a tub of water on said table through the mouth formed by the two rubbers, and pass through a slot in a horizontally reciprocating slide below the rubbers, by means of which the clothes are subjected to a sufficient amount of rubbing and squeezing to cleanse them thoroughly, the said clothes passing below into a tub of rinsing water under the table.

Improved Traction Engine.

Edward P. Gowles, Wequiock, Wis.—This invention relates to the construction of wheel hubs and axles, whereby the wheels are adapted to be vibrated or adjusted with reference to the direction of motion of the engine. It also relates to the means for effecting the adjustment; and lastly, to an arrangement for varying the speed. For running the machine fast when light, it is geared directly with the axle; but for running slower, when loaded, and still slower for drawing plows and the like, a countershaft is provided, which will gear with a train, by suitable interposing mechanism, according to the speed required. The wheel of the train which turns the rear axle is connected to it by a universal joint, like the traction wheels, except that this wheel can vibrate in every direction to allow the axle to rise and fall independently of the boiler.

Improved Lever Escapement for Watches.

William G. Schoof, Clerkenwell, Great Britain.—This invention consists in the planting—in place of the common notch of the roller, and a single pin or jewel in the lever acting on each side of the notch alternately—of a jewel or other pallet in the middle of a small crescent-shaped recess at the edge of the roller. This jewel engages two upright pins of the lever, and performs the unlocking action in connection with or without a ruby pin near the center of the roller. The resilient or elastic banking of the lever is obtained in connection with banking pins of a pivoted lever plate, and a yielding spring action thereon, which gives way when banking occurs. The resilient action may also be produced by mounting the spring upon the lever as a substitute for the spring plate, and using stationary banking pins at both sides of the lever.

Improved Whiffletree.

Andrew J. Dibble, Franklin, N. Y., assignor to himself and Daniel Miller, same place.—The end irons are made in the form of a socket, and have hooks upon their forward side cast in one piece with the body. In the end, and opposite the point of the hook, is a hole extending entirely through said irons, in which is placed a block which is held out against the said hook by a coiled spring, the rear end of which rests against an adjusting screw.

Improved Corn Planter.

James R. Ball, John S. Ball, and John G. Mole, Xenia, Neb.—The seed hoppers are attached to the upper ends, and open into the cavity of standards. A plate is placed in the cavity, and its lower part curves rearward It is hinged to another plate, the lower end of which is bent back at an angle, and rests against the dropping slide, against which it is held by a spring. The device thus forms a cut-off to prevent any more seed being carried out by the dropping slide than enough to fill its dropping cavity. The levers which operate the dropping slide pass so as to be struck by blocks attached to the spokes of the center wheel. The marker may be folded alongside the seat across the axle and frame, when not in use.

Answers to Correspondents

W. S. will find a recipe for a black finish on brass on p. 208, vol. 26.—F. J. F. will find details of the effects of ammoniacal vapor on p. 266, vol. 31. We cannot tell you of a remedy for the eruptions.—S. A. F. will find full directions for skeletonizing leaves on p. 123, vol. 29.—J. L. will find a recipe for glue that dries rapidly on. p. 33, vol. 31.—D. H. M. will find that the directions on p. 353, vol. 24, are complete.—P. F. S. will find full particulars of the German offer of a premium for a railway coupling on p. 162, vol. 29.—J. S. & Co. should refer to p. 59, vol. 24, for directions for galvanizing iron.—C. F. B. and F. M. H. should see p. 250, vol. 31, for a description of the prismatic fountain.—J. G. can bend timber by the process described on p. 43, vol. 30. To tan buffalo hides with the hair on, see p. 59, vol. 28.—V. will find full descriptions of various forms of unsinkable boats on p. 195, vol. 31.—H. B. T. will find details of the process of making artificial butter on p. 119, vol. 30.—A. & Co. will find directions for putting a black finish on iron on p. 123, vol. 29.—H. T. S. will find a recipe for leather cement on p. 208, vol. 30.—P. H. W. will find directions for gilding on glass on pp. 90, 279, 283, vol. 31.—W. E. will find a description of the process of malleablizing iron on p. 138, vol. 29.

(1) F. D. asks: If a bell glass be inverted in a dish of water, and a piece of meat suspended inside, how will the air affect the meat, the vessel being airtight? A. It will supply oxygen to the tissues of the meat, which will slowly undergo decomposition. 2. What effect will the water have on the meat? A. It will supply the atmosphere around the meat with moisture, and retard the desiccation. 3. What chemical can be put into the vessel that will destroy the decomposing property of the air? A. None which is cheap and easily used. 4. If I place ice in the vessel, will it aid in keeping the meat? A. Yes.

(2) C. T. M. asks: What will counteract the effects of sulphur in my jewelry show case? I have had vulcanized rubber goods in it, and the effect is to be seen on my gold and silver goods. A. Try standing several trays of quicklime in the case.

(3) J. S. T. asks: What is the best method of preparing annatto for coloring butter? Is any other ingredient used with it? A. Annatto contains a coloring matter which is sparingly soluble in water, but freely so in alcohol and ether. Potassa dissolves producing a deep red color; and on neutralizing the solution with an acid, it falls as an orange precipitate. The fixed oils also dissolve the coloring matter of annatto.

(4) J. S. M. asks: What metal is best to use in the seat and face of a steam engine governor, to prevent cutting? A. Hard brass is the best material; but there is none that will not cut under some circumstances.

(5) J. H. asks: Which will give more power, a 9 feet overshot water wheel, or a breast wheel using the same amount of water? A. In ordinary cases, if both wheels were well designed, they would have about the same efficiency.

(6) C. W. G. says: On p. 220, vol. 31, I read that S. T. says: "To find the power of a spring, attach a pulley and cord, with weight, and find how many pounds your spring will raise one foot high in a minute." Would not a similar rule be good to determine the power of a steam engine? If I am obliged to run up the weight more than a foot, should not the final result be divided by said number? Should the pulley be of the same size as the crank circle and keyed directly on the engine shaft? A. The method you speak of will answer, but is not ordinarily very convenient. The pulley can be made of any size.

(7) M. G. says: I have set up 5 stoves which had 6 elbows in the pipe. Pipe from the stove to chimney was 7 inches in diameter with 6 inches entrance in chimney. They all draw well. I have now set up a stove with a similar pipe with a 7 inch entrance in chimney; this smokes the rooms. Can it be possible that there is a draft downwards in the chimney, so that the smoke from the stove pipe descends? A. If the draft of the chimney were good with the six inch pipe, there is no reason why it should not be so with the seven inch pipe, unless the latter is pushed so far into the chimney as to reach the back of the flue, in which case, of course, it would be effectually closed. The pocket formed by the closed fireplace is of course filled with air, and it is not likely that the suction upon this, caused by the ascending current in the flue, could materially affect the draft of the latter. The stove pipe itself, however, may be closed with soot.

(8) A. B. asks: Is it possible to form two numerical squares that shall be to each other as 5 is to 4? A. No.

