NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences, formerly the Lyceum of Natural History, was held recently in Professor Mayer's lecture room, at the Stevens Institute of Technology. Two communications were made by Professor A. M. Mayer and one by President Henry Morton. The first paper was by Professor Mayer on

CROOKES' RADIOMETER,

and on some results obtained by the action of sound pulses on an apparatus constructed in a similar manner. Crookes was led to the construction of his delicate instrument in the following manner: He made a torsion balance consisting of a bar of pith suspended by a fine filament. One half the length of this bar was blackened. On exposing this apparatus to rays from different parts of the prismatic spectrum, he found that the torsion balance moved through spaces proportional to the thermometric effect produced by the same area of rays falling on a thermopile. Representing the motion produced by the ultra-red rays by 100, those of the other rays were as follows:

Extreme red	85	Blue	22
Red	73	Indigo	8½
Orange	66	Violet	6
Yellow	57	Ultra violet	5
Green	41		

The difficulty of ascertaining facts in Nature, even by the most careful observers, is well illustrated here by the fact that Crookes overlooked the circumstance that he was here operating with a purely accidental spectrum, the proportion of whose parts depended entirely on the nature of his prism. Had he employed the normal or diffraction spectrum produced by the passage of light through finely ruled gitter plates, his results would have been the same as those obtained many years ago in this country by Dr. Draper.

Crookes found that the bar of the torsion balance was attracted when the apparatus contained air, and repelled when it was placed in a vacuum: also that the radiation from a candle on blackened pith was 5½ times what it was on plain pith. From these observations to the construction of the radiometer was but a short step. Two fine wires, at right angles to each other, were provided with little vanes of mica blackened on one side, and the whole suspended on a pivot and enclosed in a glass vessel, from which the air was exhausted by means of a Sprengel pump. When rays of light fall on this apparatus, the differential action of the blackened and natural surfaces of the vanes gives rise to a continuous rotation. The rate of this rotation, and hence the intensity of the exciting cause, was obtained by means of a small electromagnet placed in the apparatus in such a manner as to register the number of revolutions by making a series of dots on a slip of paper.

Professor Mayer then exhibited this very delicate instrument to the meeting, and showed the increase in the velocity of rotation on bringing it nearer a source of light.

In order to measure the repulsion of a blackened surface n a vacuum, Crookes employed W. Ritchie's torsion balance, described in the "Transactions of the Royal Society" of 1830. This is so arranged that the repulsion of the blackened surface twists a fine glass thread, to which is attached a mirror projecting a beam of light on a screen. By means of a screw, the circumference of which is divided into 360°, the glass thread is turned back again until the beam occupies its original position. The amount of torsion is then read off on the screw. The extreme delicacy of this instrument may be appreciated from the fact that the $\frac{1}{100}$ of a grain produces a torsion through 10,000 degrees or about 28 rotations of the thread. As it is sensitive to 1° of rotation, it is evident that we can thus weigh $\frac{1}{10000}$ of $\frac{1}{100}=\frac{1}{1000000}$ of a grain!

A candle at a distance of 6 inches repels 2 square inches of surface of blackened pith with a force of 0·001772 grain, at 12 inches distance with a force of 0·000444 grain. Starting out with the latter figure, and remembering that the effects are as the reciprocals of the squares of the distances, we should obtain at 6 inches a force of 0·001776: which differs from the result actually obtained by experiment by only the $\frac{4}{1000000}$ of a grain.

After succeeding in constructing so perfect an instrument, it is not surprising that Crookes should be elated; but it is to be regretted that he should express himself as he did in the following extract from his paper: "A candle 12 inches off, acting on 2 square inches of surface, was found equal to 0·000444 grains; the sun, equaling 1,000 candles at 12 inches, gives a pressure of 0·44000 grain; that is equal to about 32 grains per square foot, to 2 cwt. per acre, to 57 tuns per square mile, or nearly 3,000.000,000 tuns on the exposed surface of the globe—sufficient to knock the earth out of its orbit if it came upon it suddenly." It is true he immediately modifies this statement. but it is liable to be quoted without the following disclaimer: "It must be remembered that our earth is not a lamp-blackened body enclosed in a glass case, nor is its shape such as to give the maximum surface with the minimum of weight."

Still more mischievous, however, is the pretention to "weigh a beam of light." That it is not light which causes the rotation in Crookes' radiometer has been conclusively proved by Schuster ("Proceedings of the Royal Society," April, 1876). He made a radiometer having one arm a magnet. When a strong light fell on this apparatus, it overcame the directive force of the magnet, and caused it to rotate in the usual way. Now on floating the instrument in water, and holding a magnet outside to keep it stationary in spite of the strong light falling upon it, the bulb began to rotate in a direction opposite to that which the light would have imparted to the vanes.

