nine cast iron disks, 6 feet in diameter, which are solid except for four holes in which cast iron adjustment weights can be placed for regulating the load. The counterweights run upon tracks which are built of two 15 inch channel beams spaced 20 inches apart, the tracks being braced to the posts and the bottom member by means of lattice struts and ties as shown in the illustration. The two frames are kept in line by the latticed portal, which is 16 feet deep. The inshore end of each counterweight frame is anchored down to the foundation masonry by two 1¾ inch bolts. The hoist ropes are $\frac{9}{16}$ of an inch and the counterweight ropes 1¾ inches in diameter; the latter consisting of six strands of nineteen wires wound around a hemp center. The total weight of the draw span is 138,120 pounds, and the counterweights can be so nicely adjusted, if it were desired, that one man could open and shut it in three or four minutes. The structure was built by the Union Bridge Company, of New York City, under the direction of C. W. Buchholz, chief engineer of the Erie Railroad, to whom we are indebted for the above particulars.

Transmission of Power from Niagara Falls to Buffalo Completed.

Immediately after midnight, in the early hours of Monday, November 16, the Niagara Falls Power Company made its first transmission of electric power from Niagara to Buffalo, when a current of 1,000 horse power was delivered at the station of the Buffalo Railway Company. The occasion is notable as being the first practical example of the much talked of "harnessing of Niagara" for transmission of its mighty water power to a distance. Upon the commercial success of the Buffalo venture will depend the more extensive transmission of this vast storehouse of natural energy to the various manufacturing centers that lie at a greater distance. It was on March 31, 1886, that the Niagara Falls Power Company was incorporated. The Construction Company was organized in 1889, and work was begun on October 4 of the following year. It took three years to build the tunnel, the surface canal and the first wheel pits. The canal, 250 feet wide, with an average depth of 12 feet, draws off sufficient water from the Niagara River, a mile and a quarter above the falls, to serve for the development of 100,000 horse power. The walls of the canal are pierced at intervals with ten inlets for the delivery of water to the wheel pit in the power house, which stands at the side of the canal. The pit is 178 feet deep and connects by a lateral tunnel with the main back to the river below the falls. The tunnel, which has a maximum height of 21 feet and width of 18 feet 10 inches, was a large undertaking, involving the labor for over three years of 1,000 men, the excavation of over 300,000 tons of rock, and the use of 16,000,000 bricks for lining.

In view of the unprecedented nature of the undertaking, it was decided to throw the matter of designing the electrical plant open to international competition, and two prizes were offered "for the most efficient method of converting falling water into rotary motion and of transmitting the rotary motion or power to a greater or less distance." The turbines were built after the accepted designs of Messrs. Faesch & Piccard, of Geneva, Switzerland. They work under a head of 140 feet and each develops 5,000 horse power. After a careful investigation of the power transmission plants of the world, the International Niagara Commission adopted a two-phase alternating electric generator of 5,000 horse power, developing about 2,000 volts. The first installation consists of three generators, designed by the company's electrical engineer, Prof. George Forbes, of London, and built by the Westinghouse Company. The weight of each generator is 170,000 pounds. A fully illustrated description of this plant appeared in our issue of January 25 of this year.

The first distribution of power was made to the works of the Pittsburg Reduction Company, adjacent to the canal, in August, 1895. Other and later users of the power have been the Carborundum Company, the Calcium Company, the Buffalo & Niagara Railway Company and the Niagara Falls Electric Lighting Company.

In December, 1895, the city of Buffalo granted a franchise to the company to supply power to that city, under the terms of which it must be prepared to furnish 10,000 horse power to consumers by June 1, 1896, and 10,000 additional horse power in each successive year. The first customer under this arrangement was the Buffalo Railway Company, which arranged to take 1,000 horsepower, at a rate of $36 per horse power per year. The current is transmitted by a pole line, consisting of three continuous cables of uninsulated copper, the total length of which is 78 miles.