(9) R. B. W. asks: 1. What are the right proportions of curvature for the concave and convex disks of flint and crown glass, to correct all chromatic and spherical aberration in a 3 inch achromatic object glass for a telescope, focal length being about 4 feet? A. Outside curve of crown lens, 32·25 inches radius. Ditto of flint lens, 67·16 inches. Inside curve proportional to the dispersive powers of the two lenses, varying with different glass. 2. Is there any book giving directions as to forms of lenses, and degrees of curvature, for making, of telescopes, etc.? A. "*Praktische Dioptrik*," J. J. Prechtl, Vienna, 1828, is a complete manual for making achromatic telescopes. The method of local correction, the use of a covered tunnel and artificial star, with tramway to carry the lens, and Faraday's method of clearing melted glass by sprinkling platinum sponge over it, are the chief improvements since.

(10) D. J. M. Y. asks: Does the force of gravity increase or decrease on approaching the center of the earth? A. It increases.

(11) W. H. Jr. asks: What are the comparative tensile strengths of cast and malleable iron? A. Wrought iron has from 2 to 3 times the tensile strength of cast iron.

(12) L. M. D. asks: How is the accuracy of a mercurial barometer tested? A. Usually by comparison with some standard instrument. Read T. A. Jenkins' pamphlet on "The Barometer," etc.

(13) S. N. M. says: Mädler, Mitchell, and other astronomers estimate the velocity of the sun in space at 21 miles a second. On p. 203, vol. 31, you state that velocity at 4 miles a second. Is this a typographical error, or have you later and more reliable observations as authority? A. Struve estimates the sun's velocity at 150 million miles a year, or about five miles a second. Airy thinks it is 27 miles a second. Maps of telescopic stars are now being made, to settle this question 100 years hence.

(14) W. B. F. asks: Is there any machine, device, or means by which one unskilled in mining can with certainty test a locality for gold or other metals? A. There is none.

(15) A. F. H. asks: How can I make a terrestrial telescope, 36 inches long? How long ought the focal length of the object glass to be? A. The focal length of an achromatic objective should be about fifteen times the aperture. A set of eyepieces usually consists of several powers between ten and fifty for each inch of linear aperture, and of one high power of one hundred for each inch of aperture. A terrestrial eyepiece should be of low power. Change all the dimensions of any one of those we have given, uniformly, by simple proportion, and construct your terrestrial ocular thereby.

(16) A. F. C. says: I have a 2½ inch achromatic telescope of 44 inches focus; and with the Huyghenian eyepiece, I get a power of about 80. How high a power will it stand, and how must I construct the eyepiece? A. Working powers run from ten to fifty per lineal inch of aperture. Powers occasionally used on fine nights may run from fifty to one hundred per inch of aperture.

(17) C. W. B. says: A beam is hung by two rods, one at each end, from and parallel to a similar beam. If I shorten one rod, will the suspended beam hang directly under the other as before? A. No. The suspended beam will be deflected towards the shorter rod, and the strain upon the shorter rod will be greater than that upon the longer rod in proportion to the disparity of their lengths.

(18) E. A. B. says: I have a well in a cellar, 42 feet deep and 17 inches in diameter. The ceiling or floor over cellar is 7 feet 6 inches; the kitchen adjoins the room over the cellar. I wish to provide a way to deliver water from the well, into the kitchen, above the floor if possible, at a point about 20 feet from the well, and to have the pump for this purpose at the point of delivery. The lift will not be less than 50 feet. How and with what description of pump can I do this? A. Perhaps the simplest plan would be for you to place a lift and force pump in the well at not more than twenty-five feet above the water, and arrange to work it by means of pulleys and belts operated by hand power in the kitchen. You would require two belts—one running vertically and one horizontally—and a crank at the pump handle and one in the kitchen.

(19) G. W. M. asks: 1. What is the proper size to make the cores of a telegraph magnet? A. About 2 inches long by ⅜ of an inch in diameter. 2. With what sized wire shall I coil it? A. Use No. 22 wire.

(20) J. Q. A. asks: Is there any possible way of controlling a watch so as to make it run exactly, or not to vary more than one hundredth part of a second in twenty-four hours? A. It never has been done. We are not prepared to assert that it cannot be.

(21) R. L. J. asks: What is black brimstone, and is there any other name for it? A. When sulphur or brimstone is moderately heated, it passes into a transparent and nearly colorless liquid; but when the temperature is raised to 482° Fah., this liquid becomes thick and of a dark brown color.

(22) J. S. N. asks: In a hard coal furnace, the acid or gas formed in burning Scranton or Lehigh coal condenses and rots out the pipe, especially when the smoke pipe crosses a cold hall. I have tried common stove pipe, Russian iron, and zinc coated iron, with about the same result. Is there any metal I can use? Will copper, coated with zinc or tin, resist the corrosive action? A. Zinc would hardly answer. Tin would do better; copper would probably stand some time, but its rusting would be accelerated by other causes. Sheet lead would resist the acid vapors, but might not answer so well in other respects. A silicate pipe would do.

(23) P. M. O'F. asks: Are a perspective view and photograph of the same object, from the same point of view, identically alike? To this you answer, no. Please state in what the difference consists. A. In a photograph, parts of an object which are much nearer than others are unduly magnified. 2. Are there any rules by which a draftsman may obtain, without copying from a photograph, the same general outline of an object as can be obtained by photography? A. It might be possible to make rules for the purpose mentioned, but we have never seen any, the ordinary methods for perspective drawing being generally considered better.

(24) F. C. M. says: I have been trying to make a galvanic battery as proposed by Mr. W. M. Symons on p. 209, vol. 31, but without success. Can you aid me? A. Your battery, if constructed as directed, could not possibly have been a failure; and although when in operation you could not feel the current, by applying the terminal wire to the tongue you might be able to detect its presence by taste or sensation. 2. How can I construct one of sufficient power to give a weak current or shocks? A. A small induction coil will best answer your purpose, full directions for the construction of which you will find on pp. 218, 315, 378, 379, vol. 30.

(25) J. B. H. asks: 1. Are coins molded or stamped? A. They are stamped. They could be molded. 2. Can molds or dies be made without the use of engraving, and how? A. The dies are struck from a master die, which is engraved. 3. What kind of metal is best to make the molds of? A. Soft steel is generally used.

(26) H. S. asks: What temperatures are required to volatilize, respectively, gold, silver, zinc, antimony, lead, and copper? A. The question whether certain metals volatilize during the roasting of the same, we cannot definitely answer, owing to very little data upon the subject. Gold melts at 2264° Fah., and Napier considers it to be volatile at a very high temperature; it also volatilizes when remelted in crucibles, especially when combined with copper. If the fused gold has been covered with a layer of bone ash, the ash will be covered with volatilized gold of a purple color. The microscope does not reveal globules of gold in this coating, but grains of gold may be obtained by smelting; so that the question of whether gold is volatile, in a finely divided state or in combination, is still unanswered. According to Deville, gold volatilizes when melting auriferous platinum, and may be collected by condensing the gold vapor. Silver melts at 1901° Fah., and can only be volatilized by electricity or the oxyhydrogen flame. Zinc melts at 770° Fah., and volatilizes at 2264° Fah., and burns at 932° Fah., forming ZnO, which is not volatile. Antimony melts at 806° Fah., and volatilizes at a bright white heat. Lead melts at 626° Fah., boils and volatilizes at a white heat, air being excluded. Copper melts at 2426° Fah.

(27) M. H. McK. asks: Which is best for deafening a floor, filling from the lining of the deafening up level with the joist or leaving a space under the floor? A. It is best to leave an air space above the deafening, for two reasons; it will both deafen better and be less liable to cause a dry rot in the floor plank.

