

## Journal of the Society of Arts.

FRIDAY, NOVEMBER 4, 1859.

## OPENING OF THE ONE HUNDRED AND SIXTH SESSION.

The first Ordinary Meeting of the Session will take place on Wednesday evening, the 16th inst., when Sir Thomas Phillips, F.G.S., Chairman of the Council, will deliver the introductory address.

## EXAMINATIONS.

Dr. Lindley, F.R.S., Professor of Botany in University College, London, has been appointed by the Council Examiner in Botany to the Society of Arts.

## BRITISH ASSOCIATION, ABERDEEN, 1859.

## ON A NEW MODE OF BREAD-MAKING, BY WM. ODLING, M.B., F.R.S.

The following paper was read before the Chemical Section:—

I wish to introduce to the notice of this Section of the Association a new mode of making bread, invented by Dr. Daughlish, and now practised on a somewhat large scale in London. The process is one of considerable interest, not only in a chemical, but in a manufacturing and a sanitary point of view.

The vesicular character of ordinary bread, results, as is well known, from the development of carbonic acid gas uniformly throughout a mass of fermenting dough, whereby a loose, spongy texture is imparted to what would otherwise be a dense sodden lump of baked flour and water.

In fermented bread, the carbonic acid gas thus generated within the substance of the dough, is a product of the transformation, or degradation of one of the constituents of the flour, namely, of the starch or sugar. In the plan I am about to describe, the carbonic acid gas is produced independently and super-added to the flour, which consequently need not undergo any degradation whatever.

The following description furnishes a general outline of the process: Carbonic acid gas, stored in an ordinary gas-holder, is pumped therefrom into a cylindrical vessel of water, whereby the water becomes charged with the gas. This carbonic acid water is mixed, under pressure, with the flour, and the resulting dough, which becomes vesicular on the removal of the pressure, divided into loaves and baked.

At present, the carbonic acid gas is produced in the manner usually employed by soda-water makers. A mixture of chalk and water is run into a large wooden tub, in which an agitator constantly revolves by means of an endless band, driven by a steam engine. Sulphuric acid, flowing through a leaden pipe, closed at the bottom by a leaden cup of acid, which acts as a valve, is constantly dropping, by the overflow of the cup, into the mixture of chalk and water; and the carbonic acid gas thus generated passes at once into an ordinary gas-holder having a capacity of 1,000 cubic feet, where it is stored for use. But a different mode of producing the carbonic acid has been tried with success, and is now about to be employed. This process consists in the ignition of chalk, and is interesting as being opposed to our ordi-

nary chemical notions of the circumstances under which chalk can be made to part with its carbonic acid. The chalk is heated for three or four hours in five small iron retorts resembling gas retorts. The first portion of gas, being constituted largely of air and steam, is allowed to escape; the remainder passes at once into the gas-holder. By this means a large supply of pure carbonic acid is obtained very cheaply. The lime remaining in the retorts, though not absolutely caustic, is very nearly so, and slacks readily with water.

From the gas-holder, the carbonic acid gas is usually pumped direct into the water-vessel, but sometimes into a separate reservoir of condensed gas, which then enters the water-vessel by its own elasticity. The pair of pumps are arranged to work under a pressure of 200lb. on the square inch. Any additional pressure opens a valve through which the gas re-passes into the gas-holder. The pumps are worked in a cistern of water, and the pipes leading from the pumps are encased in a sort of Liebig's condensing apparatus, whereby the great heat generated by the condensation of the gas is effectually withdrawn.

The water-vessel is a closed cylinder of copper, with hemispherical ends, tinned on the inside, about five feet high, and a foot in diameter. Its upper extremity communicates, by means of a cock, with a cistern of water placed directly above it, and, by means of another cock, with a pipe leading into the upper part of the mixing or doughing-vessel. This mixer is a hollow sphere of cast-iron, about three feet in diameter, having a rotating horizontal axis, to which the mixing arms or forks are attached. Its upper part communicates, by a pipe, with the upper part of the water-cylinder, and its lower part, by another pipe, with the lower part of the cylinder. It is furnished with two circular openings, somewhat less than a foot in diameter, one at top, one at bottom. The lids which close these openings of the mixer have each a circular rim or projection fitting into a corresponding circular groove or depression, lined with vulcanite; and the apposition is rendered pressure-tight by means of a screw. The exact mode in which these lids are adapted varies somewhat in the different mixers.

