Inventors & Inventions;

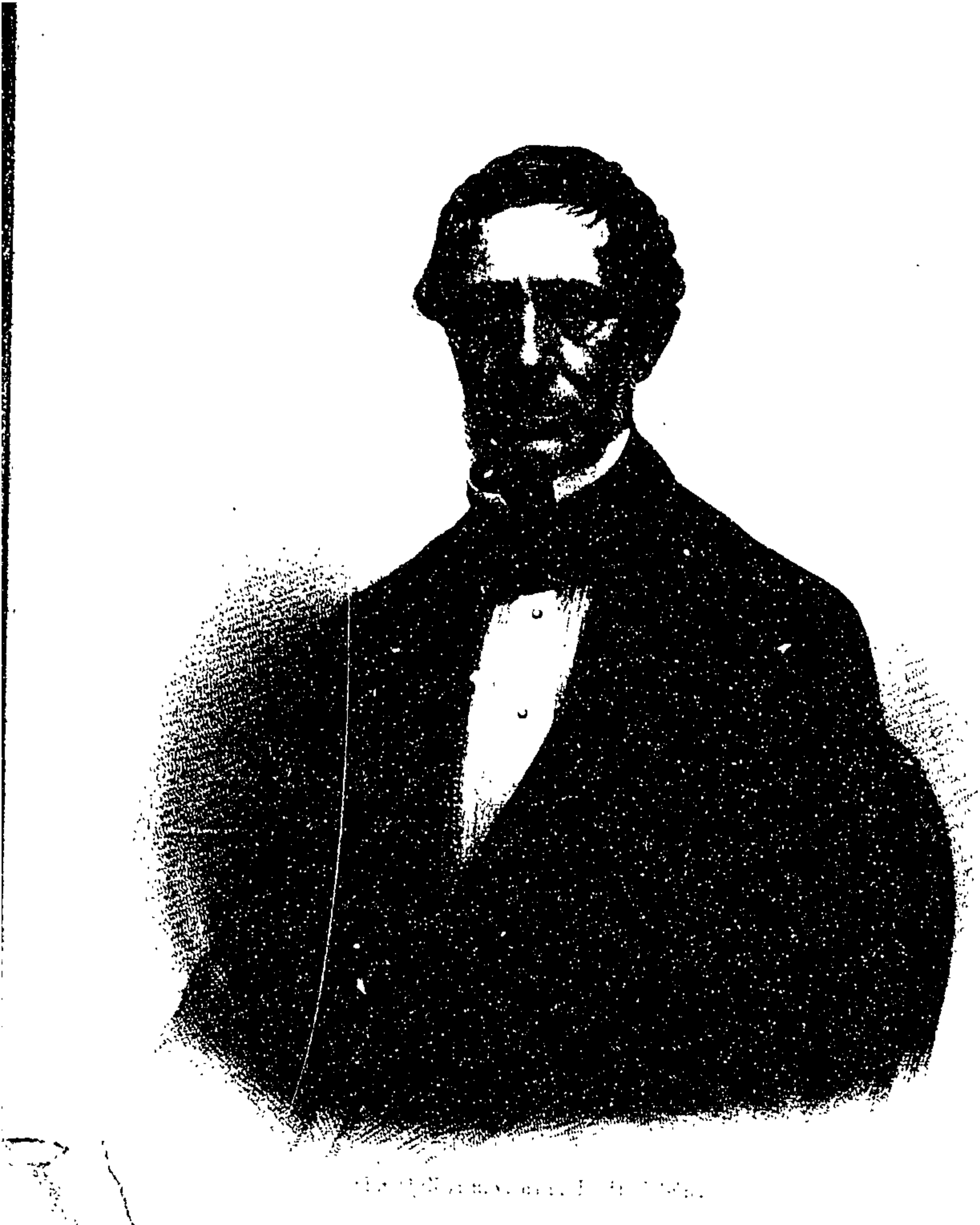
COMPRISING

I. THE PHILOSOPHY OF INVENTION.

II. THE RIGHTS AND WRONGS OF INVENTORS.

III. EARLY INVENTORS' INVENTORIES OF SECRET INVENTIONS.

PRINTED BY
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Yours very truly
Henry Dircks

July 21

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INVENTORS AND INVENTIONS,

IN THREE PARTS:

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I.

THE PHILOSOPHY OF INVENTION,

CONSIDERED STRICTLY IN RELATION TO INGENIOUS CONTRIVANCES TENDING TO FACILITATE SCIENTIFIC OPERATIONS, TO EXTEND MANUFACTURING SKILL, OR TO ORIGINATE NEW SOURCES OF INDUSTRY.

II.

THE RIGHTS AND WRONGS OF INVENTORS,

PARTICULARLY AS AFFECTED BY THE INFLUENCE OF PATENT MONOPOLY, LEGALLY AND POLITICALLY EXAMINED.

III.

EARLY INVENTORS' INVENTORIES OF SECRET INVENTIONS,

EMPLOYED FROM THE 13TH TO THE 17TH CENTURY, IN SUBSTITUTION OF LETTERS PATENT.

O

L. D. Lincoln

BY

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AUTHOR OF

"LIFE OF THE MARQUIS OF WORCESTER," "WORCESTERIANA," &c.

London:

E. AND F. N. SPON, 48, CHARING CROSS.

1867.

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HENRY BESSEMER, ESQ., C.E.,

&c. &c. &c.

MY DEAR SIR,

I know not to whom I could more appropriately dedicate this work than to yourself; and the gratification I feel in doing so is enhanced by my recollection of the friendly relations which have existed between us for nearly thirty years.

As an Inventor and Patentee you are an eminent instance of successful enterprize in a variety of scientific adaptations in the industrial arts, carried out with remarkable skill and consummate ingenuity. Of this fact your recent improvements in the manufacture of steel, whereby you virtually create a new and most important branch of manufacture, which must prove of immense national advantage and world-wide utility, offers a brilliant illustration.

The Treatise which I now inscribe to you, consists of three parts, namely:—the settling of definite terms in scientific or legal discussions of matters of invention;—an examination of the political and legal position of

patentees;—concluding with numerous inventories of the inventive secrets of olden times: a system of communication between the public and inventors now happily obsolete, in consequence of the better results obtainable through the agency of Patent Law.

In my treatment of these several topics I do not doubt that you will fully approve my views and sentiments, and

I remain,

My dear Sir,

Yours very truly,

HENRY DIRCKS.

Blackheath, Kent,
1st June, 1867.

INTRODUCTION.

THE present volume, under the general title of "INVENTORS AND INVENTIONS," combines three distinct works, each having its own preface; it is only necessary, therefore, here to mention briefly how they come to be associated.

In 1865 appeared the "Report of the Patent Law Commissioners," containing the evidence both oral and written, obtained during the years 1862, 63, and, 64. The evidence fills 222 folio pages, closely printed in double columns, and a tabulated analysis of the whole occupies eight more pages.

It would be impossible, within the present limits, to review this important document in a satisfactory manner, but one feature it possesses in too prominent a degree to be passed over unnoticed, and that is the conflicting character of its contents. The single inquiry—"*Have you reason to suppose that* PUBLIC *inconvenience is caused by the multiplicity of Patents?*"—is answered with:

Yes—by 24 witnesses, and

No—by 18 witnesses.

Again to the question—"*Do you consider that Patents ought to be refused on the ground of the trifling and frivolous nature of the* INVENTIONS *for which they are claimed?*"

We find the reply to be—

Yes—by 8 witnesses, and

No—by 21 witnesses.

Whoever has perused the voluminous Blue-Book in question, or has considered the several subjects—Inventions, Inventors, Patents, and Secret Inventions will be aware—

First—Of the indefiniteness of our language, as usually employed, in treating of Inventions, and the consequent necessity that arises of giving a precise meaning to distinguish the terms we employ in discussing the points which arise when investigating the vexed question of priority of Invention, or in distinguishing between Inventions, for scientific purposes, through their several ramifications. Hence—The Philosophy of Invention.

Second—Of all that concerns the personal interests of Inventors, particularly as affected by the amount of protection conceded to them by Patent Law.

And, third—Of the contrast that exists between Secret Inventions and Patent Inventions, the former being mostly lost to society, while the latter are preserved as stepping stones to advancement.

The three treatises collectively go far to solve some of the most striking difficulties that present themselves to our observation, on a careful perusal of the evidence accumulated in the "Report" before named, and will, therefore, it is hoped, materially assist in promoting the

accomplishment of remedial measures for securing the rights of all classes of Inventors, and considerably ameliorating their wrongs.

It appears from a communication made to "Fraser's Magazine," for April, 1867, by Baron Liebig, that he is engaged on a "History of the Development of the Ideas of Invention," the source of which ideas he conceives is not to be found in Bacon's works; be that as it may, it is most probable that the Baron's discourse will discover to us something of the metaphysics of the subject with which the first part of the present treatise is principally occupied. It has already been shown that *Ideas of Invention* may exist without resulting in practical invention, or producing anything beyond theoretical views. But *Ideas of Invention* combined with experimental trials may lead to a practical result, developing a useful and important piece of machinery, or a chemical application. The distinguishing features of the two are: 1. The IDEAL is more frequently *wrong* than otherwise; and 2. The PRACTICAL is inevitably *right*. It is the existence of the mere chance of fallacy that renders the ideal or theoretical, under all circumstances, subordinate in character and value to the practical, or realized invention.

H. D.

LONDON, *June*, 1867.

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PART I.

IN TWO BOOKS.

THE PHILOSOPHY OF INVENTION,

CONSIDERED STRICTLY IN RELATION

TO INGENIOUS CONTRIVANCES TENDING TO FACILITATE

SCIENTIFIC OPERATIONS, TO EXTEND MANUFACTURING

SKILL, OR TO ORIGINATE NEW SOURCES OF

INDUSTRY;

TOGETHER WITH REMARKS ON

DESIGN.

The art of definition, which is merely the art of fixing, in a single word or phrase, the particular circumstance of agreement of various individual objects, which, in consequence of this feeling of relation, we have chosen to class together, gives us certain fixed points of reference, both for ourselves and others, without which it would be impossible for us to know the progress which we have made, impossible to remember accurately the results even of a single reasoning, and to apply them with profit to future analysis.

THOMAS BROWN, M.D.

The simplest and first mode of acquiring technical terms, is to take words current in common usage, and by rigorously defining or otherwise fixing their meaning to fit them for the expression of scientific truths. In this manner almost all the fundamental technical terms of Geometry were formed.

WILLIAM WHEWELL, D.D.

PREFACE.

IT must appear a singular omission to all who have their attention called for the first time to the fact, that no attempt should have been heretofore made to define in a comprehensive manner the several terms employed in treating of those works of human ingenuity, known under the general denomination of INVENTIONS. We refer in vain to Technological or other Dictionaries, works on Natural Philosophy, Histories of Inventions, and the numerous works on Patent Law; for there we find 'merely convertible terms—improvements become discoveries—inventions become improvements—and so forth; whereas in Law, Logic, and Rhetoric, the analogous terms are well and most stringently defined. The consequence of this very obvious neglect is, that our Histories of Inventions are particularly confused in their language; and in our courts of law the same circumstance is not unfrequently a source of very unnecessary difficulties, calculated to disturb, or certainly to delay, the course of justice.

In literature, as in science, similar terms, such as *discovery*, *invention*, *improvement*, are of frequent occurrence with very different meanings, but without causing misapplication. This may in part be explained, not only

by the circumstance that literature is the elder of the two, but also by the fact that it systematically engages the attention of the learned with increasing activity; while the number of scientific labourers has been, as compared with that of men of letters, few and scattered. And, indeed, the literature of science, never thoroughly popular, may be said to be only emerging from comparative obscurity in our own day.

It is, unfortunately, too frequently overlooked that scientific like legal investigations can only be satisfactorily conducted by adhering to definite, restricted terms. If we use the ambiguous phraseology customary in colloquial intercourse, we cannot hope to arrive at any satisfactory critical examination of an intricate subject; and it must ever be borne in mind that it is not on ordinary, but extraordinary occasions, that a rigidly correct use of language becomes absolutely necessary.

In attempting to compose the history of any Invention, this precision of language is especially demanded, otherwise interminable intricacy will ensue, involving both the writer and his reader in a needless labyrinth—non-essentials assuming importance, while important but apparently lesser matters are possibly entirely overlooked. Precisely the same thing would happen when a patent case was being tried, if useless evidence were produced with an array of importance, and essential points lost sight of while contending with an *apparently* correct course of evidence. It is, therefore, under these circum-

stances that the importance of precisely defined terms becomes most obvious.

If an illustration were required that definitions, as here urged and supported, are something more than distinctions with little difference in their import, we might instance the very common misuse of the term "public," which, through bearing a legal and likewise a popular meaning, causes the greatest possible confusion in any debate on the subject—Whether the public is benefited or taxed by the granting to inventors a monopoly of their inventions by letters patent? The lawyer declares *the public is taxed* by granting to inventors a monopoly of their inventions. The manufacturer takes the same view of the case, argues against all kinds of monopolies, and against Patents as the worst of all, denouncing them as *a tax on the public*. But on the other side, political economists deliberately declare in their writings that of all monopolies that granted by the legislature to inventors is of the lightest possible character, calculated to improve manufactures as well as to cheapen their products by the introduction of labour-saving machinery resulting in amazingly increased production. The politician shows that *taxation* is something paid over and above the value of the raw material or the manufactured product; but, as affecting patents, that the patentee's royalty, if a tax at all, is taxation in an inverse ratio to that imposed by the Crown, because it both *lowers prices* and *enlarges the sphere of trade*.

Here we have an instance where contending parties advocating opposite principles employ the same term to express their conflicting sentiments; because it happens that while the *lawyer* speaking of the "public" may mean two or three individuals, or a special class of manufacturers, the *politician* invariably considers the "public" to be the masses—the million—the community at large.

In this first attempt to give a clear and available view of the subject of INVENTION, many deficiencies may fairly be expected to occur; cases may probably be instanced by a critical reader which the definitions given do not fully reach, and others where they would not, without some qualification, apply; but, nevertheless, it will not be unimportant to have made somewhat clearer what had hitherto been wavering and uncertain; and to have laid down a plan which, whatever may be its imperfections, may yet serve to guide other writers in raising a *more comprehensive* superstructure:—under which expectations principally the author has ventured on his present publication.

BOOK I.—CHAPTER I.

GENERAL OBSERVATIONS.

The commonwealth of science is world-wide—it is so universal as to acknowledge no sect or party—it makes no national distinctions to limit the boundary as to where or by whom a *discovery* was made, a great *invention* projected, or an important *improvement* first brought to light.

They who look on Invention as a trifling affair, or as something to be purchased or obtained at will, should be reminded of the immense number of inventions that lie neglected, almost forgotten through their deficiency in something, which after all may in itself possibly be of a very trifling nature, to give them vitality. Why is the Steam Engine not superseded? Certainly not for want of expensive experiments, and of patents found to be false even in theory when tested by actual practice. Why do not vessels sail at nearly double their present speed? Assuredly not for want of skilful experiments, large expenditure of capital, and innumerable most scientific suggestions. In short, all history and experience teaches us that the coming five or ten years may at any period overstep all anticipations of possible results from embryo mechanical, chemical, and other combinations. Who can tell what wonderful invention the next year may realize! But this all know, that it is impossible to calculate beforehand on the certainty of any great invention being produced, merely because there is a public demand for its attainment.

In an early stage of society, invention would necessarily be at its lowest ebb, little being immediately wanted beyond food, clothing, and a homestead. Progress would lead to the construction of simple implements for husbandry, the chase, or warfare. Yet primitive as all these would assuredly be, they would, if submitted to modern enquiry, present many of the elementary principles familiar to manufacturing skill.

Monuments of the most ancient date make us acquainted with a state of society in the east which affords abundant evidence of singular ability in the working of stone, metals, ivory, glass, pottery, fibres, colours, and other materials.

Several stages are observable in the onward movement of invention. It is not to Egypt, Greece, or Rome *alone* that mankind is indebted for progress in manual arts; nor yet solely to Germany, Holland, France, or Italy. Circumstances have arisen from time to time in the world's history that have favoured the progress and dissemination of arts, sciences, and manufactures, occasioning the spread of artisans and the conveyance of their intelligence from their native country to some less favoured clime; while not unfrequently the patronage of the great has in like manner had its effect in the transference of knowledge.

This rivalry among the nations of the earth has not, however, served to civilize the entire human family; savage races of men still exist whose civilization appears to be a problem yet to be solved; nude, painted tribes, illiterate, and possessing the mere canoes, huts, and simple implements known to their remote progenitors.

It may well be a matter of surprise that these two

thoroughly different states of society should maintain their position in modern times, but it may serve to convince us, if any argument on the subject were requisite, that improvement is not inherent in man; that it is not only progressive, but that its progress may for a long time be almost imperceptible. Many circumstances may lead to this, such as the predatory character of a people, the poverty of the soil, or an ungenial climate, with the infinite adverse influences arising from mismanaged government, and the consequent degradation of nations otherwise capable of vast improvement.

Mankind in a more genial state is observed to advance century after century, effecting alterations, additions, and improvements in agriculture, building, food, clothing, and other necessaries to promote personal comforts and commercial operations.

No work of art appears perfect to an enterprising mind. However simple its purpose, it may possibly be made lighter, stronger, more efficacious, or be done away with altogether. The man whose mind is thus constituted becomes an Inventor and a sure benefactor to society. He seeks to obtain some desired end through changes in old machinery or appliances, or in the substitution of more efficient means to obtain the same results.

The first requisite towards invention in any branch of labour must always be a knowledge of the subject to which the invention relates, although such acquaintance may chance to be rather theoretical than practical. The next requisite is a knowledge of certain elementary, mechanical, or other principles relating to the subject itself, or to the nature of the materials and devices constituting the invention. Indeed, no one ignorant on

such points can expect ultimate success, except through the needlessly expensive ordeal of successive failures. And again, having some general knowledge of a particular subject, the Inventor may fail in accomplishing his object unless versed in certain particular principles, on his exact attention to which will mainly depend the efficiency of the work in which he engages.

It may safely be averred that no invention results purely from accident, that is, from the mere observation of a fact that might lead to some invention by one ignorant of the art itself, or the particular science affecting it. In short, valuable inventions are often lost to the ignorant from their only seeing, but not fully estimating, accidents occurring in the laboratory or the manufactory.

Immediately on the announcement of any discovery, such, for example, as that of a new printing medium, giving rise to Lithography; of the fact that certain chemicals assist in affording pictures of objects under the influence of light, known first as Daguerreotype; or of the compact deposition of metals under the slow action of electric currents, the foundation of Electro-Metallurgy — many inventive minds are called into activity, invention follows invention, and improvement succeeds improvement with surprising rapidity. But eventually a lull occurs, and it may be long before another adventurer appears with any extremely surprising novelty.

Inventions are always shifting—never stationary; at one time there is a run on improved ship-building; at another on improved modes of warfare; then comes a change to looms, or agricultural implements, or some art

or manufacture, or matter of general interest that starts up into notability, which in its turn becomes the object of general pursuit and rivalry.

For one great invention, we meet with some hundreds or thousands of improvements. An invention may be improved in many ways and for a series of years without really altering its original character. It has been thus with the hydraulic press and many others—and it is so to the present time with the true steam engine, as invented by Watt.

That "Necessity is the mother of Invention," is an aphorism that has been long exploded, and we are more disposed to affirm that "Competition is the spur to Invention." To commerce we owe the stimulus given to all classes of improvements in arts, agriculture, and manufactures. Nation competes with nation, and manufacturer with manufacturer, to establish a character for excellence and economy.

We thus see that man in the capacity of an Inventor, is of a very different mould to the ordinary trader, although he may combine both characteristics. But abstractedly considered, the man of really inventive genius is one who goes out of the common track, becoming a seeker, a findor out of some novelty, some new method or process of production, or some entirely new art, or manufacture. It may be wholly or only partially new. Or it may be a revival of several known parts, each of which is old in itself, but presented to the world in an entirely new and interesting form. Or it may be more simple still, consisting in merely a superiority in form or in fabric; or in greater availability for the purposes intended.

But in indicating these grades in invention, we must avoid taking into account that bastard species purchased by money, the *mental* property of the poverty-stricken or the working mechanic; the *purchased* property of a trader without sense or feeling in such matters, who thus in his own name may become the possessor and patentee of another man's invention for the mere mercenary motives of trade, instead of obtaining such possession through the only legitimate channel of patenting the invention in the name of the true inventor.

We must distinguish, however, between this case and that of the inventor of an elaborate work, who, engaging a number of workmen, may receive useful hints from some of them, who might thereupon assume that they, and not their employer, were the inventors. Many complicated and large works are frequently thus carried on, without disparagement to the claims of the true and original inventor, although he might be indebted to the skill of some of the workpeople in his employ for useful suggestions.

No class of inventors are less deserving of encouragement than the self-deluded.* Ignorant and self-willed,

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* In the minutes of evidence taken before the Commissioners appointed to inquire into the working of the Law relating to Letters Patent, in 1863, occurs the examination of John Scott Russell, Esq., who stated that he had "taken out a good many Patents," and had therefore considerable experience in reference to that subject. Respecting inventions neither "new" nor "useful," he proposed to reject altogether their being patented; and passing to the consideration of inventions for mechanical possibilities, he went on to say:—"Members of this Commission are aware how many inventions there are for putting weights at a greater distance from the centre, so as to produce something equivalent to creating a power; *it is well known* that there are *hundreds* of these inventions [*i.e.* for per-

they ardently follow a perverse course with untiring determination in the pursuit of mere phantoms, all manner of chemical or mechanical monstrosities. The self-deluded are innocent pretenders, so long as their day-dreams serve only to punish themselves; but too frequently it happens that, affecting to be martyrs while announcing the splendour of their phantom fortunes, they engulph others in the loss of property which the most simple and ordinary course of enquiry through a profcssional medium would have rendered impossible, by showing that the enthusiastic visionary had excited neither enmity nor envy on the score of any "vested rights" *he* might endanger; but, on the contrary, had failed to gain sympathy, solely by reason of the untenable character of his projects.

Next to the simple, ignorant pretender, is the mere charlatan, who taking advantage of the public's ignorance of science, employs a smattering of knowledge to deceive and delude the unwary, by promising participation in some wonderful discovery he affects to have made in medicine or art. Of course it is a sealed SECRET. When patent charges were so heavy as to amount almost to a

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petual motion] *every day*, and it would be the *greatest blessing in the world* to an inventor of *that* class to stop him in his career."

"Hundreds every day" would amount to something like 30,000 annually—the worthless labour of inventors, whom it might indeed be well to save from ruin to themselves and ruin to others by their overflowing bad example. But such is *not* the fact; there is *not a dozen* patents on *that* subject in a year. Why then magnify an exceptional case of this kind to the injury of patentees generally? As well might copyright be refused to authors whose works are pronounced by a Commission not to be orthodox, with a view thereby to benefit authors and the public.

prohibitory duty on Patents for Inventions, this class of pretenders to invaluable "secrets" swarmed, and preyed on such of the wealthy as lent too willing an ear to their tales of persecuted genius, and possession of novel discoveries lying dormant for lack of gold to develop them! When, in 1852, patent charges were so considerably reduced that a comparatively small fee gave certain security to an inventor, it became evident to the body of possessors of "*secrets*," that their field of operation was curtailed, and it was no longer of avail to promise to others thousands of pounds which might be secured for a small patent charge; or, at all events, when an advance of the few pounds for a patent was all they could reasonably show it was requisite for them to call on their dupes to advance as a preliminary step. The abolishing of the patent system would most assuredly bring about a revival of this infamous cheatery in the sale of pretended *secrets*; and consequently, *the charlatan's best friend is the advocate of the abolition of all patent right for inventions.*

The great stimulus to Invention is, unquestionably, pecuniary reward. No man ever yet published any really valuable invention for the sole honour of being the reputed inventor; for a good invention is legitimately considered to be the golden road to fortune.

Inventors mostly find themselves surrounded with difficulties; firstly, to prove the correctness and value of their inventions; and secondly, to get them into public use; for an invention, however simple in itself, may involve a large outlay of capital to prove its efficiency, and afterwards to give it publicity.

The inventor is the most likely party to promote his

invention; many inventions given to the public have remained unknown except to scientific readers, until accident has brought them before enterprising manufacturers and others; abundant proof of which may be obtained from the Transactions of the Society of Arts from 1783, for more than sixty years.

Inventions that offer undoubted improvements are more satisfactory to the "general public" than to the "public manufacturers." The manufacturer assuredly desires to promote his own manufactures; but he would be placed at a great disadvantage if his engines, presses, machines, had to be continually undergoing change to meet a rapid influx of improvements. For example, it would be no loss to manufacturers if *not a single invention* were to come before the general public for the next fifty years or more. So long as competition should be at a stand, all would appear satisfactory enough. The manufacturer, therefore, improves or adopts improvements *not* as a principle, but as a trade necessity. He cannot stand still, however willing to avoid improving his own works—he must move with the times.

Thus, manufacturers virtually become the great promoters and encouragers of invention, although every great improvement absolutely imposes increased exertions, increased outlay of capital, and increased anxiety as to the final result. A manufacturer just commencing his career of enterprise has the advantage of the latest and best inventions, without laying aside an old stock of materials and machinery, and *he* it is with whom old established manufacturers have to compete.

But inasmuch as the manufacturer is of *necessity* and *not on principle* an encourager of invention, he takes

every opportunity of opposing rather than of heartily encouraging the novel ideas of an inventor. Manufacturers can therefore combine and determine to use an invention in direct opposition to patent monopoly; and, indeed, as they have done in some cases, they can agree to defend each other in any action at law, and even strive to increase the patentee's legal expenses to maintain his alleged rights. And this may be done with *apparent* fairness; because they may show that, considering the patentee exorbitant in his demands, they have offered him the amount at which they themselves assess his claim. It is not pretended, perhaps, that they could not pay his claim, and still realize more than heretofore by their products; but they show that the invention itself is not costly, and that their estimate proceeds on calculations based on *that* fact; and they object to share with the inventor any per centage of the increased value they themselves obtain on their products through his ingenuity; such additional advantage being what they consider as a "tax" on their own labour.

Thus, therefore, while the manufacturer appears to be, as an interested party, the great encourager of inventors and their inventions, we find that any encouragement actually given to them by him is rather compulsory, arising from the competition which patents place in the power of smaller capitalists. And it is not and never can be, in a mere trade sense, a desirable object with the manufacturer to encourage and disseminate improved machinery and processes in arts and manufactures. It is certain, therefore, that it is the sheer necessity of the case, arising from competition, that hastens the early and rapid introduction of decidedly good inventions when

seriously affecting large, expensive operations in manufactures.

When an invention can be kept from public knowledge and worked in *secret*, as happens with applications of many chemical discoveries, then indeed a single manufacturer willingly agrees to the full charge of the most sanguine inventor; and even engages his services, simply because he can thus for a long time monopolize a certain branch of trade. The manufacturer who might thus be shown to be paying his so-called "tax" of, say one pound per ton, or any other amount, would demur to a tithe of any such rate for a patented matter, being thereby open to public competition. Treating of monopolies, McCulloch* observes: "*Secrets* in manufactures are capable of being longer kept than *secrets* in trade;" and of enabling the possessor to obtain "extraordinary gains." These "arise from the high price which is paid for his private labour;" and they "really arise from the *monopoly* he enjoys of his discovery, or from his being able to avail himself of it without being exposed to the competition of others. This gives him the power of selling articles produced at a comparatively small expense at the same price as those produced by a more costly process." It is this class of the "public" of manufacturers that is found to be loudest in complaining of the "taxation" imposed on it by Patent Law, which ignores all *secrets*.

We thus see that INVENTION is a term applying only to some novel modifications affecting the machinery in a

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* Adam Smith's "Wealth of Nations," edited by J. R. McCulloch, 8vo. Edinburgh, 1863. Page 27.

manufacture whereby *labour* is saved, while the produce being increased or improved, or both, the manufacturer is thereby enabled to supply metal, woollen, linen, cotton, and other articles to the public at a considerably cheaper rate than before the employment of the newly invented engines, machines, and processes. It also has reference to any new production advantageously applied, such as gas, vulcanized india-rubber, iron roads, iron ships, telegraphs, electro-plating, photographing, &c., which are all likewise matters of great public utility: some reducing municipal and local taxation for lighting, travelling, &c., and others aiding in the providing of many beneficial luxuries.

BOOK I.—CHAPTER II.

OF THEORY.

THEORY is the result of that mental operation which conceives as possible a state of things non-existent; calculating from certain assumed circumstances the probable consequence. Theory thus considered, precedes, and in some changed form may also follow, every discovery: being a substitution of mental for practical investigation of the phenonema under examination. This imaginative process is the precursor of all experimental research, whether simple or complex.

The first step towards discovery in any branch of science is a course of reasoning, often forming hypothesis after hypothesis, from the most simple idea to the most elaborate combinations of known facts and assumed possible occurrences, in such order as to promise a required result when reduced to practice.

Many hoped-for discoveries have terminated in hypotheses, which are not, however, to be considered as necessarily useless: because they may still exercise a beneficial influence on other minds in proportion as knowledge extends; and even more refined experimental appliances may lead to the justification of some unrecognised theory indulged in during the infancy of a science or a new art.

The probable soundness of a theory can only be estimated from its agreement with admitted facts, any

absolute contradiction to which would stamp it with weakness and error. And yet so feeble in effect is all theory, to pierce the arcana of nature, that theories the most plausible, which have received unlimited sanction from the learned at one period, have failed when time and experience have opened out a practical demonstration.

Although in science at large, theories may be formed which will probably never lead to any results, the case is not always the same with regard to theoretical views regarding proposed inventions. And yet very plausible chemical theories may be formed which, if they could only be realized, would be a wonderful boon to mankind.

Two opposite theories cannot both be correct, nevertheless, it is singular enough that facts will occur affording evidence favourable to the possibility of adverse opinions on a single scientific subject; which may in consequence long maintain their ground, supported by rival controversialists.

As theory is only a substitution for fact, the more remote the fact the more elaborate and various may we expect to find the theories to which it will give rise; for we ever observe that in proportion to the ignorance on any subject, the more wordy may the discussion become in attempting its elucidation; a result forcibly demonstrating the feebleness of human intelligence in its highest flights to reach and comprehend the unknown.

There may sometimes occur a very short space of time between the formation of the theory, and the discovery of the fact of which it has been the loadstar; the mental process is not, however, thereby affected in its importance—a theory not being a matter of time or

extent; therefore, the quickest passing thought may sometimes suffice with a surcharged mind and practised hand to realize a practical proof.

The mere theorist possesses but little information on which to felicitate himself, and is in danger of becoming an obstacle to improvement through poverty of knowledge and the false views consequent on it; for theorising does not necessarily imply the possession of genius. To a certain extent it is natural to mankind generally to entertain some theoretical views of all natural phenomena, and thus we may always expect to find a sufficient number of crude thinkers to support the views of a plausible theoretical scholar.

Nothing short of absolute discovery or practical results can satisfy us as to the soundness of any theory previously entertained; and just as theory is a substitution for fact, so the discovery of the fact supersedes and dissipates the theory previously formed.

A fruitful mind will not be very likely to form a wild, incongruous theory, yet at the same time a single error may lead to an interminable maze; for precisely as any theory may start from a very small point, so in like manner may a very slight error frustrate its reduction to practice; and, indeed, theories oftener fail on some small but weak point, than on any larger and more obvious matter.

When the mental operation of forming theories supersedes experimental efforts to establish their soundness, there is much danger of becoming fascinated with that which is merely paradoxical and chimerical, and bending known facts to favour the purposes of such philosophical mental speculations. Just in proportion as any theoretical

speculation amuses the mind should it be received with caution. It is a fatal error in any theory when it attempts to combine facts with fanciful conceits. Much perverted ingenuity is often expended in thus attempting to establish a system of most promising character, although in reality a true "castle in the air."

Theories are always suggestive. Perhaps no theory was ever so thoroughly worthless as never to have been the cause of some support, opposition, or substitution. But the object of theory is not simply intellectual conflict, but to arrive by the shortest possible course at the ascertainment of facts.

The physicist, like the artificer, commences any new operation with some design—some plan. The very arranging of some method of practical inquiry involves the formation of theory as a guide to action.

Theories respecting matters that can readily be reduced to experiment will rarely be much discussed; at the same time there are many subjects which we might suppose had been finally disposed of by experiment, but which are yet being continually discussed afresh: after having engaged the highest talent in the country and called forth munificent expenditure in producing practical results to afford correct data.

Remarks. We have thus far stated views affecting theory as restricted to mechanical arts. Theory was the bane not the support of science down to the time of Lord Bacon, but theories have a very limited scope in modern times, wherein men do not now promise to transmute the baser metals into gold, or invent wings with which to fly.

Theory in the application here understood, is exceed-

ingly restricted. Theories leading to discoveries or inventions in applied chemistry, or in manual arts, can never take any very high flights, or in the least degree tend to retard the successful advancement of science.

Those who suppose that they are doing an especial service to science by decrying all theoretical views, overlook the fact already stated, that theory must ever precede discovery and invention. As well might the architect discard his drawings, as the chemical or the mechanical experimentalist set about his work unguided by any theory—any preconceived design or hoped-for result.

We may conceive the possibility of an astronomer, a geologist, or a physiologist indulging in elaborate and interminable theories; but not an inventor, for although he may entertain peculiar views on nautical matters, on fortifications, warfare, and warlike implements, and with regard to railroads, engineering, and many manufacturing operations, yet his theories must be comparatively circumscribed.

THEORY in the restricted application here made of it, is THE IDEAL OF INVENTION.

Cases may easily occur among ingenious men in which this ideality is confounded with reality. Thus, men of large information, of extensive experience, or practical acquaintance with the details of some particular subject, may make in their conversations or writings very happy suggestions. Something that may be known to answer well for one purpose is mentioned as capable of an application to meet the requirements of the project under consideration, but without further result than the formation of theoretical views. All such opinions unsupported by practical tests are mere ideas—mere

theory—and not the actual inventive application of any material product; but form altogether an unsupported ingenious theory verging as closely as possible on the confines of a realized invention, but not becoming any practical invention whatever. For *mental* inventions lose their character of being theories under the demonstrative proof of actual trial and final practical results.

BOOK I.—CHAPTER III.

OF EXPERIMENT.

WHAT Theory projects, the theorist next attempts to discover, his first effort being the arrangement of some demonstrative experiment: which is a step intermediate between theory and practice.

Experiment deals with the whole or part of any preconceived operation. The final result of a mechanical arrangement may appear obvious provided the working of one or more of its parts will produce certain desired effects; and it is the practical trial of any doubtful portion that affords an experimental test.

The first trial of a complete engine or machine or instrument is also an experiment, because the final result is problematical; but if successful, experiment ceases and an established invention is the result.

Experiments are usually mere partial trials to test the accuracy of preconceived opinions. And for such purposes the matters experimented on, or experimented with, may be actual portions of a large work, or substituted materials, irrespective of many otherwise important details. Experiment is, therefore, the first step to entering upon any labour on a large scale; or, it is the first practical demonstrative proof of the success, or failure, of any production complete for that object in all its parts.

Experiment is a proof or test of the accuracy of a

part or the whole of any mechanical or chemical undertaking. But strictly considered the testing of a complete work, although experimental, is not what is usually and properly understood by experiment. In forming a tubular bridge experimental trials of portions may be made even to their destruction, and this is justly termed an experiment. When, however, the proper form, dimensions, and strength of materials are ascertained, the first bridge erected, and an experimental trial instituted, no destructive means are employed, as in the original experiments.

Experiments are consequently elementary; or they are the first trials of a completely arranged, newly projected scheme; as when a model ship is propelled in a tank of water; or the principle of the same model ship adopted in the construction of an ocean steamer.

In the course of numerous experiments in various branches of science—chemistry, electricity, optics, mechanics, hydrostatics, &c.—innumerable experiments occur requiring the intervention of exceedingly ingenious contrivances to illustrate in an elementary form the nature and properties of the phenomena to which each refers. Thus we have the glass retort, the electrophorus, the prism, the æolipile, the syphon, &c., none of which are inventions in the sense of being patentable matters. That they are ingenious experimental philosophical lecture table apparatus is very true, and so far they display a moderate share of inventive skill; but in drawing the line of distinction between an experimental invention and a practical invention, we have principally to bear in mind that the first is but as a toy compared with the second, which is of public utility. When we

approach near to any line of demarcation, as in this case, in which we have to settle the distinction between demonstrative apparatus and a practical invention, there must ever arise cases so doubtfully placed in respect to such divisional line, and trenching so nearly upon it that the utmost care is required in fairly allotting to each its true character and position. A toy may possess some of the characteristics of an invention of public utility, but it is still only an experimental toy or apparatus; and these broad distinctions must ever be borne in mind.

Remarks. Nothing leads to more contention than the distinguishing where an experiment ends and a practical result begins; or, which is about the same, where experimental apparatus disappear and practical appliances commence. It is not unlike fixing the boundary between two parishes, which is arranged without much dispute when a wide river intervenes, but not when one side of a street or lane is in one parish, and the other side in another. The development of steam led to the formation of numerous automata, simple toys and apparatus; so did electricity, galvanism, and magnetism, than which few discoveries have supplied a larger number of amusive and instructive apparatus illustrative of science. It cannot be pretended that any of these are more than what they profess to be, palpable illustrations of the existence of certain elementary principles in nature, showing their properties and peculiar effects under a variety of circumstances. In none of these is there any attempt at a practical result for manufacturing purposes, and their value is never that estimated by the trader; but they are esteemed simply for the evidences they afford of the wonderful effects

of nature's laws. Every great discovery leads to the multiplication of this class of apparatus, not for the purposes of trade, but to promote scientific investigations.

It is not uncommon with writers who have not watched the progress of invention, to elevate every suggestion, every idea that has been expressed, every toy, or illustrative experimental apparatus above its proper sphere. When all these are thus placed on one level, all made to answer one purpose in a chain of evidence, the tracing of the origin of an invention becomes an arduous and hopeless undertaking.

