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No. 786.

For the Week Ending January 24, 1891.

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THE CONSTITUTION OF THE KOCH LYMPH DISCLOSED.

The scientific and medical world has been much interested in the announcement by Dr. Koch of the composition of his famous lymph. Conservative as ever in his estimate of its worth, he claims for it distinct value as a reagent for testing the existence of tubercular disease. As a remedy for disease of this nature he attributes to it a proved efficacy, particularly in earlier stages of the disease. He announces also that he proposes to see if his discovery cannot be followed up, so as to lead to analogous treatment for other diseases.

The discovery was based on observation of the effects of injection of pure cultivation of tubercle bacilli upon animals affected with tubercles as well as upon animals in good health. A healthy guinea pig thus inoculated dies. The wound caused by the inoculation closes with a sticky matter, shows signs of healing, but after ten days or two weeks a hard nodule appears, which develops into an ulcerating sore, and death ensues. But if the animal inoculated already has tuberculosis, no nodule forms in the injection wound. It hardens, turns dark, and eventually a piece falls off, leaving a flat ulceration that soon heals. The same result follows the injection of the bacilli cultivation, whether the bacilli are alive or dead. It is the effect probably of a decomposition product or extract of the dead bacilli, but not the life action of the bacilli themselves. A prolonged application of a low heat, the temperature of boiling water, and certain chemicals are alike fatal to the bacilli in the cultivation.

The next point ascertained referred to the action of the dilute cultivation with killed bacilli. This was found to be practically without action on healthy animals, but of very powerful action on those already affected. The tubercular reaction, which has been observed and described so often, was next discovered. The injected tuberculosed animal was killed by a dose that a healthy animal was indifferent to. By great dilution of the fluid before injection, death was avoided and only extended necrosis of the tissue near the place of inoculation was obtained. By extreme dilution the wound produced at the point of injection after a few days' suppuration became covered, and the lymphatic glands became reduced from their swollen condition, and a generally better condition followed.

Dr. Koch, from his studies, became convinced that the action was due to matter extracted from the dead bacilli. He, therefore, sought for a solvent, and processes for preparing a solution. As solvent he adopted a fifty per cent solution of glycerine. The processes he eventually chose he does not divulge.

The essential constituent he thinks is a derivative of the albuminous bodies. He thinks that it acts by unfitting the bodily tissue from sustaining the life of bacilli. The bacilli are killed in the patient by a product of the dead bodies of their own species, as a man might be killed by a cadaveric alkaloid, and as surgeons are killed by blood poisoning from wounds inflicted while dissecting corpses. The death of a patient is due to necrosis of the tissue. This necrotized tissue soon becomes unfit for propagation of the bacillus. By injection with lymph the same condition of unfitness is imparted to the whole body without accompanying necrosis, unless the dose is too large.

The effective constituent of the lymph can be precipitated by alcohol, and obtained mixed with other matter as a white or colored powder. In the glycerine extract it is estimated to be present in fractions of one per cent. As diluted, the quantity injected is almost inappreciable. Its potency upon affected organisms is far beyond that of the most powerful known drugs, when the infinitesimal amounts added, and the intense reaction produced in the system, is considered. As yet no large doses have been tried. The experiments on guinea pigs have proved them to be fatal.

JARRAH WOOD.

Considerable interest in the utilization of woods grown in the English colonies was awakened by the Colonial and Indian Exhibition of 1886, and this interest seems to have been steadily increasing since that date. The authorities of the Royal Gardens at Kew have recently issued a report on the jarrah timber (*Eucalyptus marginata*), of which the following are the salient features:

Various species of encalyptus have been recommended for use in England for outdoor work where strength and durability are specially desired. The freight charges from Australia, where all the species are native, are heavy, and this is one reason why the wood has not been generally introduced. Another reason is that its intense hardness makes it well nigh impossible to work in with English tools. The species of eucalyptus to which most attention was drawn at the Colonial and Indian Exhibition as structural woods was jarrah, *Eucalyptus marginata*, Smith, and the karri, *Eucalyptus diversicolor*, F. Muell. Much more attention has since been given to the development of the jarrah than the karri. The tree which produces it grows generally to the height of 100 feet, but sometimes to 150 feet. It is found only in Western Australia, extending over the greater portion of the country from the Moore River to King George's Sound, advancing to Cape Leeuwin, forming mainly the forests of these tracts. Baron Mueller, in referring to these woods in his "Report on the Forest Resources of Western Australia," says:

"The wood has attained a world-wide celebrity. When especially selected from hilly localities, cut while the sap is least active, and carefully dried, it proves impervious to the borings of the chelura, teredo, and termites. It is extensively in demand for jetties, piles, railway sleepers, fence posts, and all kind of underground structures, and it is equally important as one of the most durable for the planking and frames of ships. It is also much used locally for flooring, rafters, spars, and furniture. It is one of the least inflammable for building structures, and one of the best in Western Australia for charcoal."

Vessels constructed of jarrah wood have, after 25 years constant service remained perfectly sound, although not coppered. The wood has been tried at three places in the Suez Canal, at Suez, Port Said, and Ismailia, and after having been down seven years the trial samples were taken up in order that a report might be forwarded to Paris, and the certificate of the resident engineer pronounced the timber to be practicably indestructible. Jarrah wood has been used for street pavements in Melbourne, Australia, and in the King's Road and Westminster Road in London.

The eucalyptus is of very rapid growth, and the timber, when green, is very easily felled, split, or sawn up, but when dry it becomes very hard. The bark of many of the species abounds in tannin, and has become to some extent an article of commerce. Some of it is said to be twice as strong as oak bark. The bark of some species is remarkable for its hardness; while some throw off their outer bark in longitudinal strips or ribbons, which, hanging down from their stems or branches, present a very singular appearance.

CELEBRATION OF THE BEGINNING OF THE SECOND CENTURY OF THE AMERICAN PATENT SYSTEM.

The first century of existence of the American patent system has now been completed. In the history of the country there are to be found few more important epochs or more worthy of being adequately signalized. The inauguration of the patent laws marks the beginning of a career of unprecedented prosperity among nations. It indicates the fostering by the federal power of the most distinctive feature of the national character. The many inventions, now nearly half a million in number, set forth in the records of the United States Patent Office are a history of mechanical genius and progress of which our country and the world at large should be proud.

It is hard to believe that those who composed and accepted the constitution of the United States, and those who subsequently amended it, could have foreseen the influence which each paragraph would have on the fortunes of so many millions of people. It is definitely certain that the clauses relating to patents could never have been supposed to embody the foundations of the edifice that has been based upon them. In the first days of the republic there was but little interest in the subject of invention. The people were largely agricultural in their pursuits, and carried on their work with primitive appliances. Gradually a few patents were taken out, but up to the year 1825, including the first thirty-five years of operation, only 4,183 patents had been issued. The annual number of patents granted gradually increased from ten or twenty per annum to 299 in the year 1825. In 1854 the first great increase is observed, when the number rose from 846 for 1853 to 1,759 for 1854. Since that period they have increased until now over 20,000 are issued annually.

It is not in the mere granting of letters patent that the fostering arm of the government appears most prominent. Entitled by statute to federal protection by the judiciary, the rights of patentees have formed one of the great subjects of defense by the highest courts of the land. The district and circuit judges are the first appealed to, but from them case after case is brought before the United States Supreme Court at Washington. No subject of personal or even international right can find a higher tribunal for adjudication of its claims than is afforded to the right of the inventor.

The highest judges in the land, and those who have obtained the highest reputation as expounders of the law and as interpreters of the intentions of the legislative bodies, have pronounced strongly and unhesitatingly in favor of the inventor. No class of citizens has been the subject of higher encomium from the bench. Those judges who have been most outspoken in their appreciation of the poorly rewarded efforts of mechanical genius have been those who have attained the highest reputation. Numerous attacks have been made upon the system in Congress, but all have met with the same fate, and have failed at an early stage. To-day the nation at large may be thankful in seeing the statutes undisturbed and intact. It is a guarantee of the future progress of the country. The maintenance of laws so fruitful in good in the past promises well for the future, and is the best insurance of the continuance of inventors' efforts. The more enlightened of our legislators have uniformly opposed on the floor of the

houses of Congress any impairing of the force and scope of these statutes.

