"fines" the steel, that is, that it packs its particles and makes the grain closer. But when he tempers the tool, he is careful not to heat above a dull red, and then draws to a straw color.

A manufacturer who uses mills (milling machine cutters) in his work continually will not have a mill that has not been well forged from a bar. He prefers the drop forged blanks, which are usually made from a cut-off "chunk" from a bar of square steel. He insists that the tool must be forged to form and not cut from the merchantable bar, however well adapted as to size the bar may be.

Yet another takes a bar of three inch steel, or perhaps three and a half inches diameter, and cuts off a disk of the proper thickness for the mill he wants, chucks and drills it, mounts it on an arbor, finishes it to size, cuts the teeth, and hardens and tempers it. There is not a particle of forging in the work. The same man makes taps and reamers from the bar, choosing a bar to size, and refuses to subject the steel to the hammer. He claims that even the bar commercial steel is overworked in getting it into shape.

INVENTION AS AN ART.

To the popular mind the inventor, like the poet, is born, not made. Genius, it is thought, independent of education or practice, is its sole prerequisite. In some mysterious way Nature endows some men with power to conceive and produce new things and processes, which the world consciously or unconsciously needs, but, in the absence of the inventor's genius, is unable to get. Without a born capacity to invent, invention is deemed impossible, and rightly enough; but—herein arises the popular error—it is assumed that the faculty of original creation is a rare one, possessed by few, and not to be attained by others, however earnestly they may strive for it. On the contrary, the faculty is one common to the majority of men, more or less, and always ready to be made more under favorable conditions.

The singers in any community are relatively few; yet the most experienced teachers of music, who have had much to do in teaching music to large and unselected classes, unite in asserting that all men can learn to sing if they want to, and most men to sing fairly well.

It is much the same with invention. The innate capacity is common; its practical and profitable development is much less common, for the reason that comparatively few try to develop it, the multitude believing that the fundamental "gift" is not theirs. Accordingly, it is only by accident, or through the stress of special circumstances, that most inventors discover that there is any chance for them in that field of productive effort. Once enlisted in the work, successfully or unsuccessfully, they are pretty sure to discover that invention is an art which must, for the most part, be mastered as other arts are, by diligent study and patient effort. Unlike other arts, however, its boundaries are not limited to any one field of thought or knowledge or action, but are in every direction limitless, though practically bordered on the hither side by what men have already discovered and done.

Practically bordered; for while the reproduction of an old device may, from the inventor's standpoint, be as perfect an act of invention as the newest and most original invention might be, the field for profitable invention lies mainly in regions new and unexplored. An invention must be novel to be patentable; and, except for practice, it is only patentable inventions that are worth making. Knowledge, therefore, specific, positive, and comprehensive knowledge, of what has been done in the field in which the inventor's work is to be done, and a clear apprehension of something that remains to be done, are important elements in the successful inventor's outfit. The wider his range of such knowledge, the more numerous his opportunities to invent must naturally be, provided the manner in which his knowledge has been gained has not unfitted him for independent thought and action. A man may load himself with so many tools that he cannot work with any of them. In like manner overmuch learning may spoil a man for doing. The pack mule of an explorer's train is not likely to make many novel observations or discoveries.

To succeed in the art of invention it is commonly the rule that a habit of inventing must go hand in hand with observation and study. Sometimes a lucky hit may be made by an inexperienced inventor, just as men ignorant of minerals have stumbled on valuable mines. Nevertheless, the man who has trained himself to invent, and is in the habit of regarding every new fact or experience from the standpoint of its possible utility as a basis for invention, will excel the untrained inventor as surely in the long run as the practiced prospector will the unintelligent and inexperienced "tenderfoot." And the case in favor of the practiced inventor is even stronger, for the ability to recognize the need of an invention, though of primary importance, is less important than the ability to see how the need may be supplied and demonstrate the solution of the problem by doing it.

