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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 812.

For the Week Ending July 25, 1891.

Price 10 cents. For sale by all newsdealers

SALT PACKING—A $4,000 PRIZE CONTEST.

The government of Netherlands-India has offered the above prize to be awarded in competition as to the best method of packing salt. The salt works, which are run by the government, produce solar salt. This is stored away for a year or more, during which period it dries out and loses its hygroscopic elements in great part. It is, however, still inclined to absorb water, to become moist, and to liquefy. The conditions to be filled in packing are: 1st. The package must be proof against the action of the salt, and must not soil it or impart taste or odor. 2d. The package must preserve the salt at least two years. 3d. The package or box must close in a practical and effective manner, and be impossible of opening without certain detection. The salt once packed must be free from danger of melting. Each box must hold one kilogramme, and it must be possible to fill them accurately with this weight without weighing. The small boxes are to be packed in larger cases. The packing in 5, 10 and 25 kilogramme lots may be also provided for.

For full particulars of this competition, which is open to all the world, the Consul General of the Netherlands, New York, N. Y., should be addressed. The competition closes at the Hague, September 1, 1891.

THE EDISON ELECTRIC LAMP PATENT SUSTAINED.

On July 14, 1881. Judge Wallace, of the United States Circuit Court, handed down his decision and opinion in the celebrated suit brought by the Edison Electric Light Company against the United States Electric Light Company. The suit was brought to establish the scope of true claims of the Edison patent, No. 223,898, of January 27, 1880. Without going into details, it is enough to say that the object was to establish the validity of a basic patent in electric lighting, and one which would include as tributary to its claims all the practical incandescent lamps now in use.

The contention of the plaintiff was that every incandescent lamp for electric lighting consisting essentially of a filamentary carbon burner hermetically sealed in a glass vacuum chamber is within the terms of the patent. The first and second claims are the only ones involved In his opinion Judge Wallace rose very extensively into the merits of the case, reviewing the prior state of the art and endeavoring specifically to state what problem the inventor had addressed himself to solve, and the sufficiency of his description of his invention for the capacity of those to whom it was addressed. At that time the Judge states that Mr. Lane-Fox, in England, and Mr. Edison, of this country, were almost the only ones who believed that the subdivision of electric light might be effected by incandescent lamps of high resistance and small radiating surface, arranged in multiple arc. In those days electricians knew how to make high resistance conductors and how to vary their resistance, but what was wanting was the knowledge of how to construct a lamp with adequate mechanical strength and durability, possessing a small radiating surface and high resistance. The Judge cites the Sawyer-Mann lamp and the other old-time burners, but finds that prior to Mr. Edison's French and English patent, in 1879, no attempt had been made to form the vacuum chamber wholly of glass, with all parts sealed together by fusing. The description of novelty as set forth in the specification is accepted by the Judge. It includes a carbon filament or wire of high resistance connected to platinum wires and sealed in an exhausted glass bulb. The first claim is for a filamentary carbon of high resistance secured to metallic wires, as set forth. This the Judge concludes to be restricted to a connection between platinum and carbon filament by a specific method described in the patent, and hence not to be infringed by the defendant's structure.

But the second claim was awarded the fullest possible scope. It is for the combination of a carbon filament with a receiver made entirely of glass, and conductors passing through the glass, and from which receiver the air is exhausted. It will be readily seen that this covers the typical incandescent lamp of the present day. The specification, the Judge holds, discloses what was a radically new discovery: that it is possible to make a stable, extremely high resistance wire adapted for use in giving light when sealed up in an exhausted glass globe. In the Judge's words:

"He (Edison) was the first to make a carbon of materials and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the special form for the special purpose of imparting to it high total resistance; and the first to combine such a burner with the necessary adjuncts of lamp construction to prevent its disintegration and give it sufficiently long life. By doing those things he made a lamp which was practically operative and successful, the embryo of the best lamps now in commercial use, and but for which the subdivision of the electric light by incandescence would still be nothing but the ignis fatuus which it was proclaimed to be in 1879 by some of the learned experts who are now witnesses to belittle his achievement and show that it did not rise to the dignity of an invention."