In "The Life, Times, and Scientific Labours of the Marquis of Worcester" (page XV.), it became necessary to mark the difference existing between the mere idea of an invention, and the illustrative apparatus to demonstrate the principle only on which such idea might be founded. Without we clearly distinguish between what is experimental and what is practically useful, we can never have a proper conception of where the ones end and the other commences. The suppositionary case given is as follows:—It is not unreasonable to suppose that Electricity, using the term in its most extended sense, will some day or other supersede the employment of steam. We probably require only to be able to collect it cheaply and to control it effectually, to employ the artillery of heaven on the wide ocean, on our network of iron rails, and throughout all our manufacturing establishments.

Assuming this state of progress to be consummated, we will further suppose that A′ invents the first efficient Electric Engine, which with fifty-horse power, or more or less, is fully at work; and in course of a few years we

determine to write the history of Electric Engines. Where shall we start in our history? Did not Faraday years ago construct an electro-magnetic engine? then of coursé Faraday is the inventor also of A's engine! But we need not stop here; we have the whole history of electricity before us. How many kinds of ingenious forms of electric apparatus present themselves, some to spin round like a whirling Æolipile, the motive power being the electric fluid in place of steam; and a similar apparatus to ascend an inclined plane. There is no end of electric machines and engines; and a Patent Specification may bring to light some defunct scheme affording the nearest possible approach to the practical working engine claimed as the invention of A. But we have not done yet, we have to consider France, &c., where we may find further elementary electrical models dating before Faraday, and then of course before A! So that, on this system of investigating the claim to be a first and true Inventor, as hitherto adopted—and as followed by some writers in attempting to settle a claim for De Caus, and depreciating the just claim of the Marquis of Worcester—we may venture to predict an analogous fate for the Inventor of the Electric Engine *hereafter* to be invented by some inventor, A.

Suggestive as scientific apparatus may be and no doubt often are to inventive men, such apparatus cannot reasonably be adduced as evidence of previous publication. As well might it be pretended that the swingiug of a chandelier suspended by a long chain, and the falling of fruit in an orchard were so commonly known and frequently observed, that Galileo had no claim to his pendulum experiments; or Newton to his discovery of

the law of gravitation. Surely what is before every body's eyes must be a publication! What is absurb in these instances is not less so when attempted to lower the value of true inventions by pretending a prior claim for matters of little or no value beyond experimental purposes.

It will presently appear that we have at this juncture arrived at a most important point in the present inquiry, one on which depends the stability of all scientific history in regard to priority of Invention. We are now laying the ground-work for raising a standard and fixing the canons of criticism by which to measure and judge of the merits of inventors' claims. At this stage we are about stepping from Experiment to consider Discovery, but before doing so let it be observed that we have not yet dealt with a single Invention. We cannot allow that any merely experimental arrangement is an invention. It may be said to be an invention for a purpose, but *that* purpose is mere illustration. Experiments are not trade operations. And Experimental Apparatus are not Inventions to promote manufactures, although they are often the precursors of improvements in processes of great manufacturing utility: no Invention whatever being independent of elementary scientific knowledge.

BOOK I.—CHAPTER IV.

OF DISCOVERY.

HYPOTHETICAL views in any science, art, or manufacture, naturally lead, as already stated, to the instituting of suitable experimental investigations to establish or refute their soundness, which may result in realizing a *Discovery*, or making an *Invention*.

To a certain extent every Invention may be pronounced to be a discovery; but the converse of this will not hold good, because there is no Discovery which can be justly called an Invention.

In its limited and proper sense, then, Discovery is a term which applies only to the knowledge we obtain of some hidden principle in nature; as, for example, gravitation; electricity; mechanical, hydrostatic, pneumatic, and other laws, &c. These discoveries set bounds to human invention; thus far we can go, but never proceed further; combine them as we may, these first principles invariably maintain their integrity. Discovery, in the restricted sense thus indicated, is widely different from its common acceptation in cases where we speak of the discovery of planets, islands, objects of natural history, and the like.

Nothing is more rare than Discoveries, or more important in science. We generally trace their origin to the result of abstruse studies; or an enlarged acquaintance with a single subject continuously before the mind. It is

one thing to discover a principle in Nature's operations, and another and a very different one to apply that principle to some practical purpose through the medium of an Invention. And it is peculiar to the mental condition of men capable of making a great discovery, not to be at the same time Inventors; or at least that they do not invent objects of a higher order than their own elementary demonstrative apparatus.

Discoveries have this advantage over Inventions, that their importance is indisputable. They may result from individual or from united efforts, but each discovery, to whatever it may apply, is single and definite, being pre-existent and consequently uninventable.

The subject revealed by any discovery is often found to have lain concealed by a covering so light, as to make it a matter of surprise after it is fully developed, that it should have remained any length of time unknown. Hence discovery falls only to the lot of very exalted minds, able to discern what would ordinarily pass unnoticed, or unappreciated.

Discovery may be the result of investigations pursued in consequence of certain preconceived theories; in this way Sir Humphrey Davy discovered the metallic bases of alkalies and earths. Or it may emanate from the investigation of circumstances accidentally occurring, not being the consequence of any pre-arranged experiment; it was thus that Galvani was led to the discovery of the science called after his name—galvanism.

Remarks. No term is so abused in its applications by legal and other professions as that of *Discovery*. Every petty mechanical improvement has in its turn been graced with this highest of distinctions; and there

are few inventors who have not laid claim to the honour of being discoverers, as though they took rank with the first philosophers of past and present times. It will be a most difficult matter, therefore, to wrest this singularly expressive term from its common acceptation, to express every simple ingenious application resulting from inventive talent.

Inventors becoming patentees soon learn that Discoveries, not being Inventions, can *not* become the subjects of patents, for the Legislature has very properly determined that elementary principles, such indeed as are the results of Discoveries made from time to time in science, shall not be patentable, but only any useful applications of such principles. If the discoverer of electricity could have patented such discovery, it is clear no application of that elementary principle could have been made independent of such a patent; Patent Law, however, provides the remedy by restricting the claims of patentees to the "working or making of any manner of new manufacture."*

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* If some principle in nature could be applied only in one particular way and in no other, then the Inventor's Patent of such an Invention would in reality cover both the principle and its application. The nearest approach on record to such a case is that of Neilson's Hot Blast for Iron Smelting.

BOOK I.—CHAPTER V.

REVIEW OF THE FOREGOING EXPOSITION, DEVELOPING THE PROCESSES APPERTAINING TO PURELY SCIENTIFIC INVESTIGATIONS, IRRESPECTIVE OF APPLICATIONS IN INDUSTRIAL ARTS.

Thus far we have considered the Inventor solely in the character of a man of science. Devoted to the study of Physical Science he is naturally led to the formation of *theories* on some of tho many topics most interesting to him; he may afterwards commence a series of *experiments*, and they may result in some gratifying *discovery*. His every pursuit is marked by design, and that design is bounded by some theory. If he is a chemist he does not throw together a mass of heterogeneous materials and watch for some resulting marvel on which to speculate at leisure. And if Mechanical Philosophy engages his attention, he does not set up a number of levers and wheels, or other parts of machines at random to ascertain whether any curious effect will be produced. No such schemes to supersede the first forming of a theoretical process is ever attempted.

Whoever makes a *discovery* in science is dependent on the effects produced by some *experiment*, either instituted by himself or others. In some very rare instances, an acute observer, from his observations of some natural phenomena, has indeed made a discovery without any preconceived experiment; but such accidents are of remote occurrence.

The study of the several branches of Physics can never be advantageously pursued without having recourse to experiment after experiment through an infinity of changes. Experiments impress the True and the False indelibly on the memory.

Experiment being inseparable from the active pursuit of Natural Philosophy, we can trace back to a very remote period the employment of apparatus to demonstrate the properties of elementary principles in nature. Many of the most ancient of this class of apparatus have preserved to modern times the best possible evidence of the degree of knowledge early possessed in certain branches of Physics.

We are not to go back to antiquity for any very remarkable effects even in such attempts to demonstrate the nature and properties of heat, air, water, &c. In the infancy of science demonstrative appliances long maintained their infant form; the Æolipile of Hero ever continued as such; and so with many others.

Modern appliances of this same class are popularly styled *Philosophical Apparatus*. But the term is too large, although it may serve when no more is understood by it than lecture table Demonstrative Apparatus. Of this kind are Atwood's machine; Centrifugal apparatus; systems of levers; sectional models; apparatus illustrating sliding, rolling, collision, wheel-work, pulleys, inclined plane, wedge and screw, pendulum, &c.

There is a material difference between a model and an apparatus. A model is understood to be a perfect work shown in its full size, or on a reduced scale, as a model steam engine, steam ship, bridge, crane, &c. A piece of demonstrative apparatus, however large it

might be made, would generally be of little or no practical utility; whereas a model might be the precise plan for the whole, or any single part of a structure both useful and valuable.

Apparatus will of course very often approach the confines of practical mechanical works; thus a syringe is a very near approach to a pump, although it would prove next to useless if proposed for use in lieu of a pump for general purposes.

In attempting to fix clearly and satisfactorily the precise application of the term *Apparatus* as referring solely to demonstrative apparatus to elucidate elementary principles in any branch of physical science, the difficulty of ridding ourselves of preconceived, and probably settled notions will be continually recurring. But in the *Philosophy of Inventions* we have only to deal with one meaning; and not with all the possible applications of a word. We want definite terms in each department treating on this single subject.

All apparatus are imperfect, except for the sole purpose of illustration and demonstration; and whatever ideas they may inspire their own true character remains unaltered. Supposing any simple apparatus capable of enlargement, that very circumstance would demand appliances and additions apart from and uncalled-for in the original apparatus, thereby at once altering its character.

Some philosophical apparatus appear to go beyond these circumscribed bounds. Electrical bells are such in reality; so is a galvanic trough, and many optical apparatus; but the few exceptions that might be thus adduced need not seriously interfere with our verdict as

to the true character of any special matter; for that which is practically and generally useful among apparatus sustains a double character, so long as its transference from philosophical illustration to practical purposes demands no modifications; in which case it would be more a model than an apparatus.

One marked feature in all demonstrative apparatus results from the objects for which they are constructed, namely, to afford ocular demonstrations in support of oral statements in educational instruction; and not to promote commercial transactions of any kind.

Having thus stated the case in reference to *Apparatus*, we have in the next place to impress on the reader's mind that apparatus, thus considered, are *not* Inventions. This at first sight appears to be a most perplexing announcement. Whenever we restrict language, refusing to it that license which renders discussion obscure, we invariably encounter this very difficulty. It is usual to call every combination of mechanical parts an Invention, however useless it may be. The very arrangement of arms in an armory would by many be described as displaying much ingenious invention! The classified arrangement of engineers' patterns in their pattern lofts would far better deserve the distinction, although in either instance the term would be misplaced.

Two or three cases may suffice to place this subject in its right light. Sir Humphrey Davy contrived numerous chemical apparatus to develop his own views; but he only invented successfully on one occasion, when he produced the Miners' Safety Lamp. Professor Faraday's works are replete with diagrams of ingenious electrical

apparatus; but he is no Inventor if we except his improved gas lamp. Dr. Wollaston did, and Professor Wheatstone now does, unite both charactors, each having produced apparatus as well as practical Inventions.

Now in this restricted sense we feel warranted to say that, *Apparatus* are inapplicable for any other purposes than philosophical demonstrations, and therefore, although educationally useful contrivances, they do not attain to the practical character of Chemical and Mechanical *Inventions;* the one principally applying to assist in mental instruction; the other to enlarging the scope of manual industry.

BOOK II.—CHAPTER I.

OF INVENTION.

THERE are many persons who having attained a certain amount of knowledge in a particular branch of science, either by study, leading to a refined acquaintance with its elementary principles and the laws of nature affecting each; or, obtained through practice that knowledge which daily attention to manufacturing operations will always give, would remain satisfied with the information they had thus acquired; while there are others who would seek to extend the practical working of existing knowledge. The origin of Invention is due to a desire being aroused to alter the old methods of conducting any operation in manufacturing processes. The scientific student contrives apparatus for experiment; and he constructs simple, efficacious, and economical Inventions for the advantage of commerce, such as steam engines to drain mines, &c.; looms for weaving; gas for artificial illumination, &c. Commercial value enters into every inventor's calculations, and on the attainment of economy depend all his prospects of future fame and fortune. Its utility is the standard by which alone every invention must either stand or fall.

Invention is not an Art; it is a faculty of the mind more strongly developed in some men than in others, and is possessed by comparatively few in any great degree. No amount of acquired knowledge, no variety of scien-

tific information, and no concentration of the mind on single subjects, would of themselves have any tendency to induce invention, in the absence of a natural ability that way. Very few mathematicians or men attached to the learned professions are inventors, and there are fewer still among the class engaged in the very manufactures to which other men employed in quite opposite pursuits have nevertheless contributed numerous valuable inventions.

Neither is Invention a Science. Its course is independent of all the usual laws governing intellectual operations; and having no fixed principles of development it is not confined to one sex, or to special classes of the community.

The Inventor proposes to himself various means of simplifying some cumbrous machinery, instrument, or other matter, which appears to him capable of improvement. He effects some addition, or reduction, to increase its capabilities; or contrives a means of dispensing with it, by substituting something entirely new. Sometimes the idea of a novel arrangement presents itself to the mind almost intuitively, its source being so doubtful as to be soon lost, and even the inventor himself may participate in the surprise of those who see the efficacy of his finished work.

The medium by the assistance of which man is enabled to perform any operation in his trade or calling, or which aids in promoting domestic comforts and the luxuries of life, is mostly the result of invention.

The inventions that at present exist, if swept away, would, in all human likelihood, be re-invented in some form in future ages. The slowest progress appears rapid

while inventions are known but as some "wonder of the world;" but as they multiply with the onward movement of civilization, our reason fails to comprehend the probable result of the amazing mechanical ingenuity that is being developed.

The bare enunciation of the properties possessed by any new invention is calculated to create scepticism;—as, to take likenesses by the aid of the sun's beams;—to hold converse between correspondents thousands of miles apart, and in a few minutes space of time;—to travel above thirty miles per hour, &c.

As inventions owe their properties to scientific arrangements they are either Mechanical, or Chemical, or Optical, or Surgical, &c. The greater number, however, are unquestionably mechanical.

Few Inventions remain isolated; they usually suggest changes, which enlarge their own sphere of usefulness. Or they go out like a fashion, becoming obsolete with the advance of superior inventions; as, for example, when gas and improved candle manufacture superseded oil lamps and snuffers, &c.

Nothing that falls short of being a matter of fact can be considered as an invention; and, therefore, mere ideas are not inventions. The offering of suggestions likely to realize promised results is the nearest approach to invention, without being invention. Theories are frequently formed by men of experience possessing ingenuity enough to calculate possible results, from bringing together known facts to work in some new direction, and these are exceedingly suggestive to other minds; but they often seriously hamper the history of priority of invention, especially during the lifetime of litigant parties; because

it frequently appears to a casual, inexperienced, observer that such guesses at truth ought to be recognised as meritorious contributions to science, or to its practical application, entitling whomsoever suggested them to equal merit with that accorded to any one who has afterwards appeared, and been at considerable cost and labour. We can, however, only deal with facts to guide us in our decisions. A suggestion, however acutely made or promising in appearance, is but an *idea*, which, with whatever amount of experience it may have been propounded, still retains an entirely mental form, open to some doubt, wanting in proof to convince sceptical minds, and is *not* therefore an Invention. To suggest that water shall be decomposed, and its elements, hydrogen and oxygen, employed to generate heat by the use of jets as in the oxy-hydrogen blow-pipe, to be lighted by an electric spark, does not amount to the *making* of an Invention.* It merely

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* A recent discussion in the *Times* between James Nasmyth, Esq., the eminent engineer, and Captain W. Palliser, is much to the present purpose. Mr. Nasmyth says, that at the Cambridge Meeting of the British Association, in October, 1862, a paper was read by Mr. T. Aston, on "Rifled Guns and Projectiles;" on which a discussion having taken place, Mr. Nasmyth "advocated the employment of *chilled cast iron* as the most fit material for Shot and Shell for the special purpose of penetrating armour plates." This suggestion, although it was well received, led to no practical demonstration.

On the 27th May, 1863, seven months later, Captain Palliser obtained Letters Patent for "Improvements in Projectiles and Ordnance;" his object "being to cause so great a degree of hardness in the projectile as to enable it to penetrate thick armour plate." And in his complete Specification he claims—"the chill-casting of cast iron, steel, or wrought iron, and cast iron, for use as projectiles for ordnance."

After the publication of this Patent, Mr. Nasmyth, writing to the *Times*, 19th February, 1867, says—"In giving my Invention free for the public service on the occasion [at Cambridge], I had neither then,

suggests to others what they may *make* and apply, the manner and means, with other details, being omitted. Ideas and opinions are not, therefore, and cannot be classed as, Inventions.

Every Invention is something quite new; it must possess novelty and utility; but it may nevertheless be

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nor have I now, any pecuniary motive whatever," only "desiring to establish the *validity of my claim* to the *origination* of this important Invention."

Mr. Nasmyth's correspondence plainly shows that he has no clear conception of what it is that constitutes an Invention. He claims to have "*invented*" something, of which he made a free gift to the public in 1862; and closes his statement by claiming the "*origination*" of an important invention. He thus places last the very thing to which he has a most unqualified claim, namely, the *origination*; and makes as a first claim the *invention* itself, to which he can establish no claim. This clashing of ideas creates most unfortunate confusion; and we may readily imagine the perplexity into which even a special jury would be thrown by such language, each juryman being left (as at present happens) to put his own construction on these mis-applied terms. It is as if there could be any dispute in deciding about the winner in a race, because the second horse was within the nearest possible approach of the winning post; or, as if it were impossible to decide the respective weights of two heavy bodies because of the smallness of the fractional difference between them.

The *origination* of the invention of diamond has been long known to chemists; but the *invention* of making diamonds still remains a secret with nature.

To originate or almost Invent anything is *not* inventing it. While to follow up the ideas conceived in respect to any matter, and to prove by practice the process and effects contemplated, is the only admissible evidence in support of a *bonâ fide* Invention.

We must all admire and respect Mr. Nasmyth for his versatility of talent as an inventor; and it is, therefore, far from being a grateful task to have to show that he has taken an erroneous view of this affair, as between himself and Captain Palliser; but the case offers too striking an illustration of the necessity of employing precise terms in these discussions to be lightly passed over.

composed of many old, well-known parts, as screws, wheels, levers, &c. It must be something more than an imitation concealing some old invention. There is, however, a bastard species of Invention, giving rise to infringements, or colourable evasions of patented inventions, the dishonest products of designing men, wilfully blind to their own nefarious practices.

An Invention may relate entirely to a mechanical arrangement, such as a machine; or it may relate to the products manufactured by a new arrangement of machinery. Thus, felted carpets form one invention; and the machines for their manufacture another invention.

An Invention may also be for the whole, or only one portion of a large work; thus Watt patented his improved steam-engine; Barton confined his Invention and Patent to metallic packing. In like manner there are separate inventions for boilers, furnaces, fire bars, safety valves, condensing, and feed apparatus, &c. &c.

Some Inventions are due to the united intelligence of two individuals. Thus, on an eminent surgeon explaining to an ingenious mechanic some instrument which he desires to possess, the artisan may, with such acquired information on the subject, although perfectly ignorant of its application, successfully produce an instrument possessing all the properties required. In this case, the surgeon is the true inventor; it is he who is the director and guide; and the workman merely acts mechanically to manipulate in production.

Like inventions rarely occur simultaneously. It will, however, occasionally happen when a new art or manufacture is just being developed, and is engaging the faculties of many men in the pursuit of one object. Or

a supposed first invention is hastened into public notice by the publicity given to an invention akin to it, and which by such publicity is fully and unquestionably entitled to priority, when both are found to be alike.

Simplicity, next to efficiency, is one of the greatest recommendations any Invention can possess; and for the same reason complexity is not unfrequently an evidence of defect. Some of the most remarkable results are produced by exceedingly simple arrangements. Take for example the hydraulic press. But the very simplicity which we admire is a stumbling-block to those incapable of judging of the true merits of mechanical or other novelties. A mere change in materials may constitute an essentially valuable invention, such as the substitution of wire for hemp in making cables, bands, ropes, &c.; papier maché for wood; varnished cloth for leather, &c. Even machines that to an unpractised eye may appear very complex, such as steam-engines, looms, printing presses, &c., are simple enough in many of their details, and it is only the union of these that gives to the whole the general appearance of complexity. An object is not necessarily easy of attainment merely because when attained it appears very simple; for instance, nothing can be more simple than the substitution of one material for another, yet we were for centuries without water-proof Macintosh cloth; or wire ropes and cables.

Some Inventions are of very restricted application, as calculating machines; the Bank sovereign weighing machine to separate light coin; Watt's articulated tube for a particular Water Works Company, &c., with many

others applying to Astronomy, Surgery, &c., made for specific purposes.

Remarks.—The inventive genius of one man differs widely from that of another; in some it is a natural gift, in others it appears but weak, however well cultivated. True inventive mechanical skill is as obvious as that other phase of the same mental faculty employed on poetry, painting, or sculpture. There is no danger of our confounding the truly-gifted Inventor with the man of moderate attainments, or the mere hopeless aspirant, not wanting in ambition, but ignorant of all mechanical laws. Invention in mechanics, like Invention in literature, although often blessed with the happiest results, is not without a dark page in its history. Ignorant, absurd, wild, ridiculous attempts to work impossibilities, and to scheme things neither new nor desirable, may not inaptly be compared with the efforts of those authors whose pamphlets, poems, dramas, and other works, however denounced, are every year reproduced, as if in defiance of common sense, and all accepted canons of criticism. But in Mechanical Invention, as well as in Literature, we are obliged to allow the wheat and the tares to flourish awhile together; and the idea of clearing either Mechanical Invention or Literature of everything that is not great, genuine, and good, is perfectly Utopian.

The absence of the Inventive faculty in many eminent men is truly surprising. However industrious, shrewd, and clever they may be, they never attempt to leave the beaten track of their daily pursuits. Even manufacturers have seldom been the inventors of the machines which they employ, or the fabrics, &c., they produce in

their own business. It was Brunel, the engineer, who invented the Circular Saw, the Block-cutting machinery, &c.; and we find similar cases in the history of the origin of most great inventions.

Invention and secrecy go hand in hand. Inventors, as such, are not an associated body; each doubts his neighbour, and scarcely dares to announce his possession of a secret. "Tell me the nature of your secret and I shall soon be near finding it out"—is the warning voice that checks communication. Experimental operations are conducted in secret; and the Inventor has often to grope in the dark for want of a judicious adviser; therefore secrecy is very often the great drawback to an Inventor's progress, from his acting in too self dependent a manner, with insufficient conference with those who could aid him, but by whom he fears he might be anticipated. It is only when he has obtained a Patent that he can openly and safely test the entire propertics and value of his Invention.

In the progress of Invention we find sciences rendered effective that in an earlier state of Invention lay almost dormant. It was so for a long period with Magnetism, Electricity, Galvanism, &c.

An Invention may anticipate the age, and for awhile remain unused. For seven years the steam-engine, in its primitive form, was without a duplicate; and, thirty years elapsed before that wonderful invention was recognised and manufactured.

Inventions may undergo improvements until at different stages of their progress each deserves to rank as an individual invention, yet without destroying paternity. The modern name "steam-engine," is one applied to an

old invention, in which we mark three stages,—the Fire Engine, the Atmospheric Engine, and the true Steam Engine of Watt. Here, as in some other inventions, we perceive an unbroken line, each new invention depending on the last in regular gradation.

By possibility one man might invent a perfectly *useless* machine; and another become the true inventor of it by rendering it available as a serviceable and desirable machine. And though this may be a circumstance of rare occurrence, yet a near approach to it frequently happens, and has the result, when the useless or imperfect machine is secured by patent, of obliging, or rendering its purchase advisable, though otherwise valueless, to avoid the possibility of legal litigation.

When several inventors engage themselves independently on the same matter, the priority of invention assumes many intricate forms, only to be resolved by examining a carefully arranged chain of evidence, which will possess more or less interest according to the value and importance of the property at stake in the ultimate decision.

Priority of Invention is a constant source of contention among Inventors, and many curious cases occur in scientific history; especially when Inventions become Patent property, as then legal rights depend on priority. Hence arises the necessity of clearly understanding what is and what is not Invention; where invention begins, and in what particulars it is affected by the evidence of contending parties. In courts of law a remarkable flexibility of language has hitherto been indulged in to explain away important evidence, or to swell into importance every trivial, extraneous, or useless

fact. When everything that man constructs is called an invention, or writes about is declared to be a publication, the legal adviser may trace back to the remotest records to find some shadowy semblance of the matter he would advocate or condemn. Precise terms, although they cannot be expected to diminish litigation, are at all events capable of rendering disputes more comprehensible than they too often appear, and thereby lessening their severity.

In the legal examination of a Patent case it is not unusual, when dealing with the early development of mechanical arrangements, to *improve* one so as to answer a specific purpose, in order to make it appear more important than it is. The same thing happens in the history of Inventions when written by a partial hand. Even Arago, the Astronomer Royal of France, when claiming the Steam Engine as of French origin, showed how the hot-water fountain of De Caus might be made self-supplying!—not on the authority of anything projected by De Caus, but because such additional parts would make it bear a close analogy to the primitive steam-engine afterwards invented in England.

As inventions are either true or false, effectual or non-effective, it is neither correct nor just to rank as Inventions fallacious assemblages of mechanical parts, or proposed compositions of chemical bodies which are utterly and absolutely absurd; the merest blunders and mistakes of men who are sanguine or imperfectly informed, if not absolute impostors. It may be difficult to distinguish satisfactorily the excellence of one contrivance over some other contrivance purporting to be an improvement; but that which is false on all known

scientific principles should not be permitted to bear the same stamp with a tolerably sound invention, much less with one of acknowledged importance. But that flagrant cases of deceptive, or pretended, inventions are permitted to pass the Great Seal is undoubtedly a serious evil.

An invidious distinction is often attempted to be made between different Inventions, by those who oppose Patent Law on the ground of its being a monopoly; some Inventions they call great, some small; and the latter they would exclude altogether. The absurdity of this attempted division is easily seen by considering the commercial value of the class of small as compared with that of large inventions. As classes, small inventions are the largest class, and large ones the smallest class. Political economists generally know better than to despise the small as common; and the common as undeserving of the favour extended to what is large and magnificent. But as M'Culloch has admirably observed—"Those who cultivate mathematical and physical sciences, or who devote themselves to literature or metaphysics, have rarely any selfish motive to bias their judgment, and to tempt them to conceal or pervert the truth. But it is not so with those who engage in political and economical discussions, —— *Party influence is a copious source of delusion and error.**

* The "Literature of Political Economy." By J. R. M'Culloch. 8vo., 1845.

BOOK II.—CHAPTER II.

OF IMPROVEMENT.

THE term *Improvement* applies to some change made in an invention already existing. Improvement is invention in its secondary or minor stage, and may emanate from the original inventor, or from others using his invention. Whenever anything that is ordinarily effected by one means is so changed as to be more efficiently produced by some new arrangement, such newly constructed contrivance is said to be an improvement. We have in consequence a very extensive class of improved engines, machines, fabrics, and other manufactures.

Where *Invention* fails to supplant anything in common use, *Improvement* can generally introduce some novelty to add to old methods of production sufficient convenience and economy to induce public patronage of the improved articles.

Sometimes the term *Improvement* is extended to the whole when only a small part of any machine or other matter is the subject of an invention. Thus a steam-engine may be called an improved one, simply from having some patented invention introduced in small portions of its construction.

Improvements are only to be considered as extensions and refinements on known old or modern inventions which simplify their construction, economise their manufacture, add certain advantages, and so enlarge the demand for them.

Some improvements, as may be expected, almost

amount to being Inventions, yet they are usually distinguishable from the latter by their association with and dependence on some well-known invention. But as the slightest alteration in size, form, or quality may be designated an improvement, the term becomes, in many instances, very vague in its ordinary application.

An improved machine or manufacture may combine various improvements in several parts which unite to make a general improvement of the entire product.

Improvements may also arise from mere skill in workmanship, such as doing by common machinery what had previously been made by hand-work, or by using superior machines and tools. But such improvements are not included in the present investigation, any more than improvements that may be made in husbandry, or breeding stock, &c.

It is important to observe with regard to Improvements and Inventions, that the former are wholly dependent on the latter; otherwise great injustice would be done to the right appreciation of original invention. Thus considered, Improvements are always secondary in the order of merit. There are many persons to be found who, when they become cognizant of a valuable invention, have the ability to improve it,—but who would have found themselves utterly incapable of originating the invention.* No mere improvement can possibly suffice to deprive the original inventor of his claim to priority.

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* It would be well if the Legislature when amending the Patent Law were to institute a stage between "Inventions" and "Designs," by the introduction of "Improvements," allowing to the latter a term of only five years instead of fourteen years. This subject will, however, be further considered in the concluding chapter; and in treating of "The rights and wrongs of Inventors."

An essential difference between the opportunities of the Improver and the Inventor consists in the former having an object to guide him; while the latter produces his work amidst much uncertainty, with the toil and difficulties arising from the making of many preliminary experiments.

Improvements being much more simple in character than Inventions, will always out-number them; they are also generally less expensive, and, therefore, much more readily made public. It does not follow, however, that all "improvements" are really such. Too often they are only introduced by designing persons, and are found on trial to possess little or none of their promised superiority over some rival "improvement;" and it is this designing class of men that materially injure the interests of those who deal justly in patent property.

Remarks.—According to the legal phraseology that prevails in the wording of Letters Patent and Specifications, the distinctions which have just been made are not borne out; and we may yet long have to hear of an "Invention of Improvements in," &c.

If we consider any old invention, such as an umbrella or parasol, although each may have some new invention applied to it, yet, as a whole, it remains an improved umbrella, or an improved parasol. The covering may be a new material, or the ribs, or springs, or handle, or general construction, but still the article remains an umbrella, or a parasol.

The same line of argument would apply to a hat, or boot, or shoe, so long as the original form was maintained, and only some of its parts or materials underwent slight changes for the sake of comfort or fashion.

In book-binding the substitution of cloth for leather or paper is so far an improvement, but not an invention.

Articles of glass, earthenware, &c., may be made of particular shapes to be more suitable for packing, &c., but *their form*, although an improvement, is no invention.

Spinning, weaving, &c., afford a variety of means for producing superior articles, through the medium of the most simple improvements.

Agriculturists, builders, engineers, shipwrights, and manufacturers generally, all adopt, or are aware of, certain improved modes of procedure which ensure good results, being neither more nor less than improvements in their several manual operations.

Printing, the steam-engine, clocks, watches, all remain to us as original inventions. But how altered in four centuries of progress! Printing has led to the invention of new modes of printing; steam to the invention of superior engines and extended applications; and clocks to *a* variety of novel inventions, while these again have given rise to a multitude of improvements.

Let no one affect to despise mechanical improvements because of their number, their smallness, or the comparatively humble matters to which they frequently apply. Few men *make* discoveries, not many produce inventions, and it is to the mass of eagerly-sought improvements that manufacturers owe much of their prosperity in every civilized country.

BOOK II.—CHAPTER III.

OF DESIGN.

A THIRD and very subordinate kind of Invention is classed under the general denomination of Design. Whatever is so constructed as to serve a particular end is said to show design; the plough to break up the solid soil, and the harrow to spread the uneven clods. In the same way the arch shows wonderful design in an arrangement of materials calculated to afford strength. But by *Design* in its more enlarged acceptation we usually understand some peculiarity of arrangement to produce objects having a pleasing, elegant, or ornamental effect, whatever may be the materials employed.

Design is called into exercise in the grouping of statuary, in the general plan and all the details of architecture, and in short in every work of art; it is therefore external, and quite distinct from utility, yet it demands considerable inventive skill of that order which distinguishes the true artist from the ordinary mechanical artificer. The former displays his originality in the most simple as well as in the most elaborate of his works; while the latter operates more like the kaleidoscope, in a limited and mechanical manner, productive only of much sameness in variety.

It is to Design that we owe the plan of a building or a series of buildings, of single chambers, or their decorations. To Design belongs Ornamentation of every kind, in various materials, and in all manner of combinations.

Design may not unfitly be called the Poetry of Invention; it is invention in its loftiest, or its lightest and pleasantest moods, fanciful and fantastical, pleasant and playful, presenting much to admire amidst much that must necessarily be artificial and incongruous.

There are certain lines, figures, and forms that have been accepted as agreeable, beautiful, or perfect, such as the finest specimens of Roman and Grecian architecture, statuary, vases, and various ornamentation; there is a chasteness in design that attains grandeur by its simplicity; and beauty by its delicate association with natural forms.

The most simple Design will be geometrical, as exemplified in the forms of crystals.

Design will be greatly affected in character by the class of work to which it applies,—one kind for the architect, another for the potter; one for the sculptor, another for the painter.

Design may be gigantic, as displayed in Pyramids or Rock Temples. Or, it may limit itself to a tesselated pavement, or the carving of an ivory cabinet.

Design finds great scope in the demand for the printing of paper, or of calico goods, requiring to be decorated with patterns of endless variety and colour. In such works the skill of the designer is kept at its utmost stretch, and yet never goes beyond the interminable compositions and recompositions of the old types of nature.

The designer who is deficient in imagination and fancy may by great application produce tolerable designs, but will seldom compose any work of decided originality or novelty in design.

A fondness for art, for sculpture, for painting, and even for music and poetry, are essential to improve the taste and excite the enthusiasm of the truly great designer, who aspires to produce works of true merit.

Design has been a subject of comparatively modern inquiry, particularly as affording a source of education, for which purpose every class of drawing is studied, relating to the animate or inanimate, natural or artificial, entire subjects or only portions, to obtain as large a fund as possible of ideas of varieties in all manners of forms and varieties of objects in nature and art.

After all, Design is of but limited application. A single work is often intended to produce thousands of copies or counterparts, when the design is an entire work of art. But designs often apply only to a simple portion of a large work in architecture or furniture, and then, however often repeated, it can but be a minor design. It is the same also for castings in metals or plaster. And these employments all unite to afford encouragement to this elegant and pleasing branch of industry.

Design, to whatever it refers, is or can be made the subject of drawing, colouring, or painting; the Design is decided by some such lined or coloured drawing; all beyond being mere execution of skilful workmanship—the design, the form, the figure is ascertained by the drawn design.

The less scope a subject affords for Design the greater is the skill of the artist in producing any novelty. This is especially the case in statuary, in which (whether a single figure, or a group) the sculptor is limited, first, by the main design he wishes to effect; and next, by a

natural desire to avoid common-place, and the charge of being a copyist.

Originality may mark all the products of some great designer, either from singular skill or a prevailing novelty in reproductions of some particular portion, as where children, flowers, fruits, or other favourite subjects predominate; but originality in design must ever be the lot of few; and any over-straining to be original generally ends in puerilities, singularities, and absurditics.

Novelty must ever be a feature in design that attains any reputation. That design which consists of mere reproductions, or is of a composite character, without taste, however fanciful, will never rise above mediocrity.

Design affects so many subjects, grand or beautiful, great or small, valuable or insignificant, that while generalising on a large matter the reader may really have in mind some subject of comparative insignificance. We cannot discuss the design of a temple and of a letter of the alphabet in the same breath, and yet in certain essential points, beauty of design may exist in both; as we see in Nature the structure of a blade of grass and that of the sturdy oak equally regarded.

Design may be direct, or it may be applied. It is direct in painting and engraving; it is applied by the builder, sculptor, potter, and others. But for whatever work the design may be required, it may be effected in mere outline—all else is extraneous, as it can effect nothing beyond enriching, and thereby enhancing the design. That which is not correct in outline can never be improved by shade, colour, or wrought material.

Nothing can excel the beauty of outline in the objects of animated creation. As we never have gone and never

can go beyond these, we must be satisfied to combine them, with some incongruities and distortions, at the risk of growing grotesque.

If it were desired to invent something that never had existed, and was unaided in any line or feature by a single idea derived from natural products, such a design would be *next to an inspiration*, and a certain sign of remarkable genius. Nature is a great original, but when we observe a seal with fur, a quadruped with a duck's bill, a flying squirrel, and insects whose wings appear in size and colour like slightly faded rose leaves, one almost imagines Nature herself exhausted, and obligated to copy from her own abundant stores. How hopeless then must be the attempt to excel Nature.

Design may be pursued *at random*, or on principle. Just as Nature has her laws so must design be governed by certain limitations, which every artist will arrange and apply for himself, and his future success and fame must depend on correct judgment in forming his guiding rules in Design.

Taste in Design depends first on the artist's own mental qualifications; and next, on his advantages in studying the best works and finest designs of eminent masters. A good taste for Design once acquired is never lost, and will characterise every work emanating from its possessor from the highest to the most humble. The skill may be innate, but it must be matured by severe study and labour.

BOOK II.—CHAPTER IV.

OF THE HISTORY OF INVENTIONS.

In tracing the history of any Invention whatever to its origin we may adopt two or three methods. We may commence:—

1. With the earliest state of knowledge in regard to its elementary parts. Or,
2. With the preliminary stages suggesting improvements in the same direction. Or,
3. With the history of the invention, which may be regarded as resulting from such preliminary stages.

The history thus detailed of an invention is not the only process to be adopted, as for all practical purposes the third or last stage suffices to make us acquainted with the actual history of the invention under consideration. The history of printing does not begin with a knowledge of the fact that the hands or feet smeared with any coloured substance impress flat surfaces with their figure, and that savage tribes often imprint the surface of skins with figures of the hand first dipped in some dye. The history of the hydraulic press does not begin with the earliest use of pumps or of screw presses. And so in like manner the history of the steam-engine need not necessarily be associated with a knowledge of hot springs, the Æolipiles of the ancients, or the small steam toys and fountains used as experimental apparatus by ingenious men of science.

