## THE PROSPECTS AND PRESENT STATE OF PHOTOGRAPHY IN NATURAL COLORS.

IN TWO CHAPTERS.

I.

From the fact that the production of photographs in natural colors has twice within the past few weeks been brought forward with some degree of prominence, once at a meeting of the Polytechnic Section of the American Institute, and also at the last meeting of the Association of Operative Photographers of New York, a brief glance at the nature, modes, and prospects of heliochromy may be useful. Already photographs are taken on plates prepared by modern processes possessing such sensitiveness as to enable one to depict the action of the horse's foot in trotting, or, as was shown at the recent fair of the above institute, the swift steamboat arrested as it dashes at full speed across the line of vision of the camera. It only now remains that the splendid discovery of photography be crowned by the further discovery of the means of obtaining pictures possessing all the colors of nature, and by means so simple and certain as to be within the compass of the powers of the average operator.

The fact that several wise men, who have been imperfectly acquainted with the subject, have shaken their heads at the idea of its being possible to produce photographs having the colors of nature, need not greatly distress the experimentalist. What scathing contempt was hurled by the College of Physicians at the head of the discoverer of the circulation of the blood when he announced the fact! With what keen point did the far-seeing Sir Walter Scott ridicule the idea of a street being lighted by gas! Who is unaware of the pity expressed for the mental condition of those who proposed ocean steam navigation, communication by telegraph, and indeed nearly every startling advance in the applications of science? Even the unreasoning bigotry displayed by the British Parliament when George Stephenson advocated railway traveling by steam, was insufficient to prevent his gifted son, Robert Stephenson, from ridiculing the French project of the now accomplished Suez Canal; while in the science of photography the late Sir David Brewster often declared the impossibility of producing an accurate photograph unless by a lens the size of that of the human eye. The true investigator, while not ignoring past experience, must march beyond it.

It is a fact, to which some of the earlier volumes of the SCIENTIFIC AMERICAN bear attestation, that photographs bearing the colors of nature have been taken, and this not by a happy accident, but by design. The beaten tracks in photographic chemical routine must be departed from to secure an end, in the accomplishment of which certain well accredited laws of physical science are overridden; for, as was remarked by a speaker at one of the meetings alluded to, heliochromic chemistry recognizes an entire change in the relative activity of the various colors of the spectrum. Blue or violet light, which in ordinary photography is synonymous with white in its actinic power, here acts in the most laggard manner, while the comparatively non-chemical red light, which produces so little change upon the sensitive plates in common use, here acts in the most energetic manner.

Two objections may reasonably be urged against such examples of heliochromy as up to the present time have been produced: It is an exceedingly difficult matter to fix the colors when once obtained; and when so fixed the colors are sadly deficient in beauty and brilliancy. True, they are sufficiently pronounced to render it easy to distinguish the colors from each other, but they are yet far from being able to satisfy the requirements of a utilitarian age. Their production is a scientific, but not yet a commercial fact. Owing, perhaps, to some imaginary innate difficulty in the operations, or possibly to a want of faith in ultimate success, the laborers in this field are indeed few, the progress being commensurate. The whole superstructure of heliochromy rests as yet upon the foundations laid in 1839 by the late Sir John Herschel, who observed that paper sensitized by chloride of silver and darkened by exposure to light was then in a condition to reproduce certain colors when again exposed to the action of light under pieces of glass of various colors. From his experiments he was led to declare his belief that photography in natural colors might reasonably be expected to be brought within the range of accomplishment.