"Practice, practice, practice," said Demosthenes, is the first requisite for success in oratory. Equally is it necessary for sure success in invention. It does not follow that the would-be orator must get his practice wholly in the forum; no more need the inventor get his practice in absolutely new inventions. The numerous preliminary failures which have led up to the great success of many greatly successful inventors, while they emphasize the need of practice in this art, quite as clearly indicate the wisdom of not confining practice to what promises to be patentable. The work of the novice in invention may be, frequently is, valuable in itself; but if large success in the art is aimed at, it will not pay to suspend practice for the lack of novelties to work on. The resolution of old problems affords excellent and useful practice for the beginner, who may find a ready test for the value of his work by comparing its results with those exhibited in the perfected inventions of more practiced minds; and the habit thus gained of independently rebuilding and critically examing existing inventions will furnish admirable training for original work in fields entirely new.

The time may come when a systematic training in the art of invention, with practice in reinventing machines of greater or less complexity and the standard devices and movements of practical mechanics, will form a part of every first rate machinist's education; and similarly in other departments of productive industry. But until then those who wish to fit themselves for the cultivation of this most inviting and profitable art, the art of invention, must be their own guides.

Not the least advantage in purposely reinventing for the sake of practice comes from the circumstance that such practice-work cannot lead to loss or disappointment, while it cannot fail to lead the student to a practical working knowledge of the materials and methods employed by the most successful inventors.

Such self-training is sure to pay. Much as our inventors have already accomplished, the art of invention, as an art, is yet in its infancy; and it is safe to say that the prizes offered for its successful cultivation in the future are vastly greater and more numerous than those it has awarded to its votaries in the past.

HAS ELECTRIC LIGHT ANY EFFECT ON THE GROWTH OF PLANTS?

In conversation last week with Mr. Isaac Buchanan, one of the best known florists of New York, this question came up, and he stated that his observation inclined him to believe that when plants were used for decorative purposes in rooms where the electric light was used instead of gas, they seemed to have all the health and vigor as if growing under the light of a conservatory. He furthermore said that he had long ago observed that on moonlight nights there was always a better development of the flowers of camellias and roses during the winter months than when there was no moonlight. Hence he inferred that light, no matter how obtained, was beneficial to the growth of plants. This opinion from such an authority as Mr. Buchanan, who is well known to have had nearly half a century's experience, and who has always been a close observer, is certainly worthy of great attention.

Not long ago a French savant made extensive experiments with the use of the electric light to assist in forcing flowers during the dark days in winter, and from which wonderful results were claimed; but unfortunately the experiment was not a comparative one, being made with only one conservatory in which the light was used. To make the value of such an experiment certain, the only way would be to use two greenhouses, both growing the same kind of plants, in the same temperature, and the same soil and moisture—one to be lighted with electricity for three or four months at night, and the other left in the dark, and the results noted.

It is well known to all cultivators that the greater the amount of sunlight, the greater will be the development of the flowers. We all know that in the dark days of December and January the growth development of rosebuds, carnations, etc., is less than half of what it is in the months of March and April, when the days have lengthened, and the increased sunlight gives nearly twice the amount of light. Few commercial florists have the means or time for such expensive experiments as would be necessary to determine whether the use of the electric light in forcing flowers and fruit in greenhouses during winter could be profitably employed. It is a matter of sufficient importance, it would seem, for the Agricultural Department at Washington to take hold of. Certainly thousands of dollars have been expended by that department, in the past, on experiments which would have been of less general interest even had they proved successful. For be it known that the greenhouse industry now in the forcing of vegetables, fruits, and particularly flowers, has millions of capital invested in it throughout the land, and gives employment to tens of thousands of men; and if nature can be aided by this wonderful electric light, it will be a leap forward that the discoverer might well be proud of.

PETER HENDERSON.

Jersey City Heights, N. J., Jan. 30, 1885.

Progress of Gas Engineering.