The only plausible explanation hitherto offered of the instrument is the following: The vacuum of the Sprengel pump is not a perfect one; but in the highly rarefied air contained in the bulb, the molecules have a much greater amplitude of swing than in their ordinary condition, there being vastly fewer in the same space. Hence the currents set up by the very feeble heat of the rays of light are sufficient to produce a much more intense action than could take place in dense air. The blackened surfaces become heated more than the natural ones, and consequently repel more particles, the reaction of which causes motion; and the apparatus being free to turn, the motion becomes one of rotation, which continues until the effects on the two surfaces become equalized.

To show that the effect was due to heat, Professor Mayer interposed a glass plate between the apparatus and the diffused light from a window. The effect was to stop the rotation by cutting off the heat rays, while the light rays passed through freely. Rotation was also produced by placing the hand near the radiometer.

AN ANALOGOUS APPARATUS FOR SOUND.

In the next place, Professor Mayer exhibited an apparatus constructed by him to produce motion by means of sound pulses. Four glass resonators on cross arms were suspended by means of a string. On sounding an organ pipe in tune with the resonators, and bringing it opposite the mouth of one of them, the resonator was repelled and the apparatus commenced to rotate. This experiment was the more striking from the fact that, so far from any current of air proceeding out of the mouth of the organ pipe, the air is actually sucked in, as may be rendered visible by means of smoke from a cigar. The smoke is carried up the pipe even when the latter is closed at the top with cotton wool so as to smother the sound. On substituting disks of cardboard for the resonators, they were drawn up to the mouth of the organ pipe with considerable force. When fine silica powder was placed in the resonators, it was thrown into violent motion on sounding the pipe.

OBLITERATION OF SONOROUS SENSATIONS.

Professor Mayer next described some interesting experiments, the effect of which will be to modify our present theories of audition. He took an American clock ticking 4 beats a second and a watch ticking 5. At a distance of several feet from the ear, all the ticks of both could be plainly heard, even those which coincided. On gradually moving the watch away from the ear, a point was reached where the fifth or coincident tick of the watch became inaudible. A watch beating 4 times a second was then substituted and set to gain 30 seconds an hour on the clock. Coincidence then occurred every 2 minutes. Removing the watch 24 inches from the ear, its ticks became extinguished for 9 seconds at a time.

To determine the relative intensities of these ticks, numerous experiments were made on still nights in the country, and it was found that the ticks of the clock became inaudible at a distance of 350 feet, and those of the watch at a distance of 20 feet. The ratio of the squares of these numbers makes the ticks of the clock about 300 times more intense than those of the watch. Standing at different distances from the clock, and holding a slender stick graduated to inches and tenths against his zygomatic process, the experimenter slid a watch along the stick (taking care not to touch it) until its fifth tick disappeared. The relative intensities of clock and watch ticks at the same distance being known, their intensities at the distances in these experiments were obtained by the law of reciprocal squares. The slightest noise or breeze renders the experiment impossible.

In the same way one musical sound may obliterate the sensation of one higher than itself. To obviate the objection that this might be due to a change of timbre, Professor Mayer caused one of the notes to sound periodically by opening and shutting the resonant box of a fork with the hand at regular intervals. Now on sounding another lower note, either from a fork or an organ pipe, continuously, its timbre could only be changed during the sounding intervals of the other note, and would be restored during the intervals of silence, if the objection is just. No such effect, however, is observed. The actual result is that the sound of the fork becomes more and more feeble, and finally its sensation is entirely lost. If at this point the other sound is stopped, it is found that the fork is still vibrating and emitting a sound, which had been completely overpowered by the graver one of the pipe. The same takes place if a closed organ pipe of the same pitch is substituted for the fork and its sound is made intermittent.

Another very remarkable fact is that even a very intense sound cannot obliterate the sensation of one lower in pitch. When the ear ceases to perceive the lower sound, it is generally found, on stopping the higher one, that the lower fork has entirely ceased to vibrate. Numerous experiments have been made, through a range of four octaves and on a score of ears, always with the same result.

If a sentence is read over and over in the same tone of voice and modulation, while an Ut_3 pipe is sounding, it seems as if two persons were reading, one with a very grave voice (consisting of all the vocal sounds below Ut_3) and one with a high, squeaky, and nasal voice. The intermediate harmonies are obliterated. The fundamental tone of most notes is perceived as the strongest, because each harmonic is diminished by the sum of all below it, while the lowest is not affected by any of them. On sounding Ut_3 together with an Ut_2 free reed pipe, the component Ut_2 is perceived unaffected in intensity, while all the higher harmonics are obliterated except Mi_4 and Sol_4, which are very distinct. The deep residual sound of a New York fire alarm bell is heard distinctly through all the noises of the street higher than it is until it dies entirely away. It seems in these experiments as though we had a special sense for the lower sounds.