For the guidance of those readers who may feel desirous of instituting researches in this direction, we shall give out lines of the most successful methods by which experimentalists have worked. A polished plate of silvered copper, as used for daguerreotype, is immersed in a mixture of one part of sulphate of copper, two parts of common salt, and five of water, three ounces of which, together with a like quantity of a saturated solution of common salt, are diluted with eighteen ounces of water. It will be perceived that bichloride of copper and sulphate of soda are formed by the mixture of these substances. Into this bath the plate when immersed is rapidly coated with a violet subchloride, and this, after washing and drying, is all the preparation the plate requires to enable it to receive the colors of nature. Another method of preparing silvered plates consists in attaching one to the positive pole of a galvanic battery, a piece of platinum foil to the negative pole, and then immersing in greatly diluted muriatic acid. In the course of a minute it will pass through several stages of coloration, including yellow, blue, green, rose, and violet, at which last it must be removed, washed, dried, and heated slightly till it becomes a red color. It is now sensitive, and becomes readily impressed with all the colors. There is reason for believing, although such fact has never been published, that by this method were prepared the plates upon which Becquerel produced his famous photographs of the spectrum showing the colors. When paper or glass plates are employed instead of the silvered copper the methods by which they are prepared are analogous to those described, at least in principle. A sheet of subchlorized paper having been floated upon a solution of bichromate of potash, chloride of potassium, and sulphate of copper, and then dried in a darkened room, is now ready for exposure. In one experiment made it required an exposure under a painted magic lantern slide for a quarter of an hour to print the colors, on which occasion it was noticeable how much sooner the reds printed than the blues. Modifications of this method of preparing paper, involving the employment of nitrate of mercury, with the subsequent use of chlorate of potash and dilute sulphuric acid, have yielded paper so sensitive as to receive impressions in less than a minute. When glass or porcelain are used instead of paper, a film of collodion should be the medium in which to form the sensitive subchloride of silver, a process now easy of accomplishment.

When making some experiments under the direction of M. Chevreul, M. Niepce de St. Victor, who tried his heliochromic experiments on a large doll bedecked with jewels and resplendent with colored silk, made the remarkable discovery that black is not the mere absence of light, but is entitled to be considered a color of itself, and has a special chemical action of its own. The color of the sensitive plate was violet, and on this the camera impressed all the colors of the doll, including white; but, as the blacks had also been impressed *as* black, it led to this experiment: A hollow tube, black from the absence of light, was presented to the camera, together with another article of a definite black color, with this result, that the former was represented by an unaltered state of the original violet color of the surface, while in the latter case a very deep black resulted. The philosophy of or deductions from this singular discovery do not now claim our attention.

If the present state of photography in colors by natural or chemical means is unsatisfactory, not so is that by artificial pigments, applied, however, by the agency of light itself. This phase of heliochromy will be treated in another article.

### Completion of the Eddystone Lighthouse.

Within another month or so—much earlier than was originally anticipated—the actual building of the new Eddystone Lighthouse, so far as the masonry is concerned, will be completed, and the work of furnishing it with the lighting apparatus will then speedily begin. The whole of the stonework of the lighthouse is in fact not merely constructed, but in the hands of the actual builders, whose work consists in conveying the already prepared blocks to the reef, and fitting them in their places there. The contract for the provision of the stone for the construction of the lighthouse was, it will be remembered, taken by Messrs. Hugh Shearer & Co., of 21 Great George street, Westminster, the owners of the De Lank granite quarries near Wadebridge, and of granite quarrying rights away to Rough Tor, over an area of something like twenty square miles. The stones have been wrought in a yard at Wadebridge, where every one of 2,200 of which the lighthouse is composed—they weigh in all 6,000 tons—has been brought to the precise dimensions required and fitted to a hair's breadth, the whole of the structure being built up section by section preparatory to its shipment. This work has now been brought to a close by Messrs. Shearer & Co. six months before the expiration of the time allotted in their contract, and the last stone of the outward curve of the top gallery was dropped into its place in the presence of Mr. Douglass, the engineer of the work, who heartily congratulated Mr. Shearer upon the style in which the contract had been executed.

