

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

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

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

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VOL. XXXIX, No. 12. [NEW SERIES.] Thirty-third Year.

NEW YORK, SATURDAY, SEPTEMBER 21, 1878.

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V. ELECTRICITY, LIGHT, HEAT, ETC.—Electric Lamps in Paris. By Professor SILLIMAN. History of electric illumination. The Gramme machine. Cost of the electric light. How to make a Working Telephone. By GEO. M. HOPKINS. Full practical directions, with six full size drawings to scale, enabling any person to construct a working telephone line complete at small expense. Geographical Changes made by the Treaty of Berlin.—Dr. Thomas Oldham.
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THE ORIGIN OF AMERICAN MECHANICAL GENIUS.

The London Times of August 22 prefaces a long account of the American mechanical display at Paris with the following remarks:

"It may almost certainly be predicated of any modern mechanical congress that the Americans will carry off the palm for novel and ingenious application of force to practical purposes, the substitution of mechanism for hand labor in new and curious contrivances, which, to the amateur in such matters, surprise as much by the new ways in which old problems are attacked as by the fine way in which the work is done. The mass of invention and practical result from it produced by the Americans within the century, and especially the last 20 or 30 years, is so great and so important in results, that it presents an important problem in political economy—one especially interesting to Englishmen, as American mechanism is an offshoot from English, but an offshoot so peculiar in its character that mere heredity will not quite explain it.

"A traveler in the New World once said that the most interesting thing in America was its Americanism, and so we may say that the most curious feature of American mechanics is its distinctively American feature. As mechanical science progresses, the greater and more important inventions become elaborated by, and the property of, the nation who push that science furthest in its experimental studies. The result is foreseen, studied, and developed with method and certainty, and great industrial revolutions are effected with a certain and almost calculable progress. In this progress England has long led, and still leads, the world, owing to favorable conditions of capital and labor. Fulton built the first successful steamer on American waters; but all the latest and most important advances in steamship building are English, and the great mass of the steamers afloat are English. The first monitor was American; but the puny craft of that construction across the Atlantic would all go down before one of the last English build; and though Rodman and Dahlgren instituted the experiments to which we owe most of the present knowledge of the power of artillery and gunpowder, English artillery has left the practical transatlantic results out of the chance of competition.

"Yet in spite of this the activity and insight of the American inventive genius develop more that is new and practical in mechanism than all Europe combined. The New Englander invents normally; his brain has a bias that way. He mechanizes as an old Greek sculptured, as the Venetian painted, or the modern Italian sang. A school has grown up whose dominant quality, curiously intense, wide spread, and daring, is mechanical imagination. It is not the professed mechanic or iron master who invents, any more than the schoolmaster or the farmer. As Tintoretto left his dyeing to become a great painter, the American, be he bank clerk, pedagogue, backwoodsman, or plowman, turns in his busy brain some problem of his own, suggested by his experience of ill or too slowly done work, and like Archimedes in his bath, he suddenly finds it and rushes away with his 'Eureka' to some place where he can make his model or get it made—more frequently the former for want of funds to get it made. There was a want the man had felt, an ideal to be worked out, and in his meditation suddenly the thing flashed on him, and is complete in all its essential parts from that moment. The number of inventions, useful and useless, thrown off in this way in the course of a year, of which only a small proportion attain the realization of the Patent Office, can only be imagined by those who have lived among New Englanders at home."

The Times evidently uses "New Englander" to represent the inventive American type, not merely the men who live to the eastward of the Hudson. That type of creative thinkers prevails across the entire breadth of the States; and every year sees its development more and more to the southward. Why? It will not suffice to say that the American has a bias toward invention. How came he to have such a bias? Not by inheritance surely, for his ancestors in Europe were not distinguished that way. Not because he came of good stock, and was early thrown on his own resources, with a new world to conquer before him. The colonizing of new lands by a free and vigorous people has happened many times in the world's history, but a race of inventors never appeared before. Scarcity of labor could not have been the original cause; for in all other similar cases the result has been a natural limitation of the amount of work attempted, not a phenomenal increase of achievement through invention. No doubt these, and other conditions favorable to the development of personal vigor and individuality of character, have helped to cultivate the faculty of creative mechanical imagination, which, in its intensity, universality, and daring, has become the distinctive American characteristic. But they cannot be the mainspring of American inventiveness, for the simple reason that they are not distinctively American in origin, or more generally prevalent here than in other regions not remarkable for the inventive genius of the people.

