# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

**TERMS FOR THE SCIENTIFIC AMERICAN.**

One copy, one year, postage included..... **$3 20**
One copy, six months, postage included ..... **1 60**

**Clubs.**—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each: additional copies at same proportionate rate. Postage prepaid.

**The Scientific American Supplement**

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

**Combined Rates.**—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

VOL. XXXVIII., No. 18. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, MAY 4, 1878.


**Contents.**

(Illustrated articles are marked with an asterisk.)



TABLE OF CONTENTS OF
**THE SCIENTIFIC AMERICAN SUPPLEMENT**
**No. 122,**
**For the Week ending May 4, 1878.**

Price 10 cents. To be had at this office and of all newsdealers.

☞ Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.



Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

## HOW PATENTS AFFECT PRICES.

Give a dog a bad name—then hang him!

This is substantially the logic of no inconsiderable part of the world with regard to inventors' rights. A patent is called a tax upon the consumer, a tribute to greedy corporations, a burden upon the industry of the country; and the cry, "Away with patents!" follows as a matter of course.

A prominent speaker before the House Committee on Patents (Hon. S. A. Hurlbut) echoed, perhaps unconsciously, this estimate of the system, when he parodied Sydney Smith's description of the taxation of the English people from the cradle to the grave. "It is so in the United States in regard to patents," said the speaker. "I am told that there are patented apparatuses used sometimes during the birth process; but after the birth and until the death, there is not a step in the existence of that child, from the time that by patent pins his clothing is hooked together up to the time you carry him to his grave, an old man, in a patented coffin and in a patented hearse, that he can escape the operations of the Patent Office. They have gone so far now that his body is lowered into the ground by a patent crank, and even his grave stone is made by a patent process." Another speaker, the attorney of the Western Railroad Association, was even more severe in his protest against tribute-taking patents. Even so simple and necessary a thing as a loaf of bread, he said, "pays tribute to twenty-one classes of patents, in each of which classes many patents are now alive: the plowshare, point, handles, and tackle; the harrower, the seed sower, the cultivator, the harvester, the thrasher, and the separator; the bolts, the hopper, the stones, and the gearing of the mill; the bag, the holder of the bag, and the strap or string with which it is tied; the yeast or baking powder, the oven, the extension table, and the dishes, are each the subjects of patents to which tribute is paid."

The inference from all this is that the bread we eat costs more than it otherwise would by its share of each and all of these various tributes; that each step of our lives from the cradle to the grave is increased in difficulty and cost by the aggregate of all the burdens laid upon it by the infinite number of patents which hedge it about.

It is quite possible that the talk of the gentleman quoted was sheer buncombe; but the view indicated is seriously held by not a few honest people. For their sake let us examine the immediate effects of some of the patents complained of. Take those bearing upon the loaf of bread. The farmer's plow is patented. We may assume that a certainty; for if it were not patented he could not hope to compete with his neighbors who use patented plows. Space would fail here to trace the successive patented improvements in plows, by which the cost of plowing has been reduced. One of the latest, the substitution of chilled iron for cast steel in the mould-board, has doubled the durability of plows, and at the same time reduced their price from fifteen to twenty per cent. Within twenty years the improvement in lines of draught in plows, patented improvement, has reduced the cost of plowing at least one half. With over a hundred million acres of land under plow, the annual saving to the country effected by plow-patents must be counted by millions, and the cost of bread is proportionately diminished.

The loaf of bread "pays tribute" also to seeders, on which about six hundred patents have been issued. One effect of these machines is a uniformity and certainty in sowing, at a depth necessary to prevent winter killing in winter wheat, by which the crop is increased from one eighth to one fourth. The lowest proportion of gain for the crop of winter wheat of last year would amount to about 40,000,000 bushels; and it would have been impossible to produce the crop raised without the seeders. The simple fact that 800,000 seeders have been made during the past twenty years is proof enough that farmers find them profitable. Thanks to patents the seeders have been greatly improved in that time, and at the same time the price to farmers has been reduced fifty per cent.

