clamp fastenings. These sections are built up, one upon another, until the mould—placed vertically in the pit—reaches to the surface. This is lined with a thick layer of cement and sand to resist the heat of the melted iron. The cavity in the mould to receive the molten iron is 4 feet 9 inches in diameter at the bottom or breech of the gun, 3 feet 7 inches in diameter at the top or muzzle, and 40 feet long.

The casting is done after the Rodman system—that of cooling from the interior. To illustrate the effect of this, the mass of iron we will suppose to be divided into concentric rings, the inner one of which cools first and contracts, when the second cools, shrinking upon and firmly uniting with the first. The third, fourth, and so on then cool in order. The effect of this, as illustrated in very large guns, is great uniformity of the metal and greatly increased strength, owing to the almost total absence of internal strains and because the pressure arising from an explosion is resisted by the circles formed in the shrinking.

In the guns cast after the old method of cooling from the exterior there was always a quantity of idle metal, so to speak, but by this plan each ring or circle does its part in withstanding the pressure, and the internal strains are so distributed that no part of the iron is subjected to strains in a direction abnormal to those which it assumed when cooling.

This cooling from the interior is effected by a hollow core, consisting of a wrought iron tube, about 9 inches in diameter, covered externally with clay to resist contact with the molten iron, and made perfectly tight at the bottom, but open at the top. This tube forms the bore of the gun when cast. A circulation of cold water is kept up through the interior, as near as practicable to the hot iron, in order to cool the casting from the bore outward, that the desired contraction may be toward the center for the purpose already described. As shown in the engraving, two pipes enter the open top of the core, one for the admission of cold water and the other for the exit of the water which has become heated by its passage through the core. The large drum shown just above the pit is designed to carry off the vapors arising from the casting.

On July 9 an attempt was made to cast one of these enormous guns. The mould had been made ready, and the furnaces had been going since the day previous. Each of the three furnaces, which are located at a little distance from the pit, as shown in the cut, contained 40 tons of iron. During the melting small rectangular specimens are taken from the furnace and broken, the appearance of the fracture serving as a guide in regard to the quality of the metal, which is carefully brought to the required standard. The difficulty of breaking these samples, each of which was laid across an opening in a block and struck many blows with a sledge before it yielded, indicates the great strength of the metal. When everything was in readiness, the furnaces were tapped and the molten iron led to a mixing chamber, from which it flowed to the mould. About an hour after the mould had been filled the heavy iron flask burst open at the bottom, when the column of melted iron, nearly forty feet high and about four feet in diameter, instantly settled to the bottom of the pit and formed a cheese 13 feet in diameter and 6 feet thick. As the pit was perfectly tight and dry no explosion took place, but as the mass fell to the bottom it went with such force that a small amount was thrown out to the roof, which, together with the foundry fixtures, was burned. The damage to the flask, the recovery of the heavy mass from the pit, and putting it in shape to be remelted, is a serious loss.

Our second engraving shows a gun being moved to the machine shop. The casting is remarkably perfect, no flaws or other imperfections being visible, and even the joints formed by the various sections of the mould being hard to discern. When finished, the gun will be 30 feet long, a portion being cut from each end of the casting, 56 inches in diameter at the breech, and the bore will be 12 inches in diameter. It will be a rifled breech-loader, and the method of operating the breech block will be the "interrupted screw system," erroneously called the French method. It will be worth $28,000—about half the sum that a steel gun would have cost—and, it is calculated, will be able to throw a projectile six miles.

### Novel Form of Earth Plates.

A novel form of earth plate, in which a continuous process of depolarization goes on, has been devised by Mr. Justin Halisz, chief electrician to the Galician railways. In a square hole in the ground, about two meters deep and one meter square, there is placed a bed of coke of moderate thickness. Above this layer there is formed, by aid of a wooden tube, a column of coke six inches square reaching above the ground level, the earth being filled in around the tube. Near the upper part of the column, a few inches above the ground, there is placed a large piece of coke which has been immersed in molten lead, and to this there is connected a copper rod to which the conductor is attached. By this arrangement, the gas which forms in the soil can escape between the fragments of the coke and through the coke itself, and thus the earth contact is kept from polarization.

THE Belgian Government has officially invited all foreign governments to take part in the Universal Exhibition, which will be opened in Antwerp the 2d of May, 1885. The works, which have made this port one of the finest in the world, will then be completed and inaugurated.