Professor Mayer stated that since these discoveries he has repeatedly witnessed in orchestral music the entire obliteration of all sounds from the violins by the deeper and more intense sounds of the wind instruments, while the bass viols hold their own. From the same cause the clarinets lose their peculiar quality and charm. The leader probably heard them all; but as the ears of the audience hold different relation of distance to the several instruments, they are actually paying for his enjoyment instead of their own. His position ought therefore to be that of an average hearer. The laws of orchestration can only be arrived at by a quantitative determination of the intensities of all musical instruments. When quantitative analyses of the compound sounds in the different instruments shall have been made, the composer will be better able to command such qualities of sound as he desires to bring out. It is evident that instruments to be used in orchestras must be differently constructed from those designed for solos or quartetts, and that they must have their peculiarities of timbre exaggerated.

Professor Mayer concluded by stating that he is at present engaged in determining the intensity of sounds either existing alone or as components of compound notes.

The meeting then adjourned to President Morton's lecture room to listen to a communication on some fluorescent bodies.

FLUORESCENCE.

Professor Morton began by stating that the property of lengthening the wave length of light rays, to which fluorescence was due, was one inherent in a great range of bodies. Fluorescence is produced when light rays of one kind are converted into another having a longer wave; when the rays are lengthened so much as to exceed the limits of the spectrum, they are converted into heat. A number of fluorescing substances were then exhibited, producing effects of indescribable beauty.

Fluorescine, a substance having little color of its own, fluoresced with a rich bright green when illuminated with the electric light passing through blue or violet glass.

Eocene, the tetrabromide of fluorescine, which has naturally a delicate pink color in solution, became dark green under the same conditions. In this, as in the other solutions shown, the fluorescence produced a very noticeable opacity.

Purpurine, one of the coloring substances made from madder, became very opaque orange yellow. The tinctorial power of this and some of the other substances shown is perfectly marvelous. As much as will lie on the point of a penknife, dissolved in a gallon of water, had to be diluted again with three or four times as much water to produce a good effect. Fluorescence enables us here to distinguish with perfect certainty between the natural product and artificial purpurine. A piece of a dressing gown dyed with madder, having passed the last stage of its usefulness, had been employed for a long time as a rag to wipe up things in the laboratory. A bit of this was treated to extract the purpurine, and its fluorescence was shown to be perfectly distinct and characteristic. By thus analyzing a garment dyed with artificial preparations, we would be enabled to decide with certainty that it could not have been manufactured before the date of the invention of the artificial dyestuffs.

Chlorophyll, made by steeping exhausted tea leaves in alcohol, is a liquid of a very deep green, so deep indeed as to appear almost black. It fluoresced with a magnificent crimson.

A solution of bisulpho-bichlor-anthracenic acid, which is perfectly colorless, fluoresced with a purplish blue.

A dish of nitrate of uranium crystals fluoresced with a luminous yellow color.

An extremely beautiful effect was produced by illuminating a screen on which a large wreath encircling the monogram of the Stevens Institute of Technology was painted by means of different fluorescing substances.

President Morton concluded by exhibiting some absorption bands, and pointing out how they serve to distinguish the substances by which they are produced.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for July, 1876.

Mercury.

On July 1, Mercury rises at 3h. 33m. A. M., and sets at 5h. 56m. P. M. On July 31, Mercury rises at 4h. 29m. A. M., and sets at 7h. 6m. P. M.

Mercury is at its greatest elongation west of the sun on the 8th, and can then be best seen. It should be looked for before sunrise, a little south of the point of sunrise.

Venus.

On July 1 Venus rises at 6h. 13m. A. M., and sets at 8h. 30m. P. M. On the 31st, Venus rises at 3h. 21m. A. M., and sets at 5h. 20m. P. M.

Venus is becoming less and less conspicuous, and will probably not be noticed after the first week of July, being too nearly in range with the sun. After the middle of the month Venus should be looked for in the morning, as is has passed to the west of the sun.

Mars.

Mars is now very small, and will not be noticed by ordinary observers. It will be very near Venus on the 5th, and may possibly be seen just after sunset some 45° farther north than Venus. Mars rises on the 31st at 5h. 16m. A.M., and sets at 7h. 31m. P. M.; it cannot at that time be seen at all.

Jupiter.

On July 1, Jupiter rises at 3h. 45m. P. M., and sets at 1h. 35m. the next morning. On July 31, Jupiter rises at 1h. 47m. A. M., and sets at 11h. 35m. P. M.