There is a factor, however, which was early brought to bear upon the industrial development of American thought—a factor to whose influence American inventions can be directly traced in almost every instance; a factor distinctively American in spirit and character. That is the American patent system. If America has led the world in the evolution of new and useful ideas, it is because America was the first to see the need of, and to practically recognize the justice of, a liberal recognition of the rights of property in new ideas. It was very early discovered in consequence

that one of the quickest ways to wealth and honorable fame was through creative thought; and creative thinking became as a natural result the desire and aim of all classes of our people. The American, whatever his calling, is forever on the outlook for novelty, and thousands make invention the business of their lives, because there is money in it. A patent costs little and may bring a fortune; and the stimulus thus provided has made every American workshop an industrial school, more and more, every year, striving for the grand prize—a profitable patent. It was this feature of American life which so forcibly impressed the foreign commissioners to the Centennial Exhibition—which made them all so eager on their return to have their home governments imitate the American Patent System. The contrast between America and Europe on this score has been enormously diminished by the new laws of our European rivals. And though, in liberality to inventors, our system still bears the palm, it may be well worth while to consider whether we cannot profitably increase the incentives offered to inventors—especially inventors with little capital—and so make sure of maintaining the lead which liberality has thus far secured to this country.

After the foregoing was written and in type, the copy of the Times from which the quoted extract was taken came to hand. A paragraph not given in the early report happily justifies the explanation we have offered as to the fundamental condition of American inventiveness. In it the Times goes on to say:

"There can be no question that the efficiency and moderate cost of patent right protection in America should have the greater share of the credit of this immense activity. Invention pays, and the action of the patent laws is so secure and equitable that the investment in brain labor is a safe one, while the expense of securing a patent is so small that the capital required for preliminary enterprise is within reach of almost every inventor. A patent right is the El Dorado of the New Englander, and thousands delve there with an assiduity no mere love of invention could inspire. This is not conjecture or a priori conclusion, but opinion based on years of intercourse with the inventing Yankee, and actual experience of the working of the American patent system, which, if not perfect, is so far in advance of that of any other country that we may safely say that never has wisdom in legislation more completely brought its own reward. The economy of wages from labor saving machines in the United States is almost incalculable, while the tax for royalties on patents taken out in England alone must constitute an important item in the finances of American industry."

THE UTILIZATION OF WEEDS.

Ralph Waldo Emerson has described weeds as plants whose use has not been discovered. Too often men are content to call a plant a weed and then proceed to exterminate it without making any attempt to find out its possible uses. An Indian writer, Mr. George W. Strettell, considers from his experience gained in the Indian Forest Department that a large revenue might be derived from such plants, especially those yielding fiber—plants which require no care in cultivation, which will grow in land utterly unsuited to any other crops, and which yield fiber practically proved to be well adapted to the manufacture of paper and textile fabrics. He advocates the cultivation, at first if need be experimentally, and on a small scale, of several different plants, and especially of one, the Calotropis gigantea. The fiber of this plant has been pronounced by paper makers and manufacturers of textile fabrics as excellent; and he shows convincingly that after allowing for the cost of cultivation and of extracting the fiber, the raw material might be sold at such a price as to add considerably to the Imperial revenue. Next to the discovery of plants yielding products now in demand for industrial or medical purposes, we may rank the invention of new uses for the products of plants now considered useless. But a small portion of the vegetable world has yet been made tributary to man; and from past experience it is safe to predict that even the most noxious of weeds may yet prove to be of the highest utility.

MENTAL EXPERIMENTING.

The reduction of experiment to a mental operation is a wonderful faculty possessed by some men. They are able to plan and arrange the parts of a machine, the steps in a process, or the intricacies of a design by a purely mental act, so that when the device is embodied in matter it is the exact representation of the thing pictured in the mind. This rare faculty is not wholly a gift, as it may be acquired to a greater or less degree, and there appears no reason why it should not be more generally possessed.

The one who at the first mental inception begins to put the subject of his thoughts into tangible form by experimenting with material things, not only adds expense to his experiment, but at the same time cripples his faculties by failing to give them the opportunity to expand, as they might have done had not the effort been complicated by physical action.

