too light and powerless; we cannot rotate an inflated bladder and burst it by the weight of air contained therein, as the air would escape through the pores of the bladder, but we can burst it by the weight of the bladder itself.

If any portion of the nebulæ was left behind, it was the lighter portion, which, owing to that irresistible shrink, spiralled to either pole and like smoke from a pipe streamed on the solar orbit. True, the action of gravitation would be greatest at the poles, but the spiral would reduce it to a minimum, as in a jack screw. Nebulous rings could have formed in no other manner; spheres could have been formed by shrinking belts. TIRE.

Paris Green and Potato Bugs.

To the Editor of the Scientific American:

Much has been said, and a great deal written, concerning the use of Paris green for the destruction of the potato bug. Many advise the use of it dry, mixed with flour. Last year, I tried another way, which I think is safer and cheaper; and it proved very effectual. As it may be a benefit to many, I give it as follows:

Take one large table spoonful of Paris green and mix it with ten table spoonfuls of flour. These must be mixed very thoroughly, till the mass is of one shade ofc olor throughout. Take of this mixture, two table spoonfuls, and put it into a gallon of water. Stir this till it is all well mixed through the water, and stir it occasionally to keep it from settling,—for if it is not kept stirred, it will settle. Put the water thus prepared into a sprinkler, and apply when the plants are dry and the larvæ are at work. In a very few minutes, the larvæ will have gone to "that bourne whence no traveler returns."

The liquid applied this way, twice or three times during the season, will be sufficient to protect the plants. Used in this way, while it will destroy the insects, there is no danger of its hurting the plants; nor does sufficient go into the ground to do any harm. X. PERRY MENTOR.

Sans Souci, Ohio.

THE NEW STATE CAPITOL AT ALBANY, N. Y.

After three years labor, and at a cost of two millions of dollars, one third of the new capitol at Albany, the design for which we illustrated on page 242 of Vol. XXIII., may be considered complete. The foundations are laid, and the water table, and four feet of the first story walls, is in position.

The structure covers about three acres of ground, its width being three hundred feet, and its depth, four hundred. The cellar is excavated 26 feet and its floor is covered with a solid bed of concrete four feet in thickness. On this rest the piers of massive brickwork which, surmounted by groined arches, bear the weight of the structure. Long vaulted passages are thus formed which, intersecting each other, traverse the entire cellar, some leading to apartments in the corners of the building, others to the large hall in its center. The last mentioned division of the cellar is designed for an engine room, and is to contain four large furnaces and two engines, to be used for warming and ventilating the edifice. The ceiling of this apartment is, like those of the passages, formed of groined arches. These are 20 feet high, their spans varying from 11 to 20 feet, and are considered the finest specimens of masonry of their kind ever constructed.

The foundation of the main tower is the heaviest piece of solid stone work in the building. It is pyramidal in shape, its base being 150 feet, and its top, 80 feet square. It is sunk six feet below the surface of the cellar, and its extreme strength is necessitated by the immense superincumbent weight of tower which will be constructed entirely of stone and iron, and will reach a hight fifty feet above that of the dome of the Capitol at Washington.

The exterior foundation walls are 20 feet thick; their lower courses are built of a species of blue limestone of great hardness, obtained in Essex county in this State. The upper portions, which are more liable to be affected by frost, are constructed of Saratoga granite, and the lintels, of a very coarse granite from Fall River. The water table is built entirely of Dix Island granite, the company supplying that stone having had a contract to employ it exclusively in that part of the structure. On the completion of the water table and the consequent expiration of the Dix Island Company's contract, new proposals were invited from other quarries to supply the stone for the rest of the building. Sixteen competitors entered, and, in the end, the work was awarded to a company in Yarmouth, N. H., who agreed to furnish the stone at 75 cents per cubic foot delivered at Albany. It seems, however, and the fact will account for the delay in the progress of the work which the daily press have lately made the subject of unfavorable comment, that the Yarmouth Company failed to carry out their contract, sending only some eighteen or twenty carloads of stone around by land at considerable expense. The Keene quarry, of Keene, N. H., offering to supply their stone at 85 cents per cubic foot, the commissioners have agreed to take the balance of the material from that source.