In order to make bread, a definite quantity of water—about 20 gallons—is run into the water-cylinder, so as to about three-parts fill it, the quantity admitted being read off upon a lateral gauge. The bottom lid of the mixer having been properly attached, the cloth nozzle of a shoot is introduced into the upper opening, through which a sack of flour and three or four pounds of salt are passed, from an upper story, into the mixer. The cloth nozzle is then removed, and the upper lid properly closed. The closed mixer being then in communication with the closed water-vessel by the upper pipe, an exhausting pump connected directly with the mixer is set to work, and so rapidly and completely is the exhaustion of air from the interior of these two vessels effected, that in the course of two minutes a vacuum of 29 or 30 inches is produced. The object of this preliminary exhaustion is simply to prevent any admixture of air with the carbonic acid subsequently introduced, inasmuch as a great portion of this latter has to be used over and over again. The necessary vacuum having been obtained, carbonic acid gas is admitted, either directly from the forcing pump, or from the intermediate reservoir of condensed gas. The carbonic acid first enters the cylinder at the bottom of the contained column of water, passes through the water to the top of the cylinder, and thence into the mixer, an arrangement which promotes the thorough saturation of the water. Moreover, the gas is admitted through a rose furnished with a few minute openings only, whereby it does not pass through the water in mass, but is distributed equally throughout. The pumps are continued in action until the pressure in the two vessels has reached 100 lbs. on the square inch. Then on turning a cock at the bottom of the cylinder, which is on a higher level than the top of the mixer, the water runs

from the cylinder into the mixer by its own gravity. The kneading axis, with its arms, is next set going. The process of kneading differs from ordinary machine kneading in one important particular. The substance kneaded is not a tough vesicular mass of fermenting sponge and flour and water, difficult to incorporate, but a non-vesicular mass of flour and water only. This kneading is continued for a period varying from three to ten minutes. As a rule, the less the kneading of the flour, the whiter and more perfect the bread, but with some descriptions of flour the kneading must be continued for about ten minutes, in order to develop the elastic and tenacious characters of the gluten sufficiently to retain the carbonic acid, although with good flour, three or four minutes are generally sufficient. After the kneading is completed, the dough is forced out from the mixer by the elasticity of the contained carbonic acid.

The exit for the dough is of somewhat peculiar construction. In the bottom lid of the mixer, shielded by internal buttons to prevent the direct pressure of the gas, are two rectangular slits, each two inches long and a quarter of an inch wide. From these proceed two flat tin pipes, which gradually increase in size, trumpet-like, until they meet together, when they unite to form one circular nozzle, about 4 inches in diameter. The object of this contrivance is to prevent any sudden expansion of the dough as it becomes freed from the pressure in the mixer. Thus the section of dough, as it escapes from the mixer, occupies an area of one square inch only. It then passes through the gradually expanding trumpet pipe until its sectional area becomes equal to about 12 square inches, after which it is allowed to expand freely. The boy in charge of this exit for the dough has at his disposal a cut valve, by which the issue of the dough through the pipe is stopped or permitted. He receives the dough in a succession of tins or French moulding baskets and, by a little practice, is able to cut off from the continuous stream of dough, into each tin or basket, a quantity weighing about 2 lbs. 4 oz. The tins with the dough in them are placed at once on the floor of the oven. The dough in the baskets is emptied on to wooden peels and thence slid upon the oven bottom. This oven is what is termed a travelling oven. The bottom constitutes part of an endless chain revolving on two drums, by which the speed of its travelling can be regulated. The loaves enter at one extremity of the oven and are ejected at the other, being baked during their transit.