(28) H. S. G. asks: Can I put one water wheel under another to use the water twice over, in a deep fall? A. There is no novelty in this plan. One wheel is better than two when it can be conveniently employed; but sometimes, on account of the great size that would have to be given to one wheel, two are used.

(29) N. S. J. asks: How can I analyze water? A. Apply to a chemist. The knowledge of the method would not aid you without the necessary skill.

(30) P. & B. ask: What is the proper shape for a piece of steel, so that when one end of it is bolted firmly to a solid piece of wood and the steel struck, the sweetest and most voluminous tone may be heard? A. A flat bar, supported on the ends on ropes of straw, is ordinarily used.

(31) W. P. asks: Why does not a pump raise water 26 feet perpendicularly in a mill which is more than 700 feet from the river? A pump in a mill near the bank raises water 27 feet. Is the friction too great for the 4 inch pump, or are we at too great a hight from the water? Shall we put in another or larger pump, or sink the pipe? A. The great length of your pipe causes so much friction that your pump runs away from the water. The remedy is to provide a tank or reservoir at the distant mill and a force pump at the mill on the bank; the water will then be driven through the pipe instead of drawn through it, and the friction can be easily overcome. The water, being discharged into the tank at the distant mill, can thus be taken up by the pump stationed there and supplied where required

(32) A. V. D. V. says: I hold that the following: $7\times8\times2\times5\times0\times5\times6=6{,}300$: is correct. My friend argues that $210\times0=0$ and so on, the answer being 0. Please give us your opinion. A. Your friend is right. You may get a clear idea of the matter by imagining 0 to be a fraction whose numerator is 1, and whose denominator is infinitely large.

(33) W. H. H.—The recipes for colored stars for rockets were from eminent authority, and are correct in every particular.

(34) C. M. C. says: Atmospheric pressure is estimated at 15 lbs. per square inch. If a boiler capable of bearing only 100 lbs. pressure in the open air could be placed in a vacuum, would it not burst at 85 lbs. pressure? In other words, should there be an increase of 15 lbs. made on the bursting pressure of a boiler on account of the resistance of the atmosphere? A. This allowance is always made in proportioning a boiler, by taking the pressure of the steam to be that shown by the steam gage, while the pressure, in reality, is on an average 15 lbs. greater than this.

(35) T. C. W. asks: 1. Is paper a good conductor of cold? A. Paper is a very poor conductor of heat and (although it is not the usual way of regarding the subject) of cold. 2. Please name a few good conductors of cold. A. All the metals are good conductors.

(36) G. H. M. asks: Can gas carbon be consumed, or by any means converted into the gaseous state, as the other forms of carbon are when made to deflagrate with niter or other oxidizing agents? At present it resists this treatment. A. It can. When placed in the galvanic focus, it is completely consumed.

(37) T. J. M. & O. H. G. ask: On p. 300, vol. 31, you say that muriate of ammonia, in vapor, is taken by inhalation for bronchial affections, etc. How is the vapor produced? A. The vapor of ammonium chloride may be obtained in many ways, but perhaps the following is the safest for this purpose: Place a small quantity of ammonium chloride (common sal ammoniac) in a flask, or better still, an iron bottle, and heat strongly. The vapor should be inhaled as it comes over, for if allowed to cool it will gradually condense.

(38) J. S. asks: How high would a balloon have to ascend to get outside of the earth's attraction; and what would become of such a balloon? Would it not float in the endless space for ever? A. A balloon could not possibly ascend to more than 30 or 40 miles, the limit of our atmosphere.

(39) W. W. A. asks: How can I manufacture starch from potatoes? A. In order to extract the starch, the tubers are first freed from adhering earth by a thorough washing, and are then rasped by machinery. The pulp thus obtained is received upon a sieve, and is washed continuously by a gentle stream of water, so long as the washings run through milky. This milkiness is due to the granules of starch which are held in suspension. The milky liquid is received into vats, in which the amylaceous matter is allowed to subside; the supernatant water is drawn off, and the deposit is repeatedly washed with fresh water until the washings are no longer colored. The starch is then suspended in a little water run through a fine sieve to keep back any portion of sand, and, after having been again allowed to settle, is drained in baskets lined with ticking; the mass is then placed on a porous floor of half baked tiles, and dried in a current of air, which is at first of the natural temperature; the drying is completed by the application of a moderate heat.

(40) A. S. G. says: In your reply to J. B. T., (No. 53 in No. 13, vol. 31), your first answer amounts to saying that a vessel will be of the same weight when full of air as when exhausted. This does not seem possible; the vessel would, of course, weigh the same as the materials of which it is composed; but when it is exhausted it would be buoyed up by the external air to just the amount of the weight removed. A. A vessel with a capacity for 60 gallons, when exhausted of air, would weigh nearly an ounce lighter than when full.

(41) W. M. G. asks: What can I put into flour paste to keep it from souring? A. See p. 219, vol. 30.

What is the best motive power for a heavy leather manufacturing machine? A. Steam.

How can I find the weight of a bin of stove coal from the cubic feet of the bin? A. By first determining the weight of a known measure of the material (say one cubic foot) and then multiplying the number of cubic feet contained in the pile by the weight obtained.

(42) B. asks: Are not metallic lamps far safer than the glass ones? A. Glass lamps are conceded to be the safest where burning fluids containing light or volatile oils are used, because of their poor conductivity of heat.

(43) J. P. G. asks: 1. Is ozone poisonous? A. Yes. 2. Is it dangerous to breathe or inhale it? A. Yes. 3. If its fumes were generated in a tight place or room, would it be necessary to remove all eatables to prevent their being impoisoned? A. Not necessarily.

Can a family use water drawn through lead pipes for 20 years without being poisoned? A. Whether the lead acts upon the water depends upon the character of the water. Some waters affect lead, others do not. A very simple chemical test will answer this question.

(44) G. D. F. asks: How can I improve spectacles that are dull and scratched, and make them magnify more? A. There is no other way than to have them reground and repolished.

(45) C. D. C. says: I have been very much bothered with my nickel solution. After an article has been in the solution about an hour, japan-colored streaks appear; and when the plating has been polished, the parts that were clear in the solution stand out in relief equal to the thickness of the plating, no nickel of any thickness having been deposited on the dark spots. The inside of the vat was dressed with black varnish (some kind of preparation of coal tar). The tar got dry on the sides but not on the bottom. I then coated it over with hot asphaltum and turpentine, but the tar mixed with the asphaltum and raised air bubbles in the liquid. The solution had the smell of turpentine and asphaltum. The thing did not work any better, so I filtered the solution and scraped the vat clean inside, but it still works as described. What can I do to clean the liquid and make it work well? A. This is a question best answered by some one who has encountered and overcome such a difficulty in nickel plating. The plan followed in similar cases by chemists is to filter, either through common filters or others having an absorptive action on coloring matters. Further impurities are sometimes gotten rid of by a partial evaporation and crystallizing the pure salts out.

(46) O. H. H. asks: 1. What will remove grease, iron rust, and stains from cloth? What will take out printing ink without injuring the goods? A. The best method is to saturate the spot with benzine, which is a solvent for both grease and printer's ink, and then cover the spot thickly with powdered French chalk, which will absorb it. Repeat if necessary.