The patience of inventors too often and too easily is overcome by their great desire to see the embodiment of an idea, hence the crude and imperfect inventions, and the rough, unshapely, and unscientific machines, which exist but for a brief period, and are afterward to be found disorganized and laid away, covered with dust, corrosion, and cobwebs, the evidences of disuse.

The best proofs of the lack of the sort of mental work we

have referred to are found in the heaps of old iron awaiting remelting at the foundry or in the junk shops, where many of these inoperative machines ultimately find lodgment. Many of these machines evince mistakes and miscalculations which can be accounted for only on the ground of incapacity or an almost entire lack of thought.

Of course every one exercises a certain amount of forethought previous to any act; but we refer to that intense and systematic application of the mind to a subject which revolves it, analyses it, and puts it in all possible forms, and finally perfects it, so that when it is put into tangible form it will fulfill the expectations of the originator, without the necessity of reconstruction or material alteration.

SENATE BILL NO. 300.

At the request of Mr. W. C. Hill, Clerk of the Senate Committee on Patents, we take pleasure in saying that copies of Senate bill No. 300, with amendments, can be had by applying to him at Washington. We trust that our readers will not neglect to make themselves familiar with the changes therein proposed in our patent law, and their probable effects upon the industries of the country. With all its amendments the bill is, in our opinion, open to serious objections on several points; and it is to be hoped that all who have the integrity and usefulness of the system at heart will be prepared to lend a hand in the struggle over it, pretty sure to come off next winter in the committee room, if not in Congress.

The enemies of the system can hardly find a Congress so ill prepared to appreciate the object and character of patent legislation as that which threatened so much mischief to the industries of the country last winter. Still the risk is not small; and our inventors, farmers, artisans, and manufacturers should see to it that their representatives are properly instructed with regard to the nature and use of the Patent Office, before they return to Washington. Especially should they be made to see the criminal folly of any changes calculated to increase the cost of patents, to shorten their life, or to make them less easy to get.

THE BRITISH ASSOCIATION.

The forty-eighth annual meeting of the British Association for the Advancement of Science was held in Dublin, the week ending August 21. Though there was nothing in the matter brought before the meeting calculated to make it specially memorable, it was above the average in general interest.

The President, Dr. Spottiswoode, seems to have pitched the keynote of the meeting in his very able address, and throughout the proceedings there was a notable absence of everything sensational or provocative of controversy. Among the more important papers and addresses may be mentioned Professor Huxley's in the department of Anthropology. His review of the progress of thought—indeed the revolution in modes of scientific and popular thinking—in regard to man's nature, origin and history, was, to say the least, very encouraging. It does not take anything like so long now for men to become reconciled to new ideas as it used to.

The opening address of Professor Maxwell Simpson in the chemical section, on the educational influence of chemistry and the material advantages arising from its study, was decidedly forcible. The need of proving all things, of being exact, careful, circumspect, and rigorously honest in all one's chemical work, gives that science, properly taught, the highest rank for cultivating scientific habits of thinking. Professor T. Sterry Hunt's paper on the succession of the crystalline rocks is based on the results of many years of study of the crystalline rocks of this country. Professor C. Wyville Thomson's address before the geographical section; President Edward Easton's address before the mechanical section, on the Conservancy of Rivers and Streams; Mr. George J. Romaine's paper on Animal Intelligence; Sir John Lubbock's on Ant Life, and other papers of interest, we shall refer to hereafter.

Asking Impossibilities.

It would undoubtedly be a good thing for inventors if the Patent Office could be so omniscient and infallible in its action as to make its decisions in all cases indisputably correct and absolutely just. But seeing that human agencies are not apt to be blessed with such transcendent powers, it seems to us much safer for all concerned to have the Office play the more modest part now assigned it, leaving it to the courts to decide upon disputed points of priority and the like. It is true that patent litigation is tedious and expensive; but that, so far from being a valid reason for the Patent Office taking upon itself the work of the courts, as a correspondent insists it should, is a most cogent reason for its letting such work alone.

Our correspondent says:

"The poor inventor, after having, at great outlay of his time and money, perfected an improvement and demonstrated its utility, is almost sure (especially if it relate to any of the larger manufacturing interests) to have it seized upon by some unscrupulous party, who proceeds, in defiance of the patentee's rights, to reap the benefits of his labor and study, relying on his greater means and the profits accruing from the infringement to defend himself in law and stave off final judgment until the plaintiff shall seek a compromise or become discouraged and give it up altogether. Should the latter, however, be so fortunate as to win his case, he will, after all, have obtained only what he should have had at first, namely, a valid patent."