To meet the future demand, the Niagara Falls Power Company is preparing to install seven more generators of 5,000 horse power each, which will be exactly similar to those already in place. When the necessary extensions have been made, the pit will be 430 feet long and 185 feet deep, and the total capacity of the plant will be 50,000 horse power, or one-half of the capacity of the canal.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.................. $3.00
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(Established 1876)

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NEW YORK, SATURDAY, NOVEMBER 28, 1896.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1091.

For the Week Ending November 28, 1896.

Price 10 cents. For sale by all newsdealers.

THE LOTTERY SYSTEM AS APPLIED TO PATENT PRACTICE.

We publish on another page an abstract of a paper read by Mr. Albert Scheible before the Chicago Electrical Association. In it the subject of patents is considered from the ethical and practical standpoint, and the conclusions reached by the author are at once conservative and just. The article is most timely, for in this country the need of a reform of patent practices in certain directions was never more urgent than now.

Two or three factors underlie the relation of inventor and patent attorney, factors similar to many which are discernible in other relations of life. The inventor requires good service; his work must be executed up to the highest standard, and such work has to be paid for. Any system which purports to give such service for other than adequate compensation, by that fact makes itself an object of suspicion. Impartiality must characterize the solicitor's work. No human being can pronounce upon the merits of an untried device, and the attorney, among the many subjects for patents which are placed in his hands, must have no favorites.

The attorney, therefore, must hold a definite business relation to the inventor and the latter must feel that he is getting in the services of a thoroughly competent solicitor the best value for his expenditure of thought, time and money. His view of the case eliminates side issues. Flattery of the inventor and the skillful raising of his expectations, touching his vanity and his desire of pecuniary returns by specious promises, should not form part of the transactions.

Unfortunately, the hard working necessarily imaginative inventor has long been a subject for attack by a class of patent attorneys who apply all the methods of commercial life to getting money out of him. They will give no honest opinion as to the possible patentability of a device, because their first and only thought concerns their fees. These can only be earned by bringing the case before the Patent Office, and any doubts on the part of the inventor must be overcome by persuasion. He must be made immediate use of, and his invention is mature, from the standpoint of the unprofessional solicitor, as soon as it can be enticed into the office to yield a return in fees.

Every now and then a peculiarly flagrant example of unprofessional practice comes to the surface and seems to cast a shadow on the whole profession.

Thus a firm of patent solicitors may convert their business into a lottery system, and undertake to persuade inventors to submit themselves and their inventions to a chance competition. A system of prize awards for assumed meritorious invention, a system including cash awards and silver medals, incredible as it may seem, has actually been inaugurated by a concern of patent solicitors. Periodically the cash prize is given for the "most meritorious and simplest invention."

Only one inventor gets the prize, and for the consolation of his less fortunate brethren silver medals are issued galore. These medals are cheap affairs, but they are calculated to tickle the vanity of the thoughtless.

Should such an institution as the Franklin Institute, of Philadelphia, the American Institute, of New York, or other association of that character issue medals for real merit, there would be some discernible raison d'être. The impartiality of the judgment and the purity of the motives underlying the establishment of such a competition would be evident, as there would be no oblique motive discernible. But in the case we cite, it is a firm of private patent solicitors who, in order to boom their own business, offer these prizes, which are paid for indirectly by the inventor.

The value and significance of the award, even of the grand prize, may, however, be gaged by the fact that it happens that, in spite of the strenuous efforts of these attorneys to prevent such a result, the invention for which the prize was awarded is rejected at times by the Patent Office, and the patent refused.

The motives of the system are so clear that little sympathy seems due those who suffer by it.

The reduction of the profession of patent attorney to the low grade marked by this lottery system is to be greatly deplored. The cheap medals and insignificant cash prizes, the publishing of portraits of the victims in a cheap journal, under the same control, are simply "chromos," with which to attract customers. They combine patent soliciting with alleged patent selling and promoting, and sugar the whole with foolish awards.

The evils of such practice are great. The inventor has always been at a disadvantage in the business world, as his habits of thought, as set forth in the lecture above referred to, are not always those requisite for pecuniary success. The methods we have described are adapted simply to lead him on by appealing to the gambler's spirit in human nature. What is the cure and how are practices such as those we have described to be prevented?

