

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

I now recur to the first and most important question, whether the patent policy has actually increased the industrial resources of nations.

It is grateful to refer to the testimony upon this point, given before the committee before referred to, by intelligent practical men, thoroughly familiar with the operation of the patent laws and the condition of the arts in Great Britain. Mr. Carpmael, a patent agent of great experience, in reply to the question, "Are you of opinion that the present patent law might be safely repealed altogether, and inventions deprived of all privileges of protection?" replies, "I can only say that I can see no inducement to an inventor to come forward to benefit the manufactures of the country, unless you give him some reward. Looking through the history of the whole of the manufactures of this country, you will find that all the steps have been founded upon patents, from the earliest date up to the present time. Take any branch, whether it be the cotton manufacture, the steam engine, the manufacture of flax or wool—in the case of every one, if we trace the history of it through, which I should be happy to do if it were necessary, it will be seen that the whole system is based upon patents. Paper-making is the same, and so in every branch that I remember."

Being asked, "Can you, without difficulty, point out a certain number of very important inventions, which were preceded by such costly experiments that they could not have been carried out without the patent law?" Mr. Carpmael says:—"Watt, in the case of the steam engine, was seven years before he got the first engine to work efficiently. In the case of Arkwright's machine for spinning cotton, he was several years before he got efficiently to work. In the case of Crompton, the same; in the case of Hargraves, the same. Then, in regard to combing wool by machinery, and the first power-loom by Cartwright, he did not succeed in getting practically to work for many years, and he was rewarded by Parliament for what he had done, because he had not been remunerated in the working of his patent. The paper machine was worked out by a series of costly experiments, which never would have been entered upon but for the patent laws of the country. In this manner might I go through all our manufactures; indeed, in no instance has any manufacture grown into importance in this country except by a series of costly experiments and costly machinery, carried on for many years, in the hope of deriving benefit through grant of letters patent."

Mr. Webster, the well-known writer on patent laws, stated before the committee:—"I am quite sure of this, that if any person who may be disposed to think that patents should be done away with, comes to examine the way in which particular manufactures have been built up by reason of the large amount of capital which has been thrown into them, in reliance upon the action to be obtained by means of the protection given for a short time, he will be very much surprised. In some of the most successful inventions of the present time, it will be found that the first patent effected little; but, in attempting to work this out, further improvements were made, and fresh patents obtained, so that by the protection which has been given to different stages of the invention, and the quantity of capital which has been laid out upon it, the invention has been perfected and introduced, and made useful to the public in a time within which it never could have been done but for the money which has been employed upon it, in reliance upon the protection of the patent. The whole of our experience of cases before the privy council is proof of that, and leads to the conclusion that many inventions would never have been introduced at all without such protection; and no man, so far as my knowledge of manufactures goes, would have ventured upon those experiments had it not been from some such inducement as the reward offered by the patent law."

Mr. Bennett Woodcroft, the accomplished Superintendent of the Great Seal Patent Office in England, under the Commissioners of Patents, to whom more than any other person is due the publication of the specifications and drawings illustrative of all the patents granted in England since 1617—a work which

may be justly regarded as one of the proudest monuments of British genius—has added to the many obligations conferred upon this office by presenting to it, within the last year, a series of engravings executed in the highest style of art. Their subjects can be best described in his own words:—"Actuated by a sincere respect for mechanical genius, and a warm admiration of its productions, I have collected all the known portraits, eight in number, of the *ten mechanicians* whose inventions laid the foundation, raised the superstructure, and now secure the continuance of the cotton manufacture, the most marvellous for its extent and effects that ever employed the ingenuity of man."

Mr. Woodcroft, in a memoir which he has published containing brief biographies of inventors of machines for the manufacture of textile fabrics, observes that in looking at the progress and magnitude of the cotton manufacture, surprise is excited at the simple construction of the few machines which have produced such wonderful results, "at the lateness of their revelation and their tardy adoption." And he appositely applies to those works the words of Milton:—

Th' invention all admired, and each how he
To be th' inventor missed; so easy it seemed,
Once found, which, yet unfound, most would have
thought impossible.