The completion of the work by the present date is a matter of great importance, as it saves very much more time in the erection than the six months gained on the contract, in consequence of the early period of the season, which will enable the fitting of the lantern, and is to be proceeded with almost at once. The lighthouses of the Great and Little Basses, Ceylon—executed at the Dalbeattie granite quarries of Messrs. Shearer, Field & Co.—were also carried out much to the satisfaction of all concerned, as in the present instance well within the time named in the contract. The stones for the Eddystone have, of course, varied somewhat in size, but those of the base may be cited as fair examples, and they are each 6 feet 6 inches deep, 2 feet thick, and 3 feet 10 inches on their outer circumference.—*Building News.*

### Important Photographic Discovery.

At the meeting of the Photographic Society of Great Britain, London, May 10, Mr. Warnerke proceeded to give the details of a new discovery he had made respecting the action of pyrogallic acid on gelatino-bromide. This discovery consisted in the fact that a gelatine plate submitted to pyrogallic acid became insoluble in those parts acted upon by light, exactly in the same way as gelatine acted upon by chrome salts, the insolubility being in proportion to the amount of light and the thickness of the gelatine. This property Mr. Warnerke proposes to utilize in various ways. The drawback in the ordinary gelatine process being that, unless the exposure is very accurately timed, there is considerable danger of overexposure, and intensification being very difficult, pictures by the gelatine process are often inferior to those by collodion. By the new process he was, however, able not only to intensify, but also to overcome the drawbacks arising from overexposure. The latter he effected by using the emulsion on paper. He had found that no matter how much the paper was overexposed, the picture, provided the developer was restrained sufficiently, was not injured, while in the case of the emulsion on glass, there was not only halation of the image, but a reversal also. The transfer of the image from paper on to the glass is very easy. The paper is immersed in water, and placed in contact with a glass plate. The superfluous moisture being removed by a squeegee, the paper may then be stripped off, leaving the gelatine on the glass. Hot water is then applied, which dissolves all the gelatine not acted on by light, and the image is left upon the glass in relief. Intensification Mr. Warnerke effected by mixing with the emulsion a non-actinic coloring matter, and which is not affected by silver. Aniline colors he had found answered the purpose, and in this way special emulsion for special purposes could be prepared. This method of preparation he thought would be especially suitable for magic lantern slides. Mr. Warnerke claimed that by his discovery relief could be obtained far more easily than by the ordinary bichromatized gelatine, and therefore it was especially suitable for the Woodburytype process. By mixing emery powder with the emulsion it was rendered fit for engraving purposes, and by a combination with vitrified colors the image could be burnt in, and being so adapted for enamels. By using a suitable emulsion, however, so little gelatine could be employed as to obviate all difficulty in carbonizing. The process could also be adapted for collotype printing.

In the course of his remarks, Mr. Warnerke demonstrated the removal of a gelatine picture produced by his method from paper to glass, and showed that the mere immersion and washing in hot water fixed the picture by the dissolving of the gelatine unacted upon by light, which thus carried away the unchanged bromide of silver.

In conclusion, Mr. Warnerke stated that the sensitive paper could be used in the camera in lengths, wound on rollers, and exhibited a slide which he had made for the purpose.

### MISCELLANEOUS INVENTIONS.

An improved ice house door fastener has been patented by Mr. Francis Keil, of New York city. The invention consists in a novel combination of latching and locking mechanism, and the combination therewith of mechanism for wedging the door to its seat.

An improved gate, which can be conveniently opened from a vehicle, has been patented by Mr. Henry Salisbury, of Newburg, N. Y. The gate consists of a series of horizontal rails or slats pivoted to end uprights, the inner one of which is hinged to a post, and has a beam pivoted to its upper end, the outer end of which beam is connected with the outer end of the gate by a pivoted rod, and the inner end of this beam is provided with a weighted roller and suitable stops, so that when a rope is pulled the latches will be raised, the inner end of the beam will be raised, and the weighted pulley will roll to the end of the beam, thereby raising the outer end of the gate, which can be swung open by pulling on the rope.