After an inventor has secured a patent his standing in the federal courts protects him, but his path to the Patent Office needs guarding. The establishment of a patent bar, long since and frequently advocated, would seem the least that should be done for the protection of inventors from men of the class we speak of. At present the patent solicitor is nearly exempt from supervision, the Patent Commissioner having the right to suspend him from practice for only the worst and most obviously dishonorable practices which come under his personal cognizance after the case is filed in the Patent Office. The raising of the standing of the patent solicitor to a high professional level and the maintenance of the character of the profession is a question of the first importance. The establishment of a patent bar, subject to proper extent of jurisdiction by the Commissioner of Patents, would at once do away with the evils described. Meanwhile the inventor can protect himself to some extent by consigning suspicious firms to the oblivion which they richly deserve.

WIRE GUN CONSTRUCTION IN THE UNITED STATES.

In its recent recommendation to the Secretary of War that an allotment be made from the experimental fund for the manufacture of a ten inch experimental wire gun, the Ordnance and Fortification Board has shown a commendable desire to keep abreast of the times in the matter of heavy gun construction. In view of the uniform excellence of the results obtained with the hooped guns which have already been built for the army and navy, it is natural that ordnance officers should have looked rather coldly upon the wire-wound gun, which is built upon a system so radically different from their own. The fact, however, that they are prepared to spend $33,000 in the construction of an experimental weapon of the new type shows that they are fully alive to its great possibilities, and are determined to ascertain by practical proof the limits of its power and endurance.

On another page will be found drawings and a description of this gun, which will be sufficiently detailed to make clear to our readers the theory and method of its construction. While the subject is of great intrinsic interest as embodying one of the most brilliant applications of science to mechanics of the present day, it also has a very serious and practical value to the country at large. Recent developments in gun and armor construction—the high resistance of the one and the enormous pressures and velocities in the other—point to the universal adoption at no distant date of some system of wire-wound gun by the makers of the world.

The introduction of nickel steel and the Harvey system of face hardening has increased the resistance of armor plate so enormously that the foreign gun makers have been obliged to raise the velocity of the projectiles far above the 2,000 feet per second which was standard in foreign countries a few years ago, and is standard in this country to-day. The value of high velocity was clearly shown last September at the Indian Head proving grounds, when two 6 inch Johnson shots were fired at a 10 inch reforged nickel steel plate. The first shot, striking at the standard velocity of about 2,000 feet per second, broke up on the plate with eight inches penetration; whereas the second shot, delivered at 2,500 feet per second, made a clean penetration, and was picked up comparatively uninjured. As an instance of the high velocities which are in use abroad, it may be mentioned that the service guns of the British navy develop 2,400 feet per second; Armstrong's guns, 2,642 feet; Krupp's rapid fire guns, 2,625 feet; and Canet's rapid fire guns as high as 3,281 feet per second, all of which, of course, represents a corresponding increase in energy and penetration.

Now there are two ways in which the velocity may be increased. The gun may be lengthened and the powder gases given a longer time to exert their elastic force upon the projectile, or the length may be left the same and a quick burning powder, exerting very high pressures, may be used. In each case the resulting velocity at the muzzle will be the same; the low pressure throughout the long bore producing the same ultimate acceleration as the high pressure throughout the short bore.

At first sight it would seem advisable, on account of its lighter weight and convenience in handling, to build the shorter type of gun and use the higher powder pressures; but as a matter of fact the makers of built-up guns have not been able to turn out weapons of that type that will safely carry such pressures; and they have been driven to the alternative of lengthening the gun, until in the case of such weapons as the Canet 4·72 inch rapid fire gun it has reached the absurd and unwieldy proportions of 80 calibers. The objections to such guns, especially on shipboard, are many and obvious. They are difficult to balance, require large turret space, and the abnormally long chase is liable to be struck by the rapid fire shells of the enemy. In addition to this, such long guns will be relatively very heavy. From the above considerations it is to be hoped that, when the United States adopts high velocities, as it must shortly do, it will not attempt to secure them by increasing the length of the gun at the expense of its handiness.