The ten mechanicians to whose inventions the results produced in the cotton manufacture are by Mr. Woodcroft mainly attributed, are—Kay, who was inspired to run the shuttle on pulleys, and impel it by a short lever attached to a string, by which one weaver was enabled to do the work of two or three; Paul, who taught a method of spinning a hundred or more threads at once; Arkwright, who reinvented and revived roller spinning; Hargraves, who invented the jenny, which drew sixty or seventy threads at once; Crompton, who invented the *mule* (so called because it combined Paul's and Hargraves's inventions); Radcliffe, the author of the improvement in sizing or dressing the whole of the warp before it was wound upon the beam, thus removing the grand difficulty then existing in the art of weaving; Cartwright, who brought forth a loom which would weave cloth by a mechanical, instead of a manual, motor, and thus quadruple the power of the weaver; Jacquard, who invented the apparatus to which his name is given for selecting the warp threads, which superseded the service of the draw-boy at the loom; Roberts, who made the mule of Crompton automatic, or self-acting; and Heilmann, who, from observing his daughters comb their hair, conceived the machine for combing cotton and wool, ever since in universal adoption.

Mr. Woodcroft thus states the result in Great Britain alone, produced mainly, as he considers, by these ten inventions. In 1760, at the accession of George III., the entire value of cotton goods manufactured in England was about £200,000 a-year. In 1772 British calicoes were made to the number of 50,000 pieces. In 1816 upwards of 1,000,000 pieces were manufactured. In 1750 the population engaged in the cotton manufacture was about 20,000. In 1801 the persons engaged were about 80,000. In 1823 there were 10,000 steam-looms in Great Britain. In 1862 their number was 399,992, driven with a power of 294,000 horses, and employing 451,000 work-people in 2,887 factories, containing 30,387,457 spindles. Every one of the ten inventions which have produced these marvellous results was protected by patents; each inventor was stimulated by the reward which this protection opened to his hope, if not his fruition, and, without the prospect of appropriating to himself wealth and honor, would have shrunk from the labors of creating and introducing his invention. Granting, as is quite probable, that the individual importance of these men, in relation to the cotton manufacture, is somewhat exaggerated, and that the credit given to them should be shared with the eight hundred men who have taken out patents for improvements in this manufacture, it is no less true that the whole system of the manufacture of cotton in Great Britain is founded upon patents.

Illustrations, less striking, it may be, but not less convincing, of the beneficial influences of the protection afforded by patents, can be found in the history of the industrial arts in this country. I will point to a totally different branch of manufacture which had its undoubted origin, and has attained its perfection, in the United States—the manufacture of

india-rubber goods. The facts are obtained from records in this office and reports of committees in Congress. India-rubber was introduced into France in 1776. Dr. Priestley says that, in 1791, he saw a specimen of the gum at a stationer's, where it was used to erase pencil-marks—hence its name. In 1823 five hundred pairs of shoes, made by the natives in South America directly from the exudations of the gum-bearing tree, were imported into this country, and sold at Boston. In the years 1832, 1833, 1835, and 1836, several manufactories were established in New England for making india-rubber goods.