Of these three varieties of granite—the Dix Island, the Yarmouth, and the Keene—the Dix Island is much the coarsest in texture; the Yarmouth and Keene stones resemble each other very closely, both being white, fine, and hard. The Keene, however, is found to be slightly the most brittle under the cutting tool.

The stone is quarried in enormous blocks, some weighing as much as thirty tuns. They are so cut as to make all the angles of the building solid, or, in other words, there is no angle on the outside of the building where two stones meet and form a joint. The manipulation of these ponderous masses was, of course, at first a matter of no slight difficulty, but lately a form of derrick has been devised by which they can be raised or transported from place to place with the utmost facility. The apparatus consists of a heavy platform mounted on trucks and resting on a track, the rails of which are some sixteen feet apart. On this platform is a ponderous crane, secured by strong wooden stays. To the crane, heavy tackles are attached, the falls leading to a hoisting apparatus worked by a five horse power engine, situated on the rear end of the platform. This engine, being geared to the wheels of the latter, supplies the motive power; so that a stone can be lifted by the crane and the whole machine moved bodily to any desired point.

Seven hundred men are now at work upon the building, the majority being engaged in cutting the stone, which is supplied in the rough, into the required forms. Two large sheds serve as workshops, movable derricks running on tracks transporting the stones to any required locality. The work is systematized with the greatest care. Each man is required to work his stone through from beginning to end. The stone is numbered and the work measured, so that it can readily be seen whether the full day's work has been properly performed or not. The hands are paid by the hour. They struck some time since on account of some workmen from another State being put to work with them, and at the same time demanded $4.50 for eight hours work. A short time had elapsed, however, before the union in this city informed them that it could support them no longer, and consequently they compromised at 45 cents per hour, and signed an agreement to find no more fault either in their wages or in the fact of non-union men being put to work with them. When the present excitement commenced, a committee endeavored by threats and other means to induce another strike, but on the wages being raised to 50 cents per hour, the men declared themselves satisfied and refused to resort to any further coercive measures.

A Monster Cannon.

The Russian government has lately constructed and tested an immense smooth bore cast iron cannon, made after the method of the American Rodman guns. The *Engineer* says that the weight of this weapon in a finished state is 44 $\frac{22}{62}$ tuns. The weight of the projectile to be employed—a cast iron spherical one—is 900 lbs. In trying the gun, in all 313 rounds were fired, the normal charge of prismatic gunpowder being about 117 lb. The experiments of firing were conducted on the river Rama, the high bank across the stream serving as a butt, which was at a distance of about 1,400 yards of the gun. The weapon was placed under an iron plated covering of a peculiar construction. On the discharge of the piece, the concussion of the air was so great that in the village of Matoriloro, situated at a distance of one third of a mile, the chimney stacks fell in when the wind was blowing in that direction. The sound itself, although loud, was not deafening, and persons standing even under the iron plated covering were able to support both the noise and concussion of the air. The iron gun carriage weighs $61\frac{4}{32}$ tuns. The breech of the gun is elevated and depressed by means of a screw ratchet key. For facilitating the running forward of the gun, a system of cog wheels is introduced, and for the diminution of the recoil and the hoisting of the charge and projectiles, special appliances are provided. The moving of this enormous mass of iron can be effected easily by three men.

After the introduction into the military art of rifled cannon, the conviction became established of their unconditional superiority over the smooth bores. As regards guns of small caliber, this opinion may very likely be correct; but with respect to naval guns of the largest calibers, it would be difficult to give the preference either to the one or the other system. Without going into particulars of the merits or demerits of the one or the other description of weapon, we will point to one important difference in the effect of the spherical projectiles of the smooth bores and the oblong ones of the rifled guns; the latter will hit an iron plated target at a greater distance than the former, and, so to say, pierce it through; on the other hand, the former will produce a far greater amount of concussion, shaking loose the rivets of the plates and bolts of the target, and bounding on the plates and cracking them. Besides the difference in the destructive action of these weapons, there is an enormous difference in the cost of production. Thus, for instance, according to a statement of Mr. Grasshof, the price of a 20in. smooth bore gun will be, when produced in quantities, about $8000, whereas an 11 in. steel rifled piece corresponding to the same could not be produced under $30,000.