A simple, inexpensive, and efficient reflector, which may be readily applied to ordinary lamps or lanterns, and as readily detached when not desired, has been patented by Mr. Henry E. Haley, of Monroe, Me.

Mr. Henry W. Mattick, of Lawrenceburg, Ind., has patented a composition for filling the pores of wood, consisting of gum shellac cut in alcohol, kauri gum, spirits of turpentine, drying oil, raw linseed oil, and red lead.

An improved bail fastener, patented by Mr. John A. Marston, of Centre Sandwich, N. H., consists in combining with a splint basket and bail a metallic strip clasped about the bail, and having both ends then passed between two splints and bent divergently over them.

An improved corset has been patented by Imogene E. Banker, of Brooklyn, N. Y. The object of this invention is to furnish corsets that will give proper shape and can be worn without discomfort, and to dispense with paddings and other devices used to give form to ill-shaped persons.

Neckties and scarfs, as usually worn, are pinned to the collar, so as to be retained in place. Mr. Myer Hellman, of New York city, has patented an improved device, which is a substitute for pins for accomplishing the same object, and has the additional advantage of being more convenient in use, always at hand, and allowing adjustment after the collar and neckwear are put on the person.

A head rest, which can be folded compactly for transportation, and can be erected in a short time, has been patented by Mr. Heinrich Strauss, of Nüremberg, Germany. The head rest is formed of a sheet or piece of fabric attached to a frame, which is so constructed that the sheet is held inclined, and its tension can be regulated at will.

An improved tool for handling, opening, closing, and scraping boxes, barrels, bales, etc., has been patented by Mr. William H. Bickelhaupt, of New York city. The invention consists in a hook attached to a transverse handle, with a hammer head at one end and a claw at the other end, the hook being provided with a scraping knife projecting in the opposite direction of the hook.

Mr. Jean Escoubés, of New York city, has patented an improved shutter bower, in which a curved bar is used in combination with a catch.

An improvement in end gates for wagons has been patented by Mr. Matthew F. Allen, of Nashville, Tenn. The object of this invention is to facilitate removing the end gate of wagons for the purpose of discharging the load without removing either of the body rods. It consists in an end gate provided at one end with a sliding piece pressed outward by suitable springs, and provided with a hasp or handle, by means of which it can be withdrawn from between two cleats of the side of the wagon, so that the end gate is shortened sufficiently to be withdrawn from between the sides of the wagon.

An improvement in sewing machines has been patented by Messrs. William G. Wilson, George S. Darling, and Henry Wulff, of Chicago, Ill., assignors to Wilson Sewing Machine Company, of same place. The improvement relates to sewing machines of the class using oscillating shuttles; and it consists in certain novel features of construction that cannot be clearly described without engravings.

An improved mechanical movement has been patented by Mr. Joseph Harris, Jr., of Boston, Mass. This invention is an improvement upon the machine for changing a reciprocating into a rotary motion, described in letters patent numbered 7,902, which were granted to the same inventor January 14, 1851.

An improved spindle and bolster, in which the spindle is firmly supported, and, with its attached whirl, can be conveniently detached from the bolster when required, has been patented by Messrs. Joseph Duffy and Henry Whorwell, of Paterson, N. J. The spindle is constructed with oil chambers that facilitate the lubrication of the spindle bearings.

An improved machine for revolving cans in solder has been patented by Mr. David Klump, of Moorestown, N. J. The invention consists in a ring provided with set screws for securing it to a fire pot, and also provided with a slotted arm having the base plate of a perforated upright secured to it adjustably by a set screw, a standard secured adjustably in the perforated upright by a set screw, and having an adjustable collar clamped to its upper end, and a cylinder secured in the said collar and carrying a rotary shaft having arms attached to its forward end, and held forward by a spiral spring, so that the can will be revolved by rotating the shaft.