(47) J. B. asks: Why will a perspective view taken from a given point not be identical with a photograph taken from the same point? A. Because the method by which objects are represented on paper by the rules of perspective drawing is essentially different from that by which the same objects are projected on a plane surface by the operation of lenses. See our answer to P. M. O'F., No. 23 on p. 314.

(48) A. S. asks: How is an odometer attached to a wheel? A. It generally has a clamp. If not, it can be tied.

Will you please tell me where that engine is that has a cylinder about 108 inches in diameter by 14 feet stroke? A. There were several such cylinders in vessels belonging to the Pacific Mail Steamship Company a few years ago. Whether or not the vessels are still in service, we cannot say.

(49) B. & Co. say: We want to put a whistle on a building. Will a tin boiler holding three gallons of water furnish steam enough to blow the whistle when desirable? A. It will not be very satisfactory unless quite a small whistle is used.

(50) E. W. W. says: A friend of mine claims that there is really no such an apparatus as a suction pump, that water is brought through such a pump altogether by air pressure, and not by suction. Is he right? A. Yes.

(51) M. W. says: I dissolved some tungstate of soda in water, and wet splinters with it and dried them. They would burn about as they would if wet with alum water. How should the tungstate be used? A. It is necessary that the wood be immersed in the solution until the outer pores become well filled.

(52) H. T. S. asks: Will a piston head give the same power if made of a wedge shape, as if it had a plain straight face? A. Yes.

(53) J. B. R. asks: How can I find the specific gravity of any fluid with a specific gravity bottle? A. By finding the weight of a bottle full of the fluid at the given temperature. Then specific gravity =

$$\frac{\text{weight of bottle filled with liquid} - \text{weight of bottle}}{\text{weight of bottle filled with water} - \text{weight of bottle.}}$$

(54) H. J. H. asks: At how much greater pressure are steam boilers tested by hydraulic pressure than would be a safe steam working pressure? A. One third, commonly. 2. What proportion of the effective heating surface should the fire grate surface be? A. From 1-90 to 1-11, according to character of boiler. 3. In what state is a boiler capable of bearing the highest pressure, heated, as when steam is up, or cold? A. Generally when heated. 4. What is tensile strain in steam boilers? A. It is the strain tending to rupture the boiler. Your other questions will be answered in a forthcoming editorial on the strength of boilers.

(55) J. B. S. asks: Is soluble glass manufactured in this country? A. Yes. By liquid or soluble glass is understood a soluble alkaline silicate. Its preparation is effected by melting sand with much alkali, the result being a fluid substance. The various kinds of water glass are known as: Potassa water glass, soda water glass, double water glass, and fixing water glass. Potassa glass is obtained by the melting together of pulverized quartz or quartz sand 45 parts, potassa 30 parts, powdered wood charcoal 3 parts, the molten mass being dissolved by means of boiling in water. Soda glass is prepared with pulverized quartz 45 parts, calcined soda 23 parts, carbon 3 parts; or (according to Buchner) with pulverized quartz 100 parts, calcined Glauber salt 60 parts, and carbon 15 to 20 parts. Double water glass (potassa and soda water glass), according to Döbereiner, is prepared by melting together quartz powder 152 parts, calcined soda 54, potash 70 parts. For technical purposes, a mixture of 3 volumes of concentrated potassa water glass solution, and 2 volumes of concentrated soda water glass solution, is employed. By the name of fixing waterglass, Von Fuchs designates a mixture of silica well saturated with potassa water glass and silicate of soda. It is used to fix or render the colors permanent in stereochromy. Water glass is an important product in industry. It is used to render wood, linen, and paper non-inflammable. It is also used as a cement: in this it is equal to lime, and indeed is known as mineral lime. Another application of water glass is in the painting of stone and concrete walls, and in the manufacture of artificial stone. An interesting and important application of water glass is in the new art of mural and monumental painting, termed by Von Fuchs stereochromy or solid color.

(56) O. C. asks: If heat comes from the sun, how is it that a sunglass does not get hot when held so as to set fire to an object on the side opposite the sun? A. The action of the glass is simply to condense or concentrate to a focal point all the rays of light and luminous heat that fall on its surface. There fore, the greater the diameter of the lenses, the higher will be the temperature at the focal point, the temperature of the glass remaining the same. Burning glasses are, in many cases, made of pure rock salt, which, because of its diathermancy, transmits with equal freedom the dark and the luminous heat rays, as well as those of light. Heat is a form of motion. The old caloric hypothesis has long since been abandoned.

(57) E. D. D. asks: What is heat? A. It is defined in Watt's "Dictionary of Chemistry" as follows: "The word heat is used in common language, both as the name of a particular kind of sensation and to denote that condition of matter in which it is capable of producing this sensation to us." You will see that heat is defined by stating its effects, since the exact nature of it is not known.

Is there such a thing as an absolute vacuum? What would be the temperature of as perfect a vacuum as could be made? A. See article entitled "A Perfect Vacuum," p. 400, vol. 28.

(58) J. W. W. asks: Has the premium yet been awarded for the best means of propelling canal boats without agitating the water? A. Yes.

In what degree does gas expand on being heated? A. About 1-491 of its volume for each degree Fah. that its temperature is increased.

(59) G. H. M. asks: How can I prepare the percussion powder for brass cartridges? A. Take fulminate of mercury 6 parts, chlorate of potassa 6 parts, and antimony 6 parts.

(60) G. D. H. asks: 1. What are the duties of a bridge engineer? A. He must be able to design and construct bridges. 2. In what manner, and by whom are such men usually employed? A. They are employed by railroad and other companies, city authorities, highway commissioners, and private parties. 3. What is the customary mode of obtaining and of doing the business of that profession? A. By offering your services to those who are in need of them, and demonstrating that you have the requisite skill and experience for the work to be done. 4. What is the best way for a graduate of a school in engineering to acquire a practical working knowledge of any branch of his profession, and of getting established in it? A. The best way to acquire practical knowledge is to practice.

(61) D. B. C. says: 1. I want to build a steamboat, to run against a current of about 3 miles per hour. I wish to make the boat 12 feet wide and 16 long, with a draft of 18 inches. I have two 8 horse engines that make 200 revolutions per minute, and I propose to gear them down to 100 per minute. A. It would probably be better to gear down to a slower speed of wheel. 2. Shall I have to get a license from government? A. Yes. 3. What will it cost? A. It will cost about $40.

(62) J. W. R. asks: What is the best composition to put on a 35 foot furnace chimney, to protect it or make it last? A. There is a black varnish made from mineral oil that seems to answer very well.

(63) A. R. asks: Will a centrifugal water mill go in a vacuum? A. Yes.

Would an ordinary rocket, exploded in a vacuum infinitely large, ascend? A. Yes.

In boiling hay for paper stock in a tub with a loose cover, would there be any economy in using steam under 45 lbs. pressure instead of 20 lbs., the steam being allowed to escape in the hay through openings in the pipe? A. No.

(64) G. W. A. says: I wish to get up a metallic substance to put up cotton in. I want something light, but tough and strong, and thinner than zinc. Zinc is too costly. Can you tell me what metal or combination of metals will answer my purpose? A. You ask rather too much, in requesting us to do your inventing. You should make experiments with different materials until you find what you want.