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## REMOVAL.

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### CONGRESS AND THE PATENT OFFICE.

Congress has made a slight increase in the appropriation for the Patent Office for the year ending June 30, 1885. The Commissioner asked for $650,000 on account of salaries for those employed in the department, but was allowed only $597,170; this, with the various changes made, will give an actual increase of 52 in the number of employes. It is to be regretted that Congress could not have been induced to deal more fairly with the inventors of the country. The Patent Office badly needs more room, and its business should have been confided to a separate and independent department, as was so ably advocated by Senator Platt. But, even if such action was rather crowded over than fairly considered, on account of the nearness of a presidential campaign, there was no good reason for cutting down the appropriation asked for by the Commissioner to increase the force in the office.

The business of the Patent Office has been notoriously in arrears for more than a year past. According to a report made by the Commissioner in April, there were at that time over 5,000 cases pending in the different divisions of the office. A large proportion of these were cases which had not yet received the first inspection of an Examiner, applicants having to "wait their turn" in a manner but little less tedious than if they were litigants before the Supreme Court. In each one of the twenty-five divisions the Examiners also report an urgent need of more room, as well as of additional help, it being impossible to keep the records and the data for reference in proper order for expediting the work. The injustice thus done to inventors is utterly inexcusable, for the receipts of the office above its expenses during 1883 were $471,000, and the surplus on the 1st of January last was $2,676,476. This is money which the Government has taken from inventors for the exclusive purpose of paying for the conduct of the business, and it is neither law nor equity to divert it from that channel. The inventors have paid enough to have their business not only done well but promptly; and for them to be compelled to wait for months to have their claims passed upon, from insufficient departmental facilities, is a great injustice. Some improvement may be possible with the increased appropriation for the ensuing year, although the increase is not what it should be, and it is more than likely that it will be overbalanced by the growth of the business of the Patent Office during the next twelve months.

Of the many bills introduced for the nullification of patents not one of which was passed, it should be particularly remembered that they did *not* die with the session. The snake is not killed, but was only scotched, by the indignant remonstrances which the proposed legislation elicited. These dangerous bills will remain on the calendar, and in the same position before committees, at the opening of the next session in December, as they were left at the adjournment. It behooves all who are interested, therefore, not to cease in their watchfulness, or in their active efforts for the prevention of such reckless legislation, while the present Congress is in existence, or until next March.

### DRIVING BY FRICTION.

For many purposes for which gear wheels were formerly used surface friction wheels are now employed. If the surfaces are properly matched as to material, and are sufficiently large as to area, there appears to be no reason why friction wheels cannot be more extensively employed than they have been heretofore. One of the objections has been that there must be an end thrust, which by its friction absorbs much of the power. It is a baseless objection, as may be seen in the friction clutch of the overhead countershaft of the lathe, and in many other situations where the release of the friction is the easiest and most natural movement. To be sure, in this case the amount of contact is very large—the entire circumference of the pulley—but the principle is the same; for where the pulley friction clutch must be held as a one with the moving pulley, so the friction wheels are one so long as they are in contact, and their contact is a mere point against the circumferential contact of the pulley clutch.

An objectionable method of employing the friction driving is to use a metallic surface against a wooden or a leather surface; two surfaces of wood are better; but if iron and leather or iron and wood are used together, the driver should, in all cases, be made of the softer material. For when the driver is thrown in contact with the driven, it must make a number of revolutions before its contact will be sufficient to start the driven wheel. It is evident, therefore, that if the driver is of iron while the driven is of some softer substance, it (the driver) will wear a crease that will injure the surface of the driven wheel. It is much better, where it is practicable, to make both the driving surfaces of wood.

Excellent wheels are made of maple—hard rock maple—and of lignum vitæ, the lignum vitæ wheel to be the driven and the maple the driver. The wheels should be a cast iron spider made to receive the wood, which should be sawed into wedge-shaped or radial segments, so that the end grain of the wood bears and makes the contact surfaces. Excellent results have been obtained, also, with hard rubber (vulcanized) and wood, where there was no oil to rot the rubber, and for small wheels there is nothing better than raw hide as prepared for pickers for looms and for small gears. This will stand oil and resist its disintegrating influence.

One of the advantages of friction wheels over cogged wheels is that when they are started there is no shock, but only a gradual coming up to speed. Another is their noise-