Jupiter is so well situated in the first half of the month that observers who have small telescopes (say with two inch object glasses) can very well observe the many changes in the relative positions of its four moons. As the first satellite, or the one nearest to Jupiter, makes a revolution around the planet in less than ten days, it goes through all the changes, passing from east to west behind the planet, and in front of the planet from west to east (as seen in a telescope), becoming invisible by transit, by occultation, and by eclipse in that space of time. This satellite will show these changes of position between 7h. 30m. P. M., and midnight on July 7, 8, 9, 14, 15, 16, 22, 23, 24, 30, and 31.

On July 10 the third satellite (which is the largest, but third in the order of distance) will not be seen until near 10 P. M. (Washington time), being in front of the planet; on the 28th it will disappear at 10h. 14m. by going into the shadow of the planet. Young observers may learn much of this system of bodies by watching their movements, and may determine periods for themselves.

Saturn.

On July 1, Saturn rises at 10h. 35m. P. M., and sets at 9h. 21m. the next morning. On July 31, Saturn rises at 8h. 34m. P. M., and sets at 7h. 16m. next morning.

Saturn can be recognized on July 10 by its nearness to the moon; and by reference to the *American Nautical Almanac* it will be found that the moon occults (hides by seeming to pass over it) the planet Saturn on August 6, and again on September 2.

Uranus.

Uranus is too nearly in range with the sun to be seen. It sets at 9h. 41m. P. M., on July 1, and at 7h. 48m. P. M. on the 31st.

Sun Spots.

We are evidently passing through a minimum period of sun spots; as from May 26 to the present date, June 19, a period of 23 days, with a telescope whose object glass measures two and a half inches, no spots have been found.

NEW BOOKS AND PUBLICATIONS.

TROW'S NEW YORK CITY DIRECTORY, VOL. XC., for the year ending May 1, 1877. H. Wilson, Compiler. Price $5. New York city: The Trow City Directory Company, 11 University Place.

WILSON'S BUSINESS DIRECTORY, 1876–7. Price $2.50. New York city: The Trow City Directory Company, 11 University Place.

The peculiarity which distinguishes directories from other books is that everybody wants to consult them, yet few wish to buy them. In fact, there seems to be a kind of popular idea that directories are only magnified sign posts, to be used as freely as the signs on the street corners. This is one disadvantage with which directory publishers are obliged to contend, and which prevents the care and elaboration with which their onerous tasks are performed from being recompensed as highly as they merit. The two volumes above named are the oldest and best known works of their class, and possess a degree of accuracy which none other in this, or any other city, to our knowledge, possesses. In the city directory, there are 241,167 names, and there are seven items (business, number, etc.) to each name; yet we are told there is but one error to every 8,400 items. The number of names above given shows an increase over last year of 7,196, and also proves that the population of New York is steadily growing, notwithstanding the assertion to the contrary by some despondent croakers. Allowing that each name represents five persons—for generally it is only the name of the head of the family that is given—the increase since last year is 35,980 souls. Not only for the counting room and business man is a directory useful, but in the household such a book of reference is very convenient.

THEORY OF SIMULTANEOUS IGNITIONS. By Brevet Brigadier General H. L. Abbot, Major U. S. Engineers. Printed on the Battalion Press.

This is a treatise on the best method of securing the simultaneous ignition of many fuses distributed throughout the charge of one long mine. The theory is mathematically demonstrated at length, and a portable machine, requiring only about four horse power, is described, which will supply an magneto-electric current ample to meet nearly any demand in submarine blasting on the most extensive scale. The paper has already been referred to in these columns, in our abstract of essays read at the last session of the American Academy of Sciences.

POCKET BOOK OF USEFUL FORMULÆ AND MEMORANDA FOR CIVIL AND MECHANICAL ENGINEERS. By Guilford L. Molesworth New York city: E. & F. N. Spon, 446 Broome street.

This is the eighteenth edition of the most convenient engineer's pocket book extant. It differs from the works of Haswell and Nystrom in containing very much less information; but its contents embody just those useful suggestions and formulæ with which every engineer fills up the leaves of his private note book. It is of the right size, and contains just the facts which will be convenient to the engineer when called to examine machinery, and to make rough calculations; and not knowing exactly what the requirements are, he feels safer if he has his rules and tables handy.

A TREATISE ON UNITED STATES PATENTS. Edited by H. & C. Howson. Philadelphia, Pa.: Porter & Coates.

This is a neatly bound book of 160 pages, and contains more information of value to patentees than any work of its size that has come to our knowledge. It not only defines the nature and scope of patents, but it states what constitutes an invention, and tells the reader to whom patents are granted, how an acquired interest may be lost, etc. But the most important feature of the book is its citations in brief from decisions in the United States Supreme Court on important and peculiar cases, which gives the book a considerable value to the owners and workers of patents, as such information cannot be had except by laborious search through elaborate law reports.