Another "tribute" is paid to reapers and harvesters. The simplest reaper was the sickle. By the invention of the cradle a man's daily work in the grain field was increased seven-fold. With it a man could cut an acre and a half in ten hours, while two helpers could rake, bind, and stack the straw. Now with the combined reaper and binder a boy driving two horses can accomplish from ten to twelve times as much harvesting in the same number of hours. This machine alone has proved its capacity to save the country a hundred million dollars a year, with a proportional reduction in the cost of bread. And of like effect have been the numerous patents in each and all of the twenty-one stages in the production of the loaf.

The figures we have given are drawn from the argument of Mr. Coffin before the committee referred to. He goes on to show that the invention of a single improved cultivator has reduced the cost of raising corn from 2 to 3½ cents a bushel. At this rate the saving on the crop of last year would range between twenty-five and fifty million dollars. By the old process of hand shelling the sheller got one tenth of the corn, and a man could shell from five to six bushels in a day. Now two men with a patent sheller will shell fifteen hundred bushels a day, and the regular charge is half a cent a bushel. The saving on a crop of thirteen hundred million bushels can be easily calculated.

The owner of an invention for making horse-shoes "taxes" the public to the extent of selling shoes at the market price of horse-shoe iron. He has a large establishment for making the iron, and by converting it into shoes is able to keep his mills in operation at a small profit to himself, when otherwise they would have to remain idle, owing to the depressed condition of the general iron market. The regular saving in the cost of shoeing horses effected by the invention of horse shoe machines is twenty-five cents for each set of shoes. The general use of machine-made shoes in this country would reduce the aggregate cost of horse-shoeing from twelve to fifteen million dollars a year. In like manner patented machines for making horse-shoe nails are a "burden" to the blacksmiths to the extent of furnishing from two to three pounds of nails for the price required for one pound of hand-made nails. A machine for finishing carriage shafts has reduced this part of their cost from eighteen dollars to seventy-five cents, and thus enables the owners of the patent to send their shafts to England, Germany, and Australia, and yet compete successfully with the cheaper hand labor of those countries. A patented knitting machine (American), costing two hundred dollars, knits stockings at the rate of one sixth of a mill per pair for attendance, or sixty pairs for a cent. American patented looms have so reduced the cost of cloth making that our muslins and calicoes can be sold at the doors of English and other foreign mills cheaper than they can be manufactured there.

Thanks to patented machines, eighty-five per cent of the labor of making shoes is now done by machinery. A hundred million pairs were made on one class of machines last year. Labor is better paid than before the machines were introduced, much more is employed, the quality of the work is increased fully twenty-five per cent, and the cost of stock has advanced, yet, as Mr. Hyde pointed out, the price of shoes has been very greatly reduced, so much so that American shoes are finding sale the world over. The royalties on all the machines used in the best equipped factories, Mr. Storrow was told by a large manufacturer, are less than would be the rent on the additional room which would be required to do the work by hand!

The manufacture of saws in this country has had to "pay tribute" to something like two thousand patents. At present nearly every process in this line of manufacturing is covered by a patent. Operatives are paid one third more than fifteen years ago, while their productive capacity has been increased, by patented processes, five-fold. As a consequence saws have been so cheapened as not only to almost entirely supersede those of foreign make at home, but to make possible a large export business to England, France, and all over the civilized world.

One of the most profitable patents of late years was that on the Bessemer process of steel making, a process which reduced the cost of a ton of steel from $200 to $55. The highest royalty charged by Mr. Bessemer was $5 a ton, or a little over three per cent of the saving due to the process. The royalties on the machines which revolutionized the manufactory of hosiery and other knitted goods in England, did not exceed three per cent of the savings they effected. The aggregate royalties on the numerous machines used in shoe making are still less—3¼ cents per pair upon fine sewed work, and about 2 cents per pair on pegged work.