Invention, as understood throughout this treatise, is a term restricted to some practical, useful application of mechanics, chemistry, optics, or other science. If we were to extend the term so as to apply to any kind of temporary apparatus contrived for testing some principle in mechanics, chemistry, optics, &c., although of no use beyond the demonstrations necessary to be illustrated on the lecture table, we should encumber our present discourse with uncalled-for subdivisions. Thus we should be driven to call these, *intermediate* inventions, and the products the *resultant* inventions, or by some such distinctive names. But in the absence of any such nomenclature we have no more precise method than that of restricting our language to a definite object—as that of manufactures, of inventions that can be patented, of inventions that are manufactured, of inventions that have a fixed and definite object, giving them a commercial value.

In the history of Inventions we must never lose sight of the uses for which they are designed; and, therefore, however similar two or more inventions may appear, if *the use* of one is decidedly different from that intended for the other, they cannot be said to be alike. If one inventor contrive a toy in the form of a permanent bubble which rises in the air, and another produce a balloon with all its appendages to enable a man to travel freely through the air, the two inventions are distinct in *use*, although bearing some analogy in their outward form. What the one *might* perchance have done, gives him no claim to the achievements performed by the second inventor.

The historian of Inventions, unless he discriminates

accurately between the merits and claims of each inventor in any department of manufactures, will soon find himself lost in interminable difficulties; and the more so the further he traces his annals to a remote antiquity. It too commonly happens that persons unacquainted with this branch of investigation see in every engine, every machine, every manufacture, something to destroy its claim to originality; some copy of an old familiar scheme. They can point to old books and engravings, showing some remote resemblance, and they are at once satisfied that all inventions would prove to be but resuscitated pieces of antiquity, if their history were fully and faithfully investigated. It may be admitted that some few instances might be adduced sufficient to satisfy superficial observers, these being, however, the exceptions and not the rule as affecting modern Inventions. Yet even of the few presumed to exist, it would be found on closer inquiry that they were often shrewd guesses and suggestions, mere inferences drawn by men of enlarged acquaintance with scientific pursuits. We must never overlook, however, that mental musings are not inventions. It is no invention to say that water may some day supersede the use of coal in raising steam by being decomposed and its elementary constituents inflamed;—or, that by means of an archimedean vane on a vertical shaft a light car might be raised into the air, and then propelled forward by a horizontal shaft carrying a similar vane, the whole worked by an electric engine; or, that the use of furnaces and acids might be dispensed with in the production of soda by employing a sufficiently powerful galvanic battery to decompose marine salt.

The historian of an Invention naturally desires to trace back as far as possible all human knowledge in relation to steam, to weaving, to metallurgy, or whatever other branch of industry he may be engaged in illustrating. This course of proceeding is highly interesting and instructive; we see the progressive stages from infancy to maturity of some important art, from the rudest to the most refined productions; from the most meagre appliances to the most complicated machines: abundantly exemplified in the advances made in spinning and weaving.

But on occasions of rare occurrence some novelty comes to light which claims no ancient origin, being the result of recent discoveries of elements or principles in nature which modern skill speedily seeks to apply to some practical purpose. We no longer rub amber on woollen to show the almost magnetic attraction of the fluid eliminated, but employ that marvellous fluid to transmit intelligence to all quarters of the habitable globe, defiant of space, with the speed of lightning. Certain observed discolourations produced by light have originated a means of producing an endless variety of sun-drawn pictures. And while of old metals could only be cast after being first fused in a furnace, we have realized the casting of copper and other metals under water. These and many other recent inventions attest the rapid strides due to the unprecedented encouragement given in modern times, as compared even with the last century, to all classes of men of science, to inventors, and to novel productions tending to enlarge the sphere of human enjoyments in civilized society.

Such then is the function and proper province and

procedure of the historian of the past and present of all modern inventions. What shall we say, however, of the historian of the future? What will he not have to write of the present age, voluminous in recorded facts, and almost surfeited with invention, having every year in store nearly 30,000 patented inventions, independently of an infinitely greater number arising from accumulating lapsed patents! daily increasing the public wealth in free gifts of inventive ingenuity!*

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* Since 1852 patents in England have averaged nearly 3,000 per annum; and, as the term of a patent may extend to 14 years, it follows that every 13 years would show nearly 39,000 patented inventions in store, provided the whole were prolonged to the full period, which, however, does not happen.

BOOK II.—CHAPTER V.

RECAPITULATION, AND SUMMARY REMARKS ON THE FOREGOING OBSERVATIONS.

From what has hitherto been stated it will be observed that commencing with *Theoretical* views we next proceed to *Experimental* investigations, and that these, when successful, lead to some *Discovery* in science promoting our knowledge of the laws affecting natural phenomena.

By means of these mental and practical processes we establish a knowledge of the nature and properties of phenomena and governing principles, which we find capable of numerous practical applications. We may distinguish the first as investigations purely mental and scientific; the other as applications which are useful and commercial adaptations arising out of such acquired knowledge.

Scientific investigations are made entirely with a view to ascertain facts relating to the constitution and operations of matter, irrespective of all other considerations.

Commercial enterprise leads to the applying of all knowledge to its own extension and aggrandisement; it therefore demands the aid of Science to promote navigation, to apply foreign products so as to increase the demand for them, to improve and extend manufactures, and by every possible means to enlarge the sphere of its operations.

Science, as science, has therefore no mercenary provo-

cative to its pursuit ; while on the contrary adaptations of scientific knowledge are wholly governed by monetary considerations. Hence there is a wide distinction between all that appertains to the pursuit of science, as compared with whatever relates to its adaptations with the object of increasing trade or commerce.

When we come to consider Inventions we find that there are two classes : 1st. Those which refer to scientific apparatus ; and 2nd. Those which comprise all kinds of engines, machines, instruments, fabrics, and materials applicable to the uses of man. The first are employed in conducting scientific investigation, instruction, and elucidation ; the second are constructed wholly for trade purposes.

In the present treatise we have had no occasion to particularise at any length the characteristics of scientific apparatus, but have merely alluded to them in order to distinguish their nature and properties from the class of Inventions commercially so designated. The one being inventions of experimental and scholastic import, the other of practical utility in arts and manufactures.

When we consider Inventions, ordinarily so called, we find them diverge from original inventions into new forms or Improvements. It is thus that an original Invention may lead to a hundred or more Improvements; Invention always taking precedence, as it requirs an amount of talent and ingenuity unknown to the mere improver of a great work.

At this stage of our present investigation a most important consideration arises in respect to this class of secondary Inventions, more properly and exactly denominated as Improvements. And in a practical point of

view, as we cannot accord to Improvements anything like the genius or merit of Inventions, yet as they originate from the latter we consider the subject worthy of the attention of the Legislature in reference to an obviously necessary change in the Patent Law. Admitting the right of an Inventor to patent protection for his Invention during fourteen years, surely five years' protection might serve for a mere Improvement. It may be asked, But how would you distinguish an Invention from an Improvement? It must be admitted that not all cases would be equally clear; but provision might be made for extension in instances acknowledged doubtful. Generally they are sufficiently distinguishable. Let us suppose the case to be that of wire rope. The making of cables or ropes of any vegetable fibre other than h might be an "improvement;" but the making of the same without using vegetable fibre, by substituting iron wire, would amount to an "invention;" while any after claim for using copper wire, or other wires, would class as simply an "improvement." In like manner the making of shot for cannon of any metal but iron is of itself no "invention," and yet the substitution of steel, or of chilled cast iron, may prove a great "improvement" over other kinds of metal shot. On the other hand if shot has hitherto been made globular, then elongated, or other forms, become "inventions," provided the change of shape produces a decidedly beneficial effect, in which instance the alteration in form and in the metal used would constitute one "invention." But assuming that one form and one metal have become general, then each slight change afterwards made could only be considered as an "improvement."

There are in like manner many small additions made to engines, machines, &c., only deserving to be distinguished as "improvements," but which the present state of our Patent Law allows to be classified as "Inventions;" and they are very frequently a source of serious inconvenience to the original inventor of a useful and important piece of mechanism.

Without multiplying illustrations, it may suffice for our present purpose to notice the single instance of innumerable patents for "Smoke Burning." In the first place the very professing to *burn* smoke is a fallacy, as at best but a few ounces of carbon are combustible in hundreds of cubic feet of Nitrogen and Carbonic acid gases and vapour; and yet it is pretended to perform this chemical absurdity with positive profit! Wrong in principle, and wasteful in practice, but abundant in professions of efficiency and advantages, the schemes for smoke-burning are sufficiently numerous to induce a belief that their being dignified as "Patent Inventions" is not without its effect on the public mind. When we see in these pretended inventions no novelty whatever, nothing but imitation, a mere mixing and blending of previous patented inventions, with some delusive and useless additions, we feel convinced that we have in this, as in too many similar examples, a sufficient reason for the subdivision of all future patents into those of Inventions for *fourteen* years, and of Improvements for *five* years, more or less. If the evil complained of cannot be wholly cured, undoubtedly the shorter the period we have to endure its infliction the better.

We have classed INVENTION first, as being that stage of mechanical or other arrangement which possesses de-

cided originality of character; IMPROVEMENT next, being inventio in its second rate form; followed by DESIGN, or invention in its third or last degree, which renders artistic or mechanical productions tasteful in configuration and ornamental in themselves, or by suitable, graceful additions; but always apart from any absolute utility, and merely as an appeal to the eye to gratify our sense of the beautiful in combination, colour, size, or figure.

PART II.

THE RIGHTS AND WRONGS OF INVENTORS,

PARTICULARLY AS AFFECTED BY THE

INFLUENCE OF PATENT MONOPOLY,

LEGALLY AND POLITICALLY EXAMINED.

The evil that men do lives after them;
The good is oft interred with their bones.

JULIUS CÆSAR, *Act* 3.

There are persons found to dispute discoveries to which the claim is unexceptionable, and who dishonestly endeavour to cheat the inventor of his hard earned reward. . . . How few persons would be able, like Mr. Muntz, to devote £8,000 to the protection of their property! How many, if they were to venture perhaps their all, would, like Mr. Heath, *surrender their lives in the struggle!* In short it behoves the Legislature to consider if it cannot do more for the men who do so much for their country.

QUARTERLY REVIEW (1859).

One discovery checked, or even retarded, by exorbitant imposts, may cause a greater diminution of wealth, which would otherwise accrue to the nation, than can be compensated by tenfold the gain actually netted by the Treasury.

LORD STANLEY.

PART II.

CHAPTER I.

THE PAST AND PRESENT POSITION OF INVENTORS, ESPECIALLY AS PATENTEES;—THEIR AIM, SOURCES OF ADVANTAGE AND DISADVANTAGE IN TRADE;—WITH CONSIDERATIONS RESPECTING THE CLAIM OF INVENTORS TO A MONOPOLY OF THEIR MENTAL PROGENY.

THE history of the rights and wrongs of Inventors affords a strange mixture of gloom and sunshine, of adversity and prosperity. But alas! the general lot of inventors is sufficiently deplorable. Until a very recent period the embryo inventor was usually stigmatised as a schemer, one who neglected his business, and was by consequence a useless member of society. But superlative talent has at all times risen superior to the most adverse circumstances, stemmed every opposing difficulty, and triumphed over the scoffs of vulgar mediocrity.

The ability and valuable services of inventors as a body were so very indifferently recognised down to the 18th century, that we possess few records to establish their individual claims to our homage. Hence all memory of many interesting and valuable early inventions is entirely lost, but the names have been accidentally preserved to this present time of some few, with sufficient particulars of their secrets, to enhance our regret for that which has passed into oblivion.

Proceeding to the consideration of present times we cannot but inquire,—Which does the Inventor seek most, honour or emolument? Are Inventors recognised most by the Public or by Manufacturers? Has an Inventor any inherent claim to his invention as a disposable property? Is a Patent as at present granted what it purports to be?

These questions very naturally present themselves, but before entering on them let us consider whether the Inventor benefits society? Many might like to meet this inquiry by candidly acknowledging that to the present time invention had worked wonders, wonders so great, astounding, and multifarious, that breathing time was requisite to keep pace with the tide of invention. Or, in other words, that our indebtedness to inventors was so large that we could now afford to stand still for a considerable time to work off our vast possessions. That in fact there was already a plethora of invention, and that society could go on very satisfactorily for a long time without any further mechanical improvements. The inventor who meets with this class of disputants has little to hope for in *that* quarter.

That the Inventor has benefited society no one doubts, but some men may be quite prepared to question the degree of that benefit; and each (according to his own private interest) desires to see no further progress for some years in his own branch of business operations.

As regards the Inventor himself, he has commonly honour and profit in view. He is rightly proud of his invention, for it is something to be proud of, to stand alone in creating a new manufacture, or greatly improving an old one, and thus benefiting oneself, and

throwing employment into the way of thousands of the working classes.

But undoubtedly there is no eminent inventor who is indifferent to the commercial value of his invention. Whatever may happen to the contrary in isolated cases, the stimulus to the majority of inventors is the expected golden harvest to arise out of their labours; and very properly so: it is a perfectly legitimate expectation, deserving of all esteem and protection. The Inventor who benefits society may honourably expect the reward of his labours crowned with success in a new and untried field of enterprize.

Whatever other desires may occupy the mind of the Inventor, he never overlooks his primary claim to pecuniary consideration for the changes and improvements wrought through his means. The great stimulus to invention is the desire of recognition and reward. And if disappointed, the inventor justly feels himself more or less of a martyr in the cause he had espoused.

As to patronage in the sense of the amount of support obtained by an Inventor, it is evident that the manufacturer takes precedence of the public, although without public approval of the patented article its monetary value to the manufacturer could not exist. But a complete answer to this part of the inquiry cannot be given without considering the several cases of patentees—viz.:

1. An inventor may work his own patent, and also licence the use of it to others;
2. Or, a Manufacturer having a patent, which he finds to be of service to him in his own business, may reserve its use to himself,

and refuse to grant licences, except on prohibitory terms;

3. Or, an inventor may dispose of his patent altogether;
4. Or, an Inventor may dispose of his Invention, leaving others to patent it;
5. Or, an Inventor patenting his invention may dispose of the whole or part of it,—or, of the right for particular districts or countries;
6. Or, an Inventor may arrange with one or more independent individuals to trade for the benefit of all in a single patent.

Therefore an Inventor may really e that patronage which leads to his good fortune to one or more private or business persons; but in strictness such persons after all only change places with the Inventor, and they must make an appeal on their own behalf to public patronage for encouragement in the new undertaking.

There is a great difference, however, between the inventor of a new machine, or new manufacture, and the writer of a poem or romance. The new manufacture is patronised solely for its intrinsic value; it is no particular recommendation to state to the public with with whom it originated; the most brilliant talent, or the humblest acquirements, may have invented it, if its promised advantages are realized in its practical employment. Indeed, the character of the inventor has so little influence in mechanical matters, that he may long lie neglected, and should his future necessities demand a public appeal he might seek in vain a sorry pittance; for, however well known to the "public" of manufacturers with whom he may have been associated,

the great outside "public" may scarcely recognise his name. Not so with poems or romances, or any works of literature or pictorial art; they are seldom esteemed as being valuable while they remain anonymous, their value increasing with their merit, if afterwards their paternity becomes authenticated. We have consequently no popular inventors, properly so styled, although there are many who are successful, and whose reputation for success would command attention to any invention they might choose to bring before Government, or before manufacturing concerns.

It may seem a paradox—but it is no less true—that Inventors' patrons are among their most inveterate opponents.

This is partly to be explained by the somewhat remarkable fact that Inventions, more frequently than otherwise, come from men disconnected with the trade to which they appeal for patronage. And it is inherent in human nature not to think favourably of the worker in a new branch in which he is at best a novice, who sets his short experience against the life-long practice of old institutions. This common prejudice may never altogether die out. The old leaven is likely to cling to manufacturers from generation to generation. But whenever a change shall be effected, and the manufacturer persuade himself to believe that by study, leisure, and the bringing of new ideas to bear on an old operation, some valuable practical result may follow at the hands of an apparently very humble and unlikely individual, then, and not till then, will the path of the inventor be spread with more flowers than thorns.

On entering upon any new pursuit designed to

work a change in long approved routine, Inventors have always had to struggle against prejudice; and but too frequently against opposition of a base and most unjustifiable character. Fair discussion is at all times not only allowable, but rife with good consequences to every one interested. Derision, however, proves nothing; and those who deride most have too often only worse weapons in reserve. We can now boast of gas and of railroads as inventions of incalculable benefit; yet we are apt to forget the forebodings and oppositions they met with from our forefathers.

Two causes may account for this apparent anomaly. Firstly, the Manufacturer is aware that if the improved process is to supersede the old, his large property in machinery will fall immensely in value. And, secondly, however wealthy he may be, his good fortune is the result of successive years of close application; whereas, on the appearance of the promised novelty, he foresees that, if encouraged by him, he may be called upon to raise the inventor until he becomes the richest commoner in the land; or, if not quite so extravagant, that he at least must soon place him in a very enviable position as compared to his own. In the midst of this conflict of opposing views, his common sense dictates to him that the proposed innovation may prove ruinous, or certainly very troublesome to him; and finding many others to join him in his own way of thinking, the result, from the majority of men so minded, cannot prove advantageous to the inventor's hopes and aspirations.

But some few among a large and enlightened manufacturing community may see early that their true course is to make some conditional terms, whether afterwards

carried out or not. It is fortunate for the Inventor who meets with such desirable practical aid, even though much below his own expectation, which perhaps arises from the different grounds adopted by each, rather than from the wish on either side to take any undue advantage.

Another source of difficulty and trouble arises from the infringers of patented inventions, a class of men whose sense of moral rectitude is measured solely by legal enactments, in the reading of which they take ample latitude to excuse their nefarious practices. It is hard enough to have to deal with a single individual of this highly censurable class of the manufacturing community; but when several unite to assist in the same nefarious practice, such a combination, when carried out to destroy an inventor's property in a patented invention, demands legal interference as much as a combination of persons to rob him of any other kind of property. The laxity of moral feeling, however, among interested persons, when an invention is to be obtained by any artifice whatever; or when the use of it is desired, but an objection raised to the charge made in the way of royalty, is quite unaccountable. This vicious system, however, obtains among men who, ranking as wealthy and honourable, would be shocked at the idea of actually taking a single shilling from the inventor's pocket, although by trick, or by combination, they filch an absolute fortune as regards prospective advantages too often alienated by such means

But Inventors have not unfrequently themselves to blame for ill success and downright loss. Few men are more sanguine; and it is only when, with insufficient

means, they have set about securing to themselves the immense property that they could never doubt awaited them, that they have sighed for the assistance of some capitalist and man of business. Their little all may have been carefully sown and watched, but an adverse season setting in, they have probably reaped nothing but loss, poverty, and vexation.

The success of one Inventor often brings loss on hundreds of other Inventors, who comparing individuals, and not the genius and prudence that raised a fortune out of a combination of happy ideas leading to the improvement of an important manufacture, recklessly rush into the same arena, expecting equal laurels and aggrandisement to their utter discomfiture.

An IF attends every new invention. *If* it should not be superseded; *if* it should answer; *if* it will satisfy the public; *if* it will continue in use at its present price; *if* it has not to incur the expenses of a chancery suit; *if* the patent is valid; *if* the consumption increases; and so on. But these unstable aspects are seldom considered, except by those who are most interested in the final gain or loss.

The Inventor, knowing his patrons, and that the course of inventions is not one stream of success—knowing that law alone can, at present, settle the soundness of a patent,—and that the most sanguine inventors have failed of ultimate success, even under advantageous circumstances,—should well consider his own position before he blames the Government, or the trader. Equal protection is requisite on both sides; the Capitalist brings a certainty, the Inventor an uncer-

bility, in a trade point of view, until fully tested; and needful caution has, therefore, to be exercised by each.

But—Has an Inventor any inherent claim to his Invention as a disposable property?

It has never been disputed, until of late, that what we may give or retain, is decidedly a personal and disposable property, and has been admitted to be such from an early period of our own history; and is equally so admitted in every civilized country. Indeed such right to our mental possessions is not questioned with regard to Literature and Art, in which the man of letters and the artist are equally protected by copyright; a course which has been of late years extended to the more design or configuration of articles of manufacture.

Assuming, for the more sake of argument, that Inventors were without patent protection, what would be, we may ask, the character of their Inventions? The unprotected Inventor would be solely dependent on some munificent patron. Thus the Government might take him under its special charge. But in that case his inventions must be for matters solely required by Government. For other inventions the nobility or gentry might patronize him. But such cases do not comprehend the large body of inventors, who could scarcely hope to participate in similar advantages. And even the wealthiest sole manufacturers of a novelty, unprotected by a patent, would, so soon as they had brought it to perfection, and fully developed its capabilities, be outstripped in production by the various manufacturers throughout the country taking advantage of the experience thus afforded them.

Still there would be another resource for a certain

class of the unprotected Inventors. They might, if sufficiently supported by one or more capitalists, work in *secret*. All their machinery would have to be kept secret; no one would be allowed to become aware of its precise construction, nay, any deception that could be practised would be adopted; and the very buildings be so contrived as to keep different branches from having intercourse. Apply this scheme of *secrecy* to the working of the Jacquard loom; or, to Fourdrinier's paper-making machine; or, to Nasmyth's hammer; or, to the manufacture of Bessemer's steel; and then its absurdities and difficulties, not less than its dishonesties, must become abundantly apparent.

But if Inventions could be worked in *secret*, it is clear that we should only change the *mode* of monopoly, while the scale of operations would at the same time be very limited; and the large mass of inventions would still be without the pale of such unworthily obtained and hazardous protection.

A nobler plan, however, is yet in reserve! Let Inventors publish their Inventions, and trust to the generosity of the influential body of grateful manufacturers for compensation on any scale they may determine! Such a proposal is Utopian enough, and, however sanguine Inventors may themselves be, this scheme, suggested by Sir W. G. Armstrong, is one that we venture to assert would have the smallest possible stimulating effect on them. Invention might not, and probably would not, quite die out under all the chilling influences enumerated, but the present system of patent publication would be superseded by an obsolete kind of publication, on the model of such Inventories as were

issued from the 13th to the 17th century, and even later; announcing wonderful and sometimes incredible discoveries, inventions, and improvements, by men who probably sought thereby to avoid incurring the excessive patent charges of early times.

Should the Inventor feel alarmed lest some design is contemplated to his disadvantage, in any propositions against patent monopoly, it may be gratifying for him to learn that the proposal comes not from his adversaries, but from his assured friends! Their argument is, that he is too vigorous, too active, too productive in invention, and that his inventions entail loss on himself and his family. Misery, unmitigated misery, attends the inventor; his path is beset with "chimeras and hydras;" he is in danger of "a very slough of despond" (says one learned professor),* and there is no safety for the future generation of inventors but in making a clean sweep of all patents. Then the path of inventors will be safe and pleasant No more fortunes will be lost, while many will be saved. Inventions will (it is said) go on notwithstanding. There will be no lack of them, and no want of encouragement for such inventors as

* The Rev. James E. T. Rogers, Professor of Political Economy in the University of Oxford, read at the meeting of the British Association at Cambridge, 1864, a Paper on "Patents and Copyrights;" he also read a second paper on the same subject at the Association's meeting in Birmingham, 1865, of neither of which was even an abstract published in the Society's reports. In his first paper he admitted the legitimacy of copyrights, which opinion his second paper appeared mainly intended to correct for the sake of consistency. Professor Rogers maintains that, if patents for inventions are right, we should also protect by patent the discoverer of a gold field, a stratum of coprolites, or a system of education (such as that of Bell). To such inconsistencies are impracticable men sometimes driven to support a false position.

deserve it. Believe it who can. A more improbable fiction was never framed.

It is assumed by some that there would be as much invention as ever even in the absence of any protective laws. This is not altogether a false theory. Invention will, no doubt, never entirely stagnate, but it will materially alter in degree. As an illustration derived from experience (which any one may test) if we divide the present portion of the 19th century into two periods of 33 years each, we shall at once see the wide difference there is between the character of the first and the second moiety. And if again we divide the last 33 years equally we shall find that the last quarter of what has passed of the present century outstrips the previous three-fourths both in the character, number, and importance of the inventions patented.

The alarmists who would become destroyers of patent protection form a class which may well rank with the bygone destroyers of machinery. The patent, like the machine, places at our disposal labour-saving processes, increased supply at diminished cost, and with articles of consumption both cheaper and better in quality than those previously known.

Some pretend that the most common and ordinary materials are patented, whereby a decided stop is put to improvement, unless such improvement is in the hands of the alleged patentees. The complaint is untrue, because no known or ordinary matter can be the subject of a patent. It is assumed, however, for example, that India-rubber and Sulphur are so well known that the patent monopoly of their mixture prevents any one but the patentee from manufacturing Vulcanized India-

rubber. Where, we ask, would have been any knowledge of the result dependent on such mixture, had patent law not existed? Thus considered the argument falls to the ground at once. But to some minds every invention that relates to common things is trifling and insignificant. We have patents for blowing hot-air into blast furnaces; and for blowing air through a body of molten iron! But those who oppose patents as a vexatious monopoly only go half way in their inquiries; they content themselves with a superficial view, and never take the trouble to ascertain the true and legitimate bearing of their arguments which are both unjust and impolitic. If inventors are not entirely secure from plunder in the very face of Patent Law, by what other means could they hope to establish their rights to their own inventions, or to reap any reward for their labours from that most querulous "public"—the "public" of manufacturers? On what principle would the opponents of Patents induce Inventors to believe that non-protection is superior to Patent Law?

The most uncompromising opponents to the protection sought by Inventors are men who have no sympathy with the latter, who are themselves incapable of mechanical or other invention, and who hold inventors and inventions to be matters of course. With them it is the progress of society that gives birth to both, and they cannot bring themselves to believe that invention precedes that progress which all, justly admiring, wish to encourage. Was it progress in the art of Caligraphy which led to the Invention of Printing? or in the employment of water, wind. and animal power, that led to the

Invention of the Steam Engine? did the refinements in Metallurgy lead to the Invention of Jordantype or Electrotype? Or was it the Invention of Printing, of the Steam Engine, of Electro-Metallurgy, that spread intellectual cultivation, enlarged manufactures, increased intercourse between nations, and added a new art to that most ancient one of Metallurgy? The dependence of one on the other no one can deny; nor can we doubt that although progress may give, as it naturally does, a spur to inventive genius, it is from the influence of that genius that progress takes another impetus, and like the stars of heaven, beams with a benign influence on the face of the entire civilized world.

To men incapable of distinguishing what encourages inventive talent from what does the contrary, it might be useful to direct their attention to Art, and enquire why cathedrals are not built as of old, or even finer and larger? Why are Scripture and Historical subjects less the object of artistic ambition among painters now than formerly? The reply is that the taste of modern times is changed, that encouragement is wanting for such works; and that, in the absence of the requisite patronage, skilful architects and artists employ their abilities in other directions. Just in the same way, Invention in the mechanical arts, unless nurtured by proper protection, must droop and decay, although, in some matters, Invention would undoubtedly occasionally show itself.

The public has nothing to gain by abolishing the patent monopoly.* To manufacturers it might be of some

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* On the subject of patent monopoly we would direct attention to the *following remarks; first of Jeremy Bentham, who says:—*

"There is one species of privilege certainly very advantageous—the

advantage for the next twenty-five or fifty years, if the monopoly were disallowed, because they would have fewer conflicting interests to contend with, arising out of proposals to introduce strikingly new inventions or improvements into their works. If *their* case is one of imminent danger, if a few suffer damage in consequence of new inventions giving encouragement and employment to a new set of workers in any old field of industry, it may be worth the consideration of the Legislature whether such particular manufacturers are to be respected and protected for their early acquired fame in any branch of trade, to the exclusion of smaller capitalists, who are ready to enter upon new and more beneficial modes of production, and who are unencumbered with unwieldly machinery and overgrown establishments!

We now turn to the other side, to find what may fairly be advanced in favour of granting to all mental

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patents which are granted in England for a limited time for inventions in art and manufactures. Of all the methods of exciting and rewarding industry, this is the least burthensome, and the most exactly proportioned to the merit of the invention. This privilege has nothing in common with monopolies, which are unjustly decried.

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With respect to a great number of Inventions in the arts, an exclusive privilege is absolutely necessary, in order that what is sown may be reaped. In new inventions, protection against imitators is not less necessary than in established manufactures protection against thieves. He that has no hope that he shall reap, will not take the trouble to sow."

And secondly, of J. R. M'Culloch, who observes:—

"The expediency of granting patents has been disputed; though, as it would seem, without any sufficient reason. Were they refused, the inducement to make discoveries would in many cases be very much weakened; at the same time that it would plainly be for the interest of every one who made a discovery to endeavour if possible to conceal it."

products in natural and physical science, rights equal to those accorded to literature and art.

It might be advanced in opposition to this kind of protection that Architects are unprotected for their plans, and Ship-builders for their models, however beautiful in design, and however successful when completed on the large scale. But the design of a ship or of an edifice is mainly intended for a special work, and is compensated for in the work thus obtained. Besides, not only does no one seek to adopt the precise designs of either class of architects; but if they came within the provisions of a certain act, their decorative and ornamental portions might be Registered, and thus secured to the designer.

But the argument would lose its force for vant of sequence. The cases are totally different. Edifices and vessels are not each built on such novel plans as to give scope for exceedingly original designs; besides which no plans are accepted from any other than experienced designers—men whose education has peculiarly fittd them for the execution of that particular kind of work.

Among the different classes of patentees of invention, we may especially notice :—

1. Men holding Government situations, whose improvements apply to ordnance, ship-building, &c., and may have reference principally to naval affairs, and b of little other use. Under these circumstances the patentee might be satisfied to consider as compensation an official promotion he might obtain at home; and onl employ his patents in obtaining royalties abroad.

2. The servant of a public company, as when a railway manager, favoured by his position, obtains experience and institutes experiments, he may be content wit

his employers raising his salary, or granting him a comparatively moderate royalty; reserving to himself a greater advantage from other establishments desiring a licence under his patents.

3. A manufacturer, who may introduce some invention of his own into his engineering or other concern, and by working his own patent, obtain ample remuneration in the price obtained for his patented engines, machinery, tools, &c.

4. Or a private individual may be brought into connexion with men of business who simply carry out his patented invention in their own works for a fixed consideration, in the name of royalty. And such a patentee may, in a similar manner, grant licences to many other persons similarly situated.

To minds unacquainted with the impulse given to Invention when Inventors feel the confidence produced by possessing a legal claim to the results so produced, Inventions appear as natural, obvious, large or small matters. With them an Invention is only an alloy of metals, only some particular use of atmospheric air, only this, only that; and yet such depreciating views of invention may exist in very cultivated minds, in the minds of men who devoutly honour poetic invention in Homer or Virgil, in Shakspere or Milton. The practical invention of the mechanic is trfling compared with the fanciful product of the poet! As regards protection the cases differ. The author seeks no patent, the Inventor has no other protection but such as a patent affords. The author's publication is his copyright. You must not copy his title-page, or his book, or any considerable part of them without first obtaining his

authority. But to render the cases parallel, we must suppose some strangely romantic circumstances at present unknown in literary history. We must assume that an author, A, having lent his manuscript to a second person, B, to negotiate a sale, to read for approval, or for any other purpose, B, being thus in possession; issues such literary production as his own work. Or suppose that B had merely the reading of the MS., and having read, had copied it; or, again, suppose that B having only heard it read and never having had possession of the MS., by mere force of a retentive memory, reproduced the literary work in question, which he thereupon presumes to print and publish as the mental product of his own mind: the author, A, would stand in a very similar position to that of an unprotected inventor; with the difference that, though protected by a patent, some one might spring up either having or not having a patent, yet surreptitiously using, and pertinaciously claiming to have full right and title to the Invention of either the protected or unprotected Invention. When protected by a patent such an invention has a remedy at law. But the Inventor who is plundered of a *secret* invention finds himself utterly helpless. A literary man might be anticipated in the title of his book, but never in the subject-matter in its integrity. His manuscript might be lost or stolen, but the recovery of it by any other than the actual author would not give the finder or purchaser any shadow of right to publish as his own production the literary labour of another. In the case of Invention the matter is not equally manifest, and unfortunately there are many men who would *not* dare to steal an inventor's models,

but who would feel little or no compunction at rendering all his trouble, expense, and anxieties nugatory, by at once proceeding to patent his invention for themselves, or to damage it for future protection by immediate publication.

Men who are not themselves Inventors judge very inconsiderately and harshly in respect to inventors, considering them as a class much over-rated in the scale of being. They are looked upon as artisans, as workmen called on by the necessities of the times to work out schemes which are sure to arise when there is a public demand for them. They imagine perhaps that some such theory accounts for the steam-engine being invented, forgetting that that mighty power was evoked more than half a century before it was in the smallest degree appreciated, a whole century before it came slightly into use. It was an invention in advance of the age. Gas illumination was derided even by the greatest chemist of his time, because it also was in advance of the age. Railway travelling created the greatest doubts among statesmen, and was a doubtful speculation among capitalists, for it also was in advance of the age. And it is thus that enlightenment, or in other words progress, follows on the heels of all great inventions.

The protection given to Inventors hurts no one, and at the same time benefits the revenue. If there are foolish patents, there are also foolish books; if worthless patents, so likewise worthless books; if ruinous patents, so equally ruinous books and publications. There is no folly that an inventor may not chance to commit as well as an author. But when was the legislature ever appealed to for the withdrawal of copyright protection

to prevent the lunacy with which Pope and other wits have charged authors?

Patentees may at present possibly be censured for exorbitance in their demands, but excessive value is only a sign of prospective advantage; and it is better to have such advantages in view than to remain at a dead level of unvarying equality. If every article, every matter, every thing to which we could turn were the subject of some patent or other, the more evident would it appear to the mind of every intelligent person that inventors were the most active portion of the human race, in cheapening, improving, and extending all the necessaries and luxuries of life. Thus, whatever may be the apparently just censures on patents by *manufacturers*, it is proved by results that the general public at least are gainers by the amount of encouragement even now feebly granted by the Government to inventors through the medium of patents; although there are interested, disappointed, and selfish men, who would willingly abolish this protection to gratify personal pique, without being able to show in evidence a single substantial public advantage.

While viewing pa[illegible]ts as a monopoly, let it not be overlooked that it is the monopoly of something that was previously a *secret*—some hitherto unknown process—some entirely new manufacture—some matter or thing greatly to be desired, if at all equal to the representations made of it by its inventor. What can society lose by such a monopoly? Or rather what may it not gain? It is promised to cheapen some product of large consumption; by cheapening the process the demand is

increased; and by such increased demand, new and enlarged manufactories are brought into operation.

Lord Stanley has very justly observed in his pamphlet, "On suggested Improvements in the Patent Laws of 1852, 1853," published in 1856, that "Monopoly, *per se*, is an evil: it is an evil which we submit to in certain cases, because, without it, *invention would be checked;* but being defensible only on that ground of general advantage, it becomes a wrong where no such advantage ensues." And again, that, "To create a monopoly is an exceptional process, justified, as I have said before, only by the novelty and utility of the invention patented."

It is very true that many Inventors have been disappointed by their theories not being realized in practice, or by unforeseen difficulties and impediments; and not unfrequently by the casualties inseparable from all human transactions, deficient capital, disputes, and legal processes. But such misfortunes are contingent on business operations in all departments. All bankers, merchants, professional men, manufacturers, and traders are not equally prosperous; but who maintains that trade losses are a reason why one or the other should be refused admission on 'Change, any more than unsuccessful patentees should be held up to scorn as examples to prove the fallacy of patent protection? A patentee's misfortune is more often the mere trader's misfortune than otherwise, and ill success in either instance is no evidence that one or the other experiences more than the common fate of wanting capital and connexions.

An invention may be perfectly correct; it may be highly commendable and useful, and there may not be

a shadow of doubt as to its commercial value; but the inventor of a *good* invention, may provide himself with a *bad* patent specification; and if so, he must take the consequences on himself arising out of any mis-statements or omissions. Many inventors complain of the infringements to which they are subjected, and of other patents for similar inventions. Why should there be so many patents for sewing machines? To answer this briefly, but yet imperfectly, much of this multiplication of patents arises from the inventor not having at first fully and completely specified all he was cognizant of as pertaining to his invention. Every inventor at the outset considers that when he possesses a novel invention he stands alone, aloof from competition. But if any one has more just cause than another to complain of patents it is the patentee who finds himself in the midst of many competitors for the honour which single-handed he had claimed, and to which his enlightenment of others has led the way to many vexatious impediments. The good or evil fortune of a patentee, therefore, depends very much on his own prudence in not making public an immature invention, in fully and completely and comprehensively explaining his object and claims, and thereby leaving to others the narrowest possible opportunity of becoming competitors in the same enterprize.

Some persons have a very mean, depreciating opinion of inventions generally, and of patented ones in particular. With them all invention is the result of necessity. If the Romans had had mines, and mining had been general in the early ages, the steam-engine would as a consequence have been invented! This condition is always assumed, although in contradiction to historical

facts, which abundantly show that inventions anticipate the demand, and are seldom—if ever—its result. So much is this the case, that frequently one of the greatest obstacles to the progress of a patented invention arises from its coming before its time, thereby creating all kinds of prejudices. Railways were often pronounced to be ridiculous, and certainly dangerous; the proposed speed of travelling twenty miles per hour was laughed at by senators of the present century; and many ingenious mechanics believed that the rails, instead of being smooth, would have to be serrated, or like a rack, toothed throughout their length! No invention has been too great or too humble to escape the censure of the ignorant and prejudiced; indeed it has usually happened that opposition has increased in proportion to the importance of every proposed innovation. But times have so greatly altered, that we are nearly becoming converts to the opposite opinion of believing all things to be possible without taking into account the adverse circumstances which may be reasonably expected.

After all, what is the valuable matter about which we are contending? Is a patent as at present granted what it purposes to be?

Every patent subjects its possessor to the risk of encountering legal proceedings to contest and prove his right. And no patent is of much value until it has sustained the expenses of a heavy Chancery suit. But it is the unenviable privilege of patents of little or no value to keep out of court, unless indeed forced into it by the overweening vanity of patentees possessed of more than ordinary vanity and courage, or who find dupes to support their obstinacy.