New Fishing Smack.

A marine novelty worthy of attention was lately exhibited in Glasgow. It was a model of a welled fishing craft, 4ft. long, with 19 in. beam, clinker built and neatly finished The exhibitor was Mr. Dempster, of Kinghorn, who is well known for his advocacy of deep sea fishing, and who proposes to convert ordinary open decked fishing smacks into well decked boats, by laying a well caulked deck or flooring from stem to stern, at a hight of 2½ft. from the keelson, the space beneath this deck forming the well, which is filled with sea water from several small circular holes in the bottom of the boat. At a hight of 5ft. or 6ft. above the well deck there is another deck, which rises to within a foot of the gunwale, and which, being water tight and comfortable, is adapted for the quarters of the crew. Mr. Dempster has proved the advantages of this style of fishing craft by actual results in practice; and he claims for his system the advantage that, no matter what seas the boat may ship, it is impossible for it to be swamped, as the water immediately makes its way out at the bottom.

New Theory of Atmospheric Electricity.

A correspondent, Mr. G. Wright, of Rock Falls, writes as follows:

"The earth is surrounded by an electrical atmosphere which is subject to the law of gravitation, and is consequently more dense near the surface of the earth, and more rare in the higher regions. All the phenomena of electricity are due to the disturbance of this electrical atmosphere, in connection with the resistance of different substances to the passage of the electric fluid. When any substance has more electricity than another substance near it, it is in a positive or charged condition; when it has less, it is in a negative condition, and the attraction which negative substances exhibit for the positive is only the tendency to restore the equilibrium.

If a bladder be filled with air near the surface of the earth, and then elevated to a considerable distance, the confined air will burst the bladder and escape, because the atmosphere which surrounds it in these higher regions is of less density. So if a metallic ball, having the electrical condition natural to the surface of the earth, be suddenly elevated, its natural electricity becomes a charge, which may be drawn off by a spark. This fact can be demonstrated, on a still day when the air is free from moisture. Now, what better evidence do we want to prove that the earth is surrounded by an electrical atmosphere, more dense near the surface of the earth, and that the charge on the ball which was elevated is due to the lesser density of the electrical atmosphere which there surrounds it? When we add to this the chain of evidence which results from the explanation, of electricity in the clouds, the causes of *aurora polaris*, the daily variation of the magnetic needle, and every other electrical phenomenon, on this hypothesis, the proof is as positive that the earth is surrounded with an electrical atmosphere as that it is surrounded with an aerial one. I have spent several years in experiments and observations to demonstrate the truth of this hypothesis, and upon it to establish a theory that shall be applicable to all electrical experiments and phenomena, and am astonished at the facility with which all questions pertaining to this subject can be solved."

Refractory Clays.

Bischoff finds that the analysis of a clay gives a distinct indication as to its power of resisting extreme heats. The temperatures were measured by keeping the clay at a white heat till wires of iron or platinum were fused. The value of a refractory clay is found by the proportion of the alumina to the fusible matter, and again by that of the alumina to the silica. The more alumina a clay contains in proportion to the fusible matter (iron, alkalies, etc.,) the more refractory is it. Silica, on the contrary, augments its fusibility. Of two clays containing alumina and fusible matter in the same proportions, that which contains least silica is most refractory. Save in certain determinate cases, the clays containing alumina, silica, and fusible matter in equal proportions have an equal power of resisting fire. If we give to clays the general formula—$m\ Al^2\ O^3 + n\ Si\ O^2 + RO$, the degree of resistance to fire is measured by $\frac{m}{n}$. The higher the value of this fraction, the more refractory the clay.