On the other hand, the alternative method of employing high powder pressures calls for a gun of great elastic strength. Where it is a comparatively simple matter to construct a weapon capable of resisting the 16 to 18 tons per square inch pressure of the built-up gun burning slow powder, it is another proposition altogether to provide for the 25 to 30 tons pressure set up by the smokeless powders, and it is doubtful if the builders of hooped guns will ever successfully accomplish it. To give the necessary elastic strength to withstand such enormous strains, the metal of the gun must be subjected to an amount of mechanical working which the process of hooped construction will not admit of.

It is just here, in the mechanical manipulation which can be given to the metal of its segmental core and the wire wrapping, that the Brown wire gun is so admirably adapted for high powder pressures. The core has an elastic strength of 126,000 pounds, and the wire an elastic strength of 230,000 pounds to the square inch. The wire winding sets up such a high degree of initial compression in the segments of the bore that even under the highest powder pressure the compression at the surface of the bore will not be reduced to zero; that is to say, the interior lining of the gun will never be thrown into tension, and the pressure will be directly resisted by the wire wrapping.

Of course there are other questions besides that of power and handiness which will have to be considered, chief among which is that of endurance. This can only be determined by a prolonged series of tests such as the Ordnance Board is about to undertake. But if the segmental wire gun should develop no minor defects, it is certain that its enormous power in proportion to its weight will place it far in advance of the present style of gun. This is evident from a comparison of the proposed gun with the standard 13 inch gun of the service.

Style of Gun.	Caliber.	Weight.	Velocity.	Energy.
Hooped.	13 inch	60·5 tons	2,100 foot sec.	33,627 foot tons
Segmental wire....	10 "	30 "	3,000 " "	37,800 " "

Such figures as these speak for themselves, and further comment would seem to be superfluous; but we would point out in closing that by adopting the wire gun the Indiana, without reducing the energy per round of her main battery, would be able to put half of its present weight into larger coal supply or higher speed or better accommodation for her crew, and at the same time greatly increase the number of rounds which she could deliver in a given time. If the system were applied to her 8 inch and 6 inch batteries, there would be a proportionate decrease in weight and increase in efficiency.

DELAY IN FURNISHING COPIES OF PATENTS.

The recent reduction in the price of copies of patents, which went into effect July 1, 1896, has so greatly increased the demand that the Commissioner of Patents has been quite unable to keep the patent attorneys promptly supplied. In many cases these gentlemen have had to wait three or four days for copies which they required in prosecuting preliminary examinations and in other professional work for their clients, and as a consequence they have been blamed for a vexatious delay for which they were in nowise responsible. The commissioner admits the existence of this grievance, but says that he is powerless to remove it, for the reason that he has not the necessary funds to pay the extra force that would be needed to supply the copies as fast as they are required.

We think it is unfortunate that the finances of the Patent Office should be cut down to such a close margin that they cannot deal with a slight emergency such as this. A department whose operations are so far reaching should present some degree of elasticity in the matter of working expenses. The delays and losses which may arise from any kind of a deadlock in the operations of the Patent Office are of a nature that cannot be measured in dollars and cents, and we trust that this very serious exception to the otherwise admirable management of this department will be removed at an early date.

Dispatch and the general economy of time should be —as we believe in general they are—one of the first considerations in the planning and execution of the routine of Patent Office business; and as the present delay has grown out of special conditions, the public have every reason to hope that they will be promptly met and provided for.

Motor Cars on the Brooklyn Bridge.

The new electric motor cars to be operated on the Brooklyn Bridge, and which are to take the place of the old switching engines, are being tested, and so far have proved successful. On November 14 one of the twenty new cars was run over the bridge several times. It was tested by Chief Engineer Martin, who ascertained that from the time the bell sounded to the time the motor switched a train and got back on the siding ready for another train only forty-three seconds had elapsed, a saving over the old method of thirty-seven seconds.

It is Mr. Martin's intention to have the new motors put in operation on the bridge in a few days. The new power house will be ready about the first of the year, and then the motors will be run regularly, and trains will be run on forty-five seconds headway.