The Judge's reference to those whom he terms "the learned experts" will be appreciated by the reader.

One good point brought out in the subsequent part of the opinion is that an inventor is entitled to all that his claim covers, independent of what he or his solicitor may have thought about the meaning of the claim. The Judge says:

"There are many adjudicated cases in which it appears that the inventor builded better than he knew; where a patent has been sustained for an invention the full significance of which was not appreciated by the inventor when it was made. In the case of the Bell telephone patent there was great room for doubt whether the speaking telephone had been thought of by Mr. Bell when he filed his application for a patent, but the Court said: 'It describes apparatus which was an articulating telephone, whether Bell knew it or not.' 88 Blatch., 532."

The nearest approximations to the invention, according to the opinion, were the ribbon-shaped carbon burner of low resistance of Mr. Farmer, never sufficiently used to constitute public use, and the low resistance carbon rod burners of Sawyer and Mann. The Judge states that it is impossible to resist the conclusion that the invention of the slender thread or carbon as a substitute for the burners previously known opened the path to the practical subdivision of the electric light. This conclusion, coming near the end of the opinion, emphasizes the Judge's opinion as to the invention involved in the carbon filament as contrasted with a rod or large conductor of carbon.

The amount of money involved in the suit is very large upon its face. The accounting alone, independent of the future six years' income, would be very large. In one sense the decision and accompanying opinion will be welcome as indicating a liberal and not too technical construction of the claim of a patent.

An Artificial Railway Valley.

The tracks of the Harlem Railway, where they pass through the city of New York, traverse a dense population. The distance from the northerly boundary of the city to the Grand Central Depot, at Forty-second Street, is something over twelve miles. There are four tracks. These carry the traffic of the Harlem, the New York Central, and the New York, New Haven, and Hartford lines. The increase of population has rendered it necessary, as a measure of safety at street crossings, to lower the grade of the tracks and raise the grade of the streets at the crossings. This work, which has been in progress for several years past, has lately been completed. The masonry is very massive and substantial. The cost has been very great—some six millions of dollars in all. Going north from Forty-second Street, there are tunnels for nearly two miles. Beyond these a one mile viaduct and then an open cut, or as it might be termed a deep groove, the sides of which are lined with granite walls. Bridges are provided at all the street crossings. The approach to New York is not very attractive to the traveler. Looking upward from the narrow valley in which he is inclosed, he sees the windows in the upper stories of the high buildings that line the railway avenue. The lateral view from the car is simply a solid rampart of stone. Ten miles of this sort of sight seeing is rather monotonous, although the distance is run in from fifteen to twenty minutes.

Test for Olive Oils and Seed Oils.

For the discrimination of olive oils and other oils liable to be used for adulteration, R. Brulle applies nitrate of silver in the following manner: 25 parts of silver nitrate are dissolved in 1,000 parts of 95 per cent alcohol, and 5 c. c. of this solution are added to about 12 c. c. of the oil under examination, which should be filtered if not quite clear, then the test tube is heated in boiling water, and the effect observed.

Kind of oil.	Color after heating in boiling water.
Virgin olive oil..........	Bright green.
Olive oil of second and third pressures, containing some olive kernel oil..........	Darkens slightly, quickly changing to intense green.
Olive oil of inferior quality, strongly colored..........	Same as previous oil, but takes longer (15-20 minutes).
Cotton seed oil, pure..........	Black.
Earth nut oil..........	Brownish red, greenish as it loses in transparency.
Sesame oil..........	Dark reddish brown, not changing to green.
Rape seed oil..........	Greenish yellow, then opaque.
Poppy seed oil..........	Same as preceding.

R. Brulle states that with practice it is possible to determine in many cases thus colorimetrically 5 to 10 per cent of one of these oils in a mixture.

In the same way natural butter, which gives no change, may be distinguished from artificial butter, the latter, owing to the presence of margarine, acquiring a brick red color, and the proportions in a mixture may be approximately determined.—*Compt. Rend.*

N. W. AYER & SON, the Philadelphia advertising agents, use the following appropriate line for their motto: "Keeping everlastingly at it brings success."