(65) W. J. A. says: I have a three inch drive well with six feet of water standing, but two or three strokes of the pump empties it. I have a pump with a two inch suction pipe. The well worked very well when first sunk, the pump having one inch suction pipe. I think it is caused by corrosion of the sand screen. I had a well borer to examine it, and he said that it was caused by leaving the mouth of the well open, and he plugged it up. That I found created considerable back pressure on the pump, and at the same time did not give the desired results. Do you think if the well had been closed in the first place it would have retarded or prevented the corrosion? A. Probably your suction is choked, and that causes all the trouble. If there is plenty of water in the spring, it will only be necessary for you to use non-corrosive screens, of brass or galvanized iron.

(66) P. H. W. says: I wish to put a new screw to a steam yacht, the length of which is 42 feet, beam 7 feet. She draws 22 inches forward, and 26 aft. The wheel I now have is 38 inches in diameter, with 5 feet pitch (2 blades). Would I gain anything by using a 4 bladed screw, 36 inches in diameter and of 5 feet pitch? A. A three bladed screw would doubtless be the best.

(67) H. N. asks: 1. Is it safe to run a 3x8 engine at 300 turns per minute? A. Yes. 2. If so what power will such an engine give under 100 lbs. pressure? A. About 9 horse power, with 100 lbs. mean effective pressure. 3. What should be the size of the boiler (upright tubular) and thickness of shell? A. Boiler with 120 square feet of heating surface; shell, about 3 16 of an inch thick.

(68) A. T. S. says: I am building a small engine 1½x3 inches cylinder. What kind of piston packing is best, and how should it be put on? A. For so small a piston it is generally sufficient to make it solid, with a few grooves. 2, Could I use hemp packing without burning it, using steam at 74 lbs.? How is rubber packing applied? A. You can use either hemp or rubber packing by making a recess in the piston, and neither will be liable to burn out, with proper care. 3. What is the rule for getting size of steam and exhaust pipes? A. Make the steam pipe ¼ inch, and exhaust 5-16 inch, diameter.

(69) S. E. T. D. says: Does a pendulum of a certain length require a certain weight? If so, what should be the weight of a ball to a pendulum making one beat in a second? A. Any weight will answer if the mechanism is adapted to it.

(70) T. C. says: I have built a small pleasure yacht. Length of keel is 25 feet, beam 6 feet 6 inches, depth of hold 3 feet 10 inches. Cylinder is 6x5 inches, and boiler 60x36 inches, with 130 tubes 1¾ inches in diameter and 2 feet long. I drive a 30 inch Delamater wheel. I have driven her 6 miles against a flood tide in 44 minutes, with a pressure of 130 lbs. steam. I propose to lengthen her. How many feet should I add so as to get the utmost possible speed out of her? A. We would not recommend lengthening the boat more than 5 or 6 feet, and probably the present screw would answer. 2. Will the boat be as strong as it was before being lengthened? A. You can make the boat as strong as before by proper construction. 3. Am I required by law to have a licensed engineer and pilot? A. It will be necessary to have a licensed engineer and pilot, according to the requirements of the steamboat law.

(71) A. H. K. says: My son is desirous of learning engineering, both practically and theoretically. Would you advise his attendance at some school of design? A. He can obtain some practice in a technical school; and you will find the Stevens Institute of Technology one of the best. After his graduation, it would be well for him to enter a general machine shop and work there for some time.

(72) C. P. N. asks: How is fermentation controlled, so as to keep carbonic acid gas in the beer, that it will sparkle when filled into the glass? A. By keeping the beer in closed vessels, so as not to allow the gas to escape.

(73) G. F. B. asks: How can I construct a Leclanché galvanic battery? A. The battery consists of an ordinary porous vessel of unglazed earthenware, into which is placed a plate of carbon which is surrounded by a mixture of carbon and peroxide of manganese, tightly packed and sealed with a layer of asphaltum. The cup, thus prepared, is placed in a glass vessel, surrounded with a strong solution of chloride of ammonium (sal ammoniac) to about half its hight. A rod of amalgamated zinc is now placed in the jar, which constitutes the negative pole and completes the arrangements of the cell.

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

A. B. C.—It is muscovite. It contains no silver.—P. C. K.—No. 1 is biotite. No. 2 is garnet and tourmaline. No. 3 is quartz and tourmaline. They contain no silver.—R. H. C.—No. 1 is red hematite. No. 2 is hornblende. No. 3 is iron pyrites.—A. C. B.—A qualitative analysis of your mineral shows the presence of oxide of iron, chlorine, sulphuric acid, soda, lime, magnesia, and carbonic acid.—J. L. B.—It is tremolite.—J. E. B.—It is not red but yellow ocher, with a certain percentage of clay. You must have it properly analyzed before the value per ton can be given.—C. P. D.—A qualitative examination showed that, while the specimen sent consisted of a considerable amount of hydrated sesquioxide of iron, yet it also had a large amount of insoluble earthy matter, and we should hardly pronounce it, from the analysis thus far made, a yellow ocher in the proper sense of the word. It would be necessary to make a further analysis and determine the percentage of iron present.—We have received three specimens without any letter, name, or address. No. 1 is mica in decomposed granite. No. 2 is anhydrous sesquioxide of iron. No. 3 is calcite.—We have received 16 specimens in a wooden box, unlabeled. Two are very valuable fibrous brown hematite. Two are impure yellow jasper. Twelve are valuable chromite, and are excellent ore of chromium.

E. R. M. & P. W. ask: What will destroy the smell of naphtha in which rubber has been dissolved?—H. P. says: A lady friend of mine has a pair of scissors, which she uses constantly, and which were used by her mother fifty years ago. The polish upon them is exquisite, and they look as though they just came from the factory. On the contrary, a pair of very beautiful scissors, whose original polish was as perfect as that of the old ones, and which were presented to her two years ago, are dull and tarnished. She showed me also a surgical knife that was brought over at the same time as the scissors; nothing could be more beautiful than the polish, which neither time nor use has dulled while some more modern instruments require constant attention to keep them clean. Can you explain it?—J. H. asks: How can I weld steel?

COMMUNICATIONS RECEIVED.

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

On Developing a Country. By T. H. B.
On the Szaroch. By C. R. S.
On a Friction Brake. By W. G.
On Constant Batteries. By L. B.

Also enquiries and answers from the following:

C. M.—E. L.—R. R. R.—J. H.—A. Y. F.—P. R. G.—C. G.—F. Q.—R. L. B.—A. G.—C. H. S. D.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Where are computation tables published? Who sells horseshoe magnets? Who makes calculating machines? Where can good washing machines be obtained? Who sells a rapid knife cleaning machine?" All such personal enquiries are printed, as will be observed in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