Sir F. J. Bramwell, in his recent inaugural address as president of the Institution of Civil Engineers, made some interesting references to coal gas as a source of light, of heat, and of power. Dwelling upon the improvements that have been made in the application of gas as a prime motor, he pointed out that, whereas in the gas engine as originally introduced, 74 cubic feet of gas per hour were required to generate one indicated horse power, in the engines now made that consumption was reduced to less than one-third, each indicated horse power being the result of a consumption varying from 20 to 23 cubic feet of gas per hour. Further, that at the current low price of gas in England the cost of that hourly consumption was only about seven-eighths of a penny; and that this would compete on favorable terms with the use of coal (at ½d. per hour), on account of the attendant saving in other other directions, and consequent advantages in the abatement of smoke and reduced risk of explosion. In reference to the use of coal gas as an illuminant, Sir Frederick compared the two years 1862 and 1884; and showed that whereas in the former year 5 cubic feet gave a light of 12 candle power, at the price of 4s. to 5s. per 1,000 cubic feet, at the present time 16 candle gas costs but 2s. 10d. per thousand. Moreover, the improvements effected by regenerative burners and other modes of burning gave promise of a large increase in the candle power per cubic foot, even to the extent of more than double.

The Bell Telephone in Canada.

The Minister of Agriculture has delivered a decision in the case of the Bell Telephone Company, of Canada, declaring the patent void for the reason that the company or its representatives had imported the patented articles after twelve months from the date of the patent; also for not having manufactured in Canada such articles to the extent required by law after two years of existence of their privilege, and also for having refused to sell or deliver licenses to persons willing to pay a reasonable price for the private and free use of the patented invention.

On September 2 a petition was addressed to the Hon. J. H. Pope, Minister of Agriculture, asking that A. G. Bell's telephone patent be declared invalid. Counsel for the appellant based his claim on the failure of the Bell Telephone Company to comply with section 28 of the Patent Act of 1872, which provides as follows:

"That every patent granted under this act shall be subject, and expressed to be subject, to the condition that such patent, and all the rights and privileges thereby granted, shall cease and the patent shall be null and void at the end of two years from the date thereof, unless the patentee or his assignee or assignees shall within that period have commenced, and shall after such commencement carry on, in Canada, the construction or manufacture of the invention or discovery patented in such manner that any person desiring to use it may obtain it or cause it to be made for him at a reasonable price at some manufactory or establishment for making or constructing it in Canada, and such patent shall be void if after the expiration of twelve months from the granting thereof the patentee or his assignee or assignees for the whole or part of his interest in the patent imports or causes to be imported into Canada the invention for which the patent is granted, and provided always that in case disputes arise as to whether a patent has or has not become null and void under the provisions of this section, such disputes shall be settled by the Minister of Agriculture or his deputy, whose decision shall be final."

This decision will not make so very much difference with the company, as they are in possession of the field, and doing about all the business there is to do, having a well established plant in every town of importance in the Dominion.

Carbon for Electric Arc Lights.

Carbons for arc lights may be made, says a well informed writer, by thoroughly incorporating a mixture of finely divided carbonaceous material, such as the purer forms of coke or gas retort carbon, with some liquid substance, such as oil, tar, or sugar sirup, that, when subjected to a high temperature, is capable of being carbonized. The finely divided ingredients are thoroughly mixed and made into a stiff paste with the carbonizable liquid, and then forced by heavy hydraulic pressure through circular apertures in plates. The continuous cylindrical rods thus obtained are cut into suitable lengths, carefully dried, and then heated to incandescence in ovens while out of contact with air. By this process the carbonizable liquids are reduced to a carbon, which thoroughly binds together the various ingredients. Experience has shown that the higher the temperature and the greater the length of time during which the carbons are subjected to the baking process, the greater their hardness and the higher their electrical conductivity. In order to insure freedom from slight porosity, in most cases the carbons are subjected to a rebaking. After removal from the oven they are soaked in strong sirup, and again placed in the oven and heated to incandescence as before.

Nebraska Coal.