Fortunately we can be said to be entering on this second century under good auspices. The rights of inventors are sustained in the courts and by the houses of Congress. A century of unprecedented work by the inventor now begins. To fittingly celebrate the present epoch, the beginning of the second century of the American patent system, a central executive and advisory committees have been organized at Washington. The *personnel* of the committees includes a long list of names prominent in business and official circles. The Patent Office, United States Senate and House of Representatives, the Smithsonian Institution, the National Museum, United States Geological Survey, the United States Coast and Geodetic Survey, and many other federal bureaus and institutions are represented by their chiefs or other officials.

The centennial of the patent system has passed, because the first patent was granted in 1790. The idea of holding the proposed convention has come a year beyond the proper date for a centennial. It is therefore termed a celebration of the beginning of the second century of the American patent system. The inventor and manufacturer of inventions are appealed to by the committee to hold a fitting celebration in the national capital, to commemorate the entry into the second century of mechanical and scientific progress. They are invited to assist in putting on record the nation's appreciation of the labors of those whose work in the realm of invention has done so much to elevate their country.

It is also suggested that the occasion is a fitting one for organizing a National Association of Inventors, a society for mutual benefit, which it is obvious might accrue in many ways to the members. The committee invite all interested to communicate with their secretary, Mr. J. Elfreth Watkins, U. S. National Museum, Washington, D. C.

THE BOOK PATENT BILL.

The objectionable copyright bill, of which mention was made in our issue of the 10th inst., still lingers in the Senate, and the friends of fair and reasonable legislation hope that it may be either further postponed until next session, or amended so as better to meet the wishes of the public.

A copyright law that shall secure to authors, whether native or foreign, a reasonable reward for their labors, without detriment to the public interests, will be generally welcomed. But a law like that contained in the Senate bill is extremely objectionable, and ought never to be enacted. Among the adverse reasons are the following:

The bill authorizes the assigns of foreign authors to obtain book patents which may be prolonged for the term of 42 years, thus directly encouraging the formation of great book trusts, of the most odious description, whereby the prices of almost any class of books may be greatly advanced, and high prices maintained, without the possibility of competition. This is unfair and disastrous to the public interests.

Bills are now before Congress intended to prevent or discourage the formation of corners and trusts in food products; and similar legislation, with equal reason, should be applied to prevent trusts in intellectual products.

The object of our statesmen should be to encourage and promote the printing of books as much as possible, secure reasonable rewards to authors, and protect them from the grasp of greedy publishers. This might be accomplished by securing the benefits of the copyright to the author and his family. Some such provision as the following might answer this purpose:

"Sec —. No assignment of a copyright by the author shall be valid, but the copyright shall remain vested solely in the author, or in his wife or children if he be dead; and any persons desiring to publish a copyrighted work may do so on payment to the author of a royalty not exceeding ten per cent on the lowest price at which said work is sold by said publisher."

An amendment of this kind would be likely to prove beneficial to the public. It would not seriously interfere with free printing. It would promote rivalry between publishers in their endeavors to supply the people with the best editions at the lowest prices; this everybody wants; it would also secure to authors, native or foreign, a reasonable reward for their labors; and this also would give general satisfaction.

Another objection to the Senate bill is the provision which prolongs the copyright for 42 years—an unreasonable and unnecessary term. It is a relic of the older days when few books were issued, the prices high, and it required years to sell a small edition. In these times of rapid movements in trade and commerce a book term of five years is the equivalent of forty in the old times. Another objection to the Senate bill is the feature which makes it the duty of the Secretary of the Treasury and the Postmaster-General, with their aids and assistants in all parts of the country, to act as the pimps and spies of the assigns of foreign authors. It is made the duty of the above officials to spy out and seize all books going through the mails that infringe the copyrights of foreigners; if an American citizen coming home from abroad brings with him a purchased book on which he has already paid royalty to the author, it is to be seized on landing, unless he can produce the written consent of the man who owns the copyright for this country, signed by two witnesses. Who the said owner may be, in what part of the world he lives, the innocent citizen must find out as best he can, or be despoiled of his property.