A patent granted to an Inventor differs widely from a patent of nobility, the one being disputable, the other indisputable. An Inventor's patent is granted to him on the grounds that he is the true and first inventor, that he describes his invention fully, and that, if needful, he furnishes an exact drawing of his mechanical arrangements. But he is otherwise helpless. He has a property without enjoying absolute possession of it, and the next man that he meets, if richer, may deprive him of it, or attempt to do so, if he chooses. This is a hard case, and might be remedied, if not altogether perfected. The evil would be materially lessened if patents were submitted to a committee legally constituted for the purpose, even though such a process might be optional, and be the occasion of additional expense. It would be something to know that, after undergoing such a process, the patent was, at all events, *bona fide* property. If some such system had early become constitutional, it would by this time have been so systematised as to have become a recognized and easily manageable institution; at present the Government would unreasonably imagine all manner of difficulties to surround such an obvious and rational measure. No one doubts the tricks and chicanery that are attendent on great patent law cases in our Courts of Justice, and yet no active measures are adopted to lessen the evil. A fortune has very often to be spent in law to realize a fortune through the medium of a patented invention, which could not occur under any system with a semblance of justice in it. In the case of a patent trial, science itself appears a very Janus in Court, and the whole legal process seems like a case of life and death between rival

patentees. All this mockery of justice and mere parade of scientific knowledge might be avoided by some more judicious mode of granting patents in the first instance. A committee of examination would be one means. But a patent might graduate, and undergo examination, at the end of six, nine, or twelve months (or even later, if it appeared desirable to the patentee), in order to decide its right, either to confirm its acceptance, or its being decisively annulled.

In not being all that they might be, patents partake of the weaknesses of all political measures, in abounding in errors and imperfections, the remedies for which have perplexed legal and scientific advisers, until the subject has assumed a character of acknowledged difficulty. Instead of venturing to set an example, we inquire into the practice of America, France, Germany, and other countries. Why not at once make patent grants of progressively ascertainable value, as suggested? Why not allow them to pass an authorized ordeal before being fully and completely granted? And why not even require an income tax on their produce, in return for rendering it unnecessary to litigate their validity as at present, and in liquidation of the extra process that might be incurred? When settled thus, after sufficient time allowed to all interested opponents, a patent certified and sealed should be as clearly evidence of the right in an Invention, as are the deeds of the landowner of his right to his possessions.

Before quitting this branch of the subject we would suggest a scale of years dependent on the nature of the Patent, distinguishing the original novel schemes, significantly and correctly called INVENTIONS, from the class

flowing from them, which are properly designated IMPROVEMENTS; giving to the first protection for *fourteen* years, and to the second protection for a term not to exceed *five* years; but with power to extend such shorter period should it appear that the presumed improvement, on further consideration, was found worthy of taking place as an Invention.

Under judicious management patents would soon bear an established value, and useless patents would speedily die out. The patent of moderate value would not be overburdened by excessive fees, or still more excessive legal charges. And patents of princely value would pay the State, over and above the comparatively trifling office fees, an annual income, which, nevertheless, would fall far below legal charges incurred at present. By these or some such means the Government might render an inestimable service to society: placing the rights of the manufacturer and the patentee on a surer basis than at present, and eventually giving a healthier tone to the system of patenting Inventions than that which obtains under the existing Patent Law.

CHAPTER II.

CRITICAL EXAMINATION OF A LEADER ON PATENT MONOPOLY IN *THE TIMES*, 6TH FEBRUARY, 1863.

THE circumstances arising out of a recent action brought by a patentee against the Crown, for alleged infringement of patent rights in respect to certain improvements in iron shipbuilding, has called forth a leading article in *The Times* on patent right monopoly. The writer argues, or, more properly, declaims, against this kind of monopoly, considering patents as rather obstructing than promoting the industry of the country. It is certainly admitted that inventions of considerable importance should be rewarded; but rather by the Government than by the public.*

We shall consider the several statements in respect to this subject separately, as stated in the article in question.

It commences by observing:—"The great discoveries we should still be content to see protected as a property;" and, in contrast to these, alludes to "the little tricks and contrivances which, when they acquire the character of a property, become insufferably vexatious"—to some party or parties not named.

With regard to the "great discoveries," it is admitted

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* See the *Engineer*, 13th and 20th February, 1863.

that, "If a man will give us a new motive power, and enable us to drive our ships against wind and tide, without encumbering them with iron-work and fuel; or if from some cheap and plentiful material another man will manufacture for us some new metal which shall have the ductility and endurance of gold, and tenacity of copper, and the hardness of iron"—What then? Why, says this liberal critic, "We are quite willing that such public benefactors should have a monopoly of their inventions, until they become richer than the princes of the earth."

On the other hand, with regard to "the little tricks and contrivances" of those inventors ranked second in this category, it is remarked, "But if a man merely applies some common rule of mechanics to some use to which it does not happen to have been applied before; if he merely works out a problem which would be obvious to any one if the result to be sought for were once demanded [?], then such a man claiming a property in what he has done, so as to prevent others from doing what their common sense [?] would have prompted, is but an impediment and a nuisance." But how, or why a "nuisance and an impediment" we are not informed. Besides, the writer falls into the common error of overlooking that great and remarkable, as well as lesser, inventions come unsought for, but opportunely.

The article then proceeds to class Archimedes, Galileo, and Newton, as "great inventors," a class which has never been "induced to make discoveries by reason of their hope of patents." But still keeping in mind the second class, with their "little tricks and contrivances," it asserts, "Whereas there are at this moment several

thousand 'inventors,' who, pretending to have found out a new cut for a flannel jacket, or a cotton shirt, or a new way of whipping eggs, or putting coals on a fire, or making a cab open behind, or an omnibus before, or milking a cow, or sweeping a street,* or cutting a turnip, infest every step with their pernicious pretensions to warn everybody from ever [?] doing what these 'inventors' have never once done." [?]

The article professes that the case just decided in favour of the Crown, which terminated on the 6th inst. in the Queen's Bench, "has revived the feelings very prevalent a short time since as to the inconveniences of this system of squatting [?] upon the open heath, where all men ought to be able to range free."

After fully stating the case thus tried, it is observed: "Our object in pointing attention to this case is to mark it as a new instance of the mischievous tendencies of the present system of patents and registered inventions. We believe the *public* mind has been long made up on this subject [?], and the matter is, therefore, ripe for legislation."

The Times' view of the subject is very decisive:— "Our opinion is that the best course would be to sweep away the whole system altogether, and to reward really great inventions, which have not proved remunerative to their inventors, by a vote of public money." Or, at all events, "let us at least get rid of all those petty and vexatious monopolies which render every novelty [?] in design or manufacture unsafe, if not impossible, and

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* This seems to be aimed at Mr. Whitworth's most ingenious patented contrivances.

every step out of the beaten track a danger." While hoping to see the country delivered "from this nuisance of petty inventors," it is asserted, "If these gentlemen (the petty inventors) had their own way, we should not be allowed to eat, drink, or sleep, except by paying them for permission to use their patents;"—a sentence difficult to understand, as inventors *can* patent what invention they please. Anything more illogical than the statements here made can scarcely be imagined, and it seems almost impossible that they can have proceeded from such an organ of public opinion as *The Times*.

The first remark alludes to "great discoveries," which must be taken to mean great inventions, the authors of which, according to the opinion advanced, must be almost alchemists, or something more, in dealing with metals, and the propulsion of vessels; such men alone are considered as being entitled to benefit by patent monopoly. But in the event of the proposition "to sweep away the whole system" of patents being adopted, it is generally suggested to "reward *really great* inventions, which have *not* proved remunerative to their inventors, by a vote of public money." It is argued, 1. That great inventors like Newton, never expected patents; 2. That great inventors deserve patents; and 3. That, patents for inventions generally being abolished, great inventors would deserve Government aid; provided always, that a grateful *public*, rid of the patent "nuisance," did *not* sufficiently remunerate the "great inventor" by their patronage of his invention. The possibility of such a contingency is by no means disputed; its admission only shows the weakness of the case, as *public* aid can only come indirectly through the manufacturer.

The writer surely cannot mean to assert that great inventors never take patents (such men as the Marquis of Worcester, Watt, Arkwright, and others); and he can scarcely assume that it would be prudent for great inventors to look rather to the public purse for the reward of their ingenuity than to the community they immediately benefit.

But the writer's main business is with "petty inventors;" "great inventors," he evidently conceives, will take care of themselves—it has always been so. It is "the little tricks and contrivances" he wishes to abolish: he is for Patagonian Patents, and not Pigmy Patents.

The inventor who applies "some common rule of mechanics," or who "merely works out a problem" apparently obvious, that is with the proviso, "if the result sought for be demanded," is severely denounced. What mechanical invention is devoid of some "common rule?" and why is it, therefore, to be despised, as the production of a mere "petty inventor?" And what inventions, we should like to know, arise from a demand for them? What agriculturist ever asked the "petty inventor," or any other inventor, whether he could improve his ploughs or other implements? Hardly one invention in a thousand is owing to a direct demand to solve any "problem" whatever, made by a second party. Yet we are now told that such inventions occur in patents, and prevent "others from doing what their common sense would have prompted." Such a statement is simply ridiculous, applied as an argument against patents; and, moreover, is not true, as a matter of fact, between inventors and consumers. It is necessarily unsupported, because it is

false as affecting the great body benefited by the introduction of patented inventions, who have the option of using or not using them, and who are seldom themselves inventors of the machines they employ.

By afterwards confounding, in the same enumeration of assumed inventions and designs, the two very distinct classes of monopolies, namely, patented inventions and registered designs, some confusion is created in the mind of the reader. If a patent is of any use whatever, it is as good for a small as for a great matter. It is admitted that great inventions deserve patents; while all others are denounced as "little tricks and contrivances"—such as machines for "sweeping a street, or cutting a turnip," of which the critic says they "infest every step with their pernicious pretensions." Again, we are without a clue to any evidence whatever, and again we must declare such a censure most groundless. The "pernicious" part is pointed out as being the effect "to warn everybody from ever doing what these 'inventors' have never done." One would suppose that patents were granted for ever, even beyond a lease of 999 years, instead of only for three, four, and seven years, or in all, if duly paid for, fourteen years. But it must not be forgotten that a surprising number of patents enjoy a very short-lived monopoly, many expiring in four months, many in six months, and a very large number in three years.

But it must, indeed, be very "pernicious" to consumers, whether manufacturers or the public at large, to be withheld from ever doing what these "inventors have never once done!" Certainly this is a problem; and yet one would suppose it to mean, for example,

"that the patentee of a turnip-cutting machine, having patented an invention for that purpose, supposing it is found unserviceable, is nevertheless, through his patent, empowered to warn everybody from ever doing what he has not done. But in what way the *public* suffer, by the folly and expense incurred by such a simple invention, it is difficult to understand; we are, therefore, justified in saying that this is as ridiculous as the former statement.

What the same article states in regard to patentees, as a class, "squatting upon the open heath," may apply as between patentees, but is quite irreconcilable, considered in respect to manufacturers and the general public. An intending patentee may thus find *his* place pre-occupied. The *public* certainly cannot be said to experience any "inconveniences" from such a circumstance.

The Times imagines the case which was tried during five days in the Queen's Bench as affording "a new instance of the mischievous tendencies of the present system of patents and registered inventions." The complaint here made, instead of being directed against patents and against registrations, should be aimed at the law governing such matters.

The Times, confounding worth with magnitude, deliberately declares against "all those petty and vexatious monopolies which render every novelty in design or manufacture unsafe, if not impossible, and every step out of the beaten track a danger." By adopting the spirit of these, and similar bold assertions, it would be easy to prove that no authors producing less than a folio or quarto, or an equivalent in octavos, should have copy-

right in his works; single octavos, and above all pamphlets tracts, and such "petty" works, must "render every novelty" in literature "unsafe, if not impossible."

The grand mistake committed in *The Times*' article, arises from its objecting to patents, rather than to the loose mode of granting them. One-tenth of the patents granted by the Crown are of no legal value whatever; nay, it would not be too much to say that a larger number would be found on examination incapable of sustaining an action at law. A patent once granted ought to be a valid document, it ought to be something more than wax and parchment—something better than a mere licence to go to law. If patents are vexatious to a small minority of the public, they are doubly vexatious to a large majority of patentees. Not one patentee in a thousand becomes wealthy; not one in five hundred acquires a handsome income, not one in a hundred escapes the loss of money, and the sad remainder sit down in disappointment or despair.

If patents were granted only to the true and first inventors—only after due examination and full investigation—then a patent would really be a right, a property; and not, as it too often is at present, an absolute mockery. Easy terms of protection might be granted for a suitable period or periods meanwhile, and even with a greater final expense than at present, if needful to cover the inquiry; but a patent once granted, the patentee should be to all intents and purposes the rightful owner of the title he claims, unless in case of fraud, which the same tribunal should have power to rectify.

Much may be truly said against the grant of patents for foolish things; but to distinguish between

great inventions and little inventions—which shall or which shall not be patented—is preposterous. A valuable patent may relate to a very small matter; and some very magnificent affair may nevertheless not be worth patenting. So far as concerns these, *The Times* is entirely and seriously in error.

It is assumed in the article quoted, that inventions would be as plentiful as ever, even though there should be no patents. Little more than fifteen years ago it was not unusual to see in the scientific journals such a notice as, "No patents this week." From that time forward patents have averaged ten a day, or sixty for the week. Will it be pretended that it would be well to "sweep away" this vast tide of inventive ingenuity merely because it does not run mountains high, but comes in in ripples, and brings some scum along with it? Why denounce patents in the very face of such statistics, and cry, "there are at this moment several *thousand* 'inventors,' *pretending to have found out*," &c.?

It is remarkable how very little encouragement serves to encourage inventors. They are a sanguine race. They are the poets of machinery, the romancers in mechanics, the castle builders in architecture. Their history is in the "Arabian Nights." They are the most idly industrious race on earth, the worst paid, and best abused of the human family. To be an inventor is next to being an outcast; to scheme and neglect the shop is the fate of too many. Their lives afford them some pleasures, but more pains, cares, and anxieties. They are incurable, yet often from their maladies arise the welfare of nations. Schemers find their shame only in ill success—their honour in success;" yet to the failures

of one period are not unfrequently due the successes of a succeeding generation.

The Times' article reads very much like the language of a disappointed speculator in patent inventions, who, having bought up a few hundreds, had suddenly discovered their worthless nature, and forthwith written a leader against the entire patent system; seeing no other remedy than either to sweep them all away, or to grant none to any but "great inventors"—men ranking with Archimedes, Galileo, and Newton! Anything more illogical and splenetic than the long tirade of abuse directed against minor inventors it is difficult to conceive. Their "little tricks and contrivances," as they are styled, are supposed to relate to matters which anybody might invent; that is, if any one "demanded" such matters. Here the public are put in the place of the inventors. It is the public who have asked for some simple article, and then some artisan, on making it, is assumed to become the patentee. Not one patent in a thousand results from this inverse course. And it is long, indeed, before a patent spoon or corkscrew, or other simple article, supersedes the customary spoons and corkscrews. But *The Times*, in a splenetic mood, has determined on possessing the best and newest fashion, only it must not be patented. Is *The Times* arguing to benefit the public, or to benefit inventors? Because, if to benefit the *public*, it would have been well if the critic had pointed out the advantage to be gained; for it is generally understood that the patent article is better and cheaper than the ordinary article it proposes to supersede. Therefore, it is not very clear on what ground *The Times* "believes the *public*

mind has been long made up on this subject"—that is, "the mischievous tendencies of the present system of patents." The only explanation vouchsafed in regard to the so-called "nuisance" is the fear that "we should not be allowed to eat, drink, or sleep, except by paying them for permission to use their patents." But this relates not to the *public* at large, but to the manufacturers of Sheffield wares and Birmingham wares. No one in purchasing a patent knife, or claret jug, or coffee pot, or spring bed, is in the least inconvenienced by the fact of their being patented articles.

But it is hopeless to deal satisfactorily with a leader written in such an incoherent and thoroughly inconsistent strain; from which the "public" learns, for the first time, with some surprise, that they are suffering some terrible concealed calamity, caused by the dangerous machinations of the authors of large and small inventions, aided by that newly discovered "nuisance," Patent Monopoly.

The Times article of the 6th inst. was followed by the communication of a correspondent "Q.," whose letter appeared in its columns on the 19th. In these articles the same vague, inconclusive reasoning prevails, and it is impossible to gather from either the real object of the journal, or its correspondent in writing down patents and patentees. Persons having no private interests whatever to serve cannot but peruse both the articles in question with astonishment.

It is shown, although in a humorous strain, that, from the cradle to the grave, patented inventions aid and assist us through life. There is not one word in disparagement of them here; but the writer suddenly recovers

himself on reflecting that "patent agents," "lithographers," "scientific witnesses and advisers," and "lawyers," "grow fat on the spoils of patents and patent litigation."

"Nevertheless," he says, "the public (?) has begun seriously to inquire whether all this patenting is either necessary or desirable, and some persons even presume to ask whether we need any."

He remarks, "It is easy to find fault, but not easy to suggest amendment," in saying which we sincerely believe he truly states his own case as to his personal capability in this matter. He must have been very much punished at some time, directly or indirectly, by his own patents, or the patents of others. He writes in a passion, and has much to say, but is too angry to say it with good will, or with any other purpose than to gratify his splenetic mood, otherwise he would not presume to say, "It is not easy to suggest amendment," unless, indeed, he thinks that his own ability in the matter qualifies him to decide absolutely on the question. To such as himself it must appear anything but easy, or even approachable; to him it is as impossible as to cross a bridge having only a razor's edge.

He says, "I have deeply studied certain classes of specifications;" no doubt—deeply and interestedly; "shot of all shapes," "guns and missiles," and, sad to say, "inventor has threatened inventor with 'injunction to restrain,' &c." Touch a man's interest, and of course his spleen will show itself; he becomes the public, or as "Q." very graphically has it, "When a frog attempts to blow himself out to the size of an ox he will inevitably burst." It is thus *The Times* has permitted its correspondent to burst from mere inflation.

"We should exert a wise caution in not confounding inventors with patentees." We? For whom does "Q." speak in enunciating this apophthegm? Does he speak of the public? If so, what do the public care for the matter? Why this splitting of straws? It is just as possible for an inventor not to be a patentee as it is for a patentee not to be the inventor of the object he patents, though he may have a legal right to it by purchase; but, in more than 90 cases in 100 the patentee is the true inventor of the matter he patents.

Making a pretended distinction between the inventor and the patentee, it is stated "that the *public* is in urgent need of protection from the 'inventor-patentee' class, *et hoc genus omne*. This is a point which, at the present time, particularly deserves attention. *There is no doubt whatever that in many cases the existing patent law has operated most injuriously to the interests of the public, and has greatly retarded the progress of improvements.*" Anything more false, more ridiculous, more illogical, it is difficult to conceive. What a pity that this great advocate for the *public* did not enumerate some one or two of the "many cases."

The last *Times'* leader and its present letter on the subject of patent monopoly, show how much ignorance prevails on the subject of patents. The only safeguard for an inventor is that of obtaining a patent. The next point is to make that patent a valid security, and dependent as little as possible on future litigation. Take away patents—or, in other words, protection—and inventors must fall back on the old worn-out method of "secrets."

CHAPTER III.

CRITICAL EXAMINATION OF A LEADER ON PATENT MONOPOLY IN *THE TIMES*, 15TH AUGUST, 1864.

THE persistence of that great organ of public opinion, *The Times*, in denouncing the patent monopoly of inventions renders it equally interesting and instructive to examine such further arguments as eighteen months' experience has enabled it to bring forward :—

"We ventured," says that authority, "to suggest as the true remedy for the evils which are felt in *every department of industry* an abolition of Patents altogether. Let the State decline to enter into any more bargains with inventors, *real or imaginary*, and leave them to work out their plans as they please. A suggestion of this kind of course provokes opposition. Every owner of a successful Patent is ready to denounce a recommendation which might affect the *security* of his property."

From this announcement we learn that to patents are due "the evils" (whatever that may mean) "which are felt in *every* department of industry." We often hear much about "real" inventors, but who the "imaginary" ones may be we confess ourselves at a loss to comprehend. Then inventors are to be left "to *work* out their plans as *they* please," that is, without patent protection ; which is next to saying, that as the great body are generally poor enough, they and their inventions

may perish together. Equally perplexing is the statement that "every owner of a *successful* patent is ready to denounce a recommendation of this kind." We should rather have thought that, thus left to himself, his "*successful* patent" could not fail of increased success. Or is it supposed that invention is such a simple and easy matter that inventors would publish their *unpatented* inventions to the ultimate ruin of the "*successful* patent?" We can scarcely believe anything so monstrous can be seriously entertained.

The writer next urges that a correspondent has misapprehended a former remark:—

"That if Patents were abolished the inventor would still have his priority and his secret; he could use his discovery, and, if publicity were a necessary consequence of use, the *public* should not be called upon to pay for what is in its nature incapable of appropriation. We were arguing against any supposed *natural right* of an inventor as the basis of our existing legislation, and, consistently with this view, proposed to *leave him* alone to make what use he could of his discovery. We are not called upon to interfere because use necessitates publicity. The point is that the State or community at present goes out of its way to make a bargain with an inventor. It says to every man, 'If you think you have made a discovery and will come and tell the world what it is, you shall, provided it is a discovery, have the exclusive use of it for fourteen years.'"

Here again the patentee is assumed to be the worker of his own patented invention; he is treated as if he were a capitalist; without any protection existing he

would still have "his priority and his secret," it might be added,—and both would die with him.

The writer next avers that the *public* "should not be called upon to pay for what is in its nature incapable of appropriation." And pray what do the *public* pay? Whenever did the *public* complain of paying for patented bread, candles, soap, oil, starch, articles of clothing, sewing machines, &c.? If by the *public*, manufacturers are meant, *they* indeed may have *their* complaints,—arising from competition, and the lowering of the price of their manufactures. In no instance can a patent be any tax on the *public*, for it is to patents that the public are indebted for many luxuries and necessities unknown to our forefathers, even within the last quarter of a century.

With regard to the inventor we are advised "to leave him alone to make what use he can of his discovery," not because he himself desires such an inglorious position, but, possessing a great discovery, it is proposed to leave him without aid, without protection, without any secure means of communication with the wide world—ever too ready to appropriate the possessions of confiding and ingenious minds.

Still maintaining the same line of argument (or rather declamation) the writer proceeds:—

"No one would have a right to complain if the community receded from this position" [with respect to the mode of granting patents], "and left inventors to take care of themselves. It is, in fact, a departure from the ordinary principle of non-interference in trade, to volunteer to create an exclusive right; and the burden of showing that this exception to the general rule is expe-

dient rests upon the upholders of Patents. It is in vain for them to talk of an abstract right in inventors to an exclusive use of their discoveries. There is no such thing; *the inventor is no whit damnified if he is let alone*, and it must be shown that it is to the advantage of the *public* to enter into such a compact with him as is involved in the existence of Patents."

The expediency of upholding patents is plainly due to the enormous benefits society derives from thus encouraging the ingenuity of inventors. The genius, the talent, the ingenuity of the painter, and the author, have from time immemorial been acknowledged to be the property of their producers. And equally with Art should Mechanical and Chemical Ingenuity have their share of protection. Again, if works of luxury, amusement, and instruction deserve protection, how much larger a claim have Inventors whose labours improve and extend the manufactures and resources that promote the spread of civilization; and whose efforts have increased tenfold with enlarged facilities for patent protection?

In further support of his views the writer adds:—

"It is, for example, a sound argument against the allowance of Patents that the exclusive right given to a discoverer in April prevents a man who makes *the same discovery* by an independent process in May from using his own invention. It takes away his natural freedom of carrying out what he has *innocently* invented. This is *a fact of constant occurrence in mechanics*, but it would be ridiculous to suppose that it can be paralleled in literature. No two men ever invented the same book, and the copyright of one author cannot derogate from

the rights of a second. *Whether on the whole the arguments in favour of copyright are sound, may, perhaps, be doubted.*"*

The assumed "sound argument" here set forth overlooks the fact which destroys its force as against patents; the sole effect of it only amounts to a querulous attack on the amazing competition existing among the ingenious men who aspire to produce labour-saving machinery, cheaper and better food and clothing, cheaper articles of necessity and of luxury! Let the *public* then rejoice in learning that there is competition existing in all trades, even that of patented inventions; so that they may expect to purchase patented articles at a cheaper rate than ever. Here is an argument indeed for the political economist in favour of patent monopoly.

But fortunately we are now to be informed what—

"The real question at issue is: why should the State go out of the way to invite mechanical and chemical inventors to make a bargain with it? What are the considerations which warrant this unusual action? In whose interest should it be maintained? Is it to the advantage of inventors themselves, or of the capitalists who work their inventions, or of the *public* at large, that a right of exclusive use should be given to the man who *registers a discovery?* We believe that on examination *no one of these classes* will be found to be benefited by the Patent Laws, and *if* this conclusion be correct the laws are at once condemned."

Why? In the first instance the State is remunerated for the protection it accords; and, in the second

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* See Note, page 83.

place, society is largely benefited. It is to no purpose to distinguish individuals among the mass, whether Inventors or Capitalists. If two individuals benefit a million of the population in a way that the million might otherwise never have enjoyed, surely a wise Government acts prudently in bestowing the small encouragement that gives activity to two such persons.

The case of the Inventor is drawn very pathetically, thus :—

"It is, indeed, generally acknowledged that, whoever profits by Patent Laws, *inventors do not*. Take *any one* of the numerous mechanical discoveries which have been patented within the last twenty years and search out the history of the inventor. He will, in *a vast majority of cases*, be found to be *a poor working engineer* employed in some great manufactory ; as to *the invention, it is not his property* ; he was compelled to sell the Patent almost before he obtained it, and he is lucky if, in spite of every sacrifice, he is not loaded with debts contracted in his efforts to perfect his machine. And *if* this be the case with *a successful inventor*, what can be said of *the still more numerous class* who are lured by false hopes into *endless discoveries* which are neither *new* nor *true* ?"

After this who will not exclaim, And is it this unfortunate man whom you seek to deprive of patent protection ! "It is *generally acknowledged* that inventors do not get *any* profit by Patent Laws !" How strange that they advocate them, and seek their amendment. Have not many patentees from Watt downwards reaped princely fortunes ? And is it then really so wonderful that Patentees, like Merchants, or Manufacturers, should rank as rich and poor of their class ?"

To assert that some Inventors are unfortunate from mistaking their mission, or from errors committed through the superficiality of their knowledge, and their ignorance of what others had performed in the same direction or department, is only to declare their liability to human frailty, and to the usual chances of failure in all employments, which is the ordinary lot of humanity. Are not musicians, painters, authors, actors, and men of all professions and all trades sometimes unfortunate? Among Inventors we find men of the first character for intelligence, for enterprise, and for success in the novelties they have introduced, and which have chiefly led to improvements in manufactures, enlarging industrial resources, and facilitating commercial intercourse.

Next follows the case as regards the patrons of patents, respecting whom we learn that—

"The position of the capitalist manufacturer is not much better; whatever may be his trade, he is constantly exposed to the necessity of buying up one *little* Patent after another, or to find his improvements hampered because *some trifling detail has been registered* by a man with whom it is *impossible* to enter into *a reasonable negotiation*. Not unfrequently he has to suffer the mortification of discovering that the invention he has purchased from one man had been previously patented by another, and he has to buy it over again or stop his business. *We believe that neither inventor nor capitalist reaps any real advantage from the existing law*, and that the *only* persons who are benefited by it are the Patent agents and lawyers."

Instances of some two or three or more manufacturers "buying up one little patent after another" might pos-

sibly be adduced, but so few as not to justify the assertions here made. Price's Candle Company used to adopt this practice, but only when they saw their own interest at stake. Such instances supply a very weak argument, and one which at best is here very falsely applied; because the only conclusion from it is, that our Patent Laws are far from being perfect, and not that they are bad or useless.

The attack on two learned professions is equally injudicious and misplaced, when it is known that there are patentees whose incomes exceed from £10,000 to £200,000 per annum.

Again the cause of the "public" is argued; they are the sufferers:—

"The *public at large are the real sufferers;* they have to pay twice over for every proved invention, for they have to provide not only the honest rewards of capital and industry, but the costs of expensive lawsuits and abortive schemes.

"The defender of the Patent Laws will often confess that through their agency inventions cost the *public* more, but he contends, on the other hand, that *without them* no inventions at all would be *perfected.* Unfortunately for him reason and experience alike discredit his [?] argument. The instinct of economy is too strong in man to require any inducement to call it into exercise. The principle of least action is a law of morals no less than of physics. Every man constantly endeavours for his own convenience to do his work with the least labour, and the saving of labour is prompted by the immediate, and not by the prospective, reward."

"The *public at large* the real sufferers!" Can this be

a *lapsis pennæ?* In what sense even the "public" of manufacturing classes is damaged it is difficult to divine, for manufacturers are too intelligent a body of men to "pay twice for every proved invention" without making their customers—"the public at large" pay them three or four-fold to cover their *twice payment*—a very questionable transaction, however, and certainly not the rule, and we doubt its existence even as the exception.

Still keeping in mind "the public" it is declared that they suffer by the Patent Laws, as "through their agency *inventions* cost the *public* more." Again we ask what is meant? If a patent pen or pencil, umbrella or coat, is dearer than the unpatented article, how comes it that "the public" should be so thoroughly blind to their own interest as to purchase the patented "inventions?" What strange infatuation can beguile the purchaser into such a liberal patronage of Inventions?

Next follows the unhappy condition of one situated like the author of this essay, as the "Defender of the Patent Laws." He is admonished that "reason and experience alike discredit his argument." These are—

1. "The instinct of economy;"
4. "The principle of least action;"
3. "Man's endeavours for his own convenience;" and
4. "The saving of labour."

But it is not the advocates of Patent Monopoly, but the opponents to it, who pretend in respect to Patent Laws, "that through their agency inventions cost the PUBLIC more." Its "defenders declare" the contrary; they say, that the PUBLIC pay *a lower price* for every article of consumption that has been made the subject of a patent invention, compared with what was previously

charged to the public by manufacturers for the unpatented articles—as experienced in cotton, woollen, linen, and numerous other goods.

The Times' article offers no prospect of benefit to Inventors or the Public, except the abolition of the Patent Laws:—

"Those who look upon the existence of Patent Laws as *the necessary condition to an invention* may be asked whether there were no inventions before Patents were so much as dreamt of. The discoveries of printing and of gunpowder are two of the most important facts of *modern* history; but no exclusive rights prompted or rewarded their inventors. In our own day can it be said that the hope of commercial profit promoted the *discovery* of the electric telegraph? *But it is unnecessary to refer to particular instances.* There is a country of Europe small in extent, but *one of the most famous in the inventive arts* [?], the chosen home of many of the most delicate forms of mechanical industry—we mean Switzerland, where until recently, and for aught we know still, no Patent Law whatever existed. Discoveries were made there and inventions perfected in the interest of inventors themselves. Such *an example* [?] dispels the notion that Patent Rights stimulate discovery, and disposes of the last argument of their advocate. The entire abolition of a system which does *not* benefit the inventor, which *hampers* the producer, and *taxes* the purchaser, would, in the words of a great inventor, Sir Isambard Brunel, be 'an immense benefit to the country.'"

Printing sprang into existence 400 years ago, and the very machinery required by the novelty of the work

sufficed to give a monopoly at that slowly progressive period. Gunpowder, being a chemical composition, could be, as it no doubt was, worked for a long while in early times in *secret*, and might remain undiscovered for a considerable time in the absence of sufficient acquaintance with chemical analysis; although it so happens that gunpowder may be mechanically analysed.

The allusion to Switzerland is so singularly absurd, so overstrained and over-coloured that we allow it to pass without further remark. The writer, weak on every point, does not appear to be even aware that "Patent Rights," although they may not "stimulate discovery," yet undoubtedly afford the inventor the only probable security to obtain a *reward* for his inventions. It is neither a powerful nor a satisfactory support to an argument *against* protecting Inventors through the medium of Patent Laws to adduce the alleged saying of a wealthy and successful Patentee. One would hope that Brunel directed his censure not so much against Patents as against the heavy expenses and insecure character of the Patent Laws of his day; but these in 1852, were simplified and rendered less expensive to patentees.

The most inveterate opponents to patent monopoly have ever been: 1. Successful patentees who having worked their own way to fortune, but not without many vexations and disappointments crossing their path, raise their voices against the very system that has paved their own way to success; 2. Manufacturers who have wished to use as part of their own work the patent materials or patent articles of some other patentee, and therefore condemn the patent which prevents their progress in some work either to be, or not to be, patented; wholly over-

looking the fact that the matter in question, unless protected by a patent, might never have been known to the trade; and, 3. Infringers of patents, who have been detected in making use of a patented invention without paying any remuneration whatever to the patentee. Galled and annoyed at the consequences of an action at law, in a case which perhaps they had confidently calculated on gaining, they have ever afterwards become decided and most obstinate declaimers against patent laws; not wishing them to be amended, but desiring to see them removed from the Statute Books.

M'Culloch upholds the rights of patentees on grounds of political economy, and it is to be hoped that in the next edition of his works we shall not find his statements on the subject curtailed or altered, much less omitted by his editor.

That there are many frivolous patents is as true as that there are many great and good ones. It is absurd to say that a few vexatious cases are to suffice as an argument for sweeping away all protection. And it is quite possible to devise some scheme by which patent law shall through successive years, work out a better system than at present exists for protecting the products of the inventive talent of the country.

Mr. John Stuart Mill, M.P., has remarked that the doing away with patents would be, "not free trade, but the right of free stealing;" with which view of the subject the opinions of all patentees will fully accord. Indeed there is no theft in the opinion of some classes of society either in robbing Government of its dues, or Inventors of their inventions.

We shall conclude this chapter with the following

extract from some excellent observations made by Sir David Brewster in the *North British Review*:—

"Not only has the legislature neglected the interests of inventors, and virtually those of the public, but some of them, even men in high position, have, under the influence of evil counsels, thrown out the idea that patent rights, and, of course, copyrights, should be altogether abolished; and that the idle and the ignorant, the rich manufacturer and the wealthy capitalist, should reap the harvest of which others had sown the seed, and seize the property which mental toil had purchased, and a life-long study had made useful to society. Such a doctrine might have been expected from the wildest socialism, and, if carried into effect, would justify the seizure of every other property by those who have been robbed of their own. It is some consolation, however, to those who have been bent under a life-toil of midnight labour, or crushed beneath the heart-breaking sacrifices by which eminence in science and the arts is attained, that the heartless opinions which we condemn are entertained but by few; and it ought to be a greater consolation to the friends of social order, that such opinions have no chance of debasing our Statute Book. If the violation of the great charter of English liberty would justify the citizen in renouncing his allegiance to the Crown, the confiscation of man's intellectual property, given him by God, and consecrated by reason, would justify that extreme resistance which even loyalty is sometimes compelled to oppose to injustice."

CHAPTER IV.

CRITICAL EXAMINATION OF A LEADER ON PATENT MONOPOLY IN *THE TIMES*, 13TH SEPTEMBER, 1865.

THE article in *The Times*, published a year later than the preceding one, and which we have next to consider, commences by observing:—

"The question of the abolition of the Patent Law is fast going through all the stages which have to be passed before a general agreement can be arrived at upon it. It is *not yet the creed of the majority* that England would be better off if no Statute of Monopolies existed in the Statute Book, but such is the opinion of *some of the most cautious and influential of English thinkers.* Statesmen, lawyers, mechanicians, and political economists of the first eminence, have agreed on the expediency of abolishing the Patent Laws, and now the subject has been mooted at a meeting of the British Association."*

In these observations the minority is set in array against the majority, and the fact that at the meeting

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* Alluding to a paper read by the Rev. James E. T. Rogers, M.A., Professor of Political Economy, at Oxford. Anything more declamatory or illogical than his statements it would be difficult to conceive; and to amend an equally inconsistent communication on the same subject at Cambridge, Professor Rogers, on the occasion here noticed, included Copyright as equally to be condemned with Patent Law. See also Note, page 83.

in question there was only one zealous supporter of the cause espoused by *The Times*, is entirely suppressed, the opposition to the obnoxious doctrine here propounded having been denounced by numerous speakers in the discussion alluded to, in the Statistical Section.