The writer labors under the very common misapprehen-

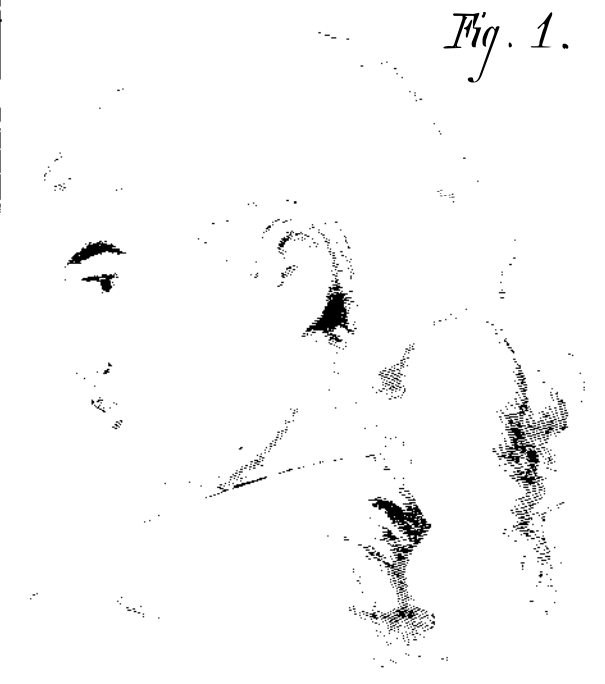
sion that it is the business of the Patent Office to confer property rights; when the truth is, its duty is rather to record claims for such rights, making such examinations as may establish the probable justness of the claims.

To undertake, as our correspondent advises, to give to each application for a patent "the most searching and exhaustive examination as to novelty and scope of claims that it is possible to make, so that the patent once issued could never have its validity questioned," would be to load the Patent Office with duties as irrelevant to its true function as the conduct of Indian affairs, the trial of pickpockets, or the management of the army and navy would be.

With two or three hundred patents a week to pass upon, any attempt of the Patent Office to usurp the functions of the courts would put it hopelessly in arrears inside of a month.

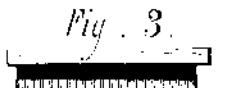
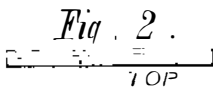
THE IMAGINATION IN THE CONSTRUCTIVE ARTS.

Without the imagination art would have no soul, and we would have nothing beyond the visible and tangible, nothing



but the gross and ponderous. The accomplished artist, with a few skillful brush strokes, places shade here and light there, until to the unimaginative there are only a few patches of color which mean nothing, while in reality there are masses of light and shade which, to the artistic, are suggestive not only of the bolder elements of the picture, but also of detail which may be supplied by the imagination. In a really artistic picture there is no outline, no rigid delineation of any part, but everything pertaining to contour is soft and mellow, more suggestive than definitive, leaving much to be supplied by the creative faculties.

The portrait, Fig. 1, is composed of masses of light and shade; there are no rigid outlines, no arbitrary guides for giving form or expression to the face, yet it has form and expression, for we imagine the lines that define the face. Each person has individual, natural, and peculiar tastes which govern the imagination, and thus control the characteristics of the picture, so that two persons cannot see in it the same face, but each sees a visage that is more or less beautiful according to the bent of his fancies.

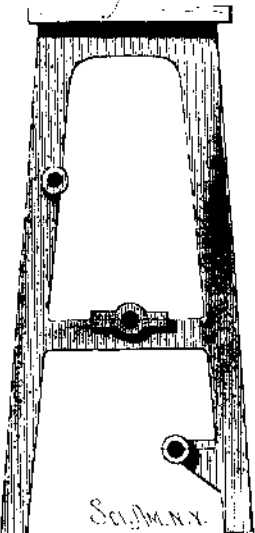


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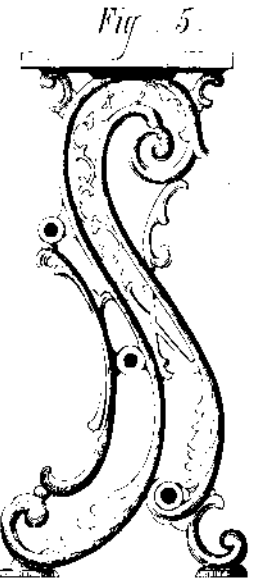
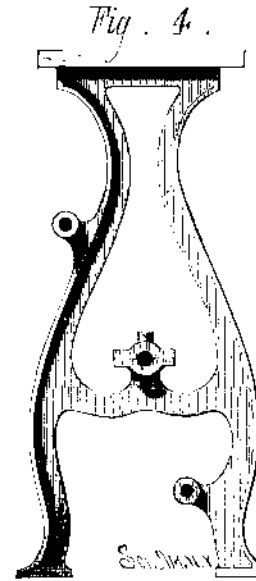
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BASE