HINTS TO YOUNG ENGINEERS UPON ENTERING THE PROFESSION. By Joseph W. Wilson, A. I. C. E. New York city: E. & F. N. Spon, 446 Broome street.

The author, in this little pamphlet of 22 duodecimo pages, has combined a good many sound practical hints, and plenty of just the advice which an engineering student requires at the threshold of his profession. It is written in a pleasant half amusing style, does not about in moral reflections, and, altogether, is an agreeable and sensible little work. More of the same kind would be welcomed by students in other professions and trades.

OUR ROADWAYS. By "Viator." New York city: E. & F. N. Spon, 446 Broome street.

Authors who append anonymous names to their productions can hardly expect much deference paid to their opinions. The present pamphlet has some useful information on pavements in general, but appears to be strongly devoted to the interests of an English wood-paving concern.

THE CLERK OF WORKS' VADE MECUM. By George Gordon Hoskins, F. R. I. B. A. New York city: E. & F. N. Spon, 446 Broome Street.

A useful volume of practical suggestions for the architect charged with the supervision of a building. It is of course mainly in accordance with English practice and customs, which detract from its practical usefulness to our architects; but it possesses hints which may be found of interest and some benefit.

DECISIONS OF THE COURTS.

United States Circuit Court—Eastern District of New York.

THE PATENT DRIVE WELL.—WILLIAM D. ANDREWS *et al. vs.* THEODORE A. CARMAN.

[In Equity.—Before Benedict, J.:—Decided April 24, 1876.]

This is a suit in equity brought by the owners of a patent issued to Nelson W. Green, on May 9, 1871, designated as reissue No. 4,372, against Theodore A. Carman for an injunction and damages, because of an infringement of their patent. *

The language of the claim may be first considered. It is as follows:

"What I claim as my invention, and desire to secure by letters patent, is: The process of constructing wells by driving or forcing an instrument into the ground until it is projected into the water, without removing the earth upward, as it is in boring, substantially as herein described." *

I understand this patent to be a patent for a process, and that the element of novelty in this process consists in the driving of a tube tightly into the earth, without removing the earth upward, to serve as a well pit, and attaching thereto a pump, which process puts to practical use the new principle of forcing the water in the water-bearing strata of the earth into a well pit, by the use of artificial power applied to create a vacuum in the manner described.

A somewhat different reading of the patent may be adopted, and supported by authority high in this court upon such a question. *

But the view I have expressed is so firmly impressed upon my mind that I shall rest my decision upon it, and leave the more learned judges before whom the patent must shortly come to detect my error, and to uphold or destroy the patent as being for a method of sinking a well pit by puncturing instead of excavating.

The interpretation I have thus given to the patent renders it unnecessary to pass upon the evidence in the case, given to show that, prior to the time when Green claims to have made his invention, well pits had been made by puncturing the earth.

Was Green the man entitled to secure the invention which his patent describes? The evidence is convincing that Green first conceived the idea, explained his idea to others, and caused the feasibility of his process to be tested by actual experiment. Comment has been made upon the fact that the particular tools and devices used in constructing the first wells made were not pointed out by Green. But such comment loses its force when it is considered that the tools and devices employed in sinking the shaft form no part of the invention claimed by Green.

The invention consists in the method of putting to a practical use the new idea or principle of increasing the productive capacity of a well by forcing water directly from the earth into the well pit, artificial power being employed to create, by the operation of a pump attached to a tube driven tightly into the earth, a vacuum in the tube and the water-bearing stratum into which it is projected, whence follows an increased pressure upon the water in the earth toward the well pit, and an abundant supply of water is afforded to the pump. This conception was of such a character that when described there was left nothing to be done but to test its correctness by an experiment so simple, and involving the means in such common use that it could be tested by any one upon the mere statement of the idea. In the present instance the process was at the outset put to the test of an experiment conducted near Green's house, in his presence, and under his directions. His idea, and his process of putting it into practical use, then became part of the property of the public, available for the purposes intended, unless it be secured by the patent in question.

Subsequent experiments are spoken of in the evidence, which may properly be claimed by Green as his experiments, for they were conducted in pursuance of his directions by those acting at the time under his orders.

Furthermore, it should be remarked in this connection that, when Green first stated his idea and described his process there, were two points of doubt, one whether force could be called into operation by the creation of the vacuum sufficient to overcome the resistance of the soil, and afford a supply of water to the pump; the other, whether practically a tube could be driven to a water-bearing stratum of the earth under various conditions of soil, always excluding, of course rock formations.