A glove fastener, which is durable and effective, and does not tear the glove, has been patented by Mr. Joseph Whitby, of Yeovil, County of Somerset, England. The invention consists in a hollow stud containing a spring which projects through slots in the sides of the stud and catches on a shoulder of an eyelet as the stud is passed through or into the eyelet, thus locking the two together, the eyelet and stud being fastened to the opposite lapels of the glove.

An improvement in stoves has been patented by Mr. William Clark, of Troy, N. Y. The object of this invention is to improve the construction of the stoves for which Letters Patent No. 122,156 were issued to the same inventor December 26, 1871, to adapt it for burning bituminous coal, and to allow the ashes to be more effectually shaken out of the fire box. The invention consists in constructing the fire box with offsets in the upper parts of its sides, and the case with openings provided with dampers in the upper parts of its sides through which air can be admitted to the upper part of the fire box, to adapt the stove to burn bituminous coal.

Mr. David Untermeyer, of New York city, has patented a finger ring so constructed that the shank can be detached from the heads and replaced with a larger or smaller shank

An improved vehicle wheel has been patented by Messrs. Charles W. Ball and Thomas Davis, of Macon, Ill. The invention consists in combining with the spokes of a wheel, a tire and metallic felly, forming a T-bar, and spoke sockets arranged on both sides of the felly, whereby strength and durability are secured to the wheel.

An improved gate latch has been patented by Mr. Albert L. Grayson, of Rutherfordton, N. C. It consists of a wire or rod of iron bent into a square loop, one end of the rod being extended to pass through the gate and have a knob or other means of turning or swinging the loop for unlocking the gate secured to it, the loop being adapted to catch over a triangular projection or keeper secured to the gate post.

A fireplace which will cause complete, or nearly complete, combustion of the gases and smoke produced by the burning fuel, and at the same time radiate the heat in a downward direction to heat the lower stratum of air, has been patented by Mr. Gerard R. Ricketts, of Quaker Bottom, O. The invention consists in an inclined radiator having current or gas arresters or deflectors on its front face, one of which may have a suitable draught passage.

Mr. William Taylor, of Chicago, Ill., has patented a device by which mops may be easily and conveniently wrung. The invention consists, principally, of two metal skeleton frames hinged together, each carrying a roller, one of the frames being curved to fit the bottom and the edge of the bucket or tub.

Mr. George C. De Lametter, of North Wolcott, N. Y., has patented an improved apparatus for drying fruit, the object of the invention being to obtain sufficient draught of heated air without the use of a blower, and to prevent the fruit on the upper trays from being sweated by the damp air rising from below.

An improved millstone sharpener has been patented by Mr. Patrick Graham, of Stockholm, Sweden. The invention consists of one or more toothed disks mounted upon or forming part of a radial arm connected with the driving spindle, to adapt the sharpener to break or sharpen the grinding surface of a millstone by being moved over the surface under pressure.

A cheap, durable, and efficient trace holder for harnesses, one which will hold the cockeyes in any position on the harness, and one with which the cockeyes may be engaged and disengaged without trouble, has been patented by Mr. Volney Stepp, of Manhattan, Kan.

Mr. Philip Thorpe, of New York city, has patented an improved pneumatic refuse-conveyer, whereby the refuse of the dwellings and the sweepings of the streets of cities may be deposited into proper receptacles and released therefrom into underground pipes, to be conveyed therein by pneumatic pressure to any desired discharging point.

A cultivator which shall be adapted for cultivating different kinds of grain, and for use upon stony or stumpy ground, has been patented by Mr. Clinton Mendenhall, of Martinsburg, W. Va. The invention consists in a wheeled frame having lugs and inclines on its forward end, and a system of levers and shafts, by means of which the plows may be lifted out of the ground.

Mr. Francis B. Snodgrass, of Harrisville, W. Va., has patented an improved root-cutting plow, so constructed as to rise and pass over obstructions that cannot be cut, and which will allow the colter to be adjusted and reversed.