No doubt the most powerful arguments that can be adduced have been employed by the present writer, and his next statement is, therefore, given *in extenso*. He confidently asserts :—

"There are two simple points which no defender of the Patent Laws has yet been able to meet, and which were *very conveniently left unnoticed at Birmingham*.* In the first place, the right of exclusive property in a *discovery* differs from all other property, with the single exception of copyright, in being purely and entirely the creature of the law. Other species of property receive the sanction of the law, but this is created by it. If a man appropriates to himself a material object, he makes it his own, whether he live in a civilized or a barbarous society, and when the law does come into operation it simply steps in and defends his possession of that which he has already. But in the case of Patent Rights and Copyrights the law, instead of defending what a man has, *gives him that which he has not;* it does not, in fact, sanction a pre-existing dominion, but creates a new privilege. This first point completely separates Copyrights and Patent Rights from any other species of property ; it shows that they are arbitrarily introduced by legislation, and throws upon their defenders the duty of

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* It may be that the learned Professor did not go to sufficient length on this head, in his communication, to satisfy *The Times*.

proving their expediency. The second point separates as completely Copyrights from Patent Rights. It is this:—No author could ever yet say that his literary career was hampered and his development checked by the privileges conferred upcn those who had written before him. No Poet, no Philosopher, no Historian ever found himself warned off from pursuing a vein of speculation because some one had already registered his *thoughts upon it.* But this is of *constant occurrence in Patent Rights.* A man makes a perfectly independent discovery of some process, and finds he cannot use it because *another man had discovered it before him.* It is impossible to say that he inflicts any injury on his predecessor, a man of whom he never heard, and of whose invention he was unconscious; and yet his natural freedom is abridged and the use of his own faculties denied him by the operation of the law. *It is notorious that the progress of mechanical discovery is constantly marked by the simultaneous revelation to many minds of the same method of overcoming some practical difficulty;* so much might be expected, since the difficulty is felt everywhere at the same time, and there are men all over the kingdom thinking about it; and as the man who first registers his discovery obtains the privilege of exclusive use, the law constantly operates with injustice to *innocent inventors*. It follows that while Copyrights and Patent Rights differ from all other rights of property in being the gratuitous products of legislation, Patent Rights differ from Copyrights in being a constant source of injustice. We have in each created privileges, but the privileges conferred upon the author work no wrong upon his fellow, while *the privileges given to the inventor*

do in numberless instances deprive other inventors of the use of their own [?] *discoveries.*"

The first of the writer's "two simple points" which we are here told the supporters of patents are so prone to lose sight of, is that Patent Law, "*instead of defend'ng what a man has, gives him what he has not.*" What can this paradoxical assertion mean? Is it meant to inform us that "a patent" does *not* defend the Invention a man purposes to defend by it; while it gives him a monopoly for fourteen years, which otherwise *he has not?* Be it so, the assertion is only putting into other words what no one denies, that patents are improvable grants, that they ought to protect a patent article more fully than at present after obtaining possession of that document by paying all fees, and punctually conforming to all legal requirements on the part of the patentee. The writer appears to consider that, every man has a legal right to be protected in respect to "material objects," his house, land, and like possessions. But to his "secrets" in art, literature, or science, even when developed as pictures, books, or engines, he has no legal claim, because they are *immaterial* products; and to establish ever so limited a right in them by Patent, or Copyright, would be to "*give him that which he has not.* The subject of "monopoly" in inventions is very simple, one on which economists are generally agreed; and all except very narrow-minded politicians allow that it is better by such means to be put in possession of the inventive genius of our countrymen, than to permit their inventions to be delayed, neglected, left immature, and eventually, in too many cases, allowed to die with their possessors. But this is only a one-sided view, for we

have to consider what would be the result if such a monopoly were not sanctioned in England, though enjoyed by the continents of Europe and America. Are inventors not to indulge a hope of reward at home as great, or greater than in France, Holland, Germany, Russia, America, and elsewhere? Until it can be shown that the field of inventive talent will widen by leaving it to yield advantages for the public good without any protection, contrary to all results hitherto experienced, we must continue to think that the "abolition" scheme is suggested by a crude, imperfect knowledge of the subject; or (which we are less disposed to believe) by personal motives arising out of vexations and disappointments in some few accidental cases.

The second point—That patents interfere with the "progress of mechanical discovery," or rather *invention*, as we presume the writer to mean, is an unfounded and unjust charge. Those who make such unjustifiable complaints allude to improvements which they could effect, prompted by the only patents against which they have thus the hardihood to object. But notice the extreme simplicity of the writer who confidently promulgates the allegation that—"the simultaneous revelation to *many minds* of the same method of overcoming some *practical difficulty*"—is absorbed by one of these "many minds," he "who first registers his discovery," or, his *invention* rather, as of course must be meant,—because "he obtains the privilege of exclusive use," against this imaginary band of "many minds." We unhesitatingly deny the validity of this assumed case. That something of the kind may have happened in one case out of hundreds or thousands of patents is just a mere matter of

possibility. Even then, we doubt not that the "*practical difficulty*" to be removed had relation to some patent invention about which these "many minds" could have afforded no suggestion leading to the result originally patented; but the invention requiring some addition or improvement, there are doubtless to be found "many minds" of common-place ability who at *that* juncture can offer some useful practical hint. What if such a mind could make some addition to the steam-hammer, is the patent which gives to the world the secret of that invention, with all its details, to be repudiated?

But the writer indulges in such sweeping, groundless assertions that it is difficult to understand on what pretext he adopts a line of argument so unlikely to serve any purpose short of defeat. As already stated, he is wholly wrong in his assertion that:—"It is *notorious* that the progress of mechanical *discovery* [invention?] is constantly marked by the simultaneous revelation to many minds of the *same method* of overcoming some practical difficulty." Suppose we give the writer the advantage of six instances out of 50,000 patented inventions, what can he hope to gain from such a fact? Is it requisite that there should be second and third and fourth divulgers of the *same* methods of constructing some novel piece of machinery, &c., following previous inventors at successive intervals? What loss can it be to the State, or to manufacturers, that these second and third inventors—"innocent [ignorant?] inventors"—find themselves anticipated by a more active and enterprising inventor who has obtained a Patent?

The discussion of this subject in such a leading journal as *The Times* cannot be lightly passed over, we therefore

proceed to the writer's next complaint. He recklessly asserts :—

"*They* [Patents] *ruin inventors*; they clog manufacturing industry, *they impose a tax upon the community*, and they benefit *only* Patent agents and lawyers. This is the conviction which forced itself upon *the minds of the most eminent members of the late Patent Law Commission* [?]. It was not Lord Stanley alone, though the opinion of so careful a thinker is entitled to much weight, but the very *lawyers* who make *the greatest gains out of Patent cases* [?], who came to the conclusion that *the Patent Laws were more injurious than beneficial to the nation.* Even the debaters at Birmingham were unanimous in condemning the operation of the present law, but they thought it might be reformed, though they refrained from specifying the reforms which would work any good. *They may dismiss this illusion from their minds. If a Patent Law be retained at all, it must be retained under the present form*; no tribunal can determine beforehand what discoveries are useful, still less whether any assumed *discovery* is or is not novel. Questions like these must be left to be determined when there are persons interested in the issue to fight it out. Nor can the expense of fighting such questions be materially abated; they involve not merely the valuable privileges which the law gives a successful litigant, but the points at issue are in themselves the most intricate that can be brought before any tribunal. If Patent Laws are to be retained, they must in the main be kept as they are; but *the more the subject is considered, the clearer will be the opinion in favour of their abolition.*"

We are here confidently assured that, Patents—

1. Ruin Inventors;
2. Clog manufacturing industry;
3. Impose a tax on the community;
4. That the Law cannot be reformed; and
5. That Patent Law, therefore, should be abolished.

The first implies that over-speculation of any kind is ruinous; and any conclusion the writer can draw from that fact in proof that patent right should be abolished, it is certain would apply with equal justice to publishing and to all commercial speculations. But is it pretended that *no* patents have ever proved remunerative?

The second is equally false. The manufactures of this country, as well as of other countries, have risen to their present commercial importance in a great measure through the valuable patents of Watt, Arkwright, and hundreds of other ingenious and intelligent patentees.

Third—The pretended imposition of a tax on the community is so abundantly absurd that it refutes itself by its very audacity.

Fourth—As regards improvement in Patent Law, a more prudent and better informed writer, reflecting on the progressive improvements effected in Patent Laws from the time of Queen Elizabeth, through Charles II., down to 1852, would have been more hopeful, and less dogmatical, than to assert that this of all laws was the most incorrigible and intractable.

And fifthly—The mere imperfections of any law are not of themselves sufficient proof of the law itself being wrong in principle and incapable of any reform. If it is to be held as a sound argument that when a law is not entirely perfect in every respect it ought to be at

once abrogated, then the leader from which we have just quoted is sound and sensible in the extreme; but we confess it is a novel scheme which only leaves an impression that the writer having to deal with a difficulty he cannot otherwise master, cuts through the knot he can neither untie nor unravel. The several speakers, with one exception, at the Meeting of the British Association in 1865, spoke in strong terms in favour of Patent Law, preferring the law we now possess rather than to be without any protection, while at the same time it was not overlooked that, much as the Patent Laws had been improved, they were still capable of great reformation. This, however, is now declared to be an "illusion," which patentees are advised to dismiss "from their minds" for ever.

"Questions" such as this legal point raises, it is said "must be left to be determined when there are *persons interested in the issue* to fight it out." To such "*persons interested*" we should like to propound the following questions:—

Have you been or are you now a patentee?

If a patentee, have you been successful?

Has your patent right been the subject of legal investigation? and if so, was the result favourable or otherwise?

If a patentee, or not a patentee, has any action ever been brought against you for infringement? and if so, were you subjected to pay damages, and to what amount?

Doubtless no more obstinate and inveterate opponents to Patent Law can be found to exist than persons in any way thus "interested."

Although the opposition attempted to be raised against patent monopoly is manifestly weak in principle, and is upheld more by dogmatical assertion than by adducing any proofs, or dispassionately discussing the several points at issue, and proceeds from an exceedingly small party; it would be unwise to adopt the very course we find to be so censurable, and we shall therefore offer a few further remarks, contrasting the Law of Patents with that of Copyright.

There are many persons who can freely discuss a subject so long as it appertains only to literature or to art; but who appear to be altogether lost when they turn to a scientific department; we consequently observe a large class who are surprised, or affect to be so, at the different position of the Inventor or Patentee from that of the author or painter protected by Copyright.

The Inventor may produce an entirely new Engine, the author an original literary production, the painter an approved composition. The Engine may be indefinitely copied, the literary work may go through many editions, and the painting may be engraved and extensively printed. As all require protection, how do Patent Right and Copyright come to differ?

There are, first, these great distinguishing features in all Patented Inventions that they are either machines, &c., for producing articles of trade; or, they are the articles themselves for immediate use. Hence something more than copyright is required for labour-saving machinery adapted for manufacturing and many operative employments. Again, if an engine, or machine, is invented, its employments are often very numerous; thus steam-engines do a great variety of work, while the

machine that weaves wool is useless for weaving cotton or flax.

But in literature and in art every work stands by itself; reliant on its intrinsic merit: in demand only by readers in one instance, or by fine art collectors in the other.

Some pretend to suppose, or from ignorance really think, that the principle of copyright which protects an author's book should equally protect an inventor's invention. They find that literary men are perfectly unshackled so far as regards the subject-matter of their works, and yet never interfere with each other, however many choose to write on the same subject; and they would have it thus with mechanical invention, and allow any one to invent an engine, machine, or instrument so long as it is of a different pattern.

We admit that no less than three distinct works have recently appeared, each giving the Life of Watt, yet all different in composition and the arrangement of materials. It is the boast of literature that translation after translation may be made of a single work without interference in the sense here implied, as we find in the translations of Homer's Iliad by Cowper, Pope, and Lord Derby. The same may be said of painting. How many subjects might be named—scriptural, historical, classical, and others on which painters have severally tried their skill simply varying the style, treatment, and composition. Here we have illustrative examples of *invention* in Art, all receiving sufficient protection through the medium of the existing law of copyright.

But *invention* as understood in reference to mechanical

and chemical subjects is widely different, and hence is incapable of protection through the same source that amply protects literary and artistic productions. What is legitimate in literature, that is, imitating without borrowing, would in the case of mechanical inventions be evasions, or infringements. It would be no infringement, however, supposing a *steam* engine to be the matter first invented, if it were followed by a *gas* engine, and that again by an *electric* engine. But supposing the invention confined to the *steam* engine, and that the first inventor employed a vertical cylinder, admitting the steam below; a second one admitting the steam from above, or reversing the cylinder; and a third fixing the cylinder horizontally, we should not here have three inventions; but only *one* invention, and *two* infringements.

Now as the case stands between men of letters and those who produce inventions; in literature it is not the subject-matter that affects any work, but the precise language employed; take, for example, two dictionaries, published at the same time, each might have its own preface and grammar; and the like words to be explained would be alike in each, but with many verbal differences in their explanations; yet such compilations would be no interference; no copyright would be infringed.

But in every new invention, properly so called, there are certain principles involved in the construction and arrangement of the several parts, designed to render it efficient for the special purpose declared, and probably also exhibited in drawings; any or all of which might be so changed in external appearance and garnished with

decorative and useless accompaniments as to lead to the supposition that, something totally different had been produced. On trial, however, it being found that both work alike, and that what one effects the other effects, the whole is declared to be an imposition and an infringement.

We thus see that copyright permits the writing of three or more biographies in relation to one subject, two or more dictionaries bearing a striking similarity, the painting of portraits, all manner of compositions designed by the artists themselves, or copied by them from nature, &c., without any infringement of the Copyright Act, so long as the book, painting, or other work of art is not a direct copy or striking imitation of any similar production. Patent Right gives no possession to the sole employment of elementary scientific principles, or to any known processes or materials; but only to any new and useful applications of them. Hence arise the improvements on any single invention that can be named, whether employing heat, electricity, levers, springs, metals, fluids, &c. This has led to the variety of steam engines—land, locomotive, and marine; high and low pressure; reciprocating and rotatory; vertical, oscillating, and horizontal, &c. &c.

The Times' article states that no poet, philosopher, or historian, finds "himself warned off from pursuing a *vein of speculation* because some one had already registered his *thoughts* upon it." And then adds—"But this is of *constant* occurrence in Patent Rights." If such were really the case we should be foremost in denouncing the odious "Rights." But the numerous

patents for Screw Propelling, and for improved Paddle Wheels, might alone suffice to dispel the false alarm here attempted to be raised. Inventors, and much less the public, however, have nothing to complain of on the grounds thus morbidly declared to exist as fetters on their "natural freedom."

CHAPTER V.

SIR W. G. ARMSTRONG'S EVIDENCE IN RESPECT TO PATENT MONOPOLY, AS REPORTED AND PRESENTED TO BOTH HOUSES OF PARLIAMENT IN 1865, IMPARTIALLY CONSIDERED.

In the year 1865 was published the "Report of the Commissioners appointed to inquire into the working of the Law relating to Letters Patent for Inventions."* It contains the evidence of various witnesses examined from 1862 to 1864. On Wednesday, 11th February, 1863, the Right Hon. Lord Stanley, M.P., in the Chair, there were present, as Commissioners, the Right Hon. Lord Overstone, Vice-Chancellor Sir W. Page Wood, Sir Hugh Cairns, Q.C., M.P., W. R. Grove, Esq., Q.C., W.M. Hindmarch, Esq., Q.C., W. E. Forster, Esq., M.P., and W. Fairbairn, Esq., C.E. The only witness then examined was Sir William G. Armstrong, whose evidence possesses much interest, being of the most striking and peculiar character; and taking into account his education as a lawyer, his changed pursuits as an engineer, and his high position among the manufacturing interests of this country, his opinions claim our most serious consideration. Four years have elapsed since his evi-

* Published by Mr. Hansard, Great Queen Street. It is a closely printed folio blue book of 256 pages, price 2s. 8d., well worth the perusal of all Inventors; and may be consulted at the Patent Office Library.

dence was given before that Commission, during which period he has been favoured with the further promulgation of his peculiar views through the medium of the press; and if he has not made many proselytes, he has at all events stimulated several in high places to imagine that his views are unanswerable, and that they, therefore, deserve unqualified belief. We contend that, in proportion as opinions so adverse to the best interests of Inventors and of the community at large remain unrebutted, will the welfare of Inventors be seriously affected; we consequently need make no further apology for singling out and especially noticing Sir William Armstrong's evidence.

On some points he was evidently an unprepared and unwilling witness, circumstances which we must allow for, and only consider as his confirmed opinions those convictions which he distinctly avers to be his in regard to the inquiries to which he gives distinct answers. It is no drawback from his opinions on the rights of inventors generally that he was totally ignorant of the fact that, by "the law in America at the present moment they grant patents to foreigners;" but, to say the least, it was exceedingly imprudent to reply to an inquiry on *that* matter by saying—"I think that the American law does *not* grant Patents *to foreigners at all.*" This is worth noticing at the outset, although it was the concluding remark in his evidence, because we naturally infer that he who is ignorant on so important a point, may be equally uninformed on many other points of legal and political importance. From a less intelligent source we might expect and excuse some looseness of expression, which coming from a superior source lessens

the weight of *that authority.* To the Chairman's very first inquiry—"You have considered the subject of the Patent Law for a considerable time?" Sir William replied—"I have." And to the second inquiry, when asked whether he had not "on various occasions expressed opinions generally hostile to the maintenance of Patents?" he replied—"I have." Now to go no further, what value are we to set on the opinion, nationally considered, of any man who would propose to do away with patents in England, and leave foreign countries to enjoy all the honour and all the advantages possible to be derived from Inventions?

Are we not justified in suspecting the absence in Sir William of any keenness of sensibility to the worth of that singular gift possessed in a high degree by few, but in a degree still eminently useful by many, which we are pleased to call Invention? To explain more fully what we mean, it is well known that there are persons afflicted with colour blindness; and a still greater number with a total incapacity to appreciate music. Dr. Dalton could not distinguish red from black; and to some persons all nature is but as it were an indian-ink drawing. Dr. Johnson said of music that of all noises it was the most endurable! So we shall find it is on the matter of Invention with Sir William Armstrong, who considers it mere adaptation, always at command when wanted.

We shall examine—1st. His views in reference to Inventors, Inventions, and Patents; and 2nd. The probable source of his extraordinary misconceptions.

To the remark—"You would prefer the abolition of all patents"—he rejoined—"That is my private opinion, but it is an opinion which I should not like to press at

the present time, because, in the first place, I feel that *I am quite in a minority on that point*, and I also doubt whether the *public* mind is ripe for so extensive a change." When asked to name any case in support of his opinion that a tribunal should first examine the claims of alleged inventors, he said—"I have experienced a great many cases, but I should rather object to specify cases, because doing so has already exposed me to a great deal of personal obloquy and vituperation; I would rather speak to *principles* than adduce particular instances." He admitted, however, that "great obstruction" arose from "the multiplicity of Patents" in his own branch of business.* The manner in which the inconvenience complained of arises he explains by stating—"One manner is this, that under the present law a Patentee who is really *not the sole or the first inventor* is allowed to take possession of *an idea* which is present to the minds of *very many persons at the same time*. Without any reference to his ec .petency to develope that idea, and to give it practical value, he is allowed to have a monopoly of it, and thereby to exclude all other persons." This remark appears to have arisen from *not* having fully considered the subject, although the statement with which he set out was, that he *had* considered the subject of Patent Law for a considerable time. Sir William names an imaginary case, one just possible to occur out of 3,000 patents in one year, in which when two, three, or more inventors are intending to patent their inventions, No. 6, or any other than No. 1, first

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* See also *the* evidence on *this* same point, by R. A. Macfie, Esq., Sugar Refiner, given in Chapter VI.

obtains protection. He thus exalts the minority to condemn the monopoly obtainable by thousands of industrious and ingenious inventors; and not content with thus misrepresenting the acts of the mass, he will not even admit that a patent, when obtained, is more than "an idea." It is always held to be most uncharitable to select isolated cases and represent them as the rule instead of the exceptions; and as here put by Sir William, we confidently challenge him to substantiate his assertion. But lest we should appear to exaggerate, we will add that in further support of his opinion, he says—"Priority in application to the Patent Office does not imply priority in invention. You have no means of ascertaining whether the person obtaining the Patent is really the first inventor, and in a great many cases I believe that he is not; in fact, the inventions, *if I may so describe them* (though I almost doubt *the reality of any such thing as pure invention at the present day*, everything is *mere adaptation*), are inventions for the most part *called forth by the requirements of the moment*. As soon as a demand arises for any machine or implement, or process, the means of satisfying that demand present themselves to *very many persons* at the same time, and it is very unfair and very impolitic, I think, that the person who gets first in the race to the Patent Office should have the means of preventing all others from competing with him in the development of that particular means or process."

When asked whether he would consider improvements in reference to the sewerage of towns as "adaptation and not invention," Sir William indirectly remarked—"The first question which I would ask is

this, are we to consider the question of Patents with reference to the interests of the *public*, or with reference to the interests of the *inventor*? I think that we must consider it either upon one footing or the other, either as a public question, or as a question for the benefit of the inventor." Being reminded that "the *public* now feel that their interest would be greatly promoted if such a contrivance should be suggested by any individual," he answered—"I think that in all cases the reward, or monopoly, or protection, or whatever it may be, should be measured by the value of the service rendered and the amount of labour expended. Very many inventions, in fact the *majority* of inventions, *are the result of mere accident*; if you let them alone they will turn up of themselves." By no possibility could more narrow views be expressed on the subject of the inventive genius of this present age. Supposing most inventions to result from accident, does Sir William consider it no merit to have eyes and understanding to comprehend and apply such "accidents?" How comes it that savage tribes, on this principle, never invent, never improve, never adapt the thousands of accidents *they* daily experience?

He proceeds, however—"There is no reason to adopt a system of monopoly for the purpose of eliciting them [inventions]; they turn up simply in the ordinary and natural course of things; but if you can show that in any particular case the *public* is clearly indebted to the labour and intelligence of an individual for an improvement, whether it is an adaptation or an invention, or whether it is a novelty or not, I should be very glad to see some rational system of reward under which he could

be benefited, although *in the great majority of cases success in such matters would bring its own reward.*"

What mental reservation could Sir William Armstrong have when he gave expression to such a sentiment? It is perfectly astounding; it is contrary to all experience, and is offered in the very face of abundant proofs that quite a contrary result occurs to that which is here put forth so authoritatively.

No one had hitherto doubted the fact that Patents have a tendency to stimulate Invention, owing to the protection (such as it is) that they afford the Inventor. Sir William says—"I think that there is very little necessity to stimulate invention." When pressed as to a mode of giving "rewards in the absence of Patent Law," he made this remarkable observation—"I believe that *if you let the whole thing alone, the position* which a man attains, the *introduction* and *prestige*, and the *natural advantages* which result from a *successful invention* and from the *reputation* which he gains as a CLEVER and ABLE man will *almost always* bring with them A SUFFICIENT REWARD;* that is my opinion, and therefore I do

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* Perhaps Sir William is unacquainted with the sad history of Henry Cort, patentee of the following inventions:—

17 January, 1783. Machinery, furnace, and apparatus; for preparing, welding, and working various sorts of iron.

11 February, 1784. Shingling, welding, and manufacturing iron and steel into bars, plates, and rods of purer quality, and in larger quantity than heretofore, by a more effectual application of fire and machinery.

These inventions referred to improvements in the puddling and rolling of iron, effecting an immensely increased production, insomuch that

not wish to press it." Comment on such a statement as this can have little avail. Anything more extravagant could not possibly be advanced, anything more at variance with the history of all past Inventors, or more sarcastic and painful to men of mind imbued with a knowledge of the capabilities of Mechanical and Chemical science, and the vast unexplored mines of wealth, which Nature yet reserves in store for the exercise of human intellect, in the competition for supremacy, which is being continually exercised between mind and matter.

On the question of reward to "a person who brings forward a discovery useful to the *public*," Sir William coldly observed—"I think that his *reward* will come naturally." And being reminded that he had suggested that without Patent Law the Inventor would reap a "reward for his services," he only reiterated his former statement, declaring—"Wherever a man really shows aptitude for invention and general cleverness in these things he NATURALLY *gets on in the world.* The mere conception of *primary ideas* in invention is not a matter involving much labour, and it is not a thing, as a rule,

Henry Cort has been appropriately styled the "Father of the British Iron Trade." This veteran lost his property through the dishonest practices of his partner in trade, and, as has been said of him, "he was purely the victim of a swindler." A son of his now living is about eighty years of age; and there were also two daughters. Iron masters are a proverbially rich body. According to Sir William's theory they must have felt great commiseration for Henry Cort, his son Richard, and the two daughters. Enriched by his inventions, and further absolutely benefited through his very downfall, how lavish they must have been to supply him with more than the ordinary comforts of life! Alas! no; at seventy years of age Richard obtained a pension, amounting to less than 2s. 9d. per day!

I think, demanding a LARGE reward; it is rather the subsequent labour which the man bestows in perfecting the invention, a thing which the Patent Laws scarcely recognise."

This attempt to distinguish between the mental operation, and the after practical process is the one most in vogue among manufacturers. It is in every sense unjustifiable, because it represents the great body of existing patentees as a class of men reaping undeserved reward for most insignificant results.

Lord Overstone inquired—"Have there not been discoveries which have been practically useful during the lifetime of the discoverers, and which have been lost to the public from the want of sufficient publication afterwards?" He replied—"I have no reason to say so," adding, "That he knew of no such cases;" thus showing how little he is aware of what may be called the *Secret History of Inventions*—in Medicine, Magnetism, Glass, Metals, Chemistry, &c. In fact, he appears to take so little, if any, heartfelt interest in the subject of Invention, scientifically and intellectually considered, that we find the general tenor of his evidence to be, to consider the matter on the basis of its money value alone as seen through the eyes of the most keen, hard-bargaining manufacturer.

Mr. Fairbairn put the case of a "poor man," observing—"Another man might come and take up his invention and deprive him entirely of the benefit of it unless he had some law to protect him." Sir William appears quite prepared to ignore all such sympathies; he states peremptorily—"I cannot agree with you that that would practically be the case; the fact is that a *primary idea*,

a mere scheme, is not in itself of much value until it has gone through the experimental stage, and has been brought to a practical condition. *I have every week letters from Inventors, and I dare say you* [Mr. Fairbairn] *have the same; I have scores of them. Poor men very often come to me* imagining *that they have made some great discovery.* It is generally *all moonshine;* or if it looks feasible it is impossible to pronounce upon its value until it has passed through that stage of preliminary investigation which involves all the labour, and all the difficulty, and all the trouble. *Many a poor man is ruined by fancying he has made a discovery which, by means of a Patent, will bring him a fortune. He loses all relish for his usual pursuits, and sacrifices his earnings to a phantom.*"

So much for Sir William's commiseration for the fate of the poor who aspire to become inventors and patentees. It was well for Watt, Arkwright, and our own Stephenson, that they had neither such advisers, nor such hopeless chances of patronage. The Mathematical Instrument Maker, the Barber, the Banksman, were no doubt all suspected by many of possessing only "moonshine."

When further pressed on the subject by Mr. Fairbairn—"Supposing the case that a man has really made a discovery"—not one—"frivolous and useless," may he not, without protection, "be deprived of it by other parties?" he replied—"I think that absolute discoveries are very rare indeed; *nearly all* INVENTIONS *are the result of one improvement built upon a preceding one. A poor man* who has the ability to make *really practical improvements* is ALMOST sure to rise in the world without the aid of Patents." *Almost* indeed and truly!

Sir William Armstrong was next questioned as to

amending the law, on which he expressed a wish for "anything which would have the effect of *choking off* a great number of these Patentees," by a combination of scientific men and legal means, affording a tribunal to establish a preliminary inquiry; although he acknowledged that this was liable to do injustice to some one or more deserving inventors. He also expressed his belief that the granting of patents ought to be contracted, and his wish "to make the granting of a Patent the exception rather than the rule," conceiving that "to diminish the number of patents taken out would be so far a gain."

The tendency of Sir William's evidence is, that inventions ought not to be patented, that any system would be bad, but that the present course of the law is inexpressibly obnoxious; yet if some system must exist, no measures to frustrate an Inventor's obtaining protection can possibly be too stringent. It is, therefore, in perfect consistence with this prejudiced feeling that he gives his views of some of the "practical grievances" which "patents occasion," to support his own case. On this point, he says—"I will begin with a grievance which I complain of personally; and that is, the necessity which I am under of taking out Patents, *not for the purpose of obtaining for myself a monopoly*, but simply for the purpose of preventing other persons from excluding me from my own inventions. It is a source of considerable expense, and of a very great deal of trouble and vexation to me. In all cases I find it necessary to take the preliminary step in a Patent, but in many cases I find it necessary actually to mature a Patent, and to take out a Complete Specification, and for this reason, that if I bring forward an invention, and do not patent

it, another person patenting an improvement upon that invention really appropriates the whole invention, because no person will take the original invention without the improvement. That is a personal grievance which I continually experience."

Sir Wm. Armstrong's three earliest patents are, viz.—

31 July, 1846. For apparatus for lifting, lowering, and hauling.
11 May, 1848. For a water-pressure engine.
22 April, 1856. For apparatus for lifting, lowering, and hauling.

They include his hydraulic hoisting apparatus as used at the London Docks' Warehouses, which had it not been a patent property would never have proved of equal profit to the Inventor. Somehow or other no "practical grievances" appear actually to have arisen. They seem not to have shown themselves until 1857, when there was considerable rivalry in the improvements of Ordnance, Fire arms, and Missiles. Thus, if we place the following patents in juxta-position, we find:—

Patents of SIR W. G. ARMSTRONG, C.B.; F.R.S.	Patents of JOSEPH WHITWORTH, Esq., L.L.D.; F.R.S.
11 Feb. 1857. Ordnance.	12 June, 1857. Ordnance, fire-arms, and projectiles; machinery employed in their manufacture.
22 July, 1857. Improvements in the mode of adjusting ordnance for fire by night or day.	19 Oct. 1858. Guns, gun-carriages, and ammunition.
15 Nov. 1858. Manufacture of Ordnance.	29 Aug. 1859. Ordnance, fire-arms, and ammunition,
10 April, 1858. Means of firing or igniting explosive projectiles.	30 Dec. 1859. Projectiles; machinery for their manufacture.
9 Mar. 1859. Rifled Ordnance, and its projectiles.	23 Aug. 1861. Improvements in sights for small arms and ordnance, and in fitting apparatus used with small arms.
18 Mar. 1859. Means of igniting explosive projectiles.	
25 Mar. 1861. Improved breech-loading cannon.	
13 Nov. 1861. Means of firing or igniting explosive projectiles.	

Now is it consistent on any principle, that the "practical grievances" which we now hear raised would ever have been mooted, had his latter eight patents been without a rival? Side by side with Mr. Whitworth's patents we find year by year a larger number by Sir W. G. Armstrong. Is it meant that there should be no rivalry in patents, that rivalry must be limited to the senate, the bar, and the marts of commerce?

But we have his own defence. He is compelled to to become a monopolist in order that a monopoly may not be practised as against him. That is one point (he says), and also to prevent his being actually deprived of his own inventions by other persons patenting improvements upon them.

And as regards any other inventor presuming to improve one of his inventions, he remarks—"I will take one of my own inventions. I will take an hydraulic crane, for example, which I will suppose that I do not patent, and I will suppose that another person invents an improved valve and applies it to hydraulic cranes, and that he patents that improvement upon hydraulic cranes. Clearly the result of that is, that if it gives an improved character to the whole machine he will obtain the monopoly of the machine, because he has a patent for the improvement, and that carries with it the machine itself." Such an example supposes a crude invention rendered effective by a contrivance which the original inventor overlooked, and which improvement is so clever that he himself cannot supersede it!*

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* Sir W. G. Armstrong here disproves his own previous statement, his present argument proving that patents *do stimulate invention*, although

When addressed by Mr. Forster in the following terms: "My question was this, that the Patent may comprise the whole of the different parts of a machine, but you or any other person might make an invention which would improve one part, but in consequence of the Patent applying to the whole you are unable to do so?" Sir William replied—"Clearly, no one attempts to improve a patented machine, because the Patentee would take all the benefit." Sir William then is wholly ignorant of the history of Inventions past or present. He probably never heard why Watt invented the Sun and Planet Motion, and may have yet to learn that the Crank as applied to the steam-engine was a patented invention; or, that patents are being continually taken out for improvements on existing patented inventions. What importance can we attach to such loose evidence?

The late Mr. Hindmarch, Q.C., well versed in a knowledge of inventions, inquired, as if surprised:—"But would not the effect be precisely the same in the case which you describe, whether you yourself patented your invention or not? If you did not patent your invention another man might patent an improvement upon it, and if you did patent it, so he might patent an improvement upon it."—"No, certainly not" (retorted Sir William), "because if he patented an improvement upon

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not in a way agreeable to the general feeling of manufacturers. The "improved valve" is clearly introduced because the inventor can secure and demand a pecuniary advantage for it under protection of a Patent. In the absence of Patent Law such improvements would lie dormant, if made; and original inventions would long retain their primitive state and imperfections. Such results Sir William perfectly well understands; but *his case*, as regards Patents is the case of *all* manufacturers. See Chap. VI.

it, his improvement would be of no value without the machine itself."

Again he is asked—"Still you could not use his improvement?"—"That is another matter. I do not complain of that; but I *complain of his sweeping away my invention by sticking an improvement upon it.*"

The case as thus put is of no value; it is the mere expression of disappointed hope, and a desire to curb competition by all possible means; it supposes some inventor who has given his invention to the world being wrong; *not* because some one else improves it, but solely because that somebody is a "Patentee," who is not blest with the liberality of the giver of the originally imperfect invention. It also supposes that an improvement being once made, no other improvement can possibly be suggested.

Sir William complains of being obliged to take out patents of which—"The grievance is, that I am subject to the expense and to going through all the trouble necessary for doing so."

In proof of this we have just shown that where he *took out* eight *patents in three years*, Mr. Whitworth took out five patents, and the thirteen patents relate to kindred subjects. However, there were many other patentees during those three exciting years; so that against his will, and from a purely patriotic motive, Sir William was "compelled to become a monopolist;" otherwise, had there been *no patent protection* for anybody, Sir William, on his own showing, would still have gone to the same trouble and expense in experimenting on and improving Ordnance that he had incurred under patent monopoly! Such liberality de-

serves to be blazoned forth, if we understand the impression intended to be conveyed by the speaker's own statements; but we confess to irrepressible doubts. The expense and trouble of patents are trifling indeed compared with the expenses and troubles that follow years of unproductive experiments. And how Sir William can persuade himself, or expect to persuade others, that costly experimenting would proceed without the least prospect of protection, it is utterly impossible to understand.

Another practical grievance, unknown except to Patentees one would suppose, is—"If I take out a Patent, then of course I am liable to litigation."

Mr. Fairbairn inquired—"If I understand you correctly, you do not appear to object to a *single* monopoly; you do not object to the inventor of a Patent useful to the public having a monopoly, but you object to a *series* of monopolies for one improvement after another?"—Sir William, with infinite candour, declared—"No; *my private opinion goes against all Patents*, but I say that I will not press that question. Then I say the next question is, to narrow the system as much as possible, so as to diminish the number of Patents, and make the obstructions as little felt as possible."

He then supports this position by remarking—"A great many Patents are granted for things which are no improvement at all."

That is, from their obstructing progress; thus—"I have many times found it necessary to desist from following up ideas of improvement in consequence of the existence of a Patent which would have absorbed such improvements when brought to maturity. The ground

is so occupied by Patentees, and there is so much uncertainty as to what Patents are valid and what are invalid, that *it is difficult to find a spot to work upon without risk of interference.*" No worlds left to conquer!

Another objection arises from previous patents interfering, of which the inventor had known nothing—"I have continually found it necessary in my own experience to turn aside from the *natural* course which one would take as a machinist, in order to avoid somebody's Patent which is of *no value at all*, a dormant Patent, which the possessor has not ability to follow up and turn to a useful result, and all that it produces is an obstruction, and you cannot follow the course which you believe to be right simply because this dormant Patent exists. *That* inconvenience I have experienced myself *several times.*"

As something approaching a remedy, he suggests—"I have already stated that I think that such a stringent preliminary inquiry should be made as would *choke off* the vast majority of these Patents."

And again to the same effect—"I think that that would be a very wholesome regulation. I think that if the Patentee was obliged to go before the first tribunal periodically, and prove that he really merited a continuance of the monopoly, it would be a very proper thing."

As to the result of such a tribunal, he says—"I believe that there is not one Patent in ten which would bear scrutiny, and the mere name of a Patent often answers all the purpose;" such Patents of course obtaining an advantage never contemplated by the Legislature.

Persisting in his objections to Patents, he states that

the Patentee—"Has a *monopoly* of the *general idea* of a machine, or the process, or whatever it is, *that nobody* can improve upon *that idea* except for the advantage of the Patentee, and, therefore, nobody will attempt to do so." Such a perversion as this it is difficult to deal with. Whoever heard of a Patent giving "a monopoly of the general idea of a machine?" And not only is this statement entirely erroneous in itself, but it is advanced to support the assumption, that imperfect patented inventions would long since have been perfected if left "open to all the intellects of the country, to grapple with the difficulties of them." It being also assumed, of course, that such guide-posts (as we may term them) would exist all the same: a state of things we doubt and deny.

We now come to a most important feature in this remarkable evidence. He observes—"The question is, whether you are to consider the interest of the *individual inventor*, or the interest of *the public*. I think it ought to be laid down which is to be considered." Vice-Chancellor Wood seemed of opinion that *both* might be considered. "THE PUBLIC OUGHT NOT TO BE SUFFERERS," replied Sir William. But, said the Vice-Chancellor—"The inventors are the inventing part of *the public*." Again Sir William observed—"Yes, but they are a very small portion of *the general public*." And he further said—"It should be clearly laid down upon which principle we are to proceed, (1) whether we are to regard the interest of *the inventor*, (2) or the question of *public policy*."

In the early part of this examination a certain class of patentees had been spoken of as obtaining "black

mail" for the use of their inventions, and others mentioned as obliging *the public* to pay a tax for matters to which the patentee had no legal right, provided always that his patent claims were thoroughly sifted by some legally constituted tribunal. It cannot be too urgently pressed on the reader's notice to observe the constant abuse that occurs in the employment of that simple term, *The Public*. In its legal sense two or three persons, or 100 or 200 persons, may be all *the public* meant to be understood; but in its popular acceptation *the public* is synonymous with the *people*, the *million*, the *general community*. The language which obtains a definite meaning in law, when transferred to popular harangues, or the columns of the public press, may appear in a very different light. So here, in this case of patent monopoly, all political economists (take, for example, Bentham, M'Culloch, and Mill), speak of *the public* as the people at large, the million; but Sir W. G. Armstrong's *public* is a very different class. *His* public is the public of engineers, iron founders, boiler makers, iron ship builders, machinists, millwrights, and all iron masters, founders, and workers in metals generally; a large body no doubt, but still only a fractional part of the body politic. And it is this class, this special *little* public, that Patent Law affects, that patents tax, and that some patentees are charged with obliging to pay "black mail." It is "the public" of spinners, weavers, dyers, and other general manufacturers, which, according to the nature of the trade to which each belongs, is taxed by patents, and has been sympathised with in leaders in *The Times* newspaper as the sorely aggrieved, afflicted, taxed PUBLIC at large. Sir William could

not be otherwise than aware of this broad distinction, and of the misapprehension to which its indefinite application may lead; but the natural acumen of wise lawyers leaves it to others to obtain a proper understanding of their utterances, which many are very apt to neglect; as in the present instance when they raise against Patentees the absurdly ridiculous charge of *taxing* THE PUBLIC. Heathcoat* introduced his improvements in lace machinery when a square yard of bobbin-net lace was priced at five guineas. How did he *tax* THE PUBLIC? Why by obtaining from the "public" of manufacturers such a royalty, or tax on the cost of machinery, that they were enabled to sell to the public at large the same measure of lace at from $4\frac{1}{2}$d. to 6d.! Was it any tax on the million when the illumination of towns by means of oil lamps was superseded by gas manufacture? Take also an instance supplied by the history of steel manufacture, producing a material which was, until lately, principally in use for tools and cutlery; but which, as obtained in large masses by the Bessemer process, has now rendered steel available for most important engineering purposes, to such an extent that it is rapidly superseding wrought iron in the manufacture of rails, wheels, and axles.