The advantages of the new process are,—1st. Its cleanliness. Instead of the dough being mixed with naked arms or feet, the bread, from the wetting of the flour to the completion of the baking, is not, and scarcely can be, touched by any one. 2nd. Its rapidity. An hour and a half serves for the entire conversion of a sack of flour into baked loaves; whereas in the ordinary process four or five hours are occupied in the formation of the sponge, and a further time in the kneading, raising, and baking of the dough. 3rd. Its preventing deterioration of the flour. In making fermented bread from certain varieties of flour, not in themselves unwholesome, the prolonged action of warmth and moisture induces a change of the starchy matter of the flour into dextrine, whereby the bread becomes sodden and dark-coloured. This change is usually prevented by the addition of alum, which is, indeed, an almost necessary ingredient in the manufacture of bread from glucogenic flour. But in operating by the new process, there is no time for the glucogenic change to take place, and consequently no advantage in the use of alum, even with any description of flour. 4th. Its certainty and uniformity. Owing to differences in the character and rapidity of the fermentation, dependent on variations of temperature, quality of yeast, &c., the manufacture of fermented bread frequently presents certain vagaries and irregularities from which the new process is entirely free. 5th. The character of the bread. Chemical analysis shows that the flour has undergone less deterioration in bread

made by the new, than in that made by the fermented process. In other words, the percentage of extractive matters is smaller. The new bread has been tried dietetically at Guy's Hospital, and by many London physicians, and has been highly approved of. It is well-known that for some years past, the use of fermented bread, in dyspeptic cases, has been objected to by members of the medical profession, the debris of the yeast being considered unwholesome, and liable to induce acidity. 6th. Its economy. The cost of carbonic acid is alleged to be less than the cost of yeast. Moreover, in making fermented bread there is a small, but necessary waste, of the saccharine constituents, which is avoided in the new process. 7th. The saving of labour and health. It substitutes machine labour for manual labour of a very exhausting kind. The sanitary condition of journeymen bakers was investigated some time ago by Dr. Guy, and found to be most lamentable, from their constant night work, and from the fatiguing and unwholesome character of their labour, particularly the kneading. In a politico-economical point of view, the process is as important as removing bread-making from a domestic manual work to a manufacturing machine-work. From the character of the apparatus, the process can only be used profitably on a large scale, and not in small bakeries.

#### ON SOLUBLE SILICATES, AND SOME OF THEIR APPLICATIONS.—By FREDERICK RANSOME, A.C.E.

The following paper was communicated to the Chemical Section:—

So much interest has recently been expressed in reference to this subject, both in this kingdom as well as upon the Continent, and so much misconception has existed, that I have felt a few remarks thereon might not inappropriately be submitted for consideration and discussion upon the present occasion.

Amongst the early accounts that were published of the application of soluble silicates, I may mention a paper by Dr. Johann Fuchs, which appeared in Kastner's "Archiv for Natural Philosophy" in 1825, page 385, in which is described a combination of silica fused with potash or soda in such proportions as to produce a glass which was soluble in boiling water, but which was insoluble in water at the ordinary temperature of the atmosphere.

Important as this product has subsequently proved to be, in the various branches of manufacture in this and in other countries, it at first attracted but little attention, and for years afterwards remained little more than a recorded chemical fact, unconnected with any of those important practical applications which have subsequently attracted so much attention in the scientific world.

From publications which have recently appeared, it would seem that Dr. Fuchs' researches and experiments upon the application of soluble silicates were mainly directed to stereochromy and to the effects produced by their admixture with various substances, such as carbonate of lime, phosphate of lime, sulphate of lime, caustic lime, dolomite, quartz, clay, and oxide of zinc and magnesia; and although these researches extended over many years, yet but comparatively little was practically done or known outside of the laboratory at Munich until the year 1855, when shortly before his death, at the age of 82 years, this learned philosopher gave to the world the result of his valuable investigations and indefatigable labours.

The researches of Dr. Fuchs were followed by those of Professor Kuhlmann, at Lille, who it appears, as early as 1840, directed his attention to the combinations that were effected by the admixture of soluble silicates with lime, either carbonate, sulphate, or caustic, and the application of soluble silicates for the purpose of hardening and preserving the porous stone of monuments and building soon forced itself upon his mind.

The method of hardening stone, &c., adopted by Professor Kuhlmann, and described by him in a pamphlet published in 1857, is, in the case of small articles, to immerse them for some hours in a solution of silicate of potash or soda, of a suitable strength, to be freely absorbed into the stone; or in the case of larger surfaces, the dilute silicate is applied by means of "fire-engines or large syringes with broad rose-nozzles," or, in instances where more convenient, by means of small brushes; the operation is repeated as often as occasion may require, until the stone has ceased to absorb. In this manner several important buildings have been treated, amongst which may be mentioned portions of the Louvre and Notre Dame, in Paris, the Napoleon Barracks, and the Exchange at Lille, and other buildings, including a portion of the New Houses of Parliament in our own land.