An improved friction brake has been patented by Mr. Abraham O. Frick, of Waynesborough, Pa. This invention relates to improvements upon that form of friction brake in which two segmental sections or shoes are made to bear against the opposite sides of the periphery of a wheel to arrest the movement of the latter.

Mr. Napoleon Prince, of St. Boniface, Manitoba, Canada, has patented a windmill, so constructed that it can be adjusted to run at any desired speed and in either direction, which will adjust itself, as the force of the wind varies, so as to run at a uniform speed. It can be readily thrown out of the wind and can be instantly stopped.

### The Engineer's Inspector.

In rolling mills and constructive ironworks a familiar and well-recognized personage is the engineer's inspector, whose duty it is, or ought to be, to test the manufactured iron, to inspect the quality of material and workmanship throughout its various stages during its progress of manufacture toward completion, and to insure their reaching the standard of perfection required. He is considered the *bete noir* of contractors, who are obliged, from policy, to hold the candle to him, and to adopt all kinds of ingenious devices to keep themselves in his good books and favor. There are inspectors and inspectors, in the same way that there are contract specifications and specifications. The *Design and Work*, London, thus classifies these personages: We have the gentlemanly inspector, whose object and pleasure it is to assist the contractor in carrying out the work intrusted to him in accordance with the common-sense terms of a fair specification. These gentlemen it is a pleasure to have about a works. They practically save the contractor the cost of an additional foreman, overlooker, or leading workman. Again, we have other inspectors, who are certainly not gentlemen in any sense of the term, whose only aim and effort appears to be to give the contractor as much trouble as possible, who continually interfere in every petty detail, and generally, as they say, have their pound of flesh. These men would have the contractor remodel and rearrange his works to suit their ideas and convenience—no two inspectors probably agreeing in their requirements, they would have the various operations and processes performed at a different time or place to that in which the establishment had been accustomed. This class of inspectors gives rise to great annoyance among contractors, and arouses a great amount of ill-temper in the workmen, who sometimes are irritated so far as to rebel and refuse to work under their inspection. When two or three of this type get together over their beer and tobacco, they laugh, chuckle, and relate anecdotes of how they have *done* this contractor, and made another one pull so much of the work to pieces as would satisfy their own sweet will—in fact, they appear to glory in the annoyance they cause.

If any of the foremen or higher officials belonging to the works offend one of this class, woe betide the unfortunate contractor. They revenge themselves upon the unoffending iron. More test pieces must be cut from the largest plates and longest angle and T-bars. Everything is rejected or objected to, if by any manner a pair of spectacles or a microscope can be found to reveal a flaw. Kirkaldy's chamber of horrors (museum of fractures, as it is euphemistically called) is invoked—and you may be sure that this inspector will have his pound of flesh, if man ever had it. The contractor may use strong language, sigh, or groan, to no effect, as the specification has him in a net, when it says, as is usually the case, that the work is to be done to the satisfaction of the engineer or his deputy.

Another class of inspectors may be termed the nervous class. These are perhaps more to be pitied than blamed, but they are perhaps more aggravating than any others. They cannot make their minds up whether a piece of work is good enough for them or not, so they keep pecking at it, first having one part pulled to pieces, and then another, until the whole is reduced to its original state of raw material; and then, perhaps Mr. Inspector adds at the last: "Ah, I think it would have done, after all!"

Another class is that of the thirsty inspectors. These are always in a state of chronic thirst, and continually throwing out hints that "this is a dry shop," or that "it is very hot to-day." They expect to be treated on every possible occasion, and of course, as it is in the power of the inspectors to hinder the execution of work, and cause the contractor extra expense, a system of judicious bribery is adopted toward them. In some works a small cellaret is kept stocked in the inspector's office with his choice liquor. In other cases constant adjournment is made to the nearest public-house or hotel, where the proprietor or his deputy gives him a "skinful," a tough old drinker being told off for his companion. In high-class works a butler is kept, and the inspector is dined *en règle*. In other works a kind of table d'hote is served for the chief officials, to which Mr. Inspector is invited, and it is curious to notice his visits are timed about meal times—he accidentally drops in just about lunch or dinner time. If late, he comes into the office with "Good morning," "How do you do?" "Oh, I am as hungry as a horse!" Or it is, "I have lunched, but I have had no whisky." To which the proprietor responds by calling John to take Mr. Inspector over the way to lunch.