When Mr. Hindmarch alluded to a Patentee as being a person who "discovers the capability of a thing which previously existed," Sir William remarked—"I object to the 'capability' being made *the subject of a monopoly.*"

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* John Heathcoat was the patentee in 1808, of machinery for making bobbin-lace, from which time to 1813, he continued introducing improvements, his rights to which were secured by ten patents successively obtained by him.

We never heard of a patent for employing the "capability" of electricity to carry messages; the "capability" of gunpowder to propel shot; or the "capability" of steam to raise or to rotate a piston. But for the application of the capability of some principle or other to act in some particular way, patents are commonly enough obtained. Sir William's confusion of ideas on this point is what we should not have expected.

He acknowledged that he had not given attention to any practical mode of dealing with invalid patents; but he suggested that the points for consideration were—"Want of utility; want of importance. I should certainly make importance a criterion as well as novelty."

When Lord Stanley observed—"You have been, I think, personally concerned in Patent cases, in defending or resisting Patents?" Sir William replied—"No; I have been very little mixed up with them. I have always kept clear of them."

Being asked—"Have you considered the question of compelling Patentees to grant licences for the use of their Patent inventions?" He said—"I think that that would be an improvement."

In support of this opinion he proposed assessing the licence fee according to the value of the Invention! adding—"An invention *without much merit* would *not* be entitled to the same licence fee as one with *considerable merit*," the Court having a jurisdiction on such points. After much inquiry on this topic, Sir William said—"I have known Patentees very exorbitant in their demands for licences, *far beyond the merits of their inventions*." Now this exaggeration, this making a solitary case out of thousands appear as a general result, is so

unfair, so unjustifiable, that whoever thus lends himself to the prejudicing a body of honourable men who are seeking only to be truthfully informed, lessens the importance of his entire evidence, and throws a cloud of doubt over that which he states in full fairness and honesty. It is truly lamentable to find Sir William thus prejudiced against the interests of thousands of patentees principally because some two or three or more of the body have been indisposed to meet his own personal views on some small matters of per centage; and in short, have only treated him with respect to their patent property, precisely as he himself would have treated them. Such a course is unjustifiable on every ground, for he endeavours to make his case clear by questioning the talent and ingenuity of inventors generally, by denying their right to any monopoly of their inventions, which he declares to be no inventions at all! And if some single inventor demands what Sir William may choose to consider an unreasonable charge, or "an exorbitant licence," according to his own self-adjusted register, he does not hesitate thereon to denounce the great mass of patentees as men equally extortionate. He cannot imagine anything less to be desired "than allowing the Patentee to fix his own price" for a licence. One feels irresistibly urged to inquire, Can it be that Sir William is retiring from further Inventing, Patenting, and Experimenting?

In the case of an Inventor having a patent, and his invention undergoing improvement in other hands, Sir William says of such a patentee that—"He gets possession of a certain idea; that, in the form in which *he conceives* it, *is of no value*, but at a subsequent period

other persons following in the same line of discovery, *probably* [?] without knowing of the existence of the Patent, make improvements, or produce the same thing in an improved form, then he takes possession of that under his patent, and is able to obtain a licence fee, and an advantage from it, which he could not otherwise do."

He afterwards added—"What I complain of is this, that a person obtaining a Patent for *a crude invention* prevents other persons from entering upon the same ground unless at their own peril [?], and I have known cases where, *in the ignorance* of the existence of a Patent, improvements have been made, and *practical* value given to an invention which has been previously patented, and then the Patentee has come forward and said,—'That is my invention, and you must pay me for using it.'"

It is difficult to deal with these assumed cases, but at the outset we may observe, that at best the instance given does not apply in one case out of 500, or we might venture to say one in 1,000 Why then elevate and make conspicuous these few exceptional cases? why travel over patents with the microscopic eyes of a house-fly to aggravate every trifling case as though it afforded a host of evidence? Sir William himself undertook the manufacture of a railway wheel in ignorance of a patent by which it was protected (and no doubt most unwillingly) arranged to pay a royalty for its use. Somehow or other patentees always do object to pay to other patentees more than "money out of pocket," as lawyers say, for their inventive products, and in this respect Sir William is, on his own showing, no exception whatever. For one such case as Sir William adduces, 5,000 might be named entirely free from any such mischance; which after all

must be attributed to an ignorant inventor, applying to an ignorant patent agent, in some country locality remote from accessible sources of information. Just as a man gets punished because he happens to be ignorant of some act of parliament, or has no sufficient legal adviser; so may an inventor, becoming a patentee, expect to suffer disappointment, the only possible result of his temerity, if his invention and his patent are the produce of combined ignorance and secrecy. Really Sir William's picture of such an inventor is not calculated to excite commiseration in these days of public libraries, printed patent specifications, indexes, and other references to existing patents; and the abundant sources of information and advice from legal, patent, and other agencies.

Sir William invariably charges Patentees with ignorance with regard to inventions, and exorbitance with regard to patent royalty. He thinks a tribunal having a power to exercise compulsory licencing would be an advantage—because, says he, "*I think that it would protect* THE PUBLIC from the exorbitant demands of patentees." Here, as in other instances, we cannot exactly blame Sir William for being desirous to bolster up his own case. Here again we have the benefit of *his* "public," the legal *public*; whereas the general reader might suppose all this sympathy arose from the most philanthropic motives, a sincere desire to supply to the general public the cheapest possible steam-engines, steam boilers, locomotives, rails, railway wheels, &c. &c. But nothing of the kind. Its true meaning might have been better expressed by some such reply as this—"I think that compulsory licencing would protect the public body of manufacturing engineers from what I consider

the exorbitant demands of patentees in iron manufacture; and thus enable manufacturers to realize from five to twenty per cent. more than they at present can obtain on certain portions of the works for which they contract." *The Times* has been deluded into the notion that it is the million, not the mere manufacturer that is to benefit by any lowering of the so-called Patentees' tax.

Mr. Fairbairn put three pertinent questions, which we will proceed to give, with Sir William's replies:—"If any Patentee is very exorbitant, it strikes me that the *public* will stand aloof?"—"Then the *public* will suffer."

"The *public* will suffer to a certain extent if it is a very valuable Patent?"—"Yes, and if the Patent has no value, the question does not arise."

"It is more than probable that the Patentee would come to his senses and find it necessary to reduce his demand?"—"I cannot help thinking that a discretion, lodged in disinterested persons upon that point, would be convenient."

Here again the million are made to do service for the manufacturers. When Sir William says—"Then the public will suffer," he means the legal *public*; his own party, not the inhabitants of Newcastle, or of Great Britain. This is another of his favourite generalizations from solitary cases to the masses; from a few engineers, or a few classes of inventors, to the sympathies of many millions of his suffering countrymen, persecuted by Patentees!

On the question of buying up patents of a particular class, inquiry was made—"Have you ever come in contact with any case in which the owner of one or two

of these Patents has managed to buy up other Patents so as to obtain full possession of an important machine, and thereby to obtain a monopoly of something which is of immense advantage to the public?"—"It has now become a very general practice for companies to buy up all the Patents upon a particular subject."

"In that case the power of fixing *an exorbitant price* really preventing the use of the article altogether operates very disadvantageously to the *public?*"—"*No doubt of it.* I feel that I am speaking upon details which I am not competent to give an opinion upon, because all these questions are answered merely upon the impulse of the moment. I have not given any consideration to them at all" *My objection to Patents is upon the broad principle.*" Very "broad" perhaps, in a trade point of view, but exceedingly narrow politically considered.

In the instance of Price's Candle Manufactory many patents were bought up, solely with a view to avoid litigious proceedings, and, therefore, no doubt, under sound judicial advice. But as candle manufacturers they produced a good and cheap commodity; they did not tax, or in any way impose, on the *public*; and if they kept their patents under their own management they certainly prevented the supply of any spurious article. If a patentee were compelled to licence all who apply to him on some low terms assessed by an irresponsible tribunal, what infamy might be brought on inventors and patentees by the production of deceptive productions bearing their brand and licence.

Sir William, adhering to his principle, observes—"The Patentee is a monopolist, whereas, in other cases

where you cannot deal satisfactorily with one man you go to another, and therefore *the public are at his mercy*. The question is, whether there should not be some control over him to insist upon moderation in his demands."

Alas! poor PUBLIC, what have you not to answer for! What a convenient handle you are for lifting a lame subject out of a slough!

Sir William always losing sight of his own position as a patentee is liberal in the censures he casts on the great body of patentees; thus he says—"I think that practically there is no doubt that the claims of Patentees are *very frequently*, and I may say *generally*, *excessive, and beyond the real value of their inventions*; but there may be cases in which new conditions of things arise, and the invention, *if invention it may be called*, becomes a matter almost of necessity, and the *public* must have it. The case which has been put I think is a very strong one, in which a public company or a large capitalist buys up all the existing Patents, and thereby acquires a power which may be *exceedingly oppressive*."

Here he wishes to make it appear that the charge or patent royalty demanded by patentees is not only "frequently" but "generally excessive," because "beyond the *real* value of their inventions;" that is, their "real value" as estimated by the manufacturer. But he is only arguing for one side, for the manufacturers of engines, railway work, &c. This does *not* apply to the *public*. The "public" would not be supplied any cheaper by the trade, on the ground that the patentee had lowered his charge of royalty for licence to use his patent. Sir William's next complaint is against persons as companies holding a number of patents, which he

finds to be "exceedingly oppressive." Oppressive to whom? Not to the *public*; nor even to manufacturers, otherwise they would not purchase.

In replying to Vice-Chancellor Wood, Sir William volunteered the statement that—"In the vast majority of cases the invention, as described by the Patentee, *is of a very crude and imperfect nature.* It often occurs that *if another person could take up that invention,* and give it his attention, he would be able to mature it and greatly add to its value; he abstains from doing so because he knows that the result of the labour which he would expend upon it will only increase the charge upon himself for using the invention; that is a case in which I think it ought to be left to the discretion of a tribunal, whether an additional charge is proper or not. *From my own experience I know of many cases in which I see that a person has a good idea, but in the form in which he has it, it is of very little value.* If I took up his idea and gave additional value to it by giving it development, it would not be fair to me for that man to say to me, 'I must charge you so much more,' or that the *public* should pay him so much more for using it. I think that he should not be paid for improvements which he has not effected. In a case of that sort the tribunal would have an opportunity of controlling his demands."

Sir William's exposition of his experience of patents reads like a story of night-mare; what an incubus a patent must be upon his mind! Patentees get all the crude ideas, and the real benefactors of society, those who *improve* "crude inventions," find themselves straightened in their good endeavours. In all this, Sir William does appear to us as though he were prov-

ing too much. Does he seriously, honestly mean all that he has stated in his evidence? If so, he is hopelessly beyond the reach of conviction.

Sir William objects to granting Patents to foreigners; he says—"*I have an objection to Patents of all kinds*, as I have already stated; but in that case, unless you wish to benefit the foreigner, unless that be the sole object, as a matter of policy, I do not see what the motive to apply the Patent system is."

But he admits—"If the Patent system is to be maintained, it may, perhaps, be expedient as a matter of reciprocation to allow foreign inventions to be patented; but I have not considered that view of the case."

On the subject of Patents in America, Sir William proved himself strangely at fault. Mr. Hindmarch inquired—"Is it not the law in America at the present moment that they will only grant Patents to foreigners upon the same terms as foreign countries grant Patents to Americans?"—"I think that the American law does not grant Patents to foreigners at all."

"I have reason to know that they grant Patents to foreigners, but only upon the same terms as the nations of those foreigners grant Patents to an American citizen?"—"*I was not aware that that was the case.*"

How a gentleman of legal education, placed in Sir W. G. Armstrong's position, a patentee, engineer, and extensive manufacturer, could evince such a want of information on a privilege protection which he was denouncing, when claimed as an equal right by his countrymen, it is quite impossible to comprehend. But indeed the whole bearing of his evidence is painfully narrow and prejudiced, devoid of all generous and proper feeling to-

wards inventive genius, or care for talent struggling under a pressure of adverse circumstances. In place of these there is an irrepressible bitterness of feeling, and ebullitions of personal resentment, seeking to appear calm under the transparent cover of affectedly moderate language.

Sir William has touched on some very few points on which all men must agree with him who feel any interest whatever in the improvement of Patent Law. No doubt many frivolous patents are granted; many invalid patents require to be quashed, and patents should not be granted to the mere *importer* of a patent from abroad, but only to the inventor. On these three points there cannot be much difference of opinion, but unfortunately, because Patent Law is not the most perfect of our laws, Sir William would distort this simple fact into a proof that it is hopelessly wrong and unimprovable, than which assumption nothing can be more unreasonable.

But the little that Sir William says to the purpose is more than counterbalanced by his pertinacious adherence to expressing a mean opinion of inventive talent. With him Invention is sure to come when invention is wanted! And the inventors are sure to reap rewards as certainly without patents as they now do under patent protection! Poor men who presume to invent excite rather his contempt than his pity; their letters to him are filled with absurd projects, and he doubts not as he gets "scores" of such letters, that other engineers are similarly inundated with the suggestions of poor working men; another proof of the necessity of adopting measures to "choke off" patents as much as possible! In these and other particulars throughout his evi-

dence, Sir William forgets that *Aquila non captat muscas*. He persistently seeks to magnify every trifle; he sees all the flaws, but none of the good qualities of Patent Law, and is so influenced by a sense of personal provocation in his own operations with patents and patentees (particularly in the manufacture of railway wheels and ordnance) that he views the whole course of the patent system with a jaundiced eye and an unconquerable sense of disgust; therefore, considering he is thus influenced, he spoke with praiseworthy candour when he observed—"I feel that I am quite in a minority."

Suppose, for the sake of argument, that we imagine Sir W. G. Armstrong's views to be accepted. Suppose there are very few real inventors, very few real inventions, no occasion to hold out encouragement to inventors because good inventions bring their own reward from masters, or the trade generally, or the public at large, entertaining such views, we should be justified in separating inventions into first, second, and third-classes? And if men of education in Sir William's position conceive invention to be so rare, and even moderately good inventions very inconsiderable, how much lower still might we not expect this stringent estimate to fall among an interested and uneducated class of manufacturers? And having once become convinced that little value attaches to an invention, but that *all the value* is in the working of it out, what compunction need any man, or any body of men, feel in saying to inventors of the class in which we find Watt, Heathcoat, or Bessemer,—remember your invention is only an "idea," the idea is not bad, nay, it is rather good, but still it is at present merely an "idea;" it has cost you

nothing, or very little, and so far as "money out of pocket" is concerned, we award you the full of such expenses; and we further award to Watt £5,000, to Heathcoat £4,000, to Bessemer £8,000. If the inventors demur, a ready answer is at hand;—the trade has combined to reward Inventors for "really good" inventions, and although such inventions are few, the funds of the Society it is found will not admit of giving higher rewards. But if the desire is expressed to apply for a special Government grant, the Society might offer its countenance and support. All this would apply to the first class Inventors; the second and third classes would have to be contented with, in some cases, an increase of wages, and in others with small annuities, or admissions to almshouses. We conceive this to be no exaggerated statement of the results likely to follow from Sir W. G. Armstrong's projected process for recognizing and rewarding Inventive talent in this country.

Sir William's narrow policy lays the foundation of one of the very worst kinds of combinations; not only tending to curb inventive enterprize, but also to curtail the present extensive system of trade competition. Sir William is well aware that the fewer competitors in the manufacture of Ordnance, for example, the better. He complains of the pressure of his Patent and legal expenses, but says nothing of the thousands of pounds expended for *experimental* purposes, which are too often an entire loss to the manufacturer; and which might all be saved if competition no longer existed to inspire the wish to outstrip the improvements of some other patentee in the same field of enterprize. So long as Sir William prefers advocating a system which only favours the

jealous feelings and impolitic principles that actuate the minority in the little "public" of manufacturers to which business pursuits attach him, he need never expect to advance beyond the assertion in his evidence—"*I feel that I am quite in a minority.*" We have reason to believe, however, that Sir William has considerably modified his views on this subject since the period when he gave the foregoing evidence.

CHAPTER VI.

EVIDENCE OF ROBERT A. MACFIE, ESQ., ON PATENT MONOPOLY, AS GIVEN BY HIM IN 1863.

A PAMPHLET was published in 1863-4, by Robert A. Macfie, Esq., of Liverpool, Sugar Refiner, on "The Patent Law Question," being a paper read at the Social Science meeting in Edinburgh, October, 1863, and which embodies the substance of his evidence, presently to be noticed. He advocates "the emancipation of industry—an object hitherto wonderfully little sought on the PUBLIC grounds that make it a matter of NATIONAL urgency." On his showing—"British manufactures have outgrown the confinement and trammels of the nursery and go-carts, and demand *freedom of action and fuller scope.*" His whole aim is, of course, therefore, to show that patent monopoly is on every ground objectionable and pernicious. "Is it not a grievance (he asks) that into going works should step the privileged inventor, and draw a large revenue from some single machine or process?" He also pleads the case of the operative, remarking—"If it were not for the obstacle that Patent Laws interpose workmen would have their wages advanced by masters naturally unwilling to lose these depositories of their *secrets*; and higher wages would be proffered by *other applicants* for the services of men who would indeed to them be treasures." But still he would reward true Inventors through the medium of a public grant out of

from £100,000, to £200,000 to be distributed annually by the State. Indeed, he can see no objection to any source of benefit to inventors that does not flow directly from the body of manufacturers whom their inventions may concern. He emphatically assures us—"Manufacturers do not grudge inventors *any amount of honour and reward.* In their name I cry: 'Decorate inventors with ribbon and medals—confer the halo of honourable mentions—distinguish by titles—recompense with money votes. All this to any extent that taste, gratitude, and interest permit or impel. ONLY LEAVE US FREE. Do not tie *our* hands and hamper us with weights in the keen race and hard struggle of modern commerce. Do not under the guise of helping us continue fetters *obviously* [?] hurtful and unfair.'"

In his pamphlet, Mr. Macfie invariably represents the case of the manufacturer as being that of the *public*, although he does not venture on attempting to substantiate his position by a single practical illustration. Throughout we find imaginary and possible, but most improbable and unlikely instances advanced to warrant his denunciation of patent monopoly. Take a few examples. He says—"Quite *commonly* an invention suggests itself to a number of persons *about the same time.*" We deny the assertion as relating to anything but some very *un*-common fact. But if a dozen men at the same time had an idea to construct wood pavement, no two would invent exactly the same method; and hence the number of patents for wood pavement. He is right when he states that inventions—"Are in their nature *capable* of being independently discovered or originated," but is wrong when he adds—"in the *same*

identical form, by a plurality of persons." If he is provided with any such curiosities of inventive collision, why does he not publish them to strengthen the cause he goes so much out of his way to support? Another of his mere assumptions occurs when he says—"Contraventions of patent right may be, and *not unfrequently are*, done unconsciously or unwittingly." Is this *one* case out of some 30,000 or more patents? Then he starts visionary cases of what the patentee might do, and might not do; probably, we must suppose, from mental derangement! Then, patents are "nets;" they are "toll-bars" —they interrupt "the thoroughfare on the highways of industrial enterprise," a most terrible, fanciful picture. Again—"*If* monopolies make articles *dear*, it is the *public* that pays the enhanced cost," says Mr. Macfie; to which we answer—"And *if* it can be shown that the public now purchase for five pence what once cost five guineas (as in lace manufacture) previous to the exercise of any patent monopoly in the production, then without doubt such monopoly makes articles *cheap*. "*If*," suggests Mr. Macfie, "a patentee makes charges that are unequal, theirs [the manufacturers] is the hardship. *If* he makes charges so high as to cause export trade or home consumption to dwindle or disappear, theirs is the loss of employment and profit that ensues." Why this inverting of the optic glass? Why suggest these baseless, unwarrantable charges? Are the so-called evils of patent monopoly really only such as affect a few to the benefit of many?

At the same meeting of the Social Science, Mr. W. Hawes, F.G.S., Chairman of Council of the Society of

Arts, gave a paper on the same subject.* He speaks very flatteringly of inventors, observing—"Philosophers, chemists, and often scientific mechanics, *whether English or foreign*, give their *ideas* and *discoveries* freely to the public; each uses the discoveries of his predecessors in inquiry to aid him in his further investigations, and to help him to earn fresh laurels. *Honour and fame*, and the *position in society* they secure are *their reward*, and one and all would be ashamed to say that their search after truth would be stopped if these laws were abolished."

He also supports Mr. Macfie's views, and favours the rewarding of Inventors by the State, "either before or after death."

On the 21st May, 1863, the Right Hon. Lord Stanley in the Chair, Mr. A. Macfie, being examined on the working of the Law relating to Letters Patent for Inventions, and having given evidence at considerable length, was further asked in regard to the amendment of the present Patent Law†:—

Chairman—"Have you any further suggestion to offer?"—"I would venture to propose that a return should be got of the number of Patents affecting Sugar Refining, and the employment of animal charcoal, in the various sugar countries and in our own, because I think *that* return would prove that we are subject to a great many Sugar Patents which our rivals in our own

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* See "The Law Magazine," vol. 16, 8vo., 1863, page 61.

† It may be as well to mention here, that all the passages given as extracts in the present and in chapters II. to V., are verbally correct, but occasionally italics or capitals have been introduced.

colonies even are not subject to. This by a particular case would illustrate the general principle. With respect to Patents generally, the subjects of Patents are of many different kinds. There are articles ready for public use. There are articles ready for use by manufacturers, but which are only helps towards making other articles ready for public use. There are *raw materials*. There are processes. There are principles. All those ought to be dealt with differently. That persons should have the power of *extorting* from manufacturers, shipowners, miners, agriculturists, &c., any amount of payment by royalties upon the use of those different kinds of *Patents* [?] is very hard. I would not pronounce it a great hardship that the inventor should be at liberty to preserve the monopoly, and charge as high a price as he pleases, for a novel mustard-pot, or carpet-brush, or any article for family use. It is a very different matter when, by *inventing* any manufacturing apparatus, or process, or *raw material* [?], that the progress of trade requires all the makers of some extensive article to employ; he embarrasses them in their operations by refusing licences, or charging prices which are burdensome and hurtful, or wrongous, and introduces disparity of terms and treatment, which is *an almost inevitable characteristic* of the system now in operation [?]. Find now-a-days a new trade, such as the original toleration or sanction of invention monopolies (at a time when all other monopolies were made illegal) of invention monopolies apparently contemplated, and few will object to its being fostered or distinguished by exclusive privileges [?]. It is wholly a distinct proposition to continue a system that has become *almost* universally, or at any

rate *far too often*; a means of letting one person interfere with other persons' *established* trades, and with their liberty to conduct these trades to the greatest *individual* and *national* advantage [?]. What is the case of manufacturers is, more or less, the case of shipowners, miners, and agriculturists. Then again, I think that it would be well to consider *who are the different parties who make inventions.* Is it workmen chiefly, or their masters, or tradesmen whom masters employ, or savans, or mere schemers, or persons who deal in inventions, and who make a sort of trade in *looking up new ideas?* Or is it invention importers we have to do with? *Very different treatment is due to those several parties or classes.* In the case of workmen it is pretty clear—that they would rather have a bird in the hand than two in the bush; they would rather have a positive though moderate Government grant than the prospect of a large sum at some uncertain future. The most important thing to be borne in mind is *the advantage to manufacturers of being free to use whatever they think fit.* To revert to my own business for illustration—it is *impossible,* with so many as 400 Patents taken out within a very few years, for sugar refiners to make themselves acquainted with them all. They must frequently be exposed to the risk of *using other people's inventions without knowing it.* That is not a very pleasant situation; *practically it is impossible to master the various Patents which have been taken out.*"

Lord Overstone—"Have you ever been seriously inconvenienced by applications being made to *you* in consequence of *your having unknowingly used some Patent*

process?"—"We have *not, except in the case* which I have *mentioned already.*"

Mr. Hindmarch—"Would it be a very expensive thing to you to buy copies of all the Specifications which come out in any one year, relating to your business?"—"*Certainly not*; I do not think that it would cost much more than *twenty shillings* a year altogether."

"Do you not know that a great many manufacturers in this country do that continually?"—"We buy a good many Specifications ourselves."

"Therefore *you have no difficulty in ascertaining what Patents have been taken out in your business?*"—"The difficulty is *to understand them*, and also *to bear them in recollection for ten or twenty years.* I have only to plead *on behalf of manufacturers* that some plan should be devised by which, while the *inventor shall be properly rewarded, the manufacturer shall be properly protected.* I have no wish that inventors should want any honorarium, or any profit which is FAIRLY THEIR DUE, but we want some plan by which *we* shall be put on a fair footing with *our rivals.* So long as we pay what our rivals do not pay the footing is not fair [?]. It is very hard indeed that a party should have the power of refusing the use of an invention which it is important for a manufacturer to have; *he might say*, 'I have an ill will against you, I will not give you a licence on any terms, yet I will give it to your neighbour' [?]. A foreigner *might* take out a Patent and *he might say* 'I will not give it to any Englishman.'"

Chairman—"Is not there sufficient security against that in the fact that he punishes himself by losing his profit?"—"I hardly think that that consideration re-

lieves us from the difficulty, because very *foolish* things are done by people. Very strange things happen in practice. *Nothing is more strange, for example, than the small number of inventors who apply to* us *to adopt their inventions.*"

Lord Overstone—"Is not *one of the strange things* which happen in practice this, that in practice *none of the apprehended grievances which you have expatiated upon have occurred?*"—"But they must occur the first hour in which we have an *important* Sugar Refining Patent. Several important Patents have been taken out, but without exception all have been previous to free trade. We must have in the ordinary course some *exceedingly important* Patents, and then *we shall be asked* to pay *probably* at the rate which I have mentioned, £20,000 a year. One firm which I could name may have to pay twice that sum for a single Patent."

"You are unable to state that that has yet occurred practically?"—"It is only ten years since the new Patent Laws have come into force, and it is for a less time that we have had free trade in sugar."

"During the last ten years the practical grievances which you apprehend as in prospect have *not* actually occurred?"—"*They have not occurred.*"

Mr. Waddington—"You account for that by saying that no Patent of value has been taken out, but you apprehend that if a Patent of real value were taken out the grievances would occur?"—"Yes; we must in that case have to pay many thousands a year."

Mr. Hindmarch—"You propose that Legislation should take place, not to cure any existing ascertained grievance, but *to prevent the possibility of any injury in future?*"—

"*Exactly; not* so much from *our experience* of grievances, as to *prevent* those evils becoming practical which in time past we have had *grounds to apprehend*, and which may be *justly feared in the future.*"

Mr. Macfie advocates free trade in the products of every inventor's ingenuity. One class may be rewarded "through a moderate Government grant," but "the most important thing to be borne in mind is the advantage to manufacturers of being free to use whatever they think fit." And of course as Mr. Macfie could not "use" as he saw "fit" any of the 400 patents in his own trade, he complains of their existence. Need we be surprised with Mr. Macfie that, but a "small number of inventors apply to *him* to adopt their inventions?

Men like Mr. Macfie always express a wish that inventors should have "any profit which is *fairly their due,*" and would persuade senators, lawyers, the public press, and the public at large, that Patentees are all alike, all exorbitant,—open to no arguments that the trader can advance, and refusing with scorn every offer it is in his power to make! Nay, that they even become scoffers capable of saying, "I have an ill will against you;" and if foreigners that they will refuse to licence "an Englishman!"

Mr. Macfie makes it a point of importance "to consider who are the different parties who make inventions;" and inquires:—

1. "Is it workmen chiefly,"—
2. "Or their masters,"—
3. "Or tradesmen whom masters employ,"—
4. "Or savans,—
5. "Or mere schemers,—

6. "Or persons who *deal* in inventions and who make a sort of trade in looking up new *ideas?*"
7. "Or is it invention importers we have to do with?"

The classification thus attempted is singular enough, but it is some or all of these whom Mr. Macfie charges with interfering "with other persons' *established* trades, and with their liberty to conduct these trades to the greatest *individual* and *national* advantage."

If such severity of censure means anything, it only declares in other words that, "Novel Inventions disturb 'established' systems of iron manufacture, of travelling by stage coaches, of illumination by means of oil lamps, of sugar-refining, dyeing, bleaching, weaving, &c. &c., so that the advantages of 'individuals' in those trades and callings are seriously interfered with, whatever may be the 'national' advantages arising out of patented improvements in these several branches."

When Mr. Macfie, Sir W. G. Armstrong, the Rev. J. E. Rogers, *The Times*, and other opponents of Patent Monopoly, can show a "*national*" *disadvantage* arising out of Patents for Inventions, it will be desirable and worthy the immediate attention of the Legislature, to suppress such a monopoly, but not until then. Mr. Macfie evinces a singular want of consistency in separating what is for "family" use from inventions affecting the "public," and in treating "brushes," &c., as not being manufactures.

He also represents it as a serious evil that there should be 400 patents for improvements in his trade of sugar refining, yet he has only been affected in one in-

stance, and out of the 399 remaining he cannot call to mind any patentee who troubled him or his partners in trade. But he looks to the *future*, and is sorely dismayed with the disasters looming in the distance! He complains bitterly—"So long as *we pay* what our *rivals do not pay* the footing is not fair." All this is sheer hallucination. His evidence goes to prove that *his rivals pay* what he does not pay!

But he argues the case of the manufacturers at large rather than his own—"I have (he says) only to plead on behalf of manufacturers that some plan should be devised by which, while *the inventor shall be properly rewarded, the manufacturer shall be properly protected.*"

Such being his desire, it only remains for the manufacturer to make his terms with the patentee through his legal adviser, and the whole matter will be most securely and satisfactorily arranged, without requiring the amendment of any existing law.

PART III.

EARLY

INVENTORS' INVENTORIES

OF SECRET INVENTIONS,

EMPLOYED FROM

THE 13TH TO THE 17TH CENTURY,

IN SUBSTITUTION OF LETTERS PATENT.

No doubt the sovereignty of Man lieth hid in knowledge; wherein many things are reserved, which kings with their treasure cannot buy, nor with their force command; their spials [scouts] and intelligencers can give no news of them, their seamen and discoverers cannot sail where they grow; now we govern nature in opinions, but we are thrall [slave] unto her in necessity; but if we would be led by her in invention, we should command her in action.

BACON.

PART III.

PREFACE.

THE Inventories of Inventions which are here for the first time presented to scientific readers in a collected form, clearly show, that in the absence of Patent Law, the position of modern inventors would retrograde, and they would be reduced to the same helpless condition that in early times fell to the lot of inventive genius. The fate of the Marquis of Worcester, the undoubted inventor of the steam-engine in its primitive form, is the latest, best known, and most remarkable instance on record of the immense difficulties with which mechanical talent has to contend in endeavouring to stem the tide of popular prejudice and disbelief. Writers of eminence in history and biography have not been wanting, in the case of the Marquis of Worcester, to represent him as a wild and whimsical schemer, and his "Century" as a composition unequalled for absurd and impossible assertions. The present collection, however, must for ever set at rest the presumptuous criticism of Walpole and others, by the evidence it affords that the "Century" was a composition written in the manner common among those inventors who were his predecessors, and who had often no other means of making public their possession of inventions of ingenuity and worth.

But this miscellany has another and most important

bearing; it affords indisputable evidence of the large amount of ingenuity that has been lost, the early possession of which could not otherwise than have largely contributed to the progress of arts, sciences, and civilization.

To inventive minds such Inventories as these are exceedingly suggestive, and the "Century," as being the best known, has been the most productive of mechanical contrivances, some of which have been avowedly derived from its very brief descriptions. Indeed, the steam-engine exhibited by Savery in 1699, and described in the "Philosophical Transactions" in 1700, only thirty-two years after the decease of the Marquis of Worcester, is an exact counterpart of that in the sixty-eighth article of the "Century."

Savery is the reputed inventor of the steam-engine he thus exhibited, but his title is open to grave doubts,* as persons were then living who had seen the Marquis's "fire-engine" raising water at Vauxhall, where it was certainly at work in 1670, if not later. It is also possible that models and drawings then existed to which Savery might obtain access. But he affected to be unacquainted with the "Century." If we believe him to be an independent inventor, we must at the same time admit that his ingenuity is without a parallel, in producing an engine of such an entirely novel character, so complete and perfect, that from first to last he was never able in the least to improve upon its construction.

It may be worth while to notice here the great simi-

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* This matter is fully examined in "The Life of the Marquis of Worcester." 8vo. 1865, pages 484—498.

larity that exists in the composition of these several Inventories, and to call attention to the fact in Patent Law that, "Letters Patent" and the "Specification" are distinct documents. The former bearing the Great Seal, has always been in use in grants by the Crown of a Licence to an Inventor, who simply declared the nature of his "Invention of improvements" very much in the style adopted in the "Century;" no *specification* of details being then required. The first "Specification" enrolled does not bear date earlier than the 3rd October, 1711.

13th Century.

WILARS DE HONECORT.*

1. *Saw Mill.*—How to make a saw by itself.

[The moving power is a current of water.]

2. *Saw to cut off Pile-heads.*—By this machine the heads of piles may be cut off under water to fix a platform upon them.

3. *Screw to raise weights.*—This is the way to make the most powerful engine known for raising weights.

[A long vertical Screw is suspended in a stout frame.]

4. *Trebuchet.*—If you desire to make the strong engine, which is called a Trebuchet, pay attention to these pages.

[A projectile machine employed in the middle ages to throw large stones by means of a sling.]

5. *Heliotropic angel.*—How to make an angel point with his finger always to the sun.

[The old kitchen-jack, with its enormous weight, descends down the wall of a house, and its regulating fly-wheel, bears the nearest resemblance to this device; a uniform rotation of the statue in 24 hours would be a very coarse approximation to the intended object.]

6. *Eagle-desk.*—How to make the eagle turn his head to the deacon during the reading of the Gospel.

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* See "Fac-simile of the Sketch Book of Wilars de Honecort, an Architect of the 13th Century. Translated and edited by Rev. Robert Willis, M.A.," &c. 4to. London, 1859.

[A puerile device, which is simply carried out by fixing the head to a portion of the bird's neck on a vertical spindle, which descends into the hollow body, and which the deacon can operate by a lever.]

7. *Hand-warmer with gimbals.*—If you desire to make a chauferette (calefactarium), or hand-warmer, you must construct a kind of apple of brass in two halves which fit together.

[The principle of its arrangement is something like that of a marine compass, and it may be turned about with burning charcoal in it, without overturning the fuel.]

8. *Tantalus Cup.*—This is a contrivance that may be made in a drinking cup.

[A bird sitting on a tower in the centre, and in the act of sipping the liquor conceals the syphon passing through them.]

9. *Perpetual Motion.*—Many a time have skilful workmen tried to contrive a wheel that shall turn of itself; here is a way to make such a one, by means of an uneven number of mallets, or by quicksilver.

[It is uncertain whether the plan was his own, or whether he only met with it in the course of his travels.]

10. *Method of cutting a screw.*—Thus is turned (or carved) the screw of a press.

[The diagram given is intended to explain the method of tracing a spiral line on a cylinder to guide the workman.]

11. *Framing of a wheel.*—In this manner the spokes of a wheel may be braced without cutting into the shaft.

[Twelve spokes are shown, the first and fourth braced with a straight piece near the axle, then the 6th and

10th with a parallel piece, which are crossed again at right angles, and so on until all are braced.]

12. *Hammer wheel.*—[This machine was probably intended for striking a bell. It consists of four figures, forming the spokes, each holding a hammer in one hand.]

13. *Crossbow, with sight.*—A crossbow that cannot miss.

[It carries at the end of its stock a sight in the shape of a hollow cone pierced at its apex, to allow the marking-man to see his aim.]

14. *Esconsa, or dark lantern.*—This is a sconce, which is useful to monks to carry their lighted candles. You can make it if you know how to turn.

[It is in form very like a wide-necked decanter, with openings in the neck to let out the heat and smoke; the candle being admitted from below.]

13th Century.

ROGER BACON.*

HE WAS BORN IN 1212, AND DIED AT OXFORD IN 1292.

OF ADMIRABLE ARTIFICIAL INSTRUMENTS.

THAT I may the better demonstrate the inferiority and indignity of Magical power to that of Nature and Art I shall a while discourse on such admirable operations of Art and Nature, as have not the least Magick in them, afterwards assign their Causes and Frames. And first of such Engines, as are purely artificial.

I.—It 's possible to make Engines to sail withall, as that either fresh or salt water vessels may be guided by the help of one man, and made sail with a greater swiftness, than others will which are full of men to help them.

II.—It's possible to make a Chariot move with an inestimable swiftnesse (such as the *Corrus falcati* were, wherein our fore fathers of old fought,) and his motion to be without the help of any living creature.

III.—It 's possible to make Engines for flying, a man sitting in the midst whereof, by burning only about an

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* See "Frier Bacon his discovery of the Miracles of Art, Nature, and Magick. Faithfully translated out of Dr. Dees own copy, by T. M., and never before in English. London, Printed for Simon Miller at the Starre in St. Paul's Church-yard, 1659." 12mo. page 17.