PUT UP YOUR JAM WHILE HOT.—It is said that ordinary jam—fruit and sugar which have been boiled together for some time—keeps better if the pots into which it is poured are tied up while hot. If the paper can act as a strainer, in the same way as cotton wool, it must be as people suppose. If one pot of jam be allowed to cool before it is tied down, litttle germs will fall upon it from the air, and they will retain their vitality, because they fall upon a cool substance; they will be shut in by the paper, and will soon fall to work decomposing the fruit. If another pot, perfectly similar, be filled with a boiling hot mixture, and immediately covered over, though, of course, some of the outside air must be shut in, any germs which are floating in it will be scalded, and in all probability destroyed, so that no decomposition can take place.

HYDROFLUORIC ACID.—Mr. A. P. S. Stuart remarks that every one who has prepared hydrofluoric acid knows that sulphuric acid and fluor spar form an exceedingly hard rock-like compound, and that it is very difficult to remove this from a platinum retort. This inconvenience may be avoided by mixing with the fluor spar about an equal weight of gypsum and the proper quantity of sulphuric acid. After the hydrofluoric acid has been expelled by heat, the mass in the retort is found to be of a pasty nature, and is easily removed by water.

FATHER CLEVELAND.—Charles Cleveland, a respected clergyman of Boston, Mass., widely known for his useful and faithful labors, died recently in that city, at the remarkable age of one hundred years—less sixteen days. He retained his faculties up to the moment of his death, and continued in the exercise of his peculiar ministrations as city missionary until within a few weeks. After attaining his majority, he spent forty years in mercantile pursuits. His work for the past forty years has been remarkable. He devoted his whole time to ministering to the poor, and his labors were highly appreciated.

STRETCHING OF CHAINS.—Professor Trowbridge, of Yale College, has stated that at the Novelty works, N. Y., he once made a chain one thousand feet long, to be used for pulling a load of ten tuns up an incline five hundred feet long and one hundred feet high. In one year he took out, little by little, sixteen feet of slack caused by stretching. The chain got stretched out in time, though, and then did not alter.

Improved Piano Truck.

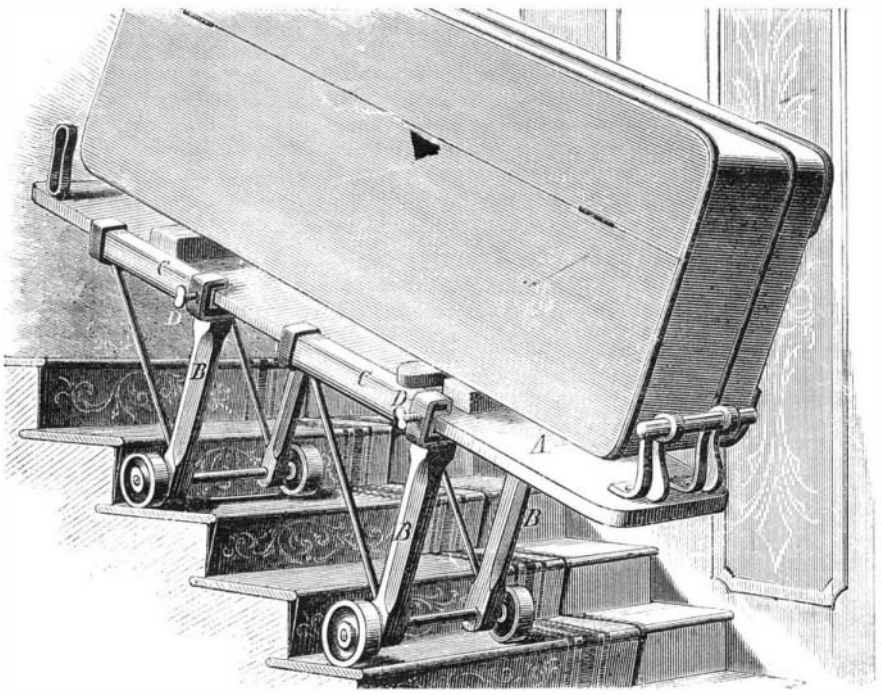
The improvement we illustrate consists in making the trucks adjustable in regard to the bed which carries the load, so that they can be fixed at any required distance apart, by whichmeans they may be fitted to stairs of various forms, and used to run pianos, or other heavy goods, up and down them. They are also readily detached from the bed when required, to facilitate loading or unloading.