Professor L. E. Hicks, of the University of Nebraska, writing in the *American Journal of Science*, says:

It has long been a mooted question, both in the minds of geologists and of practical miners, whether there is coal in Nebraska that will pay for mining. The citizens of Brownville, Nemaha County, have been making a practical test of this matter, for which they deserve much credit, since their test well has brought to light facts of great scientific interest and value irrespective of the economical results.

The boring was begun at an elevation of 919 feet above the level of the sea, and carried to the depth of 1,000 feet 10 inches, or 81 feet 10 inches below sea level. The surface rocks at Brownville are upper carboniferous, and show traces of coal, as, for instance, in the west bank of the Missouri River just above the railway station. The drill penetrated the lower coal measures, but did not pass through them. These are the productive measures of the carboniferous in Iowa and in the States farther east. Here, therefore, is the place to find coal if it exists at all in paying quantities in Nebraska. The only seam found in the lower coal measures was one of bituminous coal of fair quality, 30 inches in thickness, at a depth of 820 feet 8 inches. The boring was carried 180 feet further without encountering any more coal. Below the 30-inch seam nothing was encountered but the shales, limestones, and sandstones ordinarily found in the lower coal measures. This renders it improbable that any more coal would be found at greater depths, although the demonstration would have been more complete if the hole had been put down one or two hundred feet deeper.

Above the 30-inch seam three other thin seams were found; one 8 inches thick at a depth of 93 feet, another 14 inches thick at a depth of 242 feet, and a third 10 inches thick at a depth of 375 feet. These evidently belong to the upper coal measures, as there is an interval of nearly 400 feet of barren rocks between them and the 30-inch seam. Immediately below the 14-inch seam is a stratum of sandstone, 20 feet thick, containing water strongly impregnated with salt and other minerals in solution, which flowed out at the top of the well.

Whether the 30-inch seam can be profitably worked at a depth of 820 feet is a question for the practical miner rather than for the geologist. It would at once be answered in the negative where fuel is plenty, but in this land of prairies and magnificent distances from productive mines the answer is not so much a matter of course.

IMPROVED TRICYCLE.

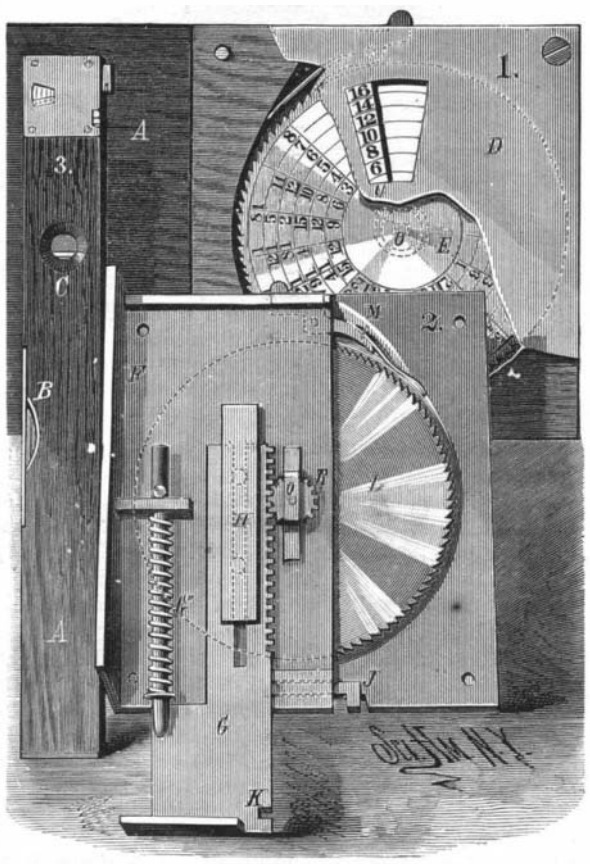
The two driving wheels are mounted rigidly on the axle supporting the vehicle frame, which is provided at its rear end with two standards carrying the seat. The steering wheel is journaled in a fork turning in the front part of the frame; the wheel is turned by means of a rod extending to within easy reach of the rider. Near one end of the axle is mounted a pinion, which engages with a cogwheel mounted outside of the frame, on a shaft placed parallel with and a short distance in front of the axle. On the shaft are two ratchet wheels, at each of which is a rocking pawl frame, which has a weight on one end and pedals on the other. The weights swing the front ends of the frames down to give the pawls a fresh grip. The two frames are depressed alternately, and by means of their pawls acting on the ratchet wheels they revolve the axle through the gearing, which is so arranged that every time a rocking frame is depressed the driving wheels make one revolution. Great speed is thus obtained. The tricycle is simple in construction and strong.