Upon their introduction into market it was found that the goods became clammy and sticky when exposed to heat, and were stiffened by the cold. They were therefore useless. In consequence of these defects, in 1839 all the companies and individuals engaged in the manufacture were ruined. The manufacture was utterly prostrated. At this time a simple workman in Connecticut, named Hayward, who had undertaken to carry on this manufacture by himself, who, to use his own words, hired the shop he worked in, and whose only income from the uncertain profits of his business was about five hundred dollars a-year, sought day and night to discover some substance which might be combined with the india-rubber and cure its defects. Absorbed in the search of what to him was the philosopher's stone, "he dreamed at night," as he asserts, that the desired solvent was sulphur. He combined the rubber with sulphur, and, to his delight, discovered that the defects in the goods were almost wholly overcome. He had miraculously, as it were, discovered a substance which combined chemically with the rubber, making, in fact, a sulphuret of rubber—indeed, a new substance, whose structure is fibrous like horn, whereas the structure of rubber alone is granular, or molecular. He obtained a patent for his discovery; but being heavily in debt, and perhaps unable to conceive of the vast consequences which would result from his invention, he sold the right to his invention for a mere pittance to Mr. Goodyear. The latter experimented upon the new compound discovered by Hayward, and discovered the art of vulcanizing it. This invention is thus described by Mr. Webster, in his great speech at Trenton:—"The great peculiarity of this vulcanizing process is this: If you take a compound of sulphur and rubber in a dry state and grind and mix them together, and apply heat, the consequence is, that the substance softens and softens as the degree of heat increases, until it reaches a certain height in the thermometer, say 212° Fahrenheit and along there, a little more or less. Well, anybody," says Mr. Webster, "who ever tried the effect, to see what would be the operation upon this compound, and finding that it ran up to a great degree of heat, softening and rendering it more and more plastic as the degree of heat was augmented, would naturally be of the opinion that if the heat was carried still higher the whole substance would melt. But Mr. Goodyear, as the result of untiring experiment, found out that, although the application of heat produced a melting effect upon this compound, rendering it more and more plastic and soft as the degree of heat augmented, yet when the heat, going on, had got up to a certain much higher degree, its effect was the reverse of what it had been, and then the rubber composition commenced to vulcanize and harden, and in fact to make metallic the vegetable substance." The result of the two inventions is thus stated by Mr. Webster:—"It introduces quite a new material into the manufacture of the arts, that material being nothing less than elastic metal. It is hard like metal, and elastic as pure original gum-elastic. Why, this is as great and momentous a phenomenon occurring to men in the progress of their knowledge, as it would be for a man to show that iron and gold could remain iron and gold, and yet become elastic like india-rubber." Mr. Goodyear obtained a patent for his discovery, and granted licenses to manufacture under his and Hayward's patents. The manufacture at once revived. Twenty years afterwards the yearly sale of goods created by these inventions in the city of Boston alone was set down at \$2,500,000. Thousands of operatives are employed in their manufacture. The uses to which the vulcanized rubber is applied are innumerable, and new uses are discovered every day. Water-proof shoes, clothing, tents, pontoons, blankets for soldiers—invaluable as they have been proved in our

service, preventing the loss of thousands of lives, and promoting the health and comfort of the soldier to a degree beyond estimation—buckets, life-preservers, mail bags, car springs, suspenders, pencil cases, combs, boxes, are only a few of the countless articles made, specimens of which may be seen in the beautiful collection deposited by Mr. Goodyear in the saloons of this office. There is probably not a family in the country that does not use these goods, and there is hardly an instance on record in which inventions have within so short a period become so essential to general comfort and convenience.

It is unnecessary to say that this great manufacture was founded upon the stimulus which the patent privilege gave to the inventors, and the protection which the patents have given to the manufacturers.

I have spoken of the great spinners and weavers who have carried the cotton manufacture to its great perfection in Great Britain. An invention in the class of textile manufactures has been made by an American, which equals in ingenuity anything which has been accomplished in Great Britain or France. The history of the invention proves that it would not have been introduced without the protection which the patent afforded, and there is precise evidence on record of the saving in money which it has effected for the consumers of the country. Previous to 1842 all three-ply and ingrain carpets were woven in hand looms, the motive power being furnished by the weaver. Numerous and costly experiments to weave ingrain carpets by power-looms had been made in England, but had proved unsuccessful. Mr. Erastus P. Bigelow, of Massachusetts, in 1842, conceived of a series of devices for making the carpet loom automatic, so that the costly labor of men might be dispensed with, and the whole process of weaving might be conducted by girls and boys. After laying his plans before many manufacturers, without obtaining their approval, he succeeded in engaging the attention of the treasurer of a manufacturing company in Lowell, who had the intelligence to see the importance of the undertaking, and to understand the grounds of its probable success. Through him he made an engagement with "the Lowell Company," which, in consideration of the exclusive right to use all his inventions then or afterwards made, so far as they could be applied to the weaving of ingrain carpets, agreed to pay the expenses of putting a trial loom in operation, and if that proved successful, to build a power-loom mill, and to pay Mr. Bigelow a certain patent rent per yard upon all carpeting woven during the existence of the patents which Mr. Bigelow was to take out for his inventions. The trial loom proved successful, and the company proceeded to erect mills to manufacture carpeting under Mr. Bigelow's patents. The cost of these works was many hundred thousand dollars, the fixed capital of the company in their carpet works being \$978,956. This vast outlay was made, and in fact the whole improvement was based, upon the protection given by the exclusive right under the patents. The invention was of such a character that it could be developed, tested, perfected, and made practically useful only by the expenditure of a vast capital. The only security for this outlay, which no individual could have made, was the protection of the patent. The company were careful to secure the right to all future improvements which the inventor might make. Encouraged by the certain though moderate reward offered by his arrangement with the company, the inventor continued for four years after the first loom was devised, to add new improvements, which were protected by five more patents; and it now presents a machine which is admitted to be unsurpassed by anything which the mechanical genius of man has ever devised. The benefits which this invention has conferred upon the manufacturing company, the inventor, and the public, are precisely shown by records in this office. The "Lowell Company" granted to the "Hartford Carpet Company" a license to use these inventions, the use being confined to these two companies. The profit in the carpet department, in the Lowell Manufacturing Company, from Oct. 31, 1859, to April 30, 1863, was \$687,801 41. The total dividends of the Hartford Carpet Company from January, 1855, to July, 1863, were \$1,009,649 50. The par value of the stock, \$100 per share. The market value, \$155 to \$160 per share.