Our engraving represents the improved truck while conveying a piano up (or down) stairs.

A is the bed, which is furnished at one end with the handle shown, and at the other with two straps, one of which is seen in the engraving. It is also furnished with four cushions, two fixed and two adjustable, on which the piano rests; three of these are partly shown between the bed and the piano. The trucks, B, are provided on both sides with grooved slides, as at C, by means of which they are made to travel on, along, or off the bed, A. They are fixed to the bed in any desired position by the screws, D.

In ascending or descending stairs the trucks are adjusted to the position shown in the drawing, so that, when one pair of truck wheels are snug against the riser of one stair, the other pair are rolling on the tread of another. By this adjustment one pair of wheels is always in position to be raised or lowered to the next stair. When required to put the piano into a wagon, the truck is raised by the straps until the handle end touches the ground, the piano resting on the handle; the upper truck is next slid off the front of the bed, which is then let down into the wagon; the other truck is then removed, and the bed and piano slid in. In taking it out, the bed is pulled out far enough to have one of the trucks put on it; the inner end is then raised until the outer end rests on the ground, when the other truck is put on; it is then gently lowered until the bed stands on all four wheels. While moving the piano over floors, sidewalks, etc., the spring of the bed between the cushions on which it rests prevents all jar to the instrument.

Altogether this seems to be a very useful as well as an ingenious invention. It is protected by patents issued March 16, 1869, and September 19, 1871. Further information may be obtained of the inventor, Mr. Charles A. French, of Davenport, Iowa.



FRENCH'S PIANO TRUCK.

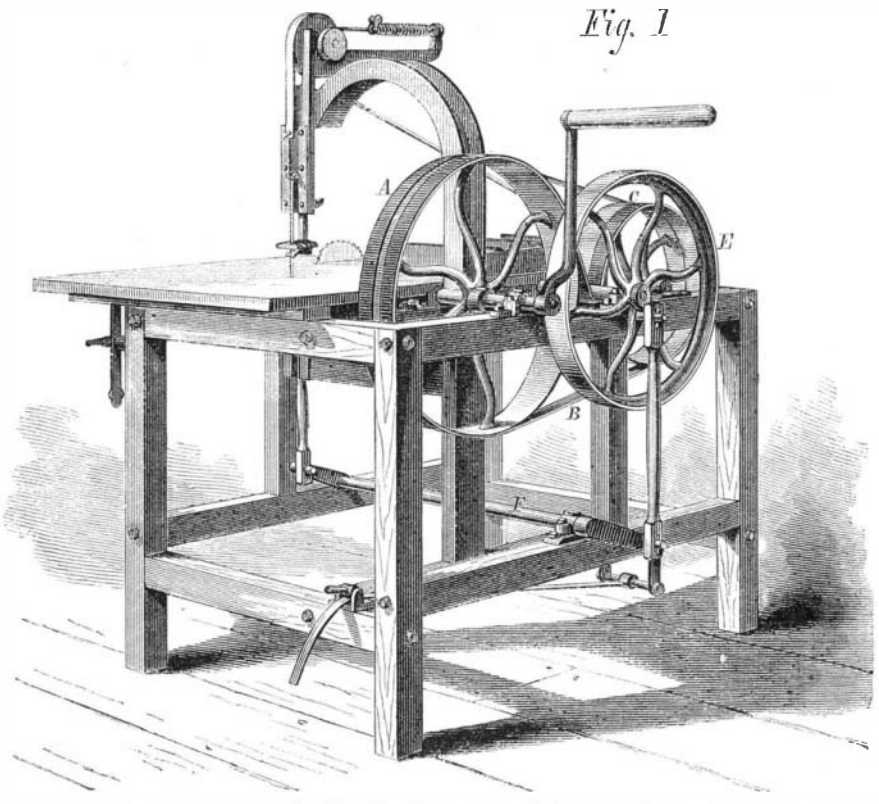
Sawing, Boring, and Planing Machine.