Irrigating Arid Lands in the West.

The many thousands of square miles of land in the western half of the United States which can be profitably cultivated only with the aid of some system of irrigation are now becoming more and more each year the subject of careful investigation, both by the government and by private parties. So much of the readily available and ordinarily good farm lands of the public domain has already been taken up that prospectors in almost every section are finding their choice limited to making a selection in some place where more or less irrigation will be a necessity, with the promise of a good reward therefor, or the acceptance of a location where the disadvantages more than outweigh the want of a sufficient amount of water. The wonderfully productive lands of Southern California, where the rich soil is of such depth as to be deemed practically inexhaustible, and the climate is such that two and even three crops can be raised in a year, have been made available almost exclusively by irrigation, and there is no doubt that, over a large portion of the lands now arid, it needs but the efficient conservation and distribution of water flowing from adjacent mountain ranges to create areas of the highest productiveness.

With the view of promoting intelligent work on a general system, this matter has formed the subject of extended investigations by the United States Geological Survey, although it is not proposed that the government shall undertake to carry out irrigation projects at the public expense, further than by the allotment of lands which may be benefited thereby to the State governments making such improvements. A recent bulletin of the census office also gives details of what has been effected in the way of irrigation in Utah, where the system was first generally applied and has been longest in operation. In that Territory there was last year in crop an irrigated acreage of 263,-473, about nine-tenths of the farms in the Territory depending upon irrigation in the cultivation of at least a portion of their land, the remaining tenth being either stock ranches or farms where the climate is less arid.

The average first cost of bringing the water to land in Utah is placed at $10.55 per acre, considerably greater than has been the case in most other localities, as the canals and ditches were generally laid out and made by farmers, without the use of surveying instruments, necessitating many subsequent changes. In some cases, however, the cost was below fifty cents an acre. In addition, a certain amount must be expended each year in maintaining the main ditches, cleaning out sediment, and often in renewing the dams and head works, this cost ranging from twenty-five cents up to three dollars an acre, the average being ninety-one cents. The average value of the products on small irrigated farms in 1889 was $19 per acre. It is estimated that the cost of preparing wild land for cultivation, including plowing, grubbing, cutting brush, fencing and leveling, averages $14.85 per acre; adding to this the Government rate of $1.25 per acre, and the first cost of $10.55 per acre for the water right, the entire cost to the farmer averages $26.65 per acre. In comparison with this, the estimated present value of the farms of the Territory, including buildings, fences and other improvements, is placed at an average of $84.25 per acre, showing an apparent profit, less cost of buildings, of $57.60 per acre.

From the main canals or large ditches the water is conducted to the farms by small laterals, and is commonly distributed in three ways—by flooding, by furrows, and by markings. Hay and other forage crops are flooded, the water being allowed to enter the field at its highest point, and find its way if possible in a thin sheet over the whole field. This method requires the greatest amount of water, and cannot always be used on account of the tendency of some soils to bake and form a hard crust. Potatoes, corn, vegetables, and all plants growing in hills or rows are irrigated by furrows, the water flowing therein gradually moistening the ground on either side. Grain is sometimes watered by flooding, but generally by marking off the ground, after the grain is planted the fields being sometimes rolled with a roller having annular projections, which make small grooves in the surface of the ground in such direction that there is a constant and gradual flow from one end to the other.

The use of flowing wells for the irrigation of gardens, orchards, and vineyards, and for domestic supply and watering stock, is also a feature of some importance in Utah. There are 2,524 of these wells, of which the census enumerators obtained particulars concerning 897, showing their average depth to be 145½ feet, and their cost $77.60 each, or 53 cents per foot. Their average diameter was about 2 inches, the flow of water averaging 26·37 gallons per minute.

