Invention and Discovery.

Two words which glibly enough fall from the lips of the average man in a careless sort of indiscrimination as if they were synonymous. But there is a vast sea of distinction between them. Literally, they are not so widely separated; but they have come to represent two totally different aspects of human action. To the writer's thinking, the terms have been greatly confused.

Columbus hardly *discovered* America, he *invented* it—that is, as to its cognizable existence. He studied, figured, applied the laws as he knew them, and determined that there must be a continent there, and he plodded on till he proved the fact, and reduced his invention to practice.

Newton *discovered* the law of gravity, one might say, without either mental or physical effort. Watt invented the steam engine, and Stephenson invented the locomotive. They felt and knew the goal was ahead, but how to reach it was the question which required invention of the highest order. Eli Whitney saw the painful and laborious methods of cleaning out cotton and shredding it, intuitively felt it could be done by machinery, went to *work*, and gave the world one of his great inventions, the cotton gin. Howe's great inspiration to place the eye at the point of a needle may be said to have been a discovery. It unfolded a picture to his mind prophetic of good to almost countless millions, but *invention* had to be invoked to give the picture life, and the sewing machine, in all its beauty, came slowly forth from the chrysalis of Howe's discovery. The irregular lathe and the modern harvester were inventions; their dim, indefinable forms loomed up in the mists of their inventors' minds, they felt the impulse of improvement, the value of the goal gained, and they went to work and at last succeeded, and the wood carver and reaping hook lost their usefulness to that extent.

The electric telegraph was never discovered; it was consistently invented. Countless devices and methods were designed, tested, thrown away—to be afterward revivified, many of them—new appliances and systems laboriously worked out, the midnight oil unsparingly sacrificed, until at last a perfected and practical system and apparatus were given to the world.

It is hard to say whether the dynamo was invented or discovered, considering its prototype, the magneto machine. The probabilities are it was an accidental discovery. The arc light was a discovery pure and simple. Electric incandescence was a discovery, but the incandescent lamp in its commercial form stands forth as one of the most beautiful examples of man's inventive faculty. The countless experiments on material, the bulb, the seal, the standardizing, the pumps, and all the appliances that go to provide us with the beautifully glowing luminary, all are ineradicable proofs of invention of the very highest order. Midnight oil and noonday sun, morning's vigor and evening's reposeful ruminations, were all called into requisition to complete the work. This is true invention.

The phonograph was originally a discovery, a happy thought of Edison's, but invention of a high order was necessary to produce the beautiful instrument of the present day. It was like Howe's needle—the germ was there, but the machine had to be devised to make it practicable.

The undulatory telephone was a discovery, a brilliant one, but still a discovery. A happy thought supplied the missing link in an incomplete chain, and when the weld of that link was accomplished the whole world was enchained in admiration, the wonderful utility of the device was quickly recognized, and the discoverer reaped a rich harvest.

The pneumatic process of Bessemer was an invention of high grade and far-reaching importance, and the Siemens regenerative furnace has proved its equal in merit as a methodical and logical invention beautifully carried out.

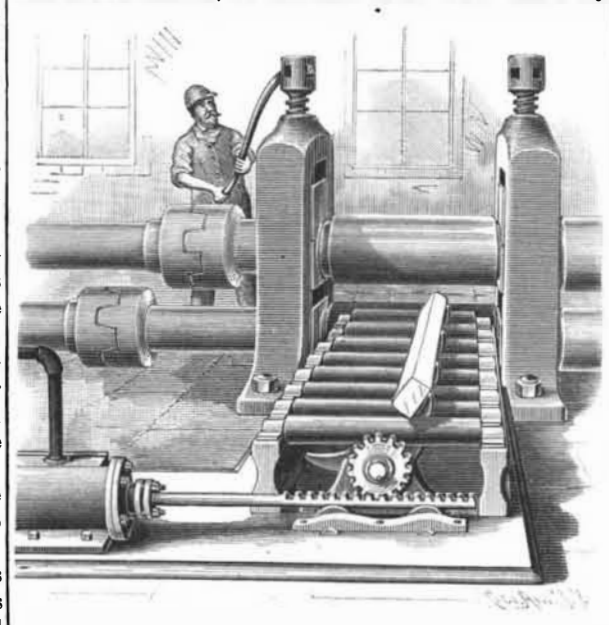
The inventor sees his goal, and consistently strives for it. He knows the object is there, and he goes energetically after it, sometimes straight to it, but oftener is many times lost in the wilderness of deluded fancy. He sees a light ahead, sighs relief and darts after it, only to find it a will-o'-the-wisp. Undaunted, he starts again, only perhaps to meet other and worse misfortunes. But he struggles on hopefully, and at last reaches the shrine of his adoration and is for the time content.