We have seen what enormous gains and savings have come to the country through a few agricultural inventions. The successful machines have paid their inventors handsomely; but their gains have been as nothing compared with those that have accrued to the users of the machines. And the same may be said of all successful patents. The public is the chief beneficiary. It is not possible for a patent to raise the price of anything. Its sole advantage to the holder consists either in enabling him to offer an entirely new and useful product to the world, as the Goodyear rubber patent, or in enabling him to furnish a better article at a given price or a standard article at a lower price than his competitors can with profit. In either case the public gains more or less during the life of the patent, and ultimately the entire profit of the improvement which the patent covers. The possibility of the alleged tribute taking hinges entirely on the assumption that the progress of invention would be the same in the absence of patents—an assumption which not only has no evidence to support it, but which all experience refutes.

## WHAT IS LIFE?

The best our dictionaries can give in answer to this question is the verbal definition of the French encyclopedia, "Life is the opposite of death," a form of words giving no clew to the nature of the phenomena, the aggregate of which we call life. Language has many pairs of similarly contrasted words, such as up and down, high and low, hot and cold, heavy and light; and to say that any one of these is not its opposite adds nothing to the definiteness of our conception of either. Are life and death, like the others we have cited, merely relative terms? Or is there such an entity as Life, the addition of which to not living matter makes it living; the subtraction of which from living matter makes it dead? Is life the result of organization, or is organization primarily the result of life? What *is* life?

When primitive man asleep in his hut dreamed of war and the chase, of journeying to distant places, conversing with the dead, and the like, his natural inference was that there was in him a special self which left the sleeping body at will, yet was forced to return on the waking of the body. And since he saw in dreamland the counterparts of everything he saw in waking life, he as naturally extended to all objects, dead as well as living, the double existence he imagined for himself.

Accordingly from the very dawn of history the conception of life as something supernatural, something superior to the

bodily organization, which left the body temporarily in sleep and trance and the stupor of drunkenness or disease, and permanently on dying, has been familiar to all thinkers. The idea of life as the result or expression of material combination came much later. Later still came the compound theory of life held by Leibnitz and Descartes and their followers, who believed in a physical life for the body and a purely spiritual life for the mind. From this point of view the body is a machine, made up of mechanical devices and operated by mechanical or purely physical powers, while it is inhabited by a soul which thinks, but takes no part in the discharge of vital functions. In the words of Leibnitz, "The body goes on in its development mechanically, and the laws of mechanics are never transgressed in its natural motions; in the soul everything takes place as though there were no body, and in the body everything takes place as though there were no soul." This view makes life the product or expression of material combinations up to the point of consciousness; above that the soul is the life.

Of the three theories, the purely spiritualistic—that is, that life is due to the indwelling presence of spirit—is at once the oldest and still the most popular. This was the conception of Pythagoras, Plato, Aristotle, and Hippocrates. It has always been the theory of the Christian Church; and it underwent many vagaries at the hands of Christian mysteries, scholastics, alchemists, and other speculative writers during the Middle Ages. At one time it was believed that each and every vital process was the work of a particular spirit, and a man's comfort and character depended on the kind of spirits that pervaded and animated him. Such were the teachings of Basil, Valentin, Paracelsus, and Van Helmont. Stahl summarily dismissed all this infinite host of immaterial intelligent governing spirits save one, the rational immortal soul. This soul, in his view, was the very principle of life. There had grown up in that day a school of chemist-doctors who resolved all the phenomena of life into chemical action. In opposition to those Stahl contended that the real life force was not only unlike the chemical force of ordinary matter, but that the two kinds of force were hostile to each other—life persisting only so long as the vital or soul force was dominant, death being the ultimate victory of the physical forces.