Tests for New Repeating Guns.

The government proposes to adopt for army use the best improved magazine guns that can be procured. Inventors will be interested in knowing what are the tests to which they must submit. We give the principal points below. The prize to the successful man will be a great one, being nothing less than the entire supply of the war department with this class of weapons.

The board, of which Col. A. V. Kautz, Eighth Infantry, is president, has drawn up and distributed its programme of tests for the coming competition between the repeating rifles of different makers who may enter the contest.

There are two sets of tests, the first being the preliminary or trial heats, so to say, for the purpose of sifting out those weapons that fail in important particulars, while the finals are for those whose breech action and magazines work effectively in the seven points of excellence required under the initial series of tests.

The first of these seven points is rapidity and accuracy of firing combined. In this there will be three tests in firing from the shoulder at a target six feet by two, placed a hundred yards away. The first has regard to the time of firing and number of hits for twenty shots, the second to the number of shots and hits within the space of two minutes, using the gun as a single loader, the third to the number of shots and hits, using it as a single loader.

The second test is that of rapidity at will, and repeats the conditions of the first test, firing, however, without aim, and from the hip, at short range, and hits or misses do not count, while the two time tests as a single loader and as a magazine gun are only one minute each.

The third is the endurance test, shown by firing 500 continuous rounds with the magazine, examining the breech mechanism at the end of each fifty, and this is to be followed with 100 continuous rounds as a single loader, in both cases, of course, without cleaning.

Then follows the dust test, which is effected in this way:

With the mechanism closed, the piece to be exposed in the box prepared for that purpose to a blast of fine sand dust for two minutes, removed, surplus sand removed by blowing thereon and wiping with the bare hand, and then fired twenty rounds under the following conditions: *a*. Magazine empty when exposed. Before firing load magazine, fire balance of cartridges as a single loader, then those in the magazine. *b*. Magazine loaded when exposed. Remove and wipe cartridges, reload and fire as above.

The fifth test is that of firing with defective cartridges. Three sorts are to be tried. One is to be cross-filed on the head, the second cut at intervals around the rim, and the third cut longitudinally from the rim all the way up. Precautions will be taken to detect any escape of gas in these cases.

Then comes the excessive charge test, in which the gun is fired five times as a single loader with a powder charge producing one-third more chamber pressure than that of the Frankfort cartridge. Finally comes the test of ease of manipulation.

The rifles that pass these tests will then be subject to four others. The first of these is with defective cartridges and dust combined, "the piece to be dusted five minutes, the mechanism being in the mouth of the blowpipe, and closed, but at full cock, then to be fired five shots, the last two defective, then without cleaning to be dusted with the breech open and fired five shots. The piece to be freed from dust only by pounding or wiping with the bare hand." Then the rifle is ready to show what it can do under the exposures of campaign, and for this purpose the rust test is devised. The breech mechanism, receiver, and magazine are cleansed of grease, and the chamber of the barrel greased and plugged, and the breech action closed. Then the butt is inserted to the height of the chamber for ten minutes in a solution of sal ammoniac exposed for two days to the air, and then fired twenty rounds.

But there is still another cause of accidents which must be considered, that of explosions in tubular magazines by jarring. This is to be investigated by giving the rifle a perpendicular jolting for two minutes, first with the magazine charged and then with it half loaded. Finally comes the test of ease and time of taking apart and putting together the breech and magazine systems.

When all this is done, regular firing tests by three men, at 100 yards, will be made; and by that time it surely ought to be possible to tell whether a rifle which has passed through this series of performances is good for anything.