The general utility of the invention depended principally upon the result of tests applied to the latter of these points of doubt. A wide range of subsequent experiment might, therefore, well be allowed for such an invention, notwithstanding the circumstance that the first experiment proved that the principle was sound, and could be usefully applied in some circumstances.

Upon this branch of the case, the contention has been whether Green was the inventor, or Byron Mudge, the person who, under the direction of Green, conducted the early experiments; and a patent issued to Mudge, October 24, 1865, is set up in the answer. The defendant does not, however, claim under Mudge's patent, or under any patent. In fact, there is no patent to Mudge, as his original patent was surrendered; and upon his application for a reissue, a case of interference between him and Green was declared, which, after a severe contest upon a large amount of testimony, and after careful argument, was decided in favor of Green. No patent to Mudge is therefore in this case, nor is Mudge called as a witness.

But the defendant contends, as he may rightfully do, that the evidence shows Mudge to be the inventor, and not Green. I cannot find upon the evidence that this defense is sustained; on the contrary, it appears quite clearly that the inventor was Green.

A patent to James Suggett is also set up. That, however, is not a patent for a process, but a combination which does not involve the use of Green's process, and to which Green makes no claim.

The whole question of prior use may at this place be disposed of. *

It is, of course, true that, prior to Green's invention, water had been pumped from a hole in the ground, and from a small hole. Doubtless, it is also true that, in some such case, where a pump had been inserted in a small hole, for the purpose of raising therefrom the water found therein, the principle of Green's invention may at times have been called into operation. No such case is here proved; but if such fact were proved, Green's right to a patent would not thereby be defeated. A chance operation of a principle unrecognized by any one at the time, and from which no information of its existence, and no knowledge of a method of its employment is derived by any one, if proved to have occurred, will not be sufficient to defeat the claim of him who first discovers the principle, and, by putting it to a practical and intelligent use, first makes it available to man.

As bearing upon the question whether the idea claimed to have been conceived by Green, and to have been put to practical use by him in his process, had before that been known and applied, it should also be noticed that, while the advantages of the process claimed by Green are many and obvious, and although since the date claimed for his invention numerous patents have been issued—some 150, I think the evidence shows—for instruments to be used in putting down the tubes of such wells, no application for any such patent appears to have been made before that time; moreover, the invention, when it was announced by Green, was received as a novelty, and since then an extensive business of constructing driven wells has sprung into existence—a business of such importance that the number of driven wells since constructed is computed by hundreds of thousands. In this State alone the number is stated by a witness to be 150,000 and upward. The change in the art of well making which the evidence discloses, of itself, goes far to prove novelty. Indeed, when it is considered that the methods in use for obtaining a supply of water from the earth are matters of common knowledge, and that a well is a thing of everyday use, everywhere, reference may be made to the common knowledge of mankind to show that it has not always been understood that a supply of water may be obtained in almost any place by simply driving down tight in the earth a tight tube and attaching thereto a pump. Even now, it is doubtless a new thing to many, to be told that if an ordinary well from which the water is drawn by a pump be filled up with dirt, and the dirt packed tightly around the pump, the productiveness of the well will be thereby increased.

My conclusion upon this branch of the case, therefore, is that the invention of Green has not been shown to have been anticipated, and is properly claimed by Green as a new and useful invention made by him.

I come now to consider the question of dedication and abandonment, which is presented by the evidence here, and is a question as important as any raised in the case.

It is contended that Green, at the time of his invention, dedicated it to the public, and also that he abandoned it as not worthy to be patented.

HISTORY OF THE DRIVE WELL AND ITS INVENTOR.

The law pertinent to this branch of the inquiry is the law in force prior to January, 1868. By the patent act of 1870, as well as by the Revised Statutes, all rights previously acquired were preserved. The law governing here is to be found, therefore, in the acts of 1836 and of 1839, as those statutes have been interpreted and applied by the courts. The facts relied upon as showing a dedication of his invention by Green are that he permitted a well made by his process at the fair grounds in Cortland, where the Seventy-sixth New York Regiment, of which he was colonel, was then stationed, to be there publicly used, and that he arranged for providing tubes to be taken with his regiment when it should move, in order to supply it with water when in hostile localities. That these facts do not amount to a dedication, I think is plain. The occasion which called forth this invention was the rumor that the rebels were intending to poison the wells in places where the Union army might come, and the report that some part of the Union army had been compelled to surrender for the want of water. There was supposed to be a necessity for some form of well that would be tight, to prevent the possibility of poison, and that could be constructed quickly, cheaply, and easily, so as to be available for a moving army. Under the pressure of this supposed necessity, Green conceived the idea of his well, and also devised the method by which that idea could be put to practical use.