Stahl's immediate successors were soon compelled to reject the idea that vital force was an intelligent force; intelligence was relegated to the soul; but they retained the notion of antagonism between vitality and the laws of mechanics, physics, and chemistry. From this point of view Bichat defined life as "The group of functions which resist death."

This idea of absolute diversity between the laws of living bodies and those which appear in "dead" matter is still a very prevalent one; but advancing science has shown it to be unfounded in reality. If it were true that in living bodies the physical and vital properties and processes are in constant and direct antagonism; or, as Bichat has said, "the physical properties fettered by the vital properties are perpetually checked in the phenomena they would tend to produce," then the intenser the life of any organism the weaker and slower should be the purely physico-chemical operations going on within it. But the exact contrary is the rule. Whatever restrains or lessens the organic processes directly diminishes vital activity; on the contrary, the more active the life the more rapid are the material changes in the organism. In the words of Claude Bernard, the alleged opposition, antagonism, or conflict between vital phenomena and physico-chemical phenomena is an error which the discoveries of modern physics and chemistry have thoroughly exploded. Life works in harmony with the other forces. Is it like them, or entirely different?

Obviously the real nature of life must be sought for in the peculiar phenomena with which life is associated. The essential characteristic of living bodies is nutrition, the product of two factors, one tending to build up the organization, the other to break it down—counting as part of the organism the food supply at any moment in the blood. Every manifestation of life involves, in this sense, organic destruction. Hence arises De Blainville's definition: "Life is a twofold internal movement of decomposition, general and continuous at once. In other words, life is a continuous dying." But there is a period when the formative element of life is predominant. In the young organism the up-building manifestly exceeds the breaking down of the organic structure. And at a still earlier period the phenomena of germinal evolution are the chief, if not the only, manifestations of life. These, however, do not differ in kind from the phenomena of nutrition; indeed, nutrition has been defined as continuous generation. The special agent of this essential life work is the germinal cell; hence arises another definition of life as the cell's impulse of organization, perhaps the closest definition that science has yet arrived at.

Whence arises that impulse? Is it a special, extra-material impulse? or is it only a mode of action of the general force of nature? Are the mysterious properties of the germ the result of molecular combination, as the properties of water arise from the combination of its constituent gases?

Here the final battle of biology must be fought. So long as life is surely known to proceed only from antecedent life, just so long will it be impossible to give a decisive answer to the question, What is life? The mystery of life lies in the evolutive power of the germ. If life is a vital spark handed down from organism to organism from the beginning, then it transcends the ken of physical science and must ever remain a mystery. If, on the other hand, life can be proved to begin *de novo* in suitable mixtures of demonstrably dead matter, as Bastian and other observers assert, that moment life ceases to be the only unique phenomenon in nature, and takes rank among the powers and potencies of ordinary matter. No wonder the controversy assumes at times a bitterness foreign to purely scientific discussions. The issues at stake are of transcendent importance, for upon the supernatural nature and origin of life hang the most revered beliefs, the most momentous theories, the most pretentious systems of the age.

## THE DECLINE OF THE IRONCLAD.

There is something which forcibly reminds one of the ancient question of the irresistible force and immovable body, in the modern futile search for impregnable ironclads and unopposable guns. A recent writer in the *Revue des Deux Mondes* very pertinently compares the naval engineering of the present day to the quest for the absolute which occupied medieval astrologers, for in both cases, as fast as progress is made, new possibilities and new necessities seem apparent, until above all rises the obvious impossibility of predicting when the desired goal shall be reached. Neither can the colossal outlay of money and time expended in attempts toward the solution of the problem of guns and armor be said to have afforded other than merely negative results. Great Britain has paid millions to discover that certain armor is not impregnable, or the converse that certain guns are not irresistible, and at the present moment a leading British engineering journal candidly avows that the total result of all experience in armor plating has reduced itself to the quandary of whether it is better to use steel armor, which will resist penetration, but which will be quickly shivered by the projectiles, or iron armor, which will not split, but which will be pierced. In the matter of guns, which now are in advance, it would seem that the limit of the size to which they can be increased must soon be fixed by the capacity of vessels to withstand the concussion and shock of their discharge. The heavier vessels are armored the stiffer they are, the less elastic, and consequently the more liable to injury by racking strain; to gain elasticity by reducing armor is of course to lessen the protection.