Instrument, which moves artificiall wings made to beat the Aire, much after the fashion of a Bird's flight.

IV.—It's possible to invent an Engine of a little bulk, yet of great efficacy, either to the depressing or elevation of the very greatest weight, which would be of much consequence in several Accidents; For hereby a man may either ascend or descend any walls, delivering himself or comrads from prison; and this Engine is only three fingers high and four broad.

V.—A man may easily make an Instrument, whereby one man may in despight of all opposition, draw a thousand men to himself, or any other thing, which is tractable.

VI.—A man may make an Engine, whereby without any corporal danger, he may walk in the bottom of the sea, or other water. There Alexander (as the Heathen Astronomer assures us) used to see the secrets of the deep.

Such Engines as these were of old, and are made even in our dayes. These all of them (excepting only that instrument of flying, which I never saw or know any who hath seen it, though I am exceedingly acquainted with a very prudent man, who hath invented the whole artifice) with infinite such like inventions, Engines and devices are feasable, as making of Bridges over Rivers without pillars or supporters.

About 1483.

LEONARDO DA VINCI.*

HE WAS BORN 1452, AND DIED 1519.

TRANSLATION OF HIS LETTER TO THE DUKE OF MILAN, LUDOVICIO IL MORO.†

Most Illustrious Signor: Having now sufficiently seen and considered the works of those who repute themselves masters and inventors of warlike instruments, whose operations and inventions I have found to be nothing out of the common way, I offer, without wishing to derogate from the merits of others, to make known to your Excellency the secrets which I possess, and of which I hope to be able to give sufficient proofs of my capability at any time you may be pleased to appoint, and in any of the things which I now propose, which for the sake of brevity shall be here under-written; viz.:—

1st. I have the means of constructing light bridges, easy of carriage, and equally adapted to pursue or escape an enemy, secure from fire, and as easy to remove as to replace; and also the means of destroying those of the enemy.

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* See "The Life of Leonardo da Vinci, with a critical account of his works, by J. W. Brown." Post 8vo. 1828, Appendix, page 203.

† The original is in the Ambrosian Library at Milan.

2nd. I know how to cut off the water from a besieged place, and to make scaling ladders, and other implements, necessary on such expeditions.

3rd. Item, if on account of the height or inaccessibility of a fortress, it cannot be easily bombarded, I have the means of destroying any such fortress, if not built on stone.

4th. I possess also the most portable and commodious means of bombarding a fortress, either with shells or fire-arms, to the great loss and confusion of the enemy.

5th. I can penetrate through caverns and other narrow ways, in order to arrive, without noise or suspicion, at a certain . . . . . so as to pass through ditches and rivers.

6th. I can construct certain covered waggons, which, by entering into the midst of an enemy with his artillery, will break through any body of men, however numerous; and behind these the infantry may follow, without opposition.

7th. Item, in case of need, I am able to cast shells, mortars, and field-pieces of beautiful forms, and quite out of the common method.

8th. When it is not possible to bombard, I know how to make use of the cross-bow, and various other instruments of offence to the enemy.

9th. In relation to naval affairs, I have the means of constructing various weapons, both for offence and defence, and vessels that are fire-proof and capable of resisting the severest bombardment.

10th In peaceful times, I think myself sufficiently skilled in the architecture of public and private build-

ings to bear a comparison with any one; and also to conduct water from one place to another.

Item, I understand the different modes of sculpture, either in marble, bronze, or terra cotta. In painting also I think myself equal to any one, let him be who he may.

I could also execute to your satisfaction the bronze Equestrian Statue which you propose to raise to the memory and lasting honour of my lord your Father, and the renowned House of Sforza.

Should any of the above-mentioned things appear either impossible or improbable, I am willing to prove the truth of what I advance, by making experiments of the same, in any of your parks, or in whatsoever place your Excellency may be pleased to appoint: to whom I most humbly recommend myself,* &c. &c.

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* This letter to Ludovicio Sforza, surnamed *Il Moro* (says the translator) is as literally translated as the subject will admit of, but several of the terms are obsolete and rather difficult to be understood.

1574.

RALPH RABBARDS
To Queen Elizabeth.*

A COPPIE OF NOTES DELIVERED TO HER MAJESTIE BY RALPHE RABBARDS.†

Speciall breife rememberances of such most pleasante serviceable and rare inventions as I have, by longe studdie and chardgeable practice, founde out, the whiche I holde myself bounde in dutie to offer with this learned worke unto your Majestie, as the firste fruites of my labor; the which, or any parte thereof, I shal be reddy to performe and put in execution, at as smalle chardge and to as greate purpose as any other ingeniors or practitioners of Christendome, when it shall please your sacred Majestie to commaunde me, not hetherto performed by any before my selfe.

I. *All kinde of waters of herbes and flowers are first distilled by discensory.*—Waters of purest substance from odors, flowers, fruites, and herbes, wholesomest, perfitest, and of greatest vertue, are first distiled by desensory, depured, and rectified, clere as christall, with its owne onlie proper vertue; taste and odor, ntinuinge many years. One spoonefull is better then a gallon of any other for any prynce, or noble person, or any that love

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* From M. S. Lansd., No. 121, Art. 14.

† He edited Ripley's "Compound of Alchemy." 4to. London, 1591.

their healthe; for medicyne inward or outward where others doe much more hurte then good, beinge unaptly distilled, and invenomed by the evill quallitie of metallyne stilles, and other defectes.

II. *Simple and compound waters.*—Water for odors, moste sweete and delicate, of many severall kyndes, bothe simple and compounde.

III. *Water of violetts and suche like.*—Water of violetts, jilly flowers, and pinckes, &c., contynue not nor reteyne not their owne proper odors and vertues, excepte they be distilled very cunningly and perfitly by desensory; or, their ordors beinge holpen by other meanes, they are not medicinable.

IV. *A precious water for purifyinge and preservinge the teethe.*—A moste precious and excellente water to purifie, preserve, and fasten the teethe, and with good order to keep them that they shall never decaye nor corrupte moste wholesome, pleasant, and comfortable.

V. *A principall water for moste outward diseases proceeding of heate and colde.*—A water that taketh awaye inflamations, rumes, swellinges, colde greifes, colde gowtes, ulcers, and other paynes; and healeth dangerous woundes, ulcers, sores, and the hardest diseases, with greate effecte and wonderfull speede, and in myne opinion farre exceedeth the farre fetched balmes.

VI. *Water for the eyes.*—Waters for the eyes prooved of many as well for preservinge and comfortinge the sighte, as to restore that which is lost.

VII. *Water to make the skynne and fleshe fayre and brighte.*—Waters to clense and keepe brighte the skynne and fleshe, and preserve it in its perfitt state.

SPECIALL OBSERVATION'S CONCERNINGE THE PREPARATIONS FOR FIREWORKS.

VIII. *An excellente kinde of salt-peter of greate force.*—Saltepeter mighte be so refyned that the powder made thereof mighte be of double the force, so that one pounde maye serve as manye shotte and as stronge as two pounde of that that is comonly used, and lesse chardge in cariage; and many other wayes apter and better for service.

IX. *A notable peece of service for your Majestie and the Realme.*—That saltpeter, minerall sulphur, pitche, aspaltum, licquidion, and drye, and many other like drugges, mighte be founde in the domynions of your Majestie, which we wante and paye most extreamely for; and God knoweth what gayne and glorie mighte redownde to your Majestie and countrey, if skillful and honest men were imployed therein.

X. *Oyles for fireworkes.*—Oyles bothe simple and composed to be distilled for fireworks, there is none to be boughte or had; he that will have them must make them.

XI. *A strange kinde of flyinge fire many wayes serviceable.*—A flyinge fire which shall, without ordynance, and farre of, wonderfully annoye any battayle, towne, or campe, and disperse even as if it did rayne fire; and the derydinge fires, being coted and made flyinge, maye touche many places, and leave them all burninge; very terrible both to men and horses.

XII. *A tridant or mace newly invented.*—A tridant or mace for many notable effectes, bothe for shotte, and to sette any thinge on fire; a very apte instru-

monte, and most soldier-like bothe for horsemen and footemen.

XIII. *Balls of mettle serving to many purposes.*—Balls of mettle to throwe into shippes, to enter into campes in the nightes, likewise in streightes or breaches, especially in battayles; and to have the said balles of all heightes, diamiters, and quantities, of a righte composition to divide in as many partes, and of such thicknes as it should; and to delyver a thousand at once amonge the enemyes with small chardge of ordynance, or other instrumentes, and to powre as much fire as your Majestie will upon any place.

XIV. *A shotte to fire in passinge.*—A shotte for greate ordynance to pierce deeper then any other shotte, and sett on fire whatsoever it strike throughe or sticketh in. A most noble ingen specially for sea service.

XV. *A forcible chariott for service defensive and offensyve.*—A firy chariott with horses, suche as never was knowne or heardе of, for any prynce or man of greate valor or vertue to be in, in the fielde or battayle.

XVI. *A firy chariott to be forc'd by engyne of greate service*—A firy chariott without horses to runne upon the battaile and disorder it, that no man shal be able to abide or come nighe the same, and wil be directed even as men will to tourne, to staye, or come directly backe upon any presente danger, or elles to followe and chase the enemye in their flighte.

XVII. *Mynes for fireworke to worke strange effectes.*—Mynes of fire and fireworke, bothe for sea and lande, to overthrowe or make havocke of all whatsoever a man will destroye.

XVIII. *A meanes to better the use of small artillery,*

moste serviceable.—To make that small shotte shall doe greater execution then the shotte that hath hetherto bynne knowne; yet where 1000 are nowe shotte, and not 10 men fall, it will appeare, by good demonstration and experience, that 10 shotte of 1000 shall hardly misse, good orders being observed.

XIX. *A newe invented targett of proofe.*—A targett of proofe, with his rest and loope hole, whereby men are notably defended and encouraged to the attemptinge of manye greate matters in service. Tenne of theis targettes are sufficiente to defende an hundred shotte, as if they were behinde a walle.

XX. *A rare invention.*—A muskett or calyver, with dyvers strange and forcible shotte, which no armor will holde out, at three quarters of a mile or more; and will also become a most forcible weapon in the hande, as good as a pollox, and, with a teice, become a perfitt shotte agayne.

XXI. *An armed pike moste forcible.*—An armed pike which a weake man maye use or handle very reddily with such force as a man will not thincke, and the same pike will also become a very good shotte at all tymes. But when they come to the very pushe they be most terrible, bothe to the shotte and the weapon.

XXII. *An engyne of notable defence for the safeguard of mens lyves.*—A carriage in manner of a walle or curteyne to defende men from shotte in approachinge any sconse or other force, and will be transformed into as many severall shapes of fortification as men will; and also be as tentes or lodginges drye above heade, and from the grounde, and also very offensyve, and of greate fury; whereof I wishe your excellente Majestie were

furnished, but as secrette as I could keepe them in myne owne harte for some greate daye of service.

XXIII. *A speciall peece of service.*—A meanes whereby our plowe-horses, carte jades, and hackneys, maye be made to doe greater service in our owne countrey, then the launces, or argulaters, or any horsemen of other nations, can possibly be able to doe in their ordinary services.

XXIV. *The rarest engyne that ever was invented for sea service.*—A vessel in manner of a gallery or galliatte to passe upon the seas and ryvers without oars or sayle, against wynde and tyde, swifter then any that ever hath bynne scene, of wonderfull effect bothe for intelligence, and many other admirable exploytes, almoste beyonde the expectation of man.

XXV. *Matters to be prepared and had in reddynes.*—Calibashes, caces, hollowe tronckes, and other instrumentes, of smalle chardge and greate effecte for the services of your Majestie and countrey many wayes, which have bynne more chardgeable to me, then they would be to your Majestie, if good order mighte be taken thercin. For some workemen have taken my money, and have spoiled my modelles and devises, and I could never gette my money, the ingions, nor yet my modelles agayne, and the devices in some sorte made publique, which I woulde have kepte secrette. But if it pleased God to put into your royall harte, both for his owne glorie, the glorie of your excellent Majestie, and your valiant nation and subjectes, to erecte some academy, or place of studdy and practice, for ingenious, pollitique and learned men, and apte artificers, as in a corporation or bodie pollitique, maintayned partly by your Majestie

and partly by your nobillitie, your clergie, and your comons, for their moste noble effectes. And whereas many corporations, societies of artes, faculties, and misteries, have bynne erected, founded, and franchised, with many honorable guiftes, liberties, and freedomes, by your Majesties moste worthy progenitors, but never any comparable to this, in glorie to your Majestie and the safetie and comforte of your countrey and people, which every vertuous and good mynded man would willingly further and maintayne for his owne good and safetie, and to the perpetuall glorie of your Majestie, and your feirce people, and valiante nation, that ingenious pollicies mighte throughly joyne with strength and valiante hartes of men. The which I referre to your Majesties moste deepe consideration, for the service of my countrey, holdinge myselfe hereby fully every waye dischardged in dutie bothe towardes your Majestie and my countrey.

Your Majesties moste loyall subjecte,
and faithfull servant,
RALPHE RABBARDS.

[To this he annexes a note to Lord Burghley.]—

"At your Honors pleasure and leisure I shall so satisfie your Lordship, that you shall not doubte of the performance of them, which none shall knowe but her Majestie and your Honor." *

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* See "The Historical Society of Science's Collection of Letters on Science," edited by J. C. Halliwell, F.R.S., &c. 8vo. 1841.

1558—1580.

ENGINES.*

1565, July 2. } No. 73.—Wm. Humphrey to Sir Wm. Cecill, concerning the working of copper mines; and recommends an Almain engineer, who can raise water one hundred fathoms high, by a newly invented engine.

1570? No. 18.—Note of services offered to the Queen by Emery Molyneux, of new inventions of shot and artillery, to be used principally in naval warfare; protection of forts and harbours; a new shot to discharge a thousand musket shot; with wild fire not to be quenched. Particulars of offensive and defensive inventions detailed.

1575? No. 74.—Description of the operation and advantages of a certain newly invented engine of war, whereby twenty-four bullets can be discharged from one piece at a time.

No. 75.—Notes by the inventor touching the engine of war. Expense of making a few at a time. It would require about

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* See "Calendar of State Papers, Domestic series, of the Reigns of Edward VI., Mary, Elizabeth, 1547—1580." Edited by Robert Lemon, F.S.A. 8vo. 1856.

100 engines to be employed at once. Desires a yearly pension in consideration of his invention.

No. 76.—A note of the effects already performed by the engine of war; of which there are 200 engines and 3,000 bullets already delivered into the Tower for service.

1580? No. 45.—John the Almain to Walsyngham. Recommends one of his countrymen, who had invented an harquebuse "that shall "containe ten balls or pelletes of lead, all "the which shall goe off, one after another, "having once given fire, so that with one "harquebuse one may kill ten theeves or "other enemies without recharging."

1583.

PROPOSALS FOR SOME INVENTIONS IN THE MECHANICAL ARTS.*

A NOTE OF SUNDRY SORTS OF ENGYNES. 1583.

1. First a carriedge with his properties to carry or drawe fyve hundreth weight with one mans strength.

2. An ingen of wonderfull strength to pull downe parcullices or irone gatts.

3. A chaine of yron non licke it in strength of his bidgnes.

4. A paire of gripes to the same chaing belonging of strange fashone.

5. A gine to hoyste or pull up earth to make rampiors.

6. A scaffolde to be removed.

7. A device to remove any burden of 10 tonne weight without horse or beast.

8. An ingen to lanch shippes.

9. A float to pase men over waters.

10. A bridg to be carried for passing an army of men ordenaunce and such licke carriges over any ryvers, &c.

11. A myll to grine by water winde or men for forte castel or towne of warr.

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* See "Rara Mathematica; or collection of Treatises on the Mathematics." Edited by J. O. Halliwell, F.R.S., &c. 8vo. 1841, page 86.

12. A crane to hoyst up 10 or 20 tonne weight.

13. A gynne to hoyst up any cannon and laie him in his carriage by one man onley.

14. An ingen for clensing or taking away of any shelves or shallow places in the river of Tems or any such river the same device maie serve for clensing of diches about citties or towns pondes or any such licke standing waters.

15. A water myll to rune longer then before tyme.

16. A winde myll and not to turne the howse about.

17. To make water workes for fountains cunditts and such licke.

18. To make pipes of lead 6 or 7 feet long without sauder.

19. To make a boat to goe fast one the water without ower or saile.*

20. To preserve a boat from drowning and the people that be therein.

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* This was a favourite project about this time. For the account of one addressed to Queen Elizabeth by Ralphe Rabbard, see MS. Lansdown, 121. And another by Edmund Jentill, in 1594, similar to the above, was one of the inventions which he offered to discover to Lord Burghley, on his release from prison, for counterfeiting foreign coin.—MS. Lansd. 77 and 113, British Museum. Note by J. O. H.

1594.

EDMUND JENTILL

To Lord Burghley.*

October 1st, 1594.

In all humilitie (right honorable) have I presumed, upon the reportes by my poore wief of your most favorable and gratious meaninge towardes my relief and release in this my distressed estate, by letter to solicite your lordship and to confesse my fault unto your honor, to lay before you suche frutes of my studdies as maye at least attenuate the offence, and move compassion in your honors mynd for my delivery. My cryme is counterfetinge of Forren coyne not currant in this realme; urged therunto, I doe protest, not through anye vitious or lascivious kind of lyvinge, but through meere and extreame want of mayntenance to susteyne my wief in her long contynued child-birth sicknes, the relief of myself and children, byinge of bookes, paying of debtes and triall of conclusions mathematicall and serviceable for my countryes good; the frutes and finall endes wherof, not suche as are common or triviall, but rare and to great use in anie state or commonwelth, not fytt for vulgar knowledge, I heere moste humbly offer in redemption of my great amisse and fault comitted, to bee performed within some small tyme after my release and some mayntenance with the recovery of my helth.

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* MS. Lansd. 77, Art. 59.

I.—An instrument, whereby the distance to anything, together with the height and breadth thereof, at one stacion or standinge only, shall be obteyned.

II.—A perpetuall motion of sufficient force to dryve a myll.

III.—A payer of compasses, which shall describe all sortes of figures geometricall and spiral lynes, and maye, for their excellencye, bee termed Euclidean Compas.

[In another paper * occurs]:—

Invencions founde of late by Edmunde Jentill for the fortefyinge of Her Majestie's Navye and the benefitt of this countroy

IV.—A device whereby twoe menne maye be sufficient to waye the waytiest anker in her Majestie's navye with greater expedition then it is nowe done with the nomber nowe used.

V.—The like device is founde, for the hoystinge of the mayne yarde with the like expedition.

VI.—A perpetuall motion is allso founde out of sufficient force to drive a mill in any standinge water or quike springe, which maie alsoe be converted to sundrie other uses comodious for all estates, which have hetherto byn supposed to be unpractyzable. [See II., above.]

VI.—A device wonderfull strange is alsoe founde out whereby a vessell of burden maie easilye and safely be guided both against the winde and tide.†

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* MS. Lansd. 113, Art. 4.

† "Letters on Scientific Subjects," published 1841, by the Historical Society of Science. Edited by J. O. Halliwell, F.R.S., &c.

1594.

SIR HUGH PLATT,*

Of Lincoln's Inn.

An offer of certaine new inventions, which the Author will bee readie to disclose upon reasonable considerations, to such as shall be willing to entertaine them, or to procure some Priviledge for them.

1. A new kinde of fire. [With an Engraving.]
2. A vessell of Wood, to brew or boile in.
3. A boulting Hatch. [With an Engraving.]
4. A portable Pumpe. [With an Engraving.]
5. A wholesome, lasting, and fresh victuall for the Navie.
6. An Engine for the making of this victual. [With an Engraving.]
7. A light garment, and yet sufficient against all rainie weather.

Nec omnes nec omnia mihi plucuere, cur ego omnibus?

Hugh Plate.

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* See "The Jewell House of Art and Nature," by Sir Hugh Plat. 4to. 1594. Book IV. pages 69—76. See also "A New, Cheape, and Delicate Fire of Cole Balls." By H. Plat. 4to. 1603.

The author's name is variously spelt Plate, Plat, and Platt.

1595.

SIR HUGH PLATT.*

Sir Hugh Platt (says Harte, in his Essay on Husbandry, II. 113), not to mention his other excellent talents, was the most ingenious husbandman of the age he lived in. He spent part of his time at Copt-hall, in Essex, or at Bishop's-hall, in Middlesex; at each of which places he had a country-seat; but his town residence was Lincoln's Inn. His Jewel-House was published by Dr. Beati, commonly called in England Dr. Boat (who, by the way was a great genius in husbandry), and the Flora's Paradise, with a second original part, was published by one Bellingham, the author's kinsman, who changed the title to *The Garden of Eden.*

Sir Hugh held a correspondence with all lovers of agriculture and gardening throughout England. And such was the justice and modesty of his temper, that he always named the author of every discovery communicated to him. In a word, no man in any age ever discovered, or at least brought into use, so many new sorts of manure.

A SUPPLIE OF CERTAINE ENGLISH WANTES.

Whereas in my late 'Apologie' published *anno* [15]93; as also sithence in my booke entituled the 'Jewell-house

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* "A Discoverie of Certaine English Wants, which are royally supplied in this Treatise. By H. Platt, of Lincolne's Inn, Esquier. Printed at London by P. S. for William Ponsonby, 1595." See also "The Harleian Miscellany." Selected and prepared by T. Park, F.S.A. 1812. 4to. Vol. IX. pages 105—110.

of Art and Nature' printed *anno* [15] 94, I have, amongst many other conceipted experimentes, tending to severall aswel profitable as delightful uses made likewise a publicke offer of sundry new and rare inventions, such as if they were brought into some generall and common use, would procure great love and securitie to the rich, sufficient maintenance and reliefe to the poore, and some credit to the author, and no smal benefit to the whole realme of England.

[He next observes]:—

It is time and high time, to let the world and all posterity to understand, that if our English artist (whereof sundrie in my knowledge are of such rare and singular conceipt, as they were able, yea, and would also be found willing, if the stipend of honor and merit were now propounded, fully to discover a world of new inventions) * * * * * * * * they would bring forth so many, so rich, and so inestimable buds and blossomes of skill, as neither any civill pollicy that hath bien hitherto shut up in printed bookes, nor any religious charity that hath bien so often and so divinely sounded in at our deafe eares, could yet produce or show any comparable effects unto them.

I.—A means to prepare beefe, veale, or mutton, without any salt; and fit to bee laide up in storehouses for many years, or to furnish long voyages withall.

II.—A defensative in the highest kinde of all armor, and artillery, whatsoever, from rusting in seven yeares after one preparation. This is a fit secret for all her majesties armories, and all the artillery of her ships; wherein the beauty of the armor is still preserved, notwithstanding his defensative upon it. It suffreth no

dampe either of fresh or brackish water to prevaile against it. This is an inestimable secret for the sea in the opinion of Sir Fr. Drake.

III.—An excellent caliver, or musket shot, exceeding all bullets that are yet had in ordinarie use: of these the author wil be ready to make such store as shal be required.

IV.—Some English secrets, whereby we may be lesse beholding either unto Spaine or Fraunce, in some of their best commodities.*

V.—A candle of much lesse price then our ordinary candles; each of them lasting 120 howers at the least. It is sodainly made.

VI.—A newe kinde of malting; wherein the one halfe of our usuall fire will be saved.

VII.—A cheape and multiplied pitch; serviceable onlie for ships and other vessels.

VIII.—A certaine and speedy way for thuning of any breach.†

IX.—The art spagiricall, which shall bee delivered in a most familiar and speedy maner for the drawing of all oiles out of gums, seedes, flowers, and aromaticall bodies; and of all waters, spirits, and salts, out of vegetables, with all necessary circumstances belonging thereto.‡

X.—An excellent oily composition, defending all iron

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* Probably similar or improved recipes on those in "The Jewel House."

† See No. 6 in "The Jewel House." 4to. 1594. "A speedy way for the inning of any breach." Page 75.

‡ See his "Jewel House," and also his "Delights for Ladies, to adorn their persons, tables, closets, and distillatories. With beauties, bouquets, perfumes, and waters." London, 12mo. 1602.

workes from rust and canker; wherewith I did furnish Sir Francis Drake in his last voyage. [See No. II.]

XI.—A pump not weighing 20 pound in weight, and yet sufficient to deliver 5 tuns of water in an hower. It is an excellent engin to water all those houses that are neer the river of Thames, or any other river in England; as also for all ships of warre.

XII.—A licour to keepe either boot, shoe, or buskin, made of drie leather, both blacke in wearing and defensible against all raine, dew, or moisture: whereof there hath bin already a sufficient triall had by divers gentlemen and others. This is to be had of the author in severall kindes.

And lastly, because I have alwaies founde it in mine owne experience, an easier matter to devise many and very profitable inventions, then to dispose of one of them to the good of the author himselfe; and because I know that there be many gentlemen in good favour, that be alwaies readie and willing to entertaine good suites, I have thought it not amisse to let them understande, that I am also as yet well furnished for them, if they come in time, and whilest my small store lasteth.—And had the author himself found any favour in his first suites, he would then have conferred these secrets freely upon his country, which now (by reason of his further charge and great losse of time that is irrecoverable) he is forced to offer in this kinde; neither pleasing himselfe, nor satisfying others, nor answering the worth of those skils which he purposeth to disclose.

1595.

HENRY MARSHALL

To Lord Burghley.*

Right Honorable,—Forasmuch as I have of late devised two rare inventions, the which may be profitable to my contrye, and damageable to the enemyes thereof; I thought it my dutie (having found your honour alwayes my especiall good lord) to offer the discoverie of the same to your lordship before anye other. The which if your honour shall thinke worthie, maye be then imparted unto Her Majestie.—

I.—The first is an engine, whereby the walle of anye towne or castle maye be defended from the force of anye canon.

II.—And the other is an engine, which shall breake the araye of anye battell being readie to joine.

The which engines are easilie made, and yett neither verie chargeable nor paynefull to transporte. I thought it good to make modelles of the same, whereby your lordship may the easelier conceive my intention, and the better judge of the benefitt and sequell pretended. London, 1 June, 1595.

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* MS. Lansd. 101, Art. 16, *Orig.* See also "Letters on Science," edited by J. O. Halliwell, F.R.S., &c. 8vo. 1841.

1596.

LORD NAPIER, OF MERCHISTON,

THE INVENTOR OF THE LOGARITHMS.

HIS CONTRIVANCES FOR THE DEFENCE OF GREAT BRITAIN.*

Secret inventions, profitable and necessary in these days for the defence of this island, and withstanding of strangers, enemies to God's truth and religion.

First.—The invention, proof, and perfect demonstration, geometrical and algebraical, of a burning mirror, which receiving of dispersed beams of the sun, doth reflex the same beams altogether united, and concurring precisely in one mathematical point, in which point, most necessarily it engendereth fire; with an evident demonstration of their error who affirm this to be made a parabolic section. The use of this invention serveth for the burning of the enemy's ships at whatsoever appointed distance.

Secondly.—The invention and sure demonstration of another mirror, which receiving the dispersed beams of any material fire, or flame, yieldeth also the former effect, and serveth for the like use.

Thirdly.—The invention and visible demonstration

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* The original document is preserved among the MSS. of Anthony Bacon, Esq., in the Lambeth Library, marked 658, anno 1596. See "Tilloch's Philosophical Magazine," page 53, vol. XVIII. 8vo. 1804.

of a piece of artillery, which shot, passeth not lineally through the army, destroying only those that stand in the random thereof, but superficially ranging abroad, within the whole appointed place, till it hath executed his whole strength, by destroying all those that be within the bounds of the said place. The use hereof not only serveth greatly against the army of the enemy on land, but also by sea, serving to destroy and cut down, at one explosion, the whole masts and tackling of so many ships as be within the appointed bounds, as well abreid as in large, so long as any strength at all remaineth.

Fourthly.—The invention of a round chariot in metal, made of the proof of double musquet, whose motion shall be such, that those that be within the same shall be more easy, more light, more speedy, and more safe in battle, than any hitherto contrived. The use hereof in moving, is to break the array of the enemy's battle, and to make passage, as also in staying and abiding within the enemy's battle. It serveth to destroy the environed enemy, by continual charges and shot of the arquebuss, through small holes; the enemy in the mean time, being amazed, and altogether uncertain what defence or pursuit to use against a moving mouth of metal.

These inventions, besides devices of sailing under the water, with divers other devices and stratagems for harming of the enemies, by the grace of God, and work of expert craftsmen, I hope to perform.

JOHN NAPIER, of Merchiston.

Anno Domini 1596, June 2.

16—?

ANONYMOUS.

CORNU-COPIA: A MISCELLANEUM OF LUCRIFEROUS AND MOST FRUCTIFEROUS EXPERIMENTS, OBSERVATIONS, AND DISCOVERIES, IMMETHODICALLY DISTRIBUTED; TO BE REALLY DEMONSTRATED AND COMMUNICATED IN ALL SINCERITY.*

[4to., containing 16 pages. No date.]

After several matters on improving income—and on husbandry, follows—

Item.—Directions how a cart may be made to draw with one horse as much as five horses; this King James beheld with his full approbation; and for the putting the same in practice throughout England, I had a patent from him in my disposal.

To make clay burn like other fire, and to be equally useful upon all occasions.

Item.—A way to convey water under the ground, up a steep hill to the uppermost part of a very high house, and to be useful at all times, in all offices about the house, and near the house, &c.

Item.—To empty and cleanse rivers and moats of all mud, without going into the water, use of boats, diverting the stream, or letting out the water by ditches, sluices, &c., and with great facility and little charge.

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* See "Harl. Miss. vol. 6." 4to. pages 27—36.

Item.—To make perfect iron with sea-coal, or pit-coal, and to charcoal pit-coal to dry malt, and for divers other necessary conveniences, and to make charcoal last long.

* * * *

Item.—To make starch, without the use and abuse of corn.

Item.—To make a composition without charge, which will perform all things equal to soap.

To make flax like silk.

* * * *

Several excellent new inventions, to take both foxes, pole-cats, and other vermin.

* * * *

To preserve timber from rotting.

* * * *

To make glue for the joining of boards, whether green or dry, that shall hold faster than the boards themselves.

* * * *

Having many other rarities of most admirable consequence, which would grow so voluminous, that I am resolved to reserve them for an additional impression. In the meantime, I shall willingly demonstrate and impart of them, by way of exchange, or otherwise, to any that shall be desirous thereof.

1635.

PROJECTS OF A FRENCHMAN.*

CONCERNING INVENTIONS OF SHIPS, GUNS, AND OTHER DEVICES.

The projects are principally for improvements in war. They comprise:—

A ship that cannot be boarded, and which will destroy everything that opposes it,—

—— in landing boats,

—— in pontoons,

—— baggage waggons, and

—— platforms for great guns, and

Lastly, The construction of a floating bathing palace, to be placed in the Thames opposite the Queen's Palace. [Denmark, or Somerset House.]

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* See "State Papers, Domestic Series, 1635." 8vo. 1864. No. 50.

1637—1682.

PRINCE RUPERT.*

He was the third son of the King of Bohemia, by the Princess Elizabeth, eldest daughter of James I. of England. He was born 1619, and died in 1682.

After the year 1666 he led a retired life, mostly at Windsor Castle, of which he was governor.

1. He delighted in making locks for fire-arms.
2. He was the inventor of a composition called after him, Prince's Metal.
3. He communicated to the Royal Society his improvements upon gunpowder, by refining the several ingredients, and making it more carefully, which augmented its force, in the proportion of 10 to 1, as compared to ordinary powder.
4. He also acquainted them through Dr. Hook, with an engine he had contrived for raising water;
5. And sent them an instrument for casting any platform into perspective, and for which they deputed a select committee to return him their thanks.

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* See "AYSCOUGH's Catalogue of the MSS. in the British Museum," 2 vols. 4to. 1782.—"CHALMERS' Biographical Dictionary," 8vo. 1816.—"WELD's History of the Royal Society," 1st vol. 8vo. 1848.—"WARBURTON's Memoirs of Prince Rupert," 3rd vol. 8vo. 1849, pages 431—434.

6. He was the inventor of a gun for discharging several bullets with the utmost speed, facility, and safety;
7. And the Royal Society received from his Highness the intimation of a certain method of blowing up rocks in mines, and other subterraneous places.
8. Dr. Hook has preserved another invention of his for making hail-shot of all sizes.
9. He devised a particular kind of screw, by means of which, observations taken by a quadrant at sea were secured from receiving any alteration by the unsteadiness of the observer's hand, or through the motion of the ship.
10. It was said that he had also, among other secrets, that of melting or running black-lead, like a metal, into a mould, and reducing it again into its original form.
11. He is considered as the inventor of mezzotinto engraving. He communicated his views to Vaillant, a painter, in Brussels, and they unitedly carried out a variety of successful experiments; their first engraved portrait being produced in 1643. The earliest of his engravings now extant is dated 1658.* He is said to have devoted himself to engraving as early as 1637.†

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* No. 1 to 11—See "CHALMER'S General Biographical Dictionary," 8vo. 1816.

† See "WARBURTON'S Memoirs of Prince Rupert," vol. 3, 1849, pages 431—434.

12. Glass-drops, known as Rupert's Drops. An account of these was given by Sir Robert Moray, to the Royal Society, on the 14th August, 1660. The first volume of their Register-book contains a long account of them and their manufacture. The Prince had a glass-house adjoining Chelsea College.*
13. A method of boring guns.
14. A method of annealing the metal for guns.
15. A mode of tempering the Kirby Fish-hooks.

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* See "WELD'S History of the Royal Society," 2 vols. 8vo. 1848.

1646.

CAPTAIN BULMER,
His Inventions.

CERTIFICATE.

Whereas Captain Bulmer made several propositions which he undertook by his art to demonstrate he hath given sufficient satisfaction that he is able,—

I.—To raise any weight from the bottom of the water to the surface without diving at all, or making use of any principle or motion, saving the form of an element only;—

II.—To keep a thing dry, and convey it under water, nothing thereof appearing to the eye;—

III.—To lift up a boat or any other weight so high as safely to deliver it on the other side of London Bridge, if need were;—

IV.—To weigh any uncertain weight without centre, and poise it so that by adding the strength of a horse hair it may be raised up higher from its rest in the aire or water.

This we could not but testifie at his request, being convinced thereof by what we have seen.

Lawrence Sarson,
William Dillingham,
Ralph Cudworth.

Copy of a Certificate from Emanuel College, Cambridge.

1648.

SIR WILLIAM PETTY.

THE ADVICE OF W.*[ILLIAM] P. [ETTY] TO MR. SAMUEL HARTLIB, FOR THE ADVANCEMENT OF SOME PARTICULAR PARTS OF LEARNING.†

Loudon, Printed 1648. 4to. pp. 34.

THERE is invented an instrument of small bulk and price, easily made, and very durable, whereby any man, even at the first sight and handling, may write two resembling copies of the same thing at once, as serviceably and as fast, (allowing two lines upon each page for setting the instruments,) as by the ordinary way: of what nature, or in what character, or what matter soever, as paper, parchment, a book, &c., the said writing ought to be made upon. * * * *

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* *In 1644, Sir William Petty invented an instrument for double writing*, which he patented for 17 years. His pentograph occasioned his becoming acquainted with the leading men of those times. He went to live at Oxford in 1648, where he became a great promoter of academical science.

† See "The Harleian Miscellany." 4to. 1810. Vol. 6, pages 1 to 14.

? 1649 to 1660.

A PROPOSITION.

[No. date.]

To Mr. Augier.

A person who makes profession of honr. and saith he hath had thar good luck to have beene knowne of Sr. Oliver Flemming during his publick employments abroad, doth propound to a friend of yor. that by a secret he hath he can with one Ship alone breake what navall army or fleet soever though never so great; And that by the same secret he shall easily and in a short time beate down all manner of earthen Forts. Offering that if the Commonwealth of England be pleased, he will goe over at his owne charge to make what tryalls soever shall be desired of him, wh. will cost nothing. He desires likewise to be assured that he shall not be forced to reveale his secret untill the agreement be made for his reward; And sayeth that the tryall shall be very speedy, and the execution as sure in general as in particular.*

* See "Birch's MSS. Brit. Museum," No. 4159, folio 150 (on a folio sheet—neatly written). Endorsed—"A Proposition sent to Mr. Augier from Paris."

1662.

DR. KNUFFLER.*

Had an engine to blow up ships. The matter of fact was not questioned, as a project of this kind had been tried by some one in Cromwell's time; but the safety of carrying them in ships being doubted, the Doctor said when he told his secret to the king, (for none but the king was to know it,) it would appear to be of no danger at all.

* See "Pepy's Diary," 1858, vol. i. p. 264.



EDWARD SOMERSET,

SIXTH EARL AND SECOND

MARQUIS OF WORCESTER;

BORN ABOUT 1601, AND DIED 3RD APRIL, 1667;

AUTHOR OF THE "CENTURY OF INVENTIONS," 1663; AND

INVENTOR OF THE STEAM ENGINE.

*** From a large Alto-relievo Medallion, modelled by JAMES LOFT, Esq., Sculptor, the likeness being derived from portraits painted by Vandyke, and by Hannemann, in the possession of HIS GRACE THE DUKE OF BEAUFORT, at Badminton, Gloucestershire.

1663.

MARQUIS OF WORCESTER.

A CENTURY

OF THE NAMES AND SCANTLINGS OF SUCH INVENTIONS,

As at present I can call to mind to have tried and perfected, which (my former Notes being lost) I have, at the instance of a powerful Friend, endeavoured now in the year 1655, to set these down in such a way as may sufficiently instruct me to put any of them in practice.

—*Artis & Naturæ Proles.*

LONDON: PRINTED BY F. GRISMOND IN THE YEAR 1663.

TO THE KINGS MOST EXCELLENT MAJESTY.