The soluble silicates have also been employed to a considerable extent in many other branches of our manufactures, &c., such, for instance, as in calico-printing, in the manufacture of soap, in the dressing of stuffs, and in the preparation of paints; but as the details of these several processes would occupy a much larger amount of time for their consideration than would be convenient upon the present occasion, I purpose to direct my remarks more particularly to the application of soluble silicates to the manufacture of stone, and to the hardening and preservation of stone and other substances.

It was early in the year 1844 that my attention was first directed to some of the defects that existed in many of the natural stones, which tended greatly to detract from their value for purposes to which they were applied; and I felt the importance of producing, if possible, an artificial stone, suitable for grinding, building, and ornamental purposes, which should possess all the advantages, and be free from many of the defects complained of in the natural stones hitherto in use. I found that with few exceptions the hardest and most durable stones were those containing the largest proportion of silica; and after a series of experiments, in which I endeavoured to combine mechanically crystals of sand, &c., by the admixture of finely-powdered glass, forced into metal moulds, under hydraulic pressure, then, by exposure to heat, fusing the glass so as to form a vitreous cement enveloping the crystals of sand, &c., and after having also tested the combination with the most powerful hydraulic and other cements, it occurred to me that if in the place of the finely-powdered glass, or the other cementing matter, I could substitute concentrated solution of glass (silicate of soda and potash), a great desideratum would be arrived at. In order to obtain the soluble silicate, I suspended the ordinary flint stones, as found from the gravel or chalk pits of the neighbourhood, in wire baskets, inside a high pressure steam boiler charged with a strong caustic solution of soda or potash, and subjecting the same to a steam pressure of from 60 to 80 lbs. per square inch. At this temperature the alkali rapidly dissolves the silice until a sufficiently neutral silicate is produced, which is then removed and evaporated down to a sp. gr. of 1750.

The stone thus made and dried was found to be excessively hard, close and uniform in texture, and capable of being moulded into any desired form; but upon exposure to water or a moist atmosphere, it gradually became soft, and was easily disintegrated. To remove this difficulty, it was necessary to subject the stone to a bright red heat in a kiln, when the free alkali of the cementing silicate combined with an additional quantity of the silice of the sand, producing an insoluble silicate no longer affected by moisture or other atmospheric influences. By varying the proportions and strength of the soluble silicate, it will readily be understood that the density and texture of the stone produced may be varied almost indefinitely, or from that of the most open and porous stone suitable for filtering water and other liquids to stones of the hardest and closest texture, resembling granite. For a time the results

appeared perfectly satisfactory, but when the stone came to be practically employed upon a large scale, and in exposed situations, the efflorescence of a salt was observable upon the surface of the stone, causing an unsightly appearance, and leading to apprehensions that disintegration would shortly follow. Upon investigation it was found that the salt thus exuding from the stone was sulphate of soda, which existed in the soda ash of commerce in part, and which was increased by the impurity of the lime used in rendering the solution caustic. This objection was at length removed by treating the caustic solution of soda with caustic baryta, before admitting it into the boiler with the flints.

From the small specimens herewith submitted, it will be seen that in the process of manufacture, this stone is capable of receiving the finest and sharpest impressions, and possesses all the characteristic appearances of the best natural sandstones; it is not liable to shrinkage or distortion under the operation of firing; it may be readily worked by the chisel, as other freestones, if required; and by a series of experiments recently made at the testing-house in her Majesty's dock yard, at Woolwich, it was proved that the power of resistance it offered to steady transverse strain was represented by 100, whilst that of

Darley Dale stone was	...	...	81
Of Grimshill-hill	..	...	37
Of Portland stone	..	...	33
Of Aubigny	..	...	31
Of Bath	..	...	13
Of Caen	..	...	12

At the same time, blocks of this stone, 2 inches cube, sustained a crushing weight of 21 tons, whilst similar blocks of Darley Dale crushed with 16½ tons. These figures are the mean results of three experiments upon each of the stones alluded to, and furnish satisfactory evidence of the suitability of the material for purposes of construction; and, as far as experience as yet shown, it is in no way injuriously affected by the alternating influences of the atmosphere, even in the most exposed and unfavourable situations.