Some inspectors require more positive bribery even than food and drink, and various devices are resorted to to find out the particular sum that is sufficient for the purpose. Numerous anecdotes, real and apocryphal, are current in many works. Thus we have an inspector finding fault with the work, when the manager comes up, and the conversation takes this line: The manager says: "I suppose if I were to put a sovereign over each of your eyes you could not see this?" To which the inspector replies: "No, I could not see it; and if you were to put another over my mouth, I could not speak about it." Another instance: The proprietor says to the inspector: "I say, do you think £200 would plane those edges and joints?" To which is replied: "I dare say it would." "Well, it's yours if you plane them." "All right," says the inspector. It is needless to say the joints and edges were never planed.

A continuous system of judicious bribery enables this class of inspector to save money enough to retire comfortably in old age. Many German and French firms, with their usual minute accuracy, include in their estimates definite sums for dinners and presents to the engineers and inspectors, but English firms leave these charges to go in with the working expenses. It is a difficult thing to know exactly where to draw the line between ordinary politeness and hospitality and deliberate bribery.

Another type of inspector is the occasional inspector, who is generally a pupil of the engineer. This young gentleman looks as if he had just come out of a bandbox. He is got up in lavender kid gloves, eyeglass, and clothes of the latest fashion; he comes down to the works in style; there is no getting over him, in his estimation, although, to judge from appearances, his knowledge of iron and steel is of a very remote character. He may have heard or read of such things, but it is questionable whether he has seen them often enough to recognize them without explanation. This type of inspector gives rise to much amusement, and affords scope for practical jokes and hoaxes of the "verdant green" style.

Many inspectors cannot trust a contractor or any of his workmen an inch further than he can see them. He will have the plates and bars cut out of the work itself, or have the test bars of castings out of the same ladle, and even in extreme cases will insist on the test bars being cast bodily on to the particular casting under inspection.

As a general rule the lower the status of the inspector the more troublesome is he to the contractor. The engineer, if the designer of a structure is satisfied with a plain, good, substantial job, will not object to the alteration of a section of iron, provided there is no loss of strength, nor will he object to small defects; but the small inspector is either too nervous, too particular, or too consequential to consent to any such deviation from the drawings and specifications as this. We are inclined to think that work is much overinspected at the present time, and very much question whether work has improved in quality in comparison with the increase of inspection. We don't think many great improvements have come from inspectors in the manufacture of iron and steel. We may point to two great examples in bridge structures—the Menai Tubular Bridge and the ill-fated Tay Bridge. The first was erected before the days of rigid inspection and engineering vagaries, the last was built when the modern system was in full bloom. We may remark that no amount of inspection will compensate for errors in design. We are not advocating the abolition of the inspector, but the judicious use of him, and careful selection of men for the office. Contractors before tendering for work always want to know who the inspector is, what sort of a man he is, and to gather some information about the inspection, as so much depends upon the individual that it constitutes to them a serious item—in fact, it is a question of profit and loss.

There is too frequently a species of unfairness about the drawing up of specifications and the interpretation of their clauses by the inspector. Looking at the other side of the question, the inspector is placed in a very difficult position. He stands between two stools. He has to do his duty to his superior officer, to see the work carried out with efficiency and correctness, and yet retain a character for amiability. Some contractors take a delight in irritating an inspector in every possible manner; and if he recriminates, they at once cry out, He is disagreeable, overstrict, unfair, etc.

The inspector is the outcome of the present age of commercial activity, and as such, concludes *Design and Work*, we have given him a place in our portrait gallery of working hands and working heads.