Sir,

Scire meum nihil est, nisi me sciro hoc sciat alter, *saith the Poet, and I most justly in order to Your Majesty, whose satisfaction is my happiness, and whom to serve is my onely aime, placing therein my* Summum bonum *in this world: Be therefore pleased to cast Your gracious Eye over this Summary Collection, and then to pick and choose. I confess, I made it but for the superficial satisfaction of a friends curiosity, according as it is set downe;*

and if it might now serve to give aime to Your Majesty how to make use of my poor Endeavours, it would crowne my thoughts, who am neither covetous nor ambitious, but of deserving Your Majesties favour upon my own cost and charges; yet, according to the old English Proverb, It is a poor Dog not worth whistleing after. *Let but your Majesty approve, and I will effectually perform to the height of my Undertaking: Vouchsafe but to command, and with my Life and Fortune I shall chearfully obey, and* maugre *envy, ignorance and malice, ever appear*

YOUR MAJESTY'S
Passionately-devoted, or otherwise dis-interested
Subject and Servant,
WORCESTER.

TO THE RIGHT HONOURABLE,
THE LORDS SPIRITUAL AND TEMPORAL;
And to the KNIGHTS, CITIZENS, AND BURGESSES *of the Honourable House of Commons; now assembled in Parliament.*

My Lords and Gentlemen,

BE not startled if I address to all, and every of you, this Century of Summary Heads of wonderful things, even after the Dedication of them to His most Excellent Majesty, since it is with His most gracious and particular consent, as well as indeed no wayes derogating from my duty to His Sacred Self, but rather in further order unto it, since your Lordships, who are His great Council,

and you Gentlemen His whole Kingdoms Representatives (most worthily welcome unto Him) may fitly receive into your wise and serious considerations what doth or may publickly concern both His Majesty and His tenderly-beloved People.

Pardon me if I say (my Lords and Gentlemen) that it is joyntly your parts to digest to His hand these ensuing particulars, fitting them to His palate, and ordering how to reduce them into practice in a way useful and beneficial both to His Majesty and His Kingdom.

Neither do I estcem it less proper for me to present them to you in order to His Majesty's service, then it is to give into the hands of a faithful and provident Steward whatsoever dainties and provisions are intended for the Masters diet; the knowing and faithful Steward being best able to make use thereof to his Masters contentment and greatest profit, keeping for the morrow whatever should be overplus or needless for the present day, or at least to save something else in lieu thereof. In a word, (my Lords and Gentlemen) I humbly conceive this *Simile* not improper, since you are His Majesty's provident Stewards, into whose hands I commit my self, with all properties fit to obey you; that is to say, with a heart harbouring no ambition, but an endless aim to serve my King and Countrey: And if my endeavours prove effectual, (as I am confident they will) His Majesty shall not onely become rich, but His People likewise, as Treasurers unto Him; and His Pierless Majesty, our King, shall become both belov'd at home, and fear'd abroad; deeming the riches of a King to consist in the plenty enjoyed by his People.

And the way to render him to be feared abroad, is to

content his People at home, who then with heart and hand are ready to assist him; and whatsoever God blesseth me with to contribute towards the increase of His Revenues in any considerable way, I desire it may be imployed to the use of His People; that is, for the taking off such Taxes or Burthens from them as they chiefly grone under, and by a Temporary necessity onely imposed on them; which being thus supplied will certainly best content the King, and satisfie His People; which, I dare say, is the continual Tend of all your indefatigable pains, and the perfect demonstrations of your Zele to His Majesty, and an evidence that the Kingdoms Trust is justly and deservedly reposed in you. And if ever Parliament acquitted themselves thereof, it is this of yours, composed of most deserving and qualified Persons; qualified, I say, with your affection to your Prince, and with a tenderness to His People; with a bountiful heart towards Him, yet a frugality in their behalfs.

Go on therefore chearfully (my Lords and Gentlemen) and not onely our gracious King, but the King of Kings, will reward you, the Prayers of the People will attend you, and His Majesty will with thankful arms embrace you. And be pleased to make use of me and my endeavours to enrich them, not my self; such being my onely request unto you, spare me not in what your Wisdoms shall find me useful, who do esteem my self not onely by the Act of the Water-commanding Engine (which so chearfully you have past) sufficiently rewarded, but likewise with courage enabled to do ten times more for the future; and my Debts being paid, and a competency to live according to my Birth and Quality setled, the rest

shall I dedicate to the service of our King and Countrey by your disposals: and esteem me not the more, or rather any more, by what is past, but what 's to come; professing really from my heart, that my Intentions are to out-go the six or seven hundred thousand pounds already sacrificed, if countenanced and encouraged by you, ingenuously confessing that the Melancholy which hath lately seized upon me (the cause whereof none of you but may easily guess) hath, I dare say, retarded more advantages to the publick service then modesty will permit me to utter: And now revived by your promising favours, I shall infallibly be enabled thereunto in the Experiments extant, and comprised under these heads practicable with my directions by the unparallel'd Workman both for trust and skill, *Caspar Kaltoff's* hand, who hath been these five and thirty years as in a school under me imployed, and still at my disposal, in a place by my great expences made fit for publick service, yet lately like to be taken from me, and consequently from the service of King and Kingdom, without the least regard of above ten thousand pounds expended by me, through my Zele to the Common good; my Zele, I say, a field large enough for you (my Lords and Gentlemen) to work upon.

The Treasures buried under these heads, both for War, Peace and Pleasure, being inexhaustible; I beseech you pardon me if I say so; it seems a Vanity, but comprehends a Truth; since no good Spring but becomes the more plentiful by how much more it is drawn; and the Spinner to weave his web is never stinted, but further inforc'd.

The more then that you shall be pleased to make

use of my Inventions, the more Inventive shall you ever find me, one Invention begetting still another, and more and more improving my ability to serve my King and you; and as to my heartiness therein there needs no addition, nor to my readiness a spur. And therefore (my Lords and Gentlemen) be pleased to begin, and desist not from commanding me till I flag in my obedience and endeavours to serve my King and Country:

For certainly you 'l find me breathless first t' expire,
Before my hands grow weary, or my legs do tire.

Yet abstracting from any Interest of my own, but as a Fellow-Subject and Compatriot will I ever labour in the Vineyard, most heartily and readily obeying the least summons from you, by putting faithfully in execution, what your Judgments shall think fit to pitch upon amongst this Century of Experiences, perhaps dearly purchased by me, but now frankly and *gratis* offered to you. Since my heart (methinks) cannot be satisfied in serving my King and Country, if it should cost them any thing; As I confess when I had the honour to be neare so obliging a Master as His late Majesty of happy memory, who never refused me his Ear to any reasonable motion: And as for unreasonable ones, or such as were not fitting for him to grant, I would rather to have dyed a thousand deaths, then ever to have made any one unto him.

Yet whatever I was so happy as to obtain for any deserving Person, my Pains, Breath and Interest imployed therein satisfied me not, unless I likewise satisfied the Fees; but that was in my Golden Age.

And even now, though my ability and means are shortened, the world knows why my heart remains still

the same; and be you pleased (my Lords and Gentlemen) to rest most assured, that the very complacency that I shall take in the executing your Commands shall be unto me a sufficient and an abundantly-satisfactory reward.

Vouchsafe therefore to dispose freely of me, and whatever lieth in my power to perform; first, in order to His Majesty's service; secondly, for the good and advantage of the Kingdom; thirdly, to all your satisfactions, for particular profit and pleasure to your individual selves, professing that in all and each of the three respects I will ever demean my self as it best becomes,

My Lords and Gentlemen, you most passionately-bent Fellow-Subject in His Majesty's service, Compatriot for the publick good and advantage, and a most humble Servant to all and every of you,

WORCESTER.

A CENTURY

OF THE NAMES AND SCANTLINGS OF INVENTIONS BY ME ALREADY PRACTISED.

1. *Seals abundantly significant.*—Several sorts of Seals, some shewing by screws, others by gages, fastening or unfastening all the marks at once; others by additional points and imaginary places, proportionable to ordinary Escocheons and Seals at Arms, each way palpably and punctually setting down (yet private from all others,

but the Owner, and by his assent) the day of the Moneth, the day of the Week, the Moneth of the Year, the Year of our Lord, the Names of the Witnesses, and the individual place where any thing was sealed, though in ten thousand several places, together with the very number of lines contained in a Contract, whereby falsification may be discovered, and manifestly proved, being upon good grounds suspected.

Upon any of these Seals a man may keep Accompts of Receipts and Disbursments from one Farthing to an hundred millions, punctually shewing each pound, shilling, peny or farthing.

By these seals likewise any Letter, though written but in English, may be read and understood in eight several languages, and in English it self to clean contrary and different sense, unknown to any but the Correspondent, and not to be read or understood by him neither, if opened before it arrive unto him; so that neither Threats, nor hopes of Reward, can make him reveal the secret, the Letter having been intercepted, and first opened by the Enemy.

2. *Seals private and particular to each owner.*—How ten thousand Persons may use these seals to all and every of the purposes aforesaid, and yet keep their secrets from any but whom they please.

3. *An one-line Cypher.*—A Cypher and Character so contrived, that one line, without returns and circumflexes, stands for each and every of the 24. letters; and as ready to be made for the one letter as the other.

4. *Reduced to a Point.*—This Invention refined, and so abreviated that a point onely sheweth distinctly and significantly any of the 24. letters; and these very points

to be made with two pens, so that no time will be lost, but as one finger riseth the other may make the following letter, never clogging the memory with several figures for words, and combination of letters; which with ease, and void of confusion, are thus speedily and punctually, letter for letter, set down by naked and not multiplied points. And nothing can be less then a point, the Mathematical definition of being *Cujus pars nulla*. And of a motion no swifter imaginable then *Semiquavers* or *Releshes*, yet applicable to this manner of writing.

5. *Varied significantly to all the* 24. *letters*.—A way by a Circular motion, either along a Rule or Ring-wise, to vary any Alphabet, even this of Points, so that the self-same Point individually placed, without the least additional mark or variation of place, shall stand for all the 24. letters, and not for the same letter twice in ten sheets writing; yet as easily and certainly read and known, as if it stood but for one and the self-same letter constantly signified.*

6. *A mute and perfect discourse by colours*.—How at a Window, as far as Eye can discover black from white, a man may hold discourse with his Correspondent, without noise made or notice taken; being, according to occasion given and means afforded, *Ex re natâ*, and no need of Provision before-hand; though much better if foreseen, and means prepared for it, and a premeditated course taken by mutual consent of parties.

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* For a curious explanation of a similar Cipher see the Harleian MSS. in the British Museum, No. 2428; or a copy of it in "The Life, Times, and Scientific Labours of the Marquis of Worcester," 8vo. 1865, pages 394—398.

7. *To hold the same by night.*—A way to do it by night as well as by day, though as dark as Pitch is black.

8. *To level Cannons by night.*—A way how to level and shoot Cannon by night as well as by day, and as directly; without a platform or measures taken by day, yet by a plain and infallible rule.

9. *A Ship-destroying Engine.*—An Engine, portable in ones Pocket, which may be carried and fastened on the inside of the greatest Ship, *Tanquam aliud agens*, and at any appointed minute, though a week after, either of day or night, it shall irrecoverably sink that Ship.

10. *How to be fastened from aloof and under water.*—A way from a mile off to dive and fasten a like Engine to any Ship, so as it may punctually work the same effect either for time or execution.

11. *How to prevent both.*—How to prevent and safeguard any Ship from such an attempt by day or night.

12. *An unsinkable Ship.*—A way to make a Ship not possible to be sunk though shot an hundred times betwixt wind and water by Cannon, and should lose a whole Plank, yet in half an hours time should be made as fit to sail as before.

13. *False destroying Decks.*—How to make such false Decks as in a moment should kill and take prisoners as many as should board the Ship, without blowing the Decks up, or destroying them from being reducible, and in a quarter of an hours time should recover their former shape, and be made fit for any imployment without discovering the secret.

14. *Multiplied strength in little room.*—How to bring a force to weigh up an Anchor, or to do any forcible

exploit in the narrowest or lowest room in any Ship, where few hands shall do the work of many ; and many hands applicable to the same force, some standing, others sitting, and by virtue of their several helps a great force augmented in little room, as effectual as if there were sufficient space to go about with an Axle-tree, and work far from the Centre.

15. *A Boat driving against wind and tide.*—A way how to make a Boat work it self against Wind and Tide, yea both without the help of man or beast; yet so that the Wind or Tide, though directly opposite, shall force the Ship or Boat against it self; and in no point of the Compass, but it shall be as effectual, as if the wind were in the Pupp, or the stream actually with the course it is to steer, according to which the Oars shall row, and necessary motions work and move towards the desired Port or point of the Compass.

16. *A Sea-sailing Fort.*—How to make a Sea-castle or Fortification Cannon-proof, and capable of a thousand men, yet sailable at pleasure to defend a passage, or in a hours time to divide it self into three Ships as fit and trimm'd to sail as before: And even whilest it is a Fort or Castle they shall be unanimously steered and effectually be driven by an indifferent strong wind.

17. *A pleasant floting Garden.*—How to make upon the *Thames* a floting Garden of pleasure, with Trees, Flowers, Banquetting-Houses, and Fountains, Stews for all kind of fishes, a reserve for Snow to keep Wine in, delicate Bathing-places, and the like; with musick made with Mills: and all in the middest of the stream, where it is most rapid.

18. *An Hour-glasse Fountain.*—An Artificial Foun-

tain, to be turned like an Hour-glass by a child in the twinkling of an eye, it holding great quantity of water, and of force sufficient to make snow, ice and thunder, with a chirping and singing of birds, and shewing of several shapes and effects usual to Fountains of pleasure.

19. *A Coach-saving Engine.*—A little Engine within a Coach, whereby a child may stop it, and secure all persons within it, and the Coachman himself, though the horses be never so unruly in a full career; a child being sufficiently capable to loosen them in what posture soever they should have put themselves, turning never so short; for a child can do it in the twinkling of an eye.

20. *A Balance Water-work.*—How to bring up water Balance-wise, so that as little weight or force as will turn a Balance will be onely needful, more then the weight of the water within the Buckets, which counter-poised empty themselves one into the other, the uppermost yielding its water (how great a quantity soever it holds) at the self-same time the lowermost taketh it in, though it be an hundred fathom high.

21. *A Bucket-fountain.*—How to raise water constantly with two Buckets onely day and night, without any other force then its own motion, using not so much as any force, wheel or sucker, nor more pullies then one, on which the cord or chain rolleth with a Bucket fastened at each end. This, I confess, I have seen and learned of the great Mathematician *Claudius* his studies at *Rome*, he having made a Present thereof unto Cardinal; and I desire not to own any other mens Inventions, but if I set down any, to nominate likewise the Inventor.

22. *An ebbing and flowing River.*—To make a River in a Garden to ebbe and flow constantly, though twenty foot over, with a childs force, in some private room or place out of sight, and a competent distance from it.

23. *An ebbing and flowing Castle-clock.*—To set a Clock in a Castle, the water filling the Trenches about it; it shall shew by ebbing and flowing the Hours, Minutes and Seconds, and all the comprehensible motions of the Heavens, and Counterlibation of the Earth, according to *Copernicus.*

24. *A Strength-increasing Spring.*—How to increase the strength of a Spring to such a height, as to shoot Bumbasses and Bullets of an hundred pound weight a Steeple-height, and a quarter of a mile off and more, Stone-bow-wise, admirable for Fire-works and astonishing of besieged Cities, when without warning given by noise they find themselves so forcibly and dangerously surprised.

25. *A double drawing Engine for weights.*—How to make a Weight that cannot take up an hundred pound, and yet shall take up two hundred pound, and at the self-same distance from the Centre; and so proportionably to millions of pounds.

26. *A to and fro Lever.*—To raise weight as well and as forcibly with the drawing back of the Lever, as with the thrusting it forwards; and by that means to lose no time in motion or strength. This I saw in the *Arcenal* at *Venice.*

27. *A most easie level Draught.*—A way to remove to and fro huge weights with a most inconsiderable strength from place to place. For example, Ten Tunne with ten pounds, and less; the said ten pounds not to fall lower

then it makes the ten Tunne to advance or retreat upon a Level.

28. *A portable Bridge.*—A Bridge portable in a Cart with six horses, which in a few hours time may be placed over a River half a mile broad, whereon with much expedition may be transported Horse, Foot and Cannon.

29. *A moveable Fortification.*—A portable Fortification able to contain five hundred fighting men, and yet in six hours time may be set up, and made Cannon-proof, upon the side of a River or Pass, with Cannon mounted upon it, and as complete as a regular Fortification, with Half-moons and Counter-scarps.

30. *A Rising Bulwork.*—A way in one nights time to raise a Bulwork twenty or thirty foot high, Cannon-proof and Cannon mounted upon it, with men to over-look, command and batter a Towne; for though it contain but four Pieces, they shall be able to discharge two hundred Bullets each hour.

31. *An approaching Blinde.*—A way how safely and speedily to make an approach to a Castle or Town-wall, and over the very Ditch at Noon-day.

32. *An universall Character.*—How to compose an universal Character methodical and easie to be written, yet intelligible in any Language; so that if an English-man write it in English, a French-man, Italian, Spaniard, Irish, Welsh, being Scholars; yea, Grecian or Hebrician shall as perfectly understand it in their owne Tongue, as if they were perfect English, distinguishing the Verbs from the Nouns, the Numbers, Tenses and Cases as properly expressed in their own Language as it was written in English.

33. *A Needle-alphabet.*—To write with a Needle and Thred, white, or any colour upon white, or any other colour, so that one stitch shall significantly shew any letter, and as readily and as easily shew the one letter as the other, and fit for any Language.

34. *A knotted String-alphabet.*—To write by a knotted Silk string, so that every knot shall signifie any letter with Comma, Full point, or Interrogation, and as legible as with Pen and Ink upon white Paper.

35. *A Fringe-alphabet.*—The like by the fringe of Gloves.

36. *A Bracelet-alphabet.*—By stringing of Bracelets.

37. *A Pinck'd Glove-alphabet.*—By Pinck'd Gloves.

38. *A Sieve-alphabet.*—By holes in the bottom of a Sieve.

39. *A Lanthorn-alphabet.*—By a Lattin or Plate Lanthorn.

40. *An Alphabet* By the Smell.
41. ——————— By the Taste.
42. ——————— By the Touch.

By these three Senses as perfectly, distinctly and unconfusedly, yea as readily as by the sight.

43. *A variation of all and each of these.*—How to vary each of these, so that ten thousand may know them, and yet keep the understanding part from any but their Correspondent.

44. *A Key-Pistol.*—To make a Key of a Chamber door, which to your sight hath its Wards and Rose-pipe but Paper-thick, and yet at pleasure in a minute of an hour shall become a perfect Pistol, capable to shoot through a Brest-plate commonly of Carabine-proof,

with Prime, Powder and Fire-lock, undiscoverable in a strangers hand.

45. *A most conceited Tinder-box.*—How to light a Fire and a Candle at what hour of the night one awaketh, without rising or putting ones hand out of the bed. And the same thing becomes a serviceable Pistol at pleasure; yet by a stranger, not knowing the secret, seemeth but a dexterous Tinder-box.

46. *An artificial Bird.*—How to make an artificial Bird to fly which way and as long as one pleaseth, by or against the wind, sometimes chirping, other times hovering, still tending the way it is designed for.

47. *An Hour Water-ball.*—To make a Ball of any metal, which thrown into a Pool or Pail of water shall presently rise from the bottom, and constantly shew by the *superficies* of the water the hour of the day or night, never rising more out of the water then just to the minute it sheweth of each quarter of the hour; and if by force kept under water, yet the time is not lost, but recovered as soon as it is permitted to rise to the *superficies* of the water.

48. *A scru'd ascent of Stairs.*—A scrued Ascent, instead of Stairs; with fit landing places to the best Chambers of each Story, with Back-stairs within the Noell of it, convenient for Servants to pass up and down to the inward Rooms of them unseen and private.

49. *A Tobacco-tongs Engine.*—A portable Engine, in way of a Tobacco-tongs, whereby a man may get over a wall, or get up again being come down, finding the coast proving unsecure unto him.

50. *A Pocket-ladder.*—A complete light portable Ladder, which taken out of ones Pocket, may be by him-

self fastened an hundred foot high to get up by from the ground.

51. *A Rule of Gradation.*—A Rule of Gradation, which with ease and method reduceth all things to a private correspondence, most useful for secret Intelligence.'

52. *A mysticall jangling of Bells.*—How to signifie words and an perfect Discourse by jangling of Bells of any Parish-Church, or by any Musical Instrument within hearing, in a seeming way of tuning it; or of an unskilful beginner.

53. *An hollowing of a Water-scrue.*—A way how to make hollow and cover a Water-scrue as big and as long as one pleaseth in an easie and cheap way.

54. *A transparent Water-scrue.*—How to make a Water-scrue tite, and yet transparent, and free from breaking; but so clear, that one may palpably see the water or any heavy thing how and why it is mounted by turning.

55. *A double Water-scrue.*—A double Water-scrue, the innermost to mount the water, and the outermost for it to descend more in number of threds, and consequently in quantity of water, though much shorter then the innermost scrue, by which the water ascendeth, a most extraordinary help for the turning of the scrue to make the water rise.

56. *An advantageous change of Centres.*—To provide and make that all the Weights of the descending side of a Wheel shall be perpetually further from the Centre, then those of the mounting side, and yet equal in number and heft to the one side as the other. A most incredible thing, if not seen, but tried before the late King (of

blessed memory) in the *Tower*, by my directions, two Extraordinary Embassadors accompanying His Majesty, and the Duke of *Richmond* and Duke *Hamilton*, with most of the Court, attending Him. The Wheel was 14. Foot over, and 40. Weights of 50. pounds apiece. Sir *William Balfore*, then Lieutenant of the *Tower*, can justifie it, with several others. They all saw, that no sooner these great Weights passed the Diameter-line of the lower side, but they hung a foot further from the Centre, nor no sooner passed the Diameter-line of the upper side, but they hung a foot nearer. Be pleased to judge the consequence.

57. *A constant Water-flowing and ebbing motion.*— An ebbing and flowing Water-work in two Vessels, into either of which the water standing at a level, if a Globe be cast in, instead of rising it presently ebbeth, and so remaineth untill a like Globe be cast into the other Vessel, which the water is no sooner sensible of, but that Vessel presently ebbeth, and the other floweth, and so continueth ebbing and flowing untill one or both of the Globes be taken out, working some little effect besides its own motion, without the help of any man within sight or hearing: But if either of the Globes be taken out with ever so swift or easie a motion, at the very instant the ebbing and flowing ceaseth; for if during the ebbing you take out the Globe, the water of that Vessel presently returneth to flow, and never ebbeth after, untill the Globe be returned into it, and then the motion beginneth as before.*

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* Nos. 22, 23, and 57, describe operations produced by the action of steam, and which depend on its alternate expansion and condensation. See "The Life, Times," &c.

58. *An often-discharging Pistol.*—How to make a Pistol to discharge a dozen times with one loading, and without so much as once new Priming requisite, or to change it out of one hand into the other, or stop ones horse.

59. *An especial way for Carabines.*—Another way as fast and effectual, but moro proper for Carabines.

60. *A Flask-charger.*—A way with a Flask appropriated unto it, which will furnish either Pistol or Carabine with a dozen Charges in three minutes time, to do the whole execution of a dozen shots, as soon as one pleaseth, proportionably.

61. *A way for Musquets.*—A third way, and particular for Musquets, without taking them from their Rests to charge or prime, to a like execution, and as fast as the Flask, the Musquet containing but one Charge at a time.

62. *A way for a Harquebus, a Crock.*—A way for a Harquebuss, a Crock, or Ship-musquet, six upon a Carriage, shooting with such expedition, as without danger one may charge, level, and discharge them sixty times in a minute of an hour, two or throe together.

63. *For Sakers and Minyons.*—A sixth way, most excellent for Sakers, differing from the other, yet as swift.

64. *For the biggest Cannon.*—A seventh, tried and approved before the late King (of ever blessed memory) and an hundred Lords and Commons, in a Cannon of 8. inches half quarter, to shoot Bullets of 64. pounds weight, and 24. pounds of pouder, twenty times in six minutes; so clear from danger, that after all were discharged, a Pound of Butter did not melt being laid upon the Cannon-britch, nor the green Oile discoloured that

was first anointed and used between the Barrel thereof, and the Engine, having never in it, nor within six foot, but one charge at a time.

65. *For a whole side of Ship-musquets.*—A way that one man in the Cabin may govern the whole side of Ship-musquets, to the number (if need require) of 2. or 3000. shots.

66. *For guarding several advenues to a Town.*—A way that against several Advenues to a Fort or Castle, one man may charge fifty Cannons playing, and stopping when he pleaseth, though out of sight of the Cannon.

67. *For Musquettoons on horseback.*—A rare way likewise for musquettoons fastened to the Pummel of the Saddle, so that a Common Trooper cannot misse to charge them, with twenty or thirty Bullets at a time, even in full career.

When first I gave my thoughts to make Guns shoot often, I thought there had been but one onely exquisite way inventible, yet by several trials and much charge I have perfectly tried all these.

68. *A Fire Water-work.*—An admirable and most forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be as the Philosopher calleth it, *Intra sphæram activitatis*, which is but at such a distance. But this way hath no Bounder, if the Vessels be strong enough; for I have taken a piece of a whole Cannon, whereof the end was burst, and filled it three quarters full of water, stopping and scruing up the broken end; as also the Touch-hole; and making a constant fire under it, within 24. hours it burst and made a great crack: So that having a way to make my

Vessels, so that they are strengthened by the force* within them, and the one to fill after the other. I have seen the water run like a constant Fountaine-stream forty foot high; one Vessel of water rarified by fire driveth up forty of cold water. And a man that tends the work is but to turn two Cocks, that one Vessel of water being consumed, another begins to force and re-fill with cold water, and so successively, the fire being tended and kept constant, which the self-same Person may likewise abundantly perform in the interim between the necessity of turning the said Cocks.

69. *A triangle Key.*—A way how a little triangle scrued Key, not weighing a Shilling, shall be capable and strong enough to bolt and unbolt round about a great Chest an hundred Bolts through fifty Staples, two in each, with a direct contrary motion, and as many more from both sides and ends, and at the self-same time shall fasten it to the place beyond a mans natural strength to take it away: and in one and the same turn both locketh and openeth it.

70. *A Rose Key.*—A Key with a Rose-turning pipe, and two Roses pierced through endwise the Bit thereof, with several handsomly-contriv'd Wards, which may likewise do the same affects.

71. *A square Key with a turning scrue.*—A Key perfectly square, with a Scrue turning within it, and more conceited then any of the rest, and no heavier then the triangle-scrued Key, and doth the same effects.

72. *An Escocheon for all Locks.*—An Escocheon to

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* "Force" as here applied appears to refer to some peculiar safety valve. A pump or syringe was called *a force*.

bo placed before any of these Locks with these properties.

1. The owner (though a woman) may with her delicate hand vary the wayes of coming to open the Lock ten millions of times, beyond the knowledge of the Smith that made it, or of me who invented it.

2. If a stranger open it, it setteth an Alarm a-going, which the stranger cannot stop from running out; and besides, though none should be within hearing, yet it catched his hand, as a Trap doth a Fox; and though far from maiming him, yet it leaveth such a mark behind it, as will discover him if suspected; the Escocheon or Lock plainly shewing what monies he hath taken out of the Box to a farthing, and how many times opened since the owner had been in it.

73. *A transmittible Gallery.*—A transmittible Gallery over any Ditch or Breach in a Town-wall, with a Blinde and Parapit Cannon-proof.

74. *A conceited Door.*—A Door, whereof the turning of a Key, with the help and motion of the handle, makes the hinges to be of either side, and to open either inward or outward, as one is to enter or to go out, or to open in half.

75. *A Discourse woven in Tape or Ribbon.*—How a Tape or Ribbon-weaver may set down a whole discourse, without knowing a letter, or interweaving anything suspicious of other secret then a new-fashioned Ribbon.

76. *To write in the dark.*—How to write in the dark as streight as by day or candle-light.

77. *A flying man.*—How to make a man to fly; which I have tried with a little Boy of ten years old in a Barn, from one end to the other, on a Hay-mow.

78. *A continually-going Watch.*—A watch to go constantly, and yet needs no other winding from tho first setting on the Cord or Chain, unless it be broken, requiring no other care from one then to be now and then consulted with concerning tho hour of the day or night; and if it bo laid by a week together, it will not erre much, but the oftener looked upon, the more exact it sheweth the time of the day or night.

79. *A total locking of Cabinet-boxes.*—A way to lock all the Boxes of a Cabinet, (though never so many) at one time, which were by particular Keys appropriated to each Lock opened severally, and independent tho one of the other, as much as concer[illegible]the opening of them, and by these means cannot be [illegible]t opened unawares.

80. *Light Pistol-barrels.*—How to make a Pistol Barrel no thicker then a Shilling, and yet able to endure a Musquet proof of Powder and Bullet.

81. *A Comb-conveyance for Letters.*—A Combe-conveyance carrying of Letters without suspicion, the head being opened with a Needle-screw drawing a Spring towards them; the Comb being made but after an usual form carried in ones Pocket.

82. *A Knife, Spoon or Fork-conveyance.*—A Knife, Spoon or Fork in an usual portable Case, may have the like conveyances in their handles.

83. *A Rasping-mill.*—A Rasping-mill for Harts-horn, whereby a child may do the work of half a dozen men, commonly taken up with that work.

84. *An arithmeticial Instrument.*—An Instrument whereby persons ignorant in Arithmetick may perfectly observe Numerations and Substractions of all Summes and Fractions.

85. *An untoothsome Pear.*—A little Ball made in the shape of a Plum or Pear, being dexterously conveyed or forced into a bodies mouth, shall presently shoot forth such and so many Bolts of each side and at both ends, as without the owners Key can neither be opened or filed off, being made of tempered Steel, and as effectually locked as an Iron Chest.

86. *An imprisoning Chair.*—A Chair made *a-la-mode*, and yet a stranger being perswaded to sit down in't, shall have immediately his armes and thighs lock'd up beyond his own power to loosen them.

87. *A Candle-mold.*—A Brass Mold to cast Candles, in which a man may make 500. dozen in a day, and adde an Ingredient to the tallow which will make it cheaper, and yet so that the Candles shall look whiter and last longer.

88. *A Brazen head.*—How to make a Brazen or Stone-head, in the midst of a great Field or Garden, so artificial and natural, that though a man speak never so softly, and even whispers into the ear thereof, it will presently open its mouth, and resolve the Question in French, Latine, Welsh, Irish or English, in good terms uttering it out of his mouth, and then shut it untill the next Question be asked.

89. *Primero Gloves.*—White Silk knotted in the fingers of a Pair of white Gloves, and so contrived without suspicion, that playing at *Primero* at Cards, one may without clogging his memory keep reckoning of all Sixes, Sevens and Aces which he hath discarded.

90. *A Dicing-box.*—A most dexterous Dicing Box, with holes transparent, after the usual fashion, with a Device so dexterous, that with a knock of it against the

Table the four good Dice are fastoned, and it looseneth four false Dice made fit for his purpose.

91. *An artificiall Ring-horse.*—An artificial Horse, with Saddle and Caparizons fit for running at the Ring, on which a man being mounted, with his Lance in his hand, he can at pleasure make him start, and swiftly to run his career, using the decent posture with *bon grace*, may take the Ring as handsomly, and running as swiftly as if he rode upon a Barbe.

92. *A Gravel Engine.*—A Scrue made like a Water-scrue, but the bottom made of Iron-plate Spade-wise, which at the side of a Boat emptieth the mud of a Pond, or raiseth Gravel.

93. *A Ship-raising Engine.*—An Engine whereby one man may take out of the water a Ship of 500. Tun, so that it may be calked, trimmed and repaired without need of the usual way of stocks, and as easily let it down again.

94. *A Pocket Engine to open any door.*—A little Engine portable in ones Pocket, which placed to any door, without any noise, but one crack, openeth any door or gate.

95. *A double Cross-bow.*—A double Cross-bow, neate, handsome and strong, to shoot two Arrows, either together, or one after the other, so immediately that a Deer cannot run two steps but, if he miss of one Arrow, he may be reach'd with the other, whether the Deer run forward, sideward, or start backward.

96. *A way for Sea-banks.*—A way to make a Sea-bank so firm and Geometrically-strong, that a stream can have no power over it; excellent likewise to save the Pillar of a Bridge, being far cheaper and stronger then Stone-walls.

97. *A perspective Instrument.*—An Instrument whereby an ignorant person may take any thing in Perspective, as justly, and more then the skilfullest Painter can do by his eye.

98. *A Semi-omnipotent Engine.*—An Engine so contrived, that working the *Primum mobile* forward or backward, upward or downward, circularly or corner-wise, to and fro, streight, upright or downright, yet the pretended Operation continueth, and advanceth none of the motions above-mentioned, hindering, much less stopping the other; but unanimously, and with harmony agreeing they all augment and contribute strength unto the intended work and operation: And therefore I call this *A Semi-omnipotent Engine*, and do intend that a Model thereof be buried with me.

99. *A most admirable way to raise Weights.*—How to make one pound weight to raise an hundred as high as one pound falleth, and yet the hundred pound descending doth what nothing less then one hundred pound can effect.*

100. *A stupendious Water-work.*—Upon so potent a help as these two last mentioned Inventions a Water-work is by many years experience and labour so advantageously by me contrived, that a Childs force bringeth up an hundred foot high an incredible quantity of water, even two foot Diameter, so naturally, that the work will not be heard even into the next Room; and with so great ease and Geometrical Symmetry, that though it work day and night from one end of the year to the

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* Nos. 25, 27, and 99, are traced to experimental applications of steam. See comments on these, with diagrams, in "The Life, Times, &c."

other, it will not require forty shillings reparation to the whole Engine, nor hinder ones day-work. And I may boldly call it *The most stupendious Work in the whole world:* not onely with little charge to drein all sorts of Mines, and furnish Cities with water, though never so high seated, as well to keep them sweet, running through several streets, and so performing the work of Scavingers, as well as furnishing the Inhabitants with sufficient water for their private occasions; but likewise supplying Rivers with sufficient to maintaine and make them portable from Towne to Towne, and for the bettering of Lands all the way it runs; with many more advantageous, and yet greater effects of Profit, Admiration and Consequence. So that deservedly I deem this Invention to crown my Labours, to reward my Expences, and make my Thoughts acquiesce in way of further Inventions: This making up the whole Century, and preventing any further trouble to the Reader for the present, meaning to leave to Posterity a Book, wherein under each of these Heads the means to put in execution and visible trial all and every of these Inventions, with the shape and form of all things belonging to them, shall be Printed by Brass-plates.

In Bonum Publicum,

&

Ad majorem DEI *Gloriam.*

1688—9.

SIR SAMUEL MORLAND

To Archbishop Tenison.*

The proposalls Sir Samuel Morland gave unto Major Wildman for the King's secret service were as followes.

I.—To open any letter though written and sealed up with all the care and nicety that is practicable; and having coppied out the contents, to seal the same up again, with as many as shall be desired; provided he have the same paper, wax and ink, that the party that wrot and sealed it shall be so far from discerning his letter to be opened or disfigured, that he shall not know his own letter from the other counterfeits.

II.—To wash a written paper as white as before it was written.

III.—To counterfeit all handwriting so dexterously, that, upon occasion of state, the king may send the coppies and keep the originalls of any letters, dispatches or other papers, till any designes be ripe for conviction.

IV.—To coppy any number of whole sheets of paper close written on both sides in as many minutes time, with this advantage, that it will be impossible for the coppies to be erronious.

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* MSS. Lambeth, 931, Orig. Also "Letters on Science." Edited by J. O. Halliwell, F.R.S., &c., 8vo. 1841.

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15.—Ten lines from top for "public manufacturers" read "public" of manufacturers.

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The descriptions [in the "Century"] are in most cases a mere statement *of the ends to be attained, or of the wonderful things to be accomplished*, without any intimations of the means to be adopted; and it is very interesting to note, under Mr. Dircks's guidance, that whatever the value of the Marquis's inventions, strictly so called, his ideas forecasted some of the most remarkable inventions of modern times.

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WORKS BY THE SAME AUTHOR.

Disesteemed and ill-treated during his lifetime, tardy justice is at length done him (the Marquis) by his present biographer, for we cannot but think that the claim of the Marquis of Worcester to be the inventor of the steam engine is now for the first time placed beyond all doubt.

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Mr. Dircks's able and exhaustive Life, Times, and Scientific Labours of the Marquis of Worcester. . . . . He has collected and published all that is likely to be brought to light relative to the life and works of

the Marquis, and has laboured at his task with a rare love and enthusiasm for his subject.—*Lives of Boulton and Watt, by S. Smiles.* 8vo. 1865.

The volume, which is so splendidly turned out by the publisher as to constitute an ornament for the drawing-room as well as a valuable addition to the library, contains a full history of Lord Worcester's life, and a reprint, with illustrative notes, of the "Century of Inventions."

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All that concerns this singular but highly talented nobleman is of great interest, not to this country only, but to the world at large, and especially to the scientific world, which owes a deep debt of gratitude to Mr. Dircks for his indefatigable and most successful researches.

Let any one read the work, and they will be convinced that not only may a great man who has been long dead yet live, but that he may live as long as the world of intellect and science shall last.—*The Monmouthshire Beacon, 13th January.*

When Mr. Dircks expresses his belief that, on account of the high intellectual gifts in *constructive ingenuity* of Edward Somerset, sixth Earl and second Marquis of Worcester, "it is impossible to name his compeer, either among the highest nobility or the most eminent scientific celebrities of Europe during the last two centuries," it may well be matter of surprise that it should have been left to the present day to furnish a Memoir of the Inventor of the steam engine. Mr. Dircks may be congratulated, therefore, on having a new and interesting subject for a scientific biography; and our readers who may remember the terms in which we spoke of "Worcesteriana" will not be surprised that we should now bear testimony to the industry and zeal with which Mr. Dircks has pursued his enquiries into the personal history, and the light which he has thrown on the scientific acquirements and pursuits of this remarkable nobleman. The reprint of the "Century of Inventions," with the Editor's comments, is not the least valuable portion of the work before us.—*Notes & Queries, 3rd March.*

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