The total receipts of the inventor from his royalty

have been \$50,432 12. The benefit to the public by this invention is, first, the production of superior goods, the texture of the power-loom carpeting being more uniform, the selvage more even, and the matching of the figures more perfect. The actual saving to consumers is thus calculated: Prior to the introduction of the power-loom, the Lowell Manufacturing Company paid, as wages for weaving by the hand-loom the description of carpeting known as two-ply, 11½ cents per yard, and for three-ply 25 cents per yard; whereas, with Bigelow's power-loom, they only pay for weaving the former article 2½ cents per yard, and for the latter 2½ cents per yard; thus showing a saving by the power-loom in wages paid for weaving of 9½ cents per yard for two-ply, and 22½ cents per yard for three-ply, being an average of 15½ cents per yard. But the saving in wages is partly neutralized by the more costly repairs of the power-loom machinery, and interest on the larger investment of capital required therefor, so that the average net saving by the power-loom is estimated at ten cents per yard. Accurate returns from the mills of the Lowell and Hartford companies up to April, 1863, show that the number of yards of carpeting woven upon looms was 25,964,185 yards; thus the saving to the people by this invention has been two million five hundred thousand dollars. That the saving in the price of manufacture of carpets has accrued to the consumers is evident from the fact that at the time Mr. Bigelow's invention was introduced the wholesale price of the best quality of two-ply carpeting was from eighty-five to ninety cents per yard, and of three-ply from one dollar and thirty to one dollar and thirty-three cents per yard; whereas, in 1860, the former description of goods, power-loom wrought, of a better quality than the hand-loom wrought, sold for from seventy to seventy-two and a half cents per yard, and the latter from ninety-five to ninety-seven and a half cents per yard, making an average reduction of over twenty per cent. It is worthy of observation that the ingrain carpets are used not so much by the wealthy as the middle classes. They give comfort and attractiveness to the homes of the people, and thus this invention, originated and introduced by the patent policy, has had a sensible effect in ameliorating and refining society.

The "Great Eastern" Steamer and the Atlantic Telegraph.