The discoverer walks along calmly toward some goal, or lies on the roadside meditating, and happening to cast his idle eyes downward, sees a gem sparkling at his feet, and he sometimes picks it up and adds it to the galaxy of the world's diadem, but he as often fails to note the scintillations that betoken its preciousness, and spurns it back into the deeper dust, to lie unseen and unknown perhaps for ages.

Which of these two promoters of the world's welfare merits the higher praise, it is needless to ask.—*Electrical Review.*

AN IMPROVED INGOT MANIPULATOR.

An improved apparatus to facilitate the handling of steel blooms, billets, slabs, etc., in a rolling mill, is illustrated herewith, and has been patented by Mr. Orlando P. Mason, of Bellaire, Ohio. The tables by



MASON'S INGOT MANIPULATOR.

means of which the ingot is fed to the rolls have driven rollers on which the ingot lies, and by which it is moved backward and forward as it is passed to and fro through the rolls. A horizontal shaft is arranged on bearings under the rollers, and provided with a series of projecting arms, preferably of crescent shape, at right angles to its axis, the arms extending upward between the rollers, and the shaft being operated by a pinion working into a rack actuated by a hydraulic cylinder, by a small reversing engine, or in any other suitable manner, the length of the rack being such as to allow the shaft to make one complete revolution. With this construction the ingot, as it lies on the rollers, can be readily moved from one side to the other, the crescent-shaped arms catching the piece on its lower corner and tumbling it over, as the horizontal shaft is put in motion by means of the reversing engine or other power.

For further information relative to this invention address Mr. John W. Cabot, Bellaire, Ohio.

NEW TYPE OF PHOTOGRAPHIC PORTRAITS.

Fig. 1 is the exact reproduction of a photograph. It gives a genuine portrait under the form of a marble bust. How such a result may be easily obtained is shown in Fig. 2. The model is placed behind a hollow column or thin pedestal of painted wood. If it be desired to represent a Roman emperor, a helmet of white cardboard is placed upon the model's head, his hair and face are whitened with rice powder, and those portions of the body that it is desired to render visible are surrounded with white flannel. The background should be formed of black velvet. It in nowise interferes with the operation if the arms be raised. After the negative is developed, the figure that it is desired to preserve is cut around with a penknife, and the arms and all the portions that are not wanted are scratched out. The glass thus becomes transparent where the scratching has been done, and in the positive the bust stands out from a black background.—*La Nature.*

Fig. 1.—A PHOTO BUST.