The carrying out of any general scheme of irrigation necessarily involves considerations which have had but little influence thus far in Utah, where there is already more land under cultivation than there is water available to mature the crops in all years. Some large reservoir sites have been examined and segregated by the Government Geological Survey, with the view to most efficiently and at a moderate expense impounding the flow from elevated areas, the water thus collected to be supplied to large sections by a series of canals on different levels. Considerable work of this kind has already been carried out in California, where the returns generally show ample profit on the outlay, but the large areas of the country which invite this method of cultivation, with abundant promise of yielding large results, have hardly as yet been touched. For this task, simple farmers' ditches are totally inadequate, but competent engineering skill must be called upon to collect and distribute a material proportion of the immense supplies of hitherto unused water often coursing in destructive floods from our great Western mountain system.

The Belgian Firearms Industry.

In the course of a report on the trade of Belgium in 1890, Consul-General De Courcy-Perry remarks that the most important industry of Liege is the manufacture of firearms. There are over 180 gunmakers in the town alone, and in the district the industry gives employment to more than 40,000 workmen. The peculiarity of the Liege gun making is that there are hardly any manufactories, as we understand the term, the various component parts of the firearms being made by the workmen at their own homes and brought in ready-made to the gunmaker, who thus merely requires premises for finishing and storing the arms. It will be at once seen how the economy realized by no extensive plant nor costly workshops being required enables the Liege maker to compete favorably with the manufacturers in, in this respect, less favored countries.

The Liege proofhouse, which is a government institution, is the oldest and by far the largest in Europe, and probably in the world, and has lately been greatly enlarged and improved. Every firearm manufactured in Belgium has to be proved at the Liege proof-house before it is allowed to be sold (with the exception of certain arms that are allowed to be sent to a recognized proof-house, to Birmingham, for instance, to be proved), and the proofmaster, in addition to his ordinary duties, is specially delegated by the government to inspect and control all firearms made in the kingdom, with the exception of the military rifles made at the government factories, which do not pass the Liege proof-house. Every double-barreled rifle and shotgun has to be proved three times. First, each barrel separately; secondly, the two barrels when soldered together; and, finally, after the breech-action has been attached; and the charge of powder employed is considerably more powerful than that used at other proof-houses.

One of the great advantages arising from this triple proof is that each class of workmen has a direct incentive to only turn out, or accept, really reliable material, for no one who has worked upon the gun is paid for his labor unless the arm passes the three proofs satisfactorily. Thus, if the barrels burst at the first proof (viz., that of each barrel separately), the barrel maker loses the cost of his labor and material, for he is obliged to replace the burst barrels without any indemnity. Should the barrels burst at the second proof, it is not the barrel maker alone who suffers, but the solderer as well, who also loses the price of his labor, because he had not examined the pair of barrels carefully enough before working on them. If the gun bursts at the third proof, all those who have worked upon the gun, from the barrel maker upward, lose the benefit of their labor; and thus, as I have said, each class of workmen has a direct personal incentive to turn out a really reliable gun. Revolvers are only proved once, but each portion of the pistol is subjected to a rigorous examination, and any defective arm is at once rejected.

There are in Europe five proof-houses, viz., Birmingham, London; St. Etienne, in France; Fellah, in Austria; and Liege; but none of the others can at all compare in importance with the last, which consumes annually from 3,000,000 to 4,000,000 cartridges and over 40 tons of gunpowder.

Liege exported in 1889 firearms to the value of 724,440*l.*, being 233,944*l.* in excess of the amount of those exported the previous year; and the importance of the Liege gun trade, as compared with that of England and France, will be apparent from the following table of comparison of the arms proved at Liege, Birmingham, and St. Etienne respectively:

FIREARMS PROVED IN 1889.

Firearms.	Liege.	Birmingham.	St. Etienne.
Single barrel	338,024	28,146	4,352
Double barrel.......	233,526	284,247	32,204
Cheap single barrel for exportation	34,557	155,079	—
Horse pistols (per pair)........	20,070	3,481	1,033
Pocket pistols.............	13,907	—	—
Revolvers	452,098	29,850	3,152
Military rifles and barrels....	32,249	28,245	—
Totals	1,124,431	529,048	40,741

It will thus be seen that the firearms proved at Liege amount to more than double those proved at Birmingham, and to nearly double those of Birmingham and St. Etienne together; and I anticipate, so great has been the increase during the past year, that when the figures are published, the firearms proved at Liege during 1890 will be found to amount to over 2,000,000.