VOSSMER'S IMPROVED TRICYCLE.

This invention has been patented by Mr. F. W. Vossmer, of 726 West Huntingdon Street, Philadelphia, Pa.

IMPROVED SPIRIT LEVEL.

In the accompanying engraving of a spirit level patented by Mr. William Grams, of Sturgis, Dakota, Fig. 1 is an enlarged side view, partly broken away, of one end of the level, Fig. 2 is an inside view of the end casing, and its mechanism for moving the indicator dial, and Fig. 3 is a face view of the level. The body, A, of the level is fitted with the usual leveling tubes, B and C. The metal plate, D, is formed with an opening, through which the numerals on the dial may be



GRAMS' IMPROVED SPIRIT LEVEL.

read, and is let flush into the face of the level. An angle plate, F, has an inner flange plate lying just behind the dial and an end plate covering the end of the level. The slide bar, G, has a foot plate which rests on the work to be leveled. This bar is held so as to slide on the plate, F, by means of pins, fixed on which is the plate, H; these pins work in a slot in the bar. A spring on the rod, G″, acts to force the slide bar outward, as indicated in Fig. 2. A slide pin, J, may be passed into the notch, K, to hold the slide bar flush with the edge of the level, so that it will not interfere with the use of the level in setting work plumb by the spirit glass, C. The indicator dial is formed upon a plate, L, having ratchet teeth which are engaged by a pawl pivoted to the plate, F. The dial is fixed rigidly to a shaft, O, which carries a pinion, R, meshing with teeth formed on the edge of the bar, G. As the bar is moved in and out, the dial will be turned to carry its radial rows of figures in front of the opening in the plate, D. The dial is divided into spaces by concentric and radial lines. Each space represents by one radial row of figures sixteenths of an inch, while the larger radially arranged figures represent full inches. The graduations of the spaces indicate the extent to which the work is out of level, and as each space passes the opening, the numerals placed at U, along one edge of the opening, serve by comparison with the numerals of the spaces to show the extent to which the work stands out of level for any given length, all the numerals reading outward. The dial is graduated according to the length of the level. The pawl, M, extends beyond the upper edge of the level, so as to be pressed with the finger.

The bolt, J, being withdrawn from the notch, the bar, G, is forced outward by the spring, the teeth of the dial escaping freely past the end of the pawl. The level is then laid on the work, the end of the pawl is depressed by the finger to disengage it from the dial, and the end of the level is depressed to carry the bar, G, inward until the spirit glass, B, indicates that the tool between its lower end and the foot of the bar, G, stands level. The pawl then being released holds the dial in the exact position to which it was carried when the true level was indicated. The dial will then show just how much the work stands out of level for any given length in the level, shown up to sixteen feet in length, and for any length beyond that the variation from a true level may be readily calculated.