Once conceived, a very simple experiment would test the soundness of the position he had taken and maintained, in discussions had respecting his plan, that it was possible to force water from the earth into the pit of a well by using a tube driven tightly into the earth for a well pit, and creating a vacuum therein by a pump attached.

This experiment, as the evidence shows, was made under the direction of Green, and in pursuance of the directions he had given, at or near his house in Courtland. The first experiment was a success in this, that it proved the possibility of obtaining a supply of water by this process; but of course it could not prove that a tube could be driven down to a water-bearing stratum in all localities with the cheapness and dispatch necessary to render the process one of general utility. It was natural, therefore, to suppose that, before the process could be declared to be satisfactory, other experiments in other and different localities should be made. He could, by law, use his invention for this purpose and permit it to be used for two years without forfeiting his right to a patent.

Under such circumstances, it would be going far to say that his act of permitting the use of his process at the camp in Cortland, where his regiment was then in camp, and of providing material wherewith to construct such wells for his regiment when it should move into hostile territory, amounted to a dedication of his invention to public use, and worked a forfeiture of his right to it.

But it is said the patent is invalid under the provisions of the act of 1839.

The act of 1839, as has repeatedly been held, has no effect to invalidate a patent, unless there be proof of a use of the invention more than two years prior to the application for the patent, and that such use was with the knowledge and allowance of the inventor. Here there is no evidence of any use or sale of the invention by Green, prior to his application for a patent, nor is there any direct proof of knowledge on his part of any such use or sale by others, during that period. There is, however, evidence that within two years prior to Green's application, some wells called driven wells were sunk in Cortland, and, as it is claimed, under such circumstances of publicity and locality, as to compel the inference that Green knew of the use of his process in their construction.

It cannot be denied that knowledge of the putting down of some of these wells on the part of Green seems highly probable. Still there is no direct evidence of such knowledge, and Green denies the knowledge under oath. Furthermore, two witnesses produced by the defense, who also reside in Cortland, and one of whom was a justice of the peace, being asked as to these wells, say that no knowledge of such wells came to them. It seems necessary, therefore, to conclude that the existence of those wells was not so notorious as to compel the inference that they were known to Green.

Here it may be noticed, also, that wells put down by James Suggett were under a patent issued to him March 9, 1864, which patent was for a combination of three instruments—an iron perforated tube, a pointed plug to use as a drill, and a pump, (Haselden *vs.* Ogden, 3 Fish. Pat. Cas., 378,) and which it is a mistake to suppose necessarily involved the use of the process claimed by Green. It does not, therefore follow that knowledge of the fact that Suggett had put down wells in Cortland necessarily amounts to notice that the process of Green was being employed by Suggett. The rule of law being that "proof of knowledge and acquiescence must be beyond all reasonable doubt, as every presumption is the other way," (Jones *vs.* Sewall, 6 Fish. Pat. Cas., 367, Clifford, J.,) I am of the opinion that Green is entitled to the benefit of the doubt raised by his own oath, and the testimony of the two Hunters.

Again, it is contended that the acknowledged fact that Green made no application for a patent till January, 1866, between four and five years after the date of his invention, shows an abandonment of the invention. But, says Woodruff, J., "lapse of time does not, *per se*, constitute abandonment. It may be a circumstance to be considered. The circumstances of the case, other than mere lapse of time, almost always give complexion to delay and either excuse it or give it conclusive effect. The statute has made contemporaneous public use, with the knowledge and allowance of the inventor, a bar when it exceeds two years, but in the absence of that and of any other colorable circumstances we know of no mere period of time which ought, *per se*, to deprive an inventor of his patent." (Russell and Erwin *vs.* Mallory, 5 Fish. Pat. Cas., 641.)

In the present instance the circumstances attending the delay are unusual; and as I consider them sufficient to excuse a delay which certainly must be deemed extraordinary, a statement of these circumstances seems necessary.

I premise the statement by repeating that upon the evidence there is no room to doubt the fact that Green at the time of his invention claimed to have made a valuable discovery, and to have invented a new process. Furthermore, that he then declared an intention to secure his process by patent, and expressed his belief that large profits would accrue to him therefrom. At that time, Green, who had been partly educated at West Point, was engaged in organizing a regiment at Cortland, his residence, and was expecting soon to take part in the war of the rebellion. Within a few days after his invention, in the discharge of what seemed to him to be his duty, he felt compelled to shoot one of the captains of his regiment named McNett. The shot was not mortal but inflicted serious injury. In the then state of the public mind this occasion gave rise to intense public excitement, out of which sprang a controversy of extraordinary bitterness, involving numerous persons and continuing several years. The effect upon Green was disastrous in the extreme. He was suspended from his command, then tried by a court of inquiry at Albany, and reinstated in command. His regiment, after having, it is said, required the protection of a battery to save it from violence at the hands of evil-disposed people of the county, removed to Washington, where Green was relieved from his command, and then dismissed the service, and subjected to military charges.