It is not in the fine arts alone that the imagination plays such an important part, for in the constructive arts this faculty is positively required. Elegance of design in architectural or engineering structures, or in machinery, is as essential as good materials or good workmanship. The builder who, through the exercise of his imaginative powers, plans and executes a beautiful structure, of necessity takes a leading position and commands his proportion of patronage; and the machine manufacturer who mixes art with his iron has the long arm of the lever when compared with others who regard weight and strength as the only requisites. To

illustrate this, we will take a machine in which certain points are necessarily fixed by the location of the shafts, the base, and the top. The inartistic and unimaginative would design a frame which, for practical purposes, might answer equally as well as any other, but it would not have that comely form which results from an artistic taste and an exercise of the imagination, and which goes a long way in making a machine popular.



The three shafts, the top, and base of the machine under consideration are the arbitrary points. The frame must be made upon the most obvious straight lines, or the imagination must supply such a design as would, while it comprehended the bearings of the shafts, the support of the top, and the proper width of base, be also pleasing to the eye. Even though it be a thing of iron, it should have symmetry; harsh straight lines should be avoided, and angles should be rounded; in fact, it must be, in a sense, beautiful, as well as subservient to the purposes of the machine.

There are certain features peculiar to every machine which must control its design to a greater or less degree, but there is opportunity on every machine to exercise skill in this direction. There are undoubtedly extremes in the matter of design—a thing may be too ornate as well as too plain.

Fig. 2 of the example which we illustrate shows the controlling points of the design; Fig. 3, the most obvious form of frame; Fig. 4, a frame of graceful shape; and Fig. 5, a frame of scrolls. In all of these the arbitrary points are precisely the same, but the frames differ materially. That shown in Fig. 3 would answer the purpose, but who would not prefer the design in Fig. 4? The design shown in Fig. 5 might properly be considered out of character for a machine, still its appearance is pleasing.

THE BAG-WORM'S MOTHER.

In the SCIENTIFIC AMERICAN of August 24 attention was called to an article in the SCIENTIFIC AMERICAN SUPPLEMENT, of the same date, describing a curious insect. The writer, Mr. Wm. H. Gibson, after much study of the insect—variously known as house-builder caterpillar, basket worm, drop worm, bag-worm, etc.—had come to the conclusion that the female was never transformed into a moth, and never had any connection with the male.

In the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found an article by Professor Riley giving the true natural history of the insect—*Thyridopteryx ephemeraformis*—with a full description of the manner in which the mysterious fertilization takes place. Professor Riley has been making experiments with the silk of this moth, which lead him to the belief that the insect, now a real pest, may some day prove valuable as a silk producer.

The Supposed New Metal Mosandrum.

It will be remembered that under the name of mosandrum Mr. J. Lawrence Smith recently described the radical of an earth that he had isolated from certain American gadolinites. The French chemist, M. Marignac, a high authority in these matters, having examined specimens of the supposed new metal, sent him by Mr. Smith, pronounces them nothing but terbium. At the same time he acknowledges the fact that from the spectroscopic studies of M. Soret there must be recognized in these minerals a metal which appears to be new to science. It is not the "mosandrum" of Mr. Smith, however, but the radical of an earth isolated by M. Delafontaine, and rightly considered by him entirely new.—*La Nature.*

New Fish.

The Gloucester fishermen are rendering Professor Baird and the cause of science very valuable aid by bringing in from the fishing banks many curious kinds of fish, heretofore thrown away as of no value. In this manner much is learned concerning the presence on the grounds visited by fishermen of Arctic and European fish. The schooner Marion, Captain Joseph W. Collins, lately arrived from a bank trip, brought in three strange fish. Two were sharks, entirely new to North America, if not, indeed, to science. The other was a fish of the genus haloporphyrus, but of undescribed species.