The tests will be made at the Springfield armory, with Frankfort arsenal experimental cartridges of Wetteren smokeless powder imported from Europe. The rifles competing must all be of 0·30 caliber, which is about the minimum of the most successful European magazine arms, that of the new model Lee being 0·303. The board includes three infantry officers, Col. A. V. Kautz, Lieut. Col. R. H. Hall, and Capt. H. B. Freeman; a cavalry officer, Capt. G. S. Anderson; and two ordnance officers, Maj. G. W. McKee and Capt. S. E. Blunt.

Inspector-General Breckenridge in his annual report says that "it is so injurious to an army to know that its arms are obsolete and inferior that the demand for something better than we have now is very earnest. Our citizens, especially the militia, are not satisfied, knowing they must pay with their lives for any lack of preparation when the next war comes." The British have their Lee repeating rifles, the French their Lebel, the Austrians their Mannlicher, in short nearly all the European nations, great and small, have adopted magazine guns, and many of them have smokeless powders giving a high initial velocity and a very long range. Probably no harm has thus far resulted from the failure to supply our army with a weapon of this character, but this is due to the fortunate continuation of peace. No one can question that it is now high time to furnish at least the regular army and portions of the militia with these modern weapons. Probably practical trials by the present board will substantially show what sort of rifle is to be issued to our troops.

Tunnels and Rapid Transit for New York.

The Hudson River tunnel, to January 1, shows a total progress of 2,720 lineal feet out of 5,500 feet under the Hudson River. The progress for some months past has been about 7 feet per day of 24 hours. The shield is reported as working well, and the engineers expect an advance of 10 feet per day under a new system of car loading now being put into operation. By removing the intermediate accumulating pump, and bringing the power of the pump direct to the hydraulic jacks, the pneumatic shield is advanced the width of one of the rings in a few minutes, which before required from two to four hours. A system of chutes is soon to be tried, one under each opening in the shield front, down which the silt will slide direct into the waiting cars, instead of shoveling it by hand as heretofore.

The rapid transit tunnel proposed by Mr. Greathead, the English engineer, for New York, Mr. Simon Sterne tells the *Engineering News*, would cost $1,000,000 per mile for two tunnels with a track in each, or $2,000,000 per mile for four tracks in four parallel tunnels. The first estimate covers stations, rolling stock and a general equipment ready for service. An estimate for a four-track road, 10 miles long, would be $20,000.000 as a maximum; $40,000,000 would build two four-track roads, says Mr. Sterne, which would do infinitely more business than the present elevated roads, which are capitalized at $60,000,000. The time for construction estimated is 2½ years from the Battery to the upper end of Central Park.

A rapid transit scheme for New York, suggested by Mr. David H. King, has colossal proportions, as far as the money required is concerned. Mr. King, however, thinks nothing is expensive that will pay 5 per cent on its bonded indebtedness. He proposes an arched masonry viaduct, 50 feet or more high and 100 feet wide, inside the house line of streets bounding the entire water front of Manhattan Island. For the central line he would acquire a strip 75 feet wide through blocks, and on this build a depressed four or six track road. He would expect to rent the arches for warehouses, and line the depressed road with shops and arcades.

BRONZE CASTING.—According to R. H. Park, of Florence, a sculptor, the art of casting large statues in one piece, as practiced by Benvenuto Cellini in casting the Perseus, which has been a lost art, has been rediscovered. The process is called *cerra perdue;* it is a wax process. The clay model is made, and the plaster reproduction is taken from it. From this the matrix is made, and the matrix is furnished with a core. The matrix is coated with wax the thickness of the bronze. The mould is then heated, and the wax runs out of a hole in the bottom, then the bronze is poured in. The results are superior, but the cost is increased by about $1,000 per statue.

Necktie Camera.

In the first number of the present volume of this paper we described a photographic necktie, by means of which photographs can be taken without the knowledge of the subject. Since the publication of the article we have learned that Mr. L. Manasse, of 88 Madison Street, Chicago, Ill., has obtained the agency of the invention and is prepared to receive orders for the instrument.