The invention we illustrate supplies workers in wood with a useful machine that can be readily adjusted for service either as a scroll saw, a circular saw, a planer, or a boring machine, and which may be run by hand or by power, as desired. Its most important feature is a skillful and effective contrivance by which the speed is multiplied and the power conveyed from the driver to the tool.

The machine is represented in Fig. 1, and Fig. 2 shows, in detail, the peculiar arrangements of pulleys and belting for conveying the power, etc. A is the driving pulley or drum. B are belts which pass around it, and around the loose pulleys, C. These belts are drawn inward, on opposite sides, as shown in Fig. 2, so as to surround the shaft or small pulley, D, and communicate motion to the same. The loose pulleys, C, run on a shaft attached to the upper ends of two levers, one of which is partly shown in Fig. 2; the lower ends of the levers are connected by a crossbar, to which is attached a strap that admits of being secured to the frame of the machine, as shown in Fig. 1. By this arrangement the tension of the belts is adjusted. The shaft, D, extends across the frame, and carries at its outer end the fly wheel, E; this is attached by a pin to a connecting rod which gives motion through a crank to the rock shaft, F, the crank being adjusted so that the revolution of the fly wheel only rocks the shaft. This motion of the rock shaft is conveyed through slides to the scroll saw, causing it to make its downward stroke; the recoil is secured by the band, pulleys, and spiral spring seen at the top of the machine.

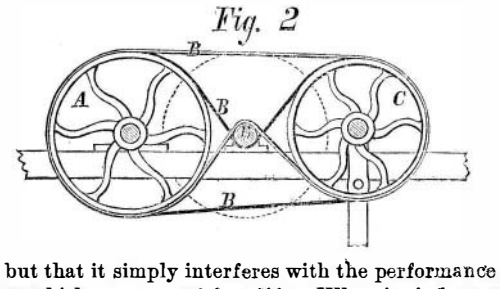
To the shaft, D, may be attached a circular saw in the ordinary manner, and to its inner end (not shown in the engraving) a cutter head, suitable for light planing or molding, or a boring tool, may be affixed. The table is provided with gages, and is adjustable to any elevation required by the character of the work. Our engraving shows both scroll and circular saw attached to the machine, but, in practice, when the scroll saw is used, all the other tools should be detached from the shaft; and when either circular saw, planer, or boring tool is employed, the crank pin of the fly wheel should be detached from the connecting rod, and the operation of the scroll saw prevented. The position of the belts on the pulley or shaft, D, puts equal pressures on opposite sides of the same, and does away with all side strain. Almost the entire periphery of the shaft is in contact with the belts, and a very large surface contact, as compared with the size of the shaft, is obtained. This, and the absence of the usual intermediate belts and pulleys employed for attaining speed, insure the utilization of the power applied and prevent its waste. We are informed that the hand power machine has been employed to saw three inch hard oak felloes and other carriage work with perfect success. It is manufactured extensively by the Greenwich Mowing Machine Company, of Greenwich, N. Y., of whom further information may be obtained.

Patented through the Scientific American Patent Agency for the inventor, Mr. William Weaver, October 3d, 1871, and January 30, 1872



WEAVER'S SAWING, BORING, AND PLANING MACHINE.

Fig. 2



Impurities in the Air.

Carbonic acid is not a poison by reason of any action on the blood. When it is present in the atmosphere in large amount, the glottis spasmodically closes, and death ensues from asphyxia. When in small proportion, it is still not taken into the system, but it interferes, to the extent of its presence, with the absorption of oxygen, and the elimination by respiration of the blood. Essentially, therefore, its action is that of a ligature to the trachœa. Thus I put this mouse into a jar of pure carbonic acid gas, and you observe that the animal dies in a few seconds. This other I place in an atmosphere containing forty per cent of carbonic acid, and death takes place after a longer interval, but still in essentially the same manner as in the first instance. If, however, as in the next experiment, I remove the animal before death takes place, and expose it to a free current of atmospheric air, recovery follows very promptly. It is hence apparent that carbonic acid gas is not a directly poisonous substance, but that it simply interferes with the performance of processes which are essential to life. When its influence is removed, provided the animal is not *in articulo mortis*, respiration goes on again as in health; just as, when a man hangs himself, and is cut down before life is extinct, recovery can generally be effected.