Experiments with Melinite at Avignon.

The experiments recently made at Avignon by the seventh regiment of engineers, by order of the Minister of War, are of great importance from a military view point. The object that the authorities had in view in trying them was to obtain an accurate idea of the effects produced by melinite when employed in large quantities, and to compare them with those produced by blasting powder.

It was necessary to proceed with extreme prudence, since it was a question of bringing into play 3,300 pounds of powder on the one hand and 2,750 pounds of melinite on the other. The ravages caused by powder were already known, but the same was not the case with regard to the effects of melinite employed in such a quantity, and the probabilities furnished by approximate calculations needed verification. So it was not till after a detailed study of the ground in different parts of France that the administration of war made its final selection and assigned to the seventh regiment of engineers the task of preparing for the experiments and carrying them out. The Ravine of Combes, situated at about four miles from Avignon, upon the right bank of the Rhone, fulfilled all the conditions required. The preparatory work, which was executed under the direction of Commandant Delort, was long and difficult.

The sinking of the three mine wells was likewise very laborious. Their sites were marked at the summit of the slope of three neighboring hills, with an interval of a hundred yards between the first two wells and a slightly greater distance between the latter and the third. They were square in section and 26 feet in depth. At their lower part there was formed a large chamber capable of holding thirty cases, each containing 110 pounds of explosive.

The first two explosions took place on the same day (Saturday, October 10), between three and four o'clock in the afternoon. It was not till the evening of the preceding day that the 3,300 pounds of powder that were to fill one of the mine chambers and 2,750 pounds of melinite that were to fill the other were brought from the arsenal of Avignon to the ravine. Around each well, within a radius of 500 yards, had been placed a cordon of sentinels to prevent the curious from venturing too near.

At a signal given by a clarion, an electric current sent from the barracks ignited the powder in one of the mines. A strong detonation and a prolonged rumbling due to the fall of the disintegrated rocks was heard, and then a great column of smoke ascended and spread [illegible] above the mine were crushed and thrown down, and the paths that gave access to the mine disappeared under the accumulated debris. A wide opening had been made in the rock, and upon the opposite side and at the bottom of the ravine were piled up masses of blocks that in some cases were 35 cubic feet in bulk. The road was buried under a layer of stones several feet in thickness, every trace of vegetation had disappeared, and the general aspect of the ravine was completely modified. The detonation was not heard at Avignon.

About an hour afterward the second explosion took place, that of the chamber charged with 2,750 pounds of melinite. It was more violent than the preceding the noise of it was distinctly heard at Avignon, and the earth was sensibly shaken at 500 yards from the mine.

The ravages caused by the melinite were appalling; less so, however, by reason of the materials displaced than by the extreme degree of comminution to which they had been reduced. Here there were no more blocks; nothing but a formidable heap of bits of rock, very few pieces reaching the size of the fist. What is a singular and unexplained fact is that upon the side of the ravine opposite that which directly suffered from the explosion the thick stratum of debris was arranged as if it had been formed by three jets directed in a parallel manner. Another point to be noted is that fissures and crevasses were exhibited for quite a wide extent around the mine. The rocks disturbed were in a state of unstable equilibrium, and the least shock sufficed to precipitate them into the ravine, where they broke up into innumerable fragments.

The experiment of October 13, that with the third mine, charged with 2,200 pounds of melinite, was no less interesting.

The consequence of the smaller charge was that the rocks were not so greatly comminuted. Nevertheless, it was easy to be seen that the debris around this mine was much more divided and more regular than that which strewed the ground in the vicinity of the powder mine.

This explosion offered a striking spectacle. At the moment of the detonation a sort of crater opened upon the hill, and, like a volcano, vomited up an enormous mass of debris, which, ascending like a wheat sheaf jet to a great height, amid an immense cloud of smoke fell back in a shower with the noise of thunder. A few seconds afterward the ravine exhibited the aspect of an indescribable chaos. The shrubs had been literally chopped in pieces by the volley of stones.