The *Great Eastern*, it is reported, is likely to leave this country for a French port. It is said, also, that she is under charter, subject to sale, to lay down the Atlantic Telegraph Cable in 1865. For this service the owners are to receive £60,000 in "greenbacks," the name now given to the share certificates of the Telegraph Company. It was calculated that the cable to connect Ireland with Newfoundland would not cost more than £600,000 but the company are endeavoring to raise another £150,000 to pay for the increased cost caused by the enlarged size and weight of the insulated wire and covering. If, however, the French Government determine upon purchasing the *Great Eastern*, she will not be available for carrying out the contract, in which case a lighter cable will have to be substituted. No progress has been made in the manufacture, nor is it necessary to commence operations for some months yet, as the storing of such a bulk would lead to sweating, and perhaps damage, before shipment. Messrs. Glass and Elliott's contracts with the gutta-percha works have been transferred to a limited liability company. The company are to receive half cash and half shares for the making and submerging the transatlantic cable, and, as the actual cost does not exceed £350,000, it is calculated that the company will be fully reimbursed for their outlay, whether the cable ultimately succeeds or fails. Should the *Great Eastern* be sold, and a smaller cable be decided on, in consequence of the difficulty of finding a ship large enough to convey 4,122 tons of this dead weight, allowing also for space to wind round drums, it is thought that a reduction will be made in the price, and the old capital of £600,000 adhered to. This connecting Europe and America by submarine telegraphy appears to be beset not only with electrical but with nautical and pecuniary difficulties. At the meeting of the shareholders of the Atlantic Telegraph Company, recently, the chairman stated that the paid-up capital of the company represented only £316,000. If, then, the heavy cable can-

not be laid, it is useless resorting to the small one, and the impression gains ground that we are once more to have a failure.—*Mitchell's (London) Steamship Journal*.

Discovery in Photometry.

It is the established practice in measuring the light of illuminating gas to compare the light of a five feet Argand burner with that of a spermaceti candle burning 120 grains an hour; and when the candle used burns less or more than the 120 grains it has been regarded as a matter of course that the light would vary in the same proportion. But the scientific evidence given before the committee of the House of Lords, in England, on the bill of the Birmingham and District Gas Consumers Company, respecting the illuminating power of the gas supplied by the two existing companies in that town, has shown that a candle burning a large quantity of spermaceti, yields more light in proportion to the material consumed than a candle burning a small quantity. The *Journal of Gas Lighting* (London), after giving a full history of the case, remarks:—

"These experiments demonstrate that the illuminating power of burning candles increases in a greater ratio than the direct proportion of the consumption of spermaceti. It has long been known that the illuminating power of gas increases in a greater proportion than the quantity consumed, but we believe it had not been previously known that the same law operates in the combustion of candles. It is evident, from the results of the photometrical experiments with the gas supplied by the Birmingham companies, that no correct conclusions can be drawn from proportionate quantities of either the gas or spermaceti consumed, inasmuch as the amount of light is influenced by the quantity of combustible matter burned within a given time. It has been suggested that some rule may be established by which the influence on the light of the flame, produced by the relative quantities of spermaceti undergoing combustion, may be determined and allowed for. Thus, it is probable that—after the proportions have been reduced to 120 grains consumed per hour—if 1 per cent, for each grain of spermaceti the candle may consume per hour less than 120 grains, be deducted from the indications of the photometer, and if 1 per cent. be added to similar indications of the photometer for each grain the candle may consume more than 120 grains, the results attained would not be far from the truth. But until the subject has been further investigated it would not be safe to assume positively that such a scale of compensation would be correct. The new light which these experiments have thrown on photometry, shows the necessity for the adoption of some more certain standard of comparison than a spermaceti candle, the consumption of which it is impossible to regulate with accuracy. The Carcel lamp—which is similar to the 'moderator' lamp—is adopted generally on the Continent as the standard of comparison, and it possesses these advantages—the consumption of oil may be regulated with the greatest nicety, while its flame approaches in luminosity that of nine candles. At the same time, it must be observed that the lamp-wick requires great attention, and the shape and size and position of the chimney have much more influence in effecting perfect combustion than the chimney of a gas-flame. The difficulty of attaining a correct indication of the illuminating power of gas by comparison with other flames points to the adoption of the atmospheric test, invented by Professor Erdmann, which was favorably noticed in our columns on the 9th of February last. By that instrument, as we there stated, neither photometers, nor candles, nor blackened chambers, are required, the illuminating power of the gas being determined by the quantity of atmospheric air mixed with a given quantity of gas before it ceases to give white light. Such a simple method of testing the illuminating power of gas has peculiar claims to favor at the present time, as the difficulty of attaining accurate results by photometrical observations has been shown by the Birmingham experiments to be even greater than before supposed."

VINEGAR FROM WATERMELONS.—Take ripe watermelons, scrape out the inside, press out the juice, strain, and then boil it down one half; put it away the same as other vinegar, and it will make an article equal or next to cider vinegar.