He was, in addition, harassed by civil suits brought to charge him with personal liability for articles used by his regiment. He was also arrested, and then indicted for the shooting of McNett, and after repeated postponements of the trial, effected because of the excited state of the public mind, was tried in 1866, and, the jury having disagreed, was discharged.

During this period he also became involved in church difficulties arising out of the shooting of McNett, was expelled from the church, and compelled to appeal to the Bishop, and also became involved in litigation with the pastor of his church.

His efforts during this period to secure a reversal of the order dismissing him from the service were constant and absorbing, and were attended with such anxiety of mind as to give rise to the charge that he was insane. This state of things continued up to 1866, during which period he was of necessity often absent from Cortland, at Albany and at Washington; and he devoted his entire time to the controversy in which he had become involved, abandoning all other occupation, and exhausting all his means. The pressure of these circumstances was such that he became discouraged and despondent, and was, in fact, driven near to madness. The extraordinary nature of the circumstances in which the man was placed during these years is fully proved by many witnesses of character.

These circumstances certainly give complexion to his omission to secure his invention by patent, and serve to furnish a proper excuse for such omission.

In regard to a man so circumstanced, it would hardly be safe, in face of his positive oath to the contrary, to infer an intention to abandon an invention which evidently he always considered of great importance. This conclusion is strengthened by the uncontroverted fact that when in November, 1865, Green saw by an advertisement in the paper that driven wells were being put down, although he was advised by counsel defending him on the indictment, not to apply for a patent, as he would thereby increase the number of his enemies, and prejudice him on the trial of the indictment then about to come on, nevertheless he did then, and in opposition to the advice of his counsel, file his application and assert his right to the invention.

I conclude, therefore, that, upon the facts of this case, it must be held that the defendant has not produced that full measure of actual proof which is necessary to sustain the defense of abandonment. *

As to the question of infringement, I do not understand that it is disputed; at any rate, it is clearly proved. There must therefore be a decree for the complainant in accordance with the prayer of the bill.

[*George Gifford*, *Milo Goodrich*, *B. F. Tracy*, and *J. C. Clayton*, for complainants.
W. D. Shipman, *S. L. Warner*, and *S. A. Robinson*, for defendant.]

United States Circuit Court—District of Massachusetts.

PATENT SHEEP-SHEARING MACHINE.—WILLIAM EARLE, JR., *et al vs.* CHARLES F. HARLOW *et al.*

[In Equity.—Before Shepley, J.—Decided October term, 1875, *to wit*: April 4, 1876.]

The question presented in this case is mainly one of infringement. The complainants are the owners of the patent reissued to them as assignees of Adoniram I. Fullam, December 23, 1873, for a new and useful improvement in devices for shearing sheep. *

In a sheep-shearing device where power is employed to operate the cutters, it is immaterial what kind of power is employed when the two separate devices are operated in the same way to produce substantially the same effect.

The patent of Fullam, December 23, 1873, is not limited to an engine operated by the expansive force of steam, by any fair construction of the specification or claims. In this patent, as well as in the Hamilton and Harlow patent of September 1, 1864 (employed by defendants), a power is generated at a source of supply at a desired point, and is transmitted through a flexible tube, so as to be available to actuate an engine in the portable handle, which converts that power at any other point at the will of the operator.

Decree for complainant.

[*George E. Betton*, for complainants.
James E. Maynadier, for defendant.]

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED DOLL HEAD.

Carl Wiegand, New York city.—This consists of a doll head that is molded of sections made of interior layers of paper or pasteboard and outer layers of muslin, that are joined by a paste of suitable consistence.

IMPROVED PAINTERS' SCAFFOLD CHAIR.

John R. Crockett, Flatonia, Tex.—The invention consists of a scaffold made in the shape of a chair, with mechanism to raise and lower by a suspension rope that is carried over suitable friction pulleys of the chair frame.

IMPROVED BEAM SCALE.

Jacob J. Hopper, New York city.—This is an improved beam scale for weigh masters, ice wagons, and other purposes, by which the weight is not required to be placed upon and detached from the beam for each weighing. It consists of a beam scale, in which the beam is made of U shape, with the suspension fulcrum at the upper shorter leg, the weight being hung below the fulcrum and sliding along the lower extended leg.

IMPROVED SHOE LAST.

Robert Taylor, New York city.—This consists of an oblique joint in the last at the shank and under the instep piece, so contrived that the heel can be detached from the ball portion and taken out readily. The last can thus be removed from the shoe without stretching the heel of the latter over the heel of the last, by which the heel is often torn, and the shank is frequently broken.