PHOTOGRAPHIC NOTES.

Improvements in the Soda Developer.—A number of experiments conducted by the editor of the *British Journal of Photography* show that the addition of chloride of ammonia to the ordinary carbonate of soda and pyro developer will prevent the yellow staining of the negative, in fact acts as a substitute for sodium sulphite. The strength of the carbonate of soda solution is 15 grains to each ounce of water, even 12 grains to the ounce will do, to which is added 4 grains of chloride of ammonia. In mixing the developer a few minims of this solution, say 20 minims to 2 ounces of a pyro or eikonogen solution, will be sufficient, or more may be added to hasten development if needed. In some cases, it is advisable to add a half grain to the ounce of bromide of ammonium.

It is said to work well in connection with hydroquinone, but sulphite of soda should be present to prevent a slight yellow stain that is liable to occur.

Another modification is the use of caustic soda or potash.

The developer as applied to the plate is prepared as follows:

Pyro................................ 6 grains.
Sulphite of soda.....................20 "
Caustic soda......................... 6 "

or

Caustic potash....................... 8 "
Chloride of ammonia.................. 8 "
Water................................ 2 oz.

To each ounce of solution one grain of bromide of ammonium should be added.

A Few Improved Developers.—From the *British Journal of Photography* we take the following formulas:

The Paramidophenol Developer, recommended as being energetic, keeps well and does not stain the film, introduced by A. & L. Lumiere.

Water ....1000 parts.
Sodium sulphite...................... 200 "
Sodium carbonate..................... 100 "
Paramidophenol....................... 12 "

Another combination is—

Water................................1000 parts.
Sodium sulphite...................... 200 "
Carbonate of litmus.................. 12 "
Paramidophenol....................... 12 "

The latter form is preferred. The developer is on the eikonogen order.

Mixed Eikonogen and Hydroquinone Developer.—M. Angerer, after numerous experiments, suggests the following proportions as giving excellent results:

Solution A.

Water................................1250 parts.
Sodium sulphite...................... 150 "
Eikonogen............................ 22½ "
Hydroquinone......................... 7½ "

Solution B.

Water .... 250 parts.
Carbonate of potash.................. 75 "

For use mix one part of solution B with five parts of solution A. If over-exposure is suspected, use less of B. Negatives of any desired density can be had with this developer, made on fast plates.

Direct Platinotype Printing Process.—Invented by Herr Wischeropp. The main point is to use a chemically pure solution of an iron salt, and to dry it on the paper so quickly that it cannot penetrate to any appreciable depth. To effect this, the paper is hung up to dry in a box at a temperature of 56° C. for two minutes. The solutions employed are:

A.

Sodium ferrous oxalate............... 40 parts.
Sodium oxalate three per cent........100 "
Chlorate of potassium................ 0·1 "

B.

Distilled water...................... 60 parts.
Potassium platino-chloride........... 10 "

In A, the solutions which Pizzighelli keeps separate are combined and the useless glycerine omitted.

Solution A requires to be renewed frequently, but B will keep for any length of time. To produce a good effect, the paper, after having been dried, should be kept in the dark room for some time. The more quickly the printing is done, the better the tones obtained.

Danger of Poisoned Fish.

The *Lancet* contains a warning against the use of iced fish. Ice spoils the freshness, firmness, and flavor of fish by rendering it, prior to putrefaction, insipid, soft, and flabby. Where fish is preserved on ice, it appears that the ice only favors putrefaction by furnishing a constant supply of moisture, carrying with it the putrefactive bacteria derived from its unclean surroundings, so that this iced fish remains covered with fresh solutions of filth pregnant with putrefactive bacteria. On the other hand, keeping fish dry and cold can in no way favor putrefaction.