Phosphuretted hydrogen—a form of phosphide of hydrogen—is given off from all animal bodies, and especially fish; phosphorus abounding in these animals. It is the element which renders luminous the emanations from decomposing substances, and is frequently seen in the form of masses of luminous vapor over graveyards and other places where phosphorized bodies are undergoing decomposition. It is exceedingly poisonous, and acts with great energy on the living animal body when absorbed into the blood through respiration.

Sulphuretted hydrogen is still more poisonous, and is a constant emanation from decomposing animal matter. Dupuytren found that $\frac{1}{800}$ part of this gas in the atmosphere was sufficient to kill birds in a few seconds. In my own experiments, I found that small animals died after a few minutes when the $\frac{1}{1000}$ part of sulphuretted hydrogen was present.

As you see now, I place this mouse under a large bell glass, and introduce a very small amount of sulphureted hydrogen. The animal dies quietly, after an exposure of less than five minutes.

This was probably the chief agent in causing death in several cases which have occurred in churchyards and dissecting rooms.

The ammoniacal compounds and carbureted hydrogen are also highly deleterious, and when inhaled in concentrated forms are speedily fatal.

But, besides these, there is reason to suppose that there are present, in the atmosphere contaminated with animal emanations, certain living organisms.

The Diamond Fields of South Africa.

On the geological questions connected with these diamond fields, Mr. John Paterson has propounded some new views based on a minute and careful examination of the appearances which presented themselves to him on a visit to the diamond fields. He discredits the theories which would refer the presence of diamonds in Grequaland West to any distant sources, and thinks the evidence incontestable that the marl soil, as he named it, in which the gems are now found, is the true matrix soil of the diamond. This marl soil, he considers to be the metamorphosed carboniferous shales of the country, and the change which has worked upon these shales, by which they have been transformed from the black carboniferous shale into the whitish ashy marl in which the diamonds are found, he attributes to intrusions of greenstone trap, which traverse the country from N. E. to S. W. in continually recurring dykes. Mr. Paterson gave some very interesting details of the extent and richness of the diamond diggings in South Africa, and in his picture of the Gong-Gong and Delport Diggings as "Great Rushes" in diggers' phrase, resembling in extent and richness Colesberg Kopje, but now nearly worked out, not by the hand of man in a few years, but by the angry waters of the Vaal River through many ages he found much groundwork of hope that the diamond discoveries of South Africa are to be no fleeting passing industry, but a continuous employment, not only for many years but for many ages.

Testing Burning Fluids.

Pethuel Millspaugh of Kent, Conn., has obtained letters patent for an improved test for burning fluids.

This invention provides an improved instrument for testing kerosene oil and other illuminating fluids, and also for determining the specific gravity of fluids generally. The apparatus consists of an upright glass cylinder which is supported in the top of a chamber formed in the upper part of the base. A lamp is placed in the base, the heat from which is transmitted through the chamber to the lower part of the glass cylinder, and the chamber may be made to contain air, water, etc., as required to regulate its intensity. The glass cylinder contains a thermometer, which is fixed therein, and is closed at the top with a brass cover. The burning fluid to be tested is made to completely fills the glass cylinder, so that the thermometer is entirely submerged, and cannot be affected by the surrounding atmosphere. An orifice in the brass cover is opened to allow the escape of vapor from the fluid under test, and, when necessary, the lamp is lighted. A flame is held over the orifice, and at the moment the evolved vapor is ignited the temperature of the fluid is corectly indicated by the thermometer. In ascertaining specific gravities by this instrument a hydrometer is also placed within the glass cylinder in such a manner that its scale tube is free to move up or down through a hole in the brass cover. The surface of the fluid tested is plainly visible through the glass cylinder, and the scale may be accurately read.

QUICKSILVER has been found near Austin, Texas.