So again, the whole question of constructing armored war vessels is about as unsettled as it very well can be. The Inflexible, supposed to combine in herself all the best expedients of advanced naval constructive skill, is a failure, and the verdict of an official board, translated into plain English, is, "Don't build another ship like her." Few concur in the proper mode of protecting a vessel. Some advocate unarmored ends and heavily armored citadel; some, heavily armored ends and lightly armored midship portion; some advise armor all over, even to far below the water line; some propose a mere belt; and so on in every variety.

If it were possible to cover a vessel all over with iron thick enough to stop the largest projectile, the problem would be easy to solve, but to do this is to render the ship unmaneuverable. She would be like a shark that has to turn over to bite, and while the fish turns the intended victim escapes, or if injured, like an armored knight of the olden time, who, when unhorsed, was at the mercy of his enemy, for his armor prevented his running away. In the Austro-Italian battle of Lissa, the ironclad Rè d'Italia became helpless from an injury to her rudder, and a wooden vessel, a mere transport hastily fitted up for action, rammed her and sent her to the bottom at a single blow. A more suggestive instance happened during the late Russo-Turkish war, in the splendid attack of the unarmored Russian gunboat Vesta on one of the largest Turkish ironclads. The battle was fought at rifle range, and in a short time two of the Vesta's guns were dismounted, her rudder was jammed, and a fire near her magazine broke out, while the Turk poured in 15 inch and 7 inch shell as fast as his six guns could be worked. Just as the destruction of the Vesta seemed certain, a lucky shot from her alighted on the Turk's unprotected deck and struck his boilers, and with what steam the latter had left he ran away, the Vesta's injuries unfortunately preventing her following up her advantage.

Such instances as the above, besides the other considerations stated, are sufficient to show the inefficiency of heavy ironclads, without bringing torpedoes into the question at all; but as these terrible engines of war must play the chief part in all future naval conflicts, the disappearance of the heavy ironclad will be the almost certain consequence of their employment. At the time we write, the finest of England's fleets lies virtually at the mercy of torpedo attacks, and there is no concealment made of the anxiety occasioned thereby. The crews are kept constantly vigilant, guns are kept loaded, signal stations established, and every possible precaution taken in the face of the mere possibility that hostilities may break out. It is openly doubted, if the Russians succeed in gathering the torpedo craft, planting the fixed torpedoes, and increasing their movable torpedo armament on the Dardanelles (which measures are known to be afoot), whether the English squadron can make its escape from the *cul de sac* in which it has placed itself. The Austro-Italian war, short as it was, showed the inefficiency of armored vessels. In the Franco-Prussian war the French were unable to use them at all. The Russo-Turkish war has again shown their disadvantages; and an Anglo-Russian conflict, it would seem, can only furnish positive proof of what is already reasonably made certain.

Symptoms of reaction from the ideas which generated the modern ironclad are already visible. Far-sighted Germany, although recognizing the fact that her ironclads are no longer formidable compared with those of later date, refuses to build any more heavily armored vessels. For the protection of her coasts, light draught gunboats carrying large guns will be constructed, and her fleet, it is said, will be used for defensive purposes, never going into action at sea except when forced into it, or under specially favorably conditions. The days of such exploits as those of Farragut at New Orleans and Mobile are gone by, for torpedoes render them impossible. Invasions by fleets are obsolescent, and all signs indicate that the navy of the future will be such defensive gunboats as Germany contemplates, and light swift cruisers whose sole duty will be the destruction of an enemy's commerce.