October 13, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alloy, metallic, H. W. Wright	156,007
Animal fats, products from, G. B. Van Brunt	155,816
Auger, earth, R. J. Gardner	155,939
Bale tie, A. A. Goldsmith	155,867
Bale tie, G. W. Scott	155,981, 155,982
Bale tie, cotton, J. Adams	155,848, 155,849
Bayonet, trowel, E. Rice (r)	6,083
Bed bottom, J. T. Elwell	155,934
Bed bottom, D. Illestand	155,947
Bed bottom, L. Traber	155,998
Bed bottom frame, F. N. Frost	155,866
Bed, sofa, W. Livingstone	155,876
Boiler feeder, H. Howe	155,870
Boiler indicator, steam, H. S. Cole	155,828
Boilers, making wash, Wells & Bentley	155,907
Bolt-threading die, H. H. Morgan	155,840
Bone black, manufacture of, S. Blau	155,919
Boot heel, M. Bray	155,787
Boots, inlay for sandal, T. Owens	155,968
Borax, etc., from water, separating, O. Holden	155,948
Bottle stopper, W. E. Hawkins	155,833
Box, domino, W. J. Craig	155,792
Bracelet, S. S. Grant	155,911
Bridle rosette and gag swivel, Harris *et al.*	155,796
Buckle, L. Sterne	155,813
Buggy, spring board, J. G. Nicolay	155,809
Burial casket, O. M. Allen	155,914
Burner, lamp, W. N. Weeden	155,846
Butter box, S. Boyd	155,786
Butter tubs, fastening covers to, Barney *et al.*	155,916
Capstan, power, Manton & Remington	155,877
Car brake, W. C. Shearer	155,984
Car bridge, cattle, A. H. Hart	155,868
Car coupling, H. G. P. Jennings	155,954
Car coupling, A. Neel	155,883
Car coupling, M. J. Roach	155,890
Car coupling, F. W. Rowe	155,892
Car coupling, M. P. Scott	155,983
Car coupling, J. Sherman	155,985
Car coupling, J. B. Stamour	155,993
Car coupling, I. R. Titus	155,996
Car coupling pin die, C. H. Williams	155,910
Car detaching, electric, W. W. Carson	155,858
Car starter, W. R. Landfear	155,958
Carbureter, A. C. Rand	155,974
Card-setting machine, A. B. Prouty	155,972
Carriage, child's, S. P. Campbell *et al.*	155,857
Carriage wrench, T. Blodgett	155,785
Carriage reversible handle, J. Zimmerman	155,847
Cartridge, J. Orcutt	155,841
Cartridge loading implement, T. L. Sturtevant	155,994
Cartridge shells, annealing, A. C. Hobbs	155,835
Caster, table, D. Sherwood (r)	6,084

Casters, wire wheel for, W. F. Collier 155,289
Chairs, foot rest for, J. Wayland 156,004
Chairs, spring bottom for, E. Savoral 155,979
Chopper and cultivator, C. B. Harrison 155,945
Cigar bunching machine, B. H. Meyer 155,805
Cigar mold, F. C. Miller 155,806
Clamp board for elliptic springs, R. Vose 155,817
Clipping machine, animal, W. S. Burgess 155,855
Clod crusher, R. R. Redfield 155,975
Clothes frame, A. B. Jaquith 155,952
Clothes pounder, F. H. Perry 155,812
Condenser, C. L. Kidder 155,803
Cooler, beer, H. W. Beins 155,917
Corkscrew, W. P. X. Smith 155,895
Cornice tool, S. Ferris 155,864
Corpse cooler, P. Weber 155,818
Cot, folding, C. H. Deane 155,794
Cotton scraper, W. Sandlin 155,893
Cultivator, S. Jones 155,956
Currents, creating artificial, E. Bantz (r) 6,086
Curry comb, C. B. Rogers 155,977
Cutter, vegetable, Z. T. Hartman 155,797
Dairy vessel, F. D. Stone 155,899
Dial, sun, D. B. Scofield 155,894
Door check, D. Gundelfinger 155,942
Drilling machine tripod, J. B. Waring 156,003
Dummy, N. Ward 155,906
Edge plane, H. Vail 155,901
Elevator, dress, E. Stewart 155,898
Engine, steam, R. Eickemeyer 155,933
Fence, farm, W. C. Banks 155,915
Fifth wheel, J. Skeen 155,988
Floor beam, I. C. Martin 155,960
Furnace, heating, Bishop & Aiken 155,851
Furnace, steam boiler, C. D. Smith 155,896
Gas, illuminating, W. M. Jackson 155,872
Gate, farm, W. R. Jenkins, Jr 155,953
Glass, manufacture of, H. Percival 155,887
Glass shield for lock furniture, J. P. Adams 155,913
Governor, steam, J. D. Lynde 155,838
Grain cleaner, S. B. Johnson 155,955
Grain, unloading, D. A. Morris 155,882
Grapevines, training, J. B. Tillinghast 155,995
Grate, D. G. Stafford 155,844
Grating cellar, A. Wissler 155,911
Hammer, power, A. L. S. Chenot 155,859
Harness draft equalizer, E. W. Davis 155,930
Harrow, F. Donohue 155,830
Harvester, C. W. Parker 155,810
Harvester rake, N. Carl 155,924
Harvester rake, W. K. Miller 155,964
Hats, package for, J. C. Budd 155,922
Hog trough, J. H. Hunter 155,951
Hoisting machines, brake for, E. Benjamin 155,822
Hook, snap, W. E. Sparks 155,843
Knife, bench, C. A. Warfield 156,002
Knife, splitting, Gerling & Broderick 155,831
Lamp collar, W. B. Carrington 155,925
Leather, burnish for, J. Clausen 155,860
Leather-pebbling machine, M. Dolan 155,931
Lighter, head light, G. M. Davis 155,793
Lock furniture shield, J. P. Adams 155,913
Locket, T. L. Michel 155,963
Logs, device for sorting, L. W. Pond 155,842
Lounge, N. H. Borgfeldt 155,921
Mash machine, Schimper & Immen 155,980
Mattress, H. E. Smith 155,990
Measuring instrument, distance, J. B. Thomas 155,997
Medical compound, L. Anderson 155,820
Mill tram, F. G. Wallace 156,001
Mill, paint, R. Byrne 155,826
Molding machine, O. Meyer 155,880
Moldings, machine for dressing, J. C. Brandon 155,853
Motion, etc., transmitting, W. T. Hamilton 155,943
Motor, hydraulic, W. O. Wakefield 156,008
Padlock, J. Adams 155,912
Paperpulp digester, W. F. Ladd 155,836
Paper-ruling machine, J. Tregurtha 155,815
Pavement, iron, G. R. Snow 155,992
Photographic screen, H. Hammenstede 155,944
Piano pedal attachment, S. W. Blake 155,823
Planchets, etc., cutting, F. M. Huntington 155,800
Planter, cotton, Remsen & Russell 155,889
Planter, cotton, O. H. Trout 155,903
Planter, seed, L. S. Connor 155,929
Plating, nickel, P. A. Normandeau 155,884
Plow, gang, Howes, Dorr, & Webster 155,871
Plow, walking, T. F. & W. Vandegrift 155,905
Plow, wheel, T. E. C. Brinly 155,825
Pocket implement, compound, A. N. Clark 155,790
Press, screw, C. W. Creenshaw 155,862
Press, steam and hydraulic, J. F. Taylor (r) 6,085
Printing patterns, J. D. McDonald 155,879
Printing press, W. M. Clark 155,927
Pump, E. Buzby 155,923
Pump for deep wells, F. McCabe 155,861
Pumps, bucket for chain, A. W. Newhall 155,965
Radiator, steam, A. A. Griffing 155,795
Radiator, steam, W. H. Shock 155,986
Raft slide, J. Viles, 2d 156,000
Railway crossing, W. J. Morden 155,808
Railway signal, electric, Teseé et al 155,900
Railway switch, F. W. Collins 155,791
Rake, horse hay, B. Owen 155,967
Rake, horse hay, R. Wilson 156,005
Rein button, C. E. Haynes 155,834
Roll for rolling shafting, disk, M. Hoagland 155,799
Row lock, J. W. Norcross 155,966
Saddle seat, spring, J. L. Sommerville 155,897
Salt, manufacture of, O. E. Pohl 155,971
Sash fastener, P. Bradford 155,824
Sash fastener, W. R. Mills 155,881
Saw, hand, H. Howson 155,950
Saw set, J. Legget 155,875
Saw setting and filing device, W. Weber 155,819
Sawing machine, crosscut, J. Thompson 155,902
Sawing laths, machine for, B. F. Haley 155,832
Sawing machine, scroll, J. E. Brown 155,854
Scaffold, M. Perkins 155,969
Scale stock frame, S. Hetfield 155,946
Scoop, cart-loading, A. Vreeland 155,815
Screw-threading rods, R. Boeklen 155,920
Scrubber and mop combined, G. Pirrung 155,888
Seat and table, folding, W. Tetley 155,901
Seeding machine, A. W. Fricke 155,938
Separator, seed, W. E. Lee 155,874
Sewing machine, E. Drake 155,932
Sewing machine, O. S. Hazard 155,798
Sewing machine attachment, J. W. Robards 155,976
Sewing machine, boot, H. Dunham, Jr. (r) 6,081
Sewing machine quilters, W. H. Null 155,885, 155,886
Sewing machine take-up, J. V. D. Eldredge (r) 6,087
Sewing machine trimmer, W. H. Springer (r) 6,089
Shaft coupling, J. F. Light 155,837
Shank cutting machine, I. Frechette 155,937
Shingle block sapper, etc., Bassett & Nichols 155,850
Shingle machine, F. A. Huntington (r) 6,082
Shoe, S. A. West 155,909
Shovel, T. B. De Forest 155,829
Shutter fastener, D. F. Hutchinson, Jr 155,801
Sifter, coal and ash, H. A. Luscomb 155,959
Sole-nailing machine, McKay & Fairfield 155,962
Spindle step, W. Mason 155,878
Spinning mule, self-acting, McCreery & Crighton 155,804
Sprinkle, P. A. Bowen 155,852
Steering apparatus, J. L. Cathcart 155,926
Stocking supporter clasp, R. Eberle 155,863
Stone, slag for artificial, W. H. Smith 155,990
Stove, H. M. Smith 155,991
Superheater, T. B. Field 155,865
Table, folding, J. N. Valley 155,999
Telegraph line tube, T. Fell 155,936
Tenoning machine, C. H. Radcliff 155,973
Threshold, Moore & Whitney 155,807
Time recorder, electric, E. T. Gilliland 155,940
Toaster, bread, W. Camp 155,789
Toy, automatic, R. J. Clay 155,827
Toy cracker, V. Platz 155,970
Tray, hog, P. Well 155,908
Truss, J. L. Rowe 155,891
Tubing coupling, E. W. Wolfe 155,006
Valve for steam, water, etc., Peet & Poland 155,811
Valve, safety, E. H. Ashcroft 155,821
Vegetables, etc., preserving, Holgate & Tupper 155,949
Vehicle wheel, H. Bender 155,918
Wagon body, F. Clemens 155,861
Wagon standard and bolster, J. Skeen 155,987
Wash tub stool, V. Royle 155,978
Washing machine, J. B. Farrar 155,935
Washing machine, W. Hilton 155,869
Washing machine, D. Kunkel 155,873
Water closet, W. Stockton 155,814
Waterproofing composition, T. Butler 155,856
Weather strip, C. A. Judd 155,957
Womb supporter, J. Maas 155,839
Wood for pavements, etc., treating, A. Brisbane 155,788
Wool, destroying vegetable matters in, F. R. Joly 155,802