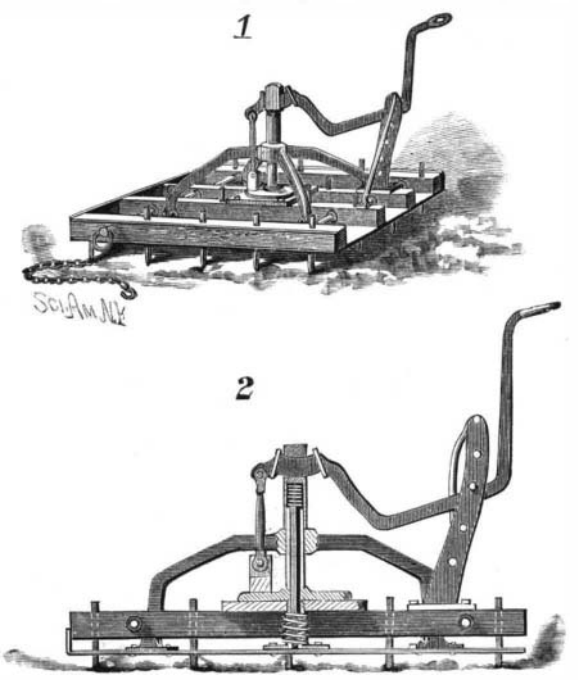
A FRIEND at our elbow says he is tired of hearing the cry of *overproduction* so generally repeated as the cause of our hard times. He suggests, for a change, *lack of consumption* to be the cause.

Genius Should Be Recognized.

It is not generous to withhold an expression of sympathy for those who have failed in the accomplishment of great undertakings, in which they have embarked all their pecuniary, physical, and intellectual resources. As a general rule, people are hardly considerate enough toward the unsuccessful. There is too much disposition to forget their pluck and perseverance, and sneer at their trustfulness. We ought to bear in mind that it is this sublime audacity of faith to which we are indebted for the marvelous achievements of our age. The struggles, trials, repulses, defeats, which have preceded most, if not all, of the triumphs of ingenuity which steam and electricity have wrought must have been very wearing to the nervous system. The patience and courage of inventors are proverbially heroic, but we seldom know, or care to know, anything about them till they have won the crown of victory. Happily, genius is irrepressible, and not easily daunted because it lacks appreciation. It is continually astonishing the its world with fresh exploits, and there is little fear that its progress will be stayed by obstacles of any sort. Still, it could be wished that the recognition and commendation of every effort to benefit mankind were more general and hearty than they are. It is a wise policy to encourage and foster the inventive spirit, in whatever useful channel it may be directed. The mechanical arts have been completely revolutionized within a generation by the introduction of novel machinery. In our own trade these appliances for utilizing labor have been wonderfully multiplied, and are constantly increasing. The results of them are seen in such a limitless capacity for production that the only way we can prevent the supply from running ahead of the demand is by lightening the toils of our artisans.

IMPROVED HARROW.

A thin plate of steel or iron, of the same area as the harrow, is fitted on the teeth in such a manner that it can be moved up to the under side of the frame or down to the points of the teeth, in order to force down the trash collecting on the teeth and make it leave the points; it is also used as a gauge to regulate the depth of the teeth in the ground, and also for a smoothing plate to smooth the surface of the ground, by setting it down to the points of the teeth, when it will run upon the surface. To the center of the top of the plate is connected a rod which extends through a tubular standard supported on top of the frame. This standard acts as a stay for the rod and as a guide for a spider frame, the lower ends of the arms of which are attached to the plate. The top of the rod connects with a presser which surrounds the top of the standard, and rests on top of the hub of the spider frame. The upper end of the presser is joined to a hand lever, whose short arm is connected to a link jointed to the top of the harrow frame. The long arm of the lever swings along a standard attached to the top of the frame, and formed with a series of pin holes to hold the lever in different positions, according to the distance it is required to set the plate down along the teeth. The plate is raised by a coiled spring surrounding the lower end of the rod. A second coiled spring, fitted in the socket of the presser, is so arranged as to act in conjunction with the lower spring to lift the plate. The lever passes through a slot in the upper part of the presser, and has a curved notch in the upper side—the presser being correspondingly curved—to form a good bearing and easy working joint. The plate is formed with flanges on its forward edges to prevent earth from collecting between it and the under side of the frame.



DREW, LEISNER & NELSON'S IMPROVED HARROW.

This invention has been patented by Messrs. C. Drew, A. W. Leisner, and Philip Nelson, and further particulars can be obtained by addressing the latter at Las Vegas, New Mexico.