## CONGRESS AND THE PATENT OFFICE FUNDS.

It has been the practice for some years past, says a correspondent, to pay into the United States Treasury all the fees received at the Patent Office, and for Congress to appropriate such money from the general funds as it thought fit, to carry on the business of the Patent Office; the amount appropriated lately being generally more in accordance with the ideas of the particular congressmen having charge of the appropriation bill than with the necessities of the case as pointed out by the amount asked for on behalf of the Patent Office.

The appropriation of $106,680, asked for by the Patent Office for the current fiscal year for printing the *Gazette*, the specifications of patents, patent heads, etc., titles to drawings, etc., was cut down to $65,000, although it was well known from the experience of previous years that the amount of printing required to carry on the business of the office could not be done for that sum, unless the number of patents issued fell off in proportion, of which there was not the least probability. Nevertheless, although the necessity for the whole sum asked for was capable of mathematical demonstration, Congress in its misdirected desire for economy refused to appropriate anything more than the sum mentioned; and as a result the appropriation has all been expended on needed work, which causes the stoppage of the printing of the Patent Office *Gazette* with the issue of March 26, and of the specifications of patents with those bearing date April 2. As the patents cannot be sent out without the printed specifications, the patents which should be issued on the succeeding weeks will have to be suspended until Congress appropriates more money, by the deficiency bill now before it, to carry on the printing.

In the deficiency bill, the $40,000 asked for to finish the printing for the remainder of the fiscal year has been cut down to $30,000, and it may be yet further reduced before passing both houses. To get along with the $30,000, even if that much is granted, the printing of the Alphabetical Index of Patents, which has been in preparation some time, will have to be postponed. This work, when published, will be a great help to inventors and attorneys, and it is believed that every dollar spent on it will be returned to the Patent Office in the sales of copies.

It is now proposed to cut down the examiners' salaries from ten to fifteen per cent, when it is well known that many of the best officers resign even at the present salaries because they can obtain a better income outside the office than in it. If the Patent Office is to be, as it ought to be, provided with a corps of examiners capable of appreciating the nice points of inventions, skilled in mechanics and learned in the law, fair salaries will have to be paid. Economy on this point may save a few thousands to the Treasury, but a single patent wrongfully issued may cost the public many times more than the saving thus effected, and a patent refused that ought to have been granted may delay the introduction of an invention that would save the people generally tenfold the amount saved by the proposed reduction of salaries.

For several months past the "burnt district" of the Patent Office has had nothing but a temporary tarred paper roof on it, although a large portion of the business of the Patent Office, and much of the Interior Department, is done in that part covered by the paper roof, and much inconvenience is felt for want of room. The attention of Congress has been called again and again to the necessity of something being done to remedy this, but thus far without result.

Now, why this mistaken policy of stinting the Patent Office? Is it because the Government is so poor that the money cannot be raised to make the needful appropriations for printing, paying proper salaries, and for necessary repairs? If this were so, and the Government had to pay out its own money, there might be some excuse. The Government, however, is not called upon to pay a penny of its own for either of the purposes mentioned, as it now has lying idle in its coffers over eleven hundred thousand dollars belonging to the Patent Office funds, which the office has received over and above expenses and paid into the national Treasury, every cent of which of right belongs to the Patent Office and should be kept for its use. Congress can find time and money enough to provide tens of thousands of dollars for an unnecessary mint in New Orleans, and appears willing enough to appropriate hundreds of thousands of dollars for the payment of confederate mail claims, but is not willing that the Patent Office—the only government institution that is purely self-sustaining—should control and spend its own revenues. All that is wanted from Congress is that the Patent Office may help itself with its own income, that it may use some of the money that it has garnered up, not from a tax on labor but as the price of protection to inventions, which money should be devoted to that purpose, to the encouragement of inventors, and to spreading information that may help them on their way, and not be allowed to lie in a constantly accumulating hoard, doing good to none.