APPLICATIONS FOR EXTENSION.

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

31,102.—CAR SPRING.—T. F. Allyn. Dec. 30.
31,128.—HOISTING APPARATUS.—E. G. Otis. Dec. 30.
31,152.—EVAPORATOR.—G. F. J. Colburn. Jan. 6.
31,168.—GAS REGULATOR.—C. L. Herring. Jan. 6.
31,204.—FARE BOX.—W. B. Bartram. Jan. 6, 1874.
31,211.—SEWING MACHINE.—L. W. Langdon. Jan. 6.

EXTENSIONS GRANTED.

30,381.—DAMP.—J. E. Ambrose.
30,400.—SOCKET COUPLING.—E. P. Gleason.
30,415.—GAS REGULATOR.—J. G. Leffingwell.
30,442.—FILING GIN SAWS.—S. Yeatman.
30,446.—MAGAZINE FIRE ARM.—B. T. Henry.

DISCLAIMER.

30,400.—SOCKET COUPLING.—E. P. Gleason.

DESIGNS PATENTED.

7,791.—WAIST BELT.—G. G. Bates, New York city.
7,792.—TABLE CUTLERY.—C. W. Hill, Derby, Conn.
7,793.—STAIR PLATES.—W. T. Mersereau, Orange, N. J.
7,794 & 7,795.—C. T. Meyer et al., Bergen, N. J.
7,796.—CARPET.—C. A. Righter, Philadelphia, Pa.
7,797 & 7,798.—SCREW HEADS.—W. M. Smith, W. Meriden, Ct.
7,799 to 7,802.—HITCHING POST.—J. Davies, Muskegon, Mich.
7,803.—STOVE DOOR.—I. A. Sheppard, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,016.—LICORICE PASTE.—D. V. Arguimbau, Br'klyn, N. Y.
2,017.—CIGARS.—J. S. Bailey, Providence, R. I.
2,018.—WAX LEAVES, ETC.—A. De E. Bloodgood, N. Y. city.
2,019.—CARRIAGES.—J. B. Brewster & Co., N. Y. city.
2,020.—SOAP.—Colgate & Co., New York city.
2,021.—WRITING INKS.—C. L. Lochman, Carlisle, Pa.
2,022.—COUGH MEDICINE.—C. A. Pelton, Middletown, Ct.
2,023.—FERTILIZERS.—Piedmont Guano Co., B'more, Md.
2,024.—SHOVELS, ETC.—B. Rowland & Co., Phila, Pa.
2,025.—HOSIERY.—J. A. Guivet, Paris, France.
2,026.—HAIR RESTOR.—Tilton et al, San Francisco, Cal.
2,027.—RUBBER COMPOUNDS.—Whalebone Rubber Co., New York city.

SCHEDULE OF PATENT FEES.

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

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

OCTOBER 8 to 16, 1874.

3,920.—O. A. Howland, Toronto, York county, Ont. Mode of carriage on allied land and water routes in substitution for lockage and canals, called "Howland's Improved Mode of Carriage on Allied Land and Water Routes." Oct. 8, 1874.

3,921.—J. L. Joyce, New Haven, New Haven county, Conn., U. S. Improvements on boots and shoes, called "Joyce's Protection Toe." Oct. 9, 1874.

3,922.—A. S. Babbit, Keeseville, Essex county, N. Y., U. S., and H. L. Isham, Plattsburgh, N. Y., U. S. Improvements on washing machines, called "Babbit's Belt Washing Machine." Oct. 9, 1874.

3,923.—J. Sears, Chicago, Cook county, Ill., U. S. Improvements on soldering apparatus, called "Sears' Patent Aero-Gas Soldering Copper." Oct. 9, 1874.