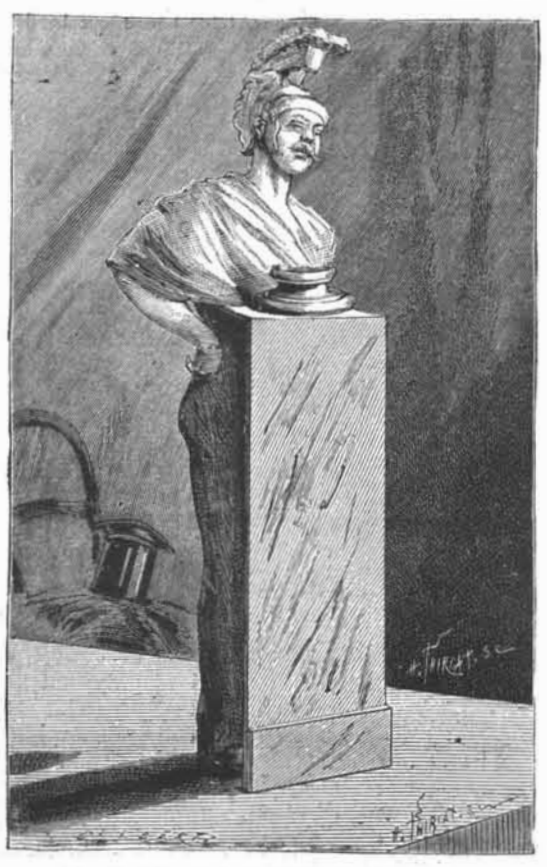


Fig. 2.—HOW THE BUST IS OBTAINED.

Electrical Street Railways.

"The Solution of the Municipal Rapid Transit Problem" was the subject of a paper recently read before the American Institute of Electrical Engineers by Frank J. Sprague. The actual operation of street railroads by electricity is bringing to view the obstacles which are to be overcome, and the success already attained leads Mr. Sprague to believe that municipal rapid transit is to be solved by the adoption of some system of electrical propulsion. It is his opinion that the data and experience obtained in the operation of the Union Passenger Railway in Richmond, Va., prove that electricity meets all the requirements for traffic of that character, while the grades are heavier and the curves sharper than will be encountered in most American cities. The Richmond road aggregates thirteen miles of track through nine miles of streets, and is operated from a central station, the power being derived from three 125-horse power engines. The cost of running the cars is $1.98 for operating and $1.48 for station expenses—a total of $3.46 per car per day or eighty-mile run. This does not include executive expenses, taxes, nor general charges of that character. The overhead system he considered the best and most economical, and, if properly constructed, has no objectionable features. For the operation of a similar surface railroad in New York City, conductors could be advantageously suspended underneath the elevated railroad structure.

The Fortifications of the Future.

General Brialmont, Inspector-General of Belgian Fortifications, says the defenses of the Meuse are the material guarantee of Belgian neutrality and autonomy, and constitute a line of defense for France. The valley of the Meuse is continued in France by the valley of the Oise, which is not sufficiently defended. The twenty-one forts which are being constructed in Belgium, and which are capable of offering effectual resistance, are a barrier closing at the same time the gates of Belgium and those of France. Thirty months will suffice for their construction, which has been undertaken by competent French contractors. The system adopted is that of metallic cupolas. Metallic cupolas will be the fortifications of the future. The common belief that the power of explosives may be indefinitely developed is, says the general, contrary to facts. All recently invented explosives are of nearly the same value. There is no reason to believe that greater destructive force can be obtained by means of explosives. The steel cannon hooped with iron represents also the maximum of resistance which can be obtained from the tube conveying the explosives. The problem of defense is thus simplified, as the projectiles which can be directed against the metallic cupolas have arrived at the highest possible degree of power. The metallic cupolas resist the most powerful cannon, and the ripping of some cupolas during the recent trials at Chalons does not prove the contrary, because no work can withstand a protracted fire at only 200 meters distance. In regular war there is no firing at 200 meters. Germany is erecting metallic cupolas in her fortresses, while France is only discussing the matter, and has virtually no longer a fortified frontier on the east.

Dangers of the Emery Wheel.

By the bursting of an emery wheel in the carriage factory of R. M. Stivers, in East Thirty-first Street, this city, Henry Dunwald, a young grinder, was killed. He was bending over the wheel, and some of the flying fragments crushed in his chest. Dunwald was twenty-two years of age and unmarried. He had selected the wheel as one without a flaw, and he had sole charge of it in the factory.