3,924.—J. E. Billings, Boston, Suffolk county, Mass., U. S. Improvements on bricks, called "Billings' Universal Angle Brick." Oct. 9, 1874.

3,925.—E. Weston, Buffalo, Erie county, N. Y., U. S. Improvements on steam boilers, called "The Weston Boiler." Oct. 9, 1874.

3,926.—G. M. Robinson, St. Armand, P., Q., assignee of J. and G. Bacon, Medina, Wis. Improvement in weather strips, called "Bacon's Weather Strip." Oct. 13, 1874.

3,927.—D. Francis, Birkenhead, Chester county, England, Improved arrangements or apparatus convertible into a desk, seat, and table, called "Francis' Convertible Desk." Oct. 13, 1874.

3,928.—G. Angst, Zurich, canton of Zurich, Switzerland. Improvements on knitting machine, called "Improvements in Knitting Machines." Oct. 13, 1874.

3,929.—E. Wasell, London, Ont. Improvements in bridge building, called "Improved Trussed Girder Bridge." Oct. 13, 1874.

3,930.—L. D. Hurd and F. G. Butler, Bellows Falls, Rockingham, Windham county, Vt. Improved clothes pin or clamp, called "The Climax Clothes Pin." Oct. 13, 1874.

3,931.—J. W. Gamewell, Hackensack, N. J., U. S., M. G. Crane, Newton, Mass., U. S., and E. Rodgers, Boston, Mass., U. S. Improvements in electro-telegraphic non-interference repeaters, called "Electro-Telegraphic Non-Interference Repeater." Oct. 13, 1874.

3,932.—Wm. Cahill, Syracuse, Onondaga county, N. Y., U. S. Improvements in combined reversible kneeling and foot bench, called "Cahill's Combined Reversible Kneeling and Foot Bench." Oct. 13, 1874.

3,933.—M. Attenborough, Sherbrooke, P. Q. Improvements on a machine for ventilating rooms, called "Attenborough's Balance Ventilating Sashes." Oct. 13, 1874.

3,934.—W. T. Bunnell and A. G. Ronan, Ottawa, Ont. Improvements on clothes wringer, called "Bunnell & Ronan's Clothes Wringer." Oct. 13, 1874.

3,935.—H. A. Whiting, New York city, U. S. Improvements on machine for binding and wiring hat frames, called "Whiting's Machine for Binding and Wiring Hat Frames." Oct. 13, 1874.

3,936.—J. Abell, Woodbridge, York county, Ont. Improvements in threshing machines, called "Abell's Improved Revolving Grate." Oct. 13, 1874.

3,937.—H. C. Kerstine, Cleveland, Cuyahoga county, O., U. S. Improvements in grate bars, called "Kerstine's Grate Bars." Oct. 13, 1870.

3,938.—D. W. Baird, Geneva, Ontario county, N. Y., U.S. Improvement on concealed jointed braces or stays for carriage tops, called "Baird's Concealed Jointed Top Brace." Oct. 13, 1874.

3,389.—G. W. Vosburgh, Eau Claire, Eau Claire county, Wis., U. S. Improvements on harness pads, called "The Eau Claire Collar Pad." Oct. 13, 1874.

3,940.—H. Gnosill, Hamilton, Ont. Improvement in beer faucets, called "Gnosill's Improved Beer Faucet." Oct. 13, 1874.

3,941.—W. H. Cowell, Buffalo, Erie county, N. Y., U. S. Improvements on games to be played with picture cards, called "The Puppet Show of Punch and Judy set to Cards." Oct. 16, 1874.

3,942.—E. Cliff and R. Vase, New York city, U. S. Improvements in elliptic spring, called "Cliff's Elliptic Spring." Oct. 16, 1874.

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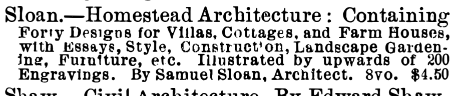

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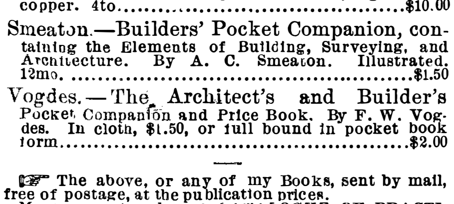

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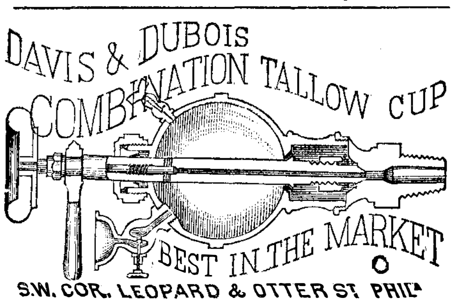

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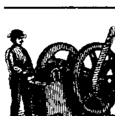

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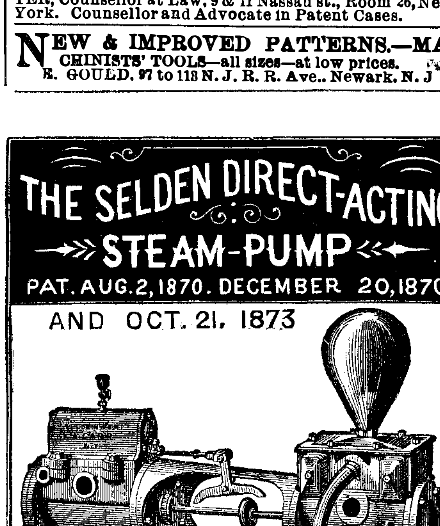

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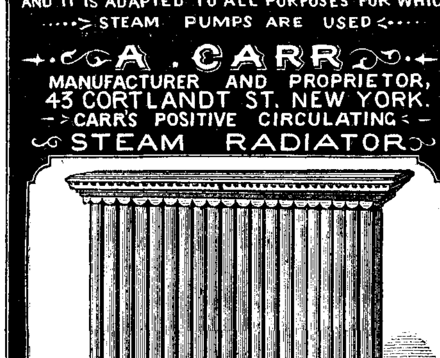

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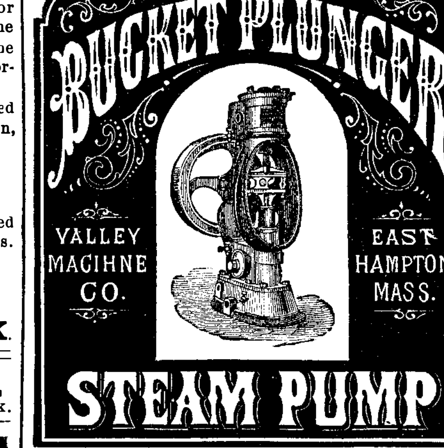

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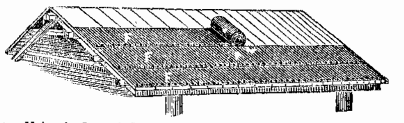

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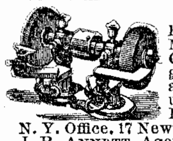

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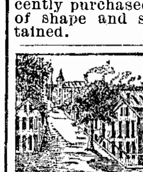

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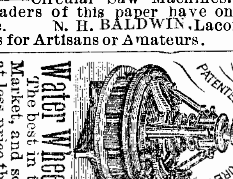

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