From the satisfactory results obtained in the manufacture of stone, by means of the soluble silicate, and observing, in several instances that came under my notice, that the stones so produced had stood uninjured for years under precisely the same circumstances that produced decomposition in natural building stones, I was led to consider how the soluble silicate could be applied to soft natural stones, so as to harden their surface and prevent decay, the principal cause of which, in many descriptions of stone at least, is now generally admitted to arise from the absorption of moisture, which, often containing acids, especially sulphuric and carbonic acid in solution, acts chemically on the stone, or produces disintegration by the alternate expansion and contraction caused by changing temperature.

The class of stones more generally used for construction, in ordinary cases, are limestones, whether oolitic or otherwise, magnesian limestones, and sandstones. These are all free stones, which are, for the most part, composed of grains, whether quartz, carbonate of lime, or carbonate of magnesia, cemented together generally with carbonate of lime; they vary considerably in hardness and relative weight, and generally those of densest character are the most desirable and the least absorbent. When these stones are exposed in the damp impure atmosphere of large manufacturing or populous towns, they, or their cementing media, are soon acted upon by the carbonic or sulphuric acid contained in the atmosphere, and held in solution in the rain water, which is readily absorbed within the natural crevices, or between the grains of the stone itself, and then, contracting or expanding with the variation of temperature, the surface of the stone becomes disintegrated, small scales are first thrown off, or, as is frequently the case, the surface assumes a loose powdery appearance from the destruction of the cementing medium,

the general result being, that a process of decay commences, which is continued until the entire surface of the stone is destroyed, and the building is seriously disfigured. To remedy these evils many processes have been proposed, but as they been for the most part required the use of oily or fatty matters, which, besides producing a disagreeable appearance, are liable to rapid decomposition from the oxidising effects of the atmosphere, they have been found inadequate to the desired purpose. It appeared to me that, in order to impart hardness and durability to these soft and easily decomposable stones, it was necessary to effect a process which should not only externally close the pores against the absorption of deleterious agents, but that should also at the same time bind more firmly together the several atoms of which the stone was composed, and for this purpose I had recourse to the solutions of silicates of soda and potash. These I found, when applied upon stones in dry situations, produced an amazing increase of hardness, and which, so long as it was protected from moisture, appeared to be thoroughly effective; but in operating with these solutions upon a practical scale out of doors, I found that a shower of rain or even a humid state of the atmosphere at once removed the portion of the silicate next the surface of the stone before it had absorbed sufficient carbonic acid to precipitate the silica, and in order to avoid the liability to this objection, my next step was to apply a weak acidulated solution immediately after the silicate, which, by combining with the alkali, formed a chloride of sodium or chloride of potassium, leaving the silica free in the pores of the stone.

It, however, was soon evident that silica in the form of a gelatinous hydrate possessed no cohesive properties, and was therefore inadequate to impart much if any solidity to a crumbling mass, and I therefore directed my attention to find some other substance in solution which, by combining with the soluble silicate, would, by double decomposition, produce an insoluble, indestructible precipitate possessing the desired properties.

Silicate of lime has long been known to be one of the strongest cementing media with which we are acquainted, and is, practically speaking, indestructible by time and other external agencies. It is the substance that imparts the valuable properties to our best and strongest hydraulic cements, the formation of which insures the stability of our solid concrete masses, and which has conferred such enduring properties on the old Roman mortars. I therefore concluded that if it were possible to form silicate of lime in the structure of the stone (independently of any decomposition of the stone itself), so as completely to envelope the several atoms of which it is composed, I should succeed in producing a result which would at once materially increase its hardness, at the same hermetically closing all the pores, and be lasting in its effects. Chloride of calcium suggested itself to me as offering the advantages I had been seeking, and a few experiments were then sufficient to satisfy me that I was not mistaken. I first treated the stone or other material with a solution of silicate of soda, sufficiently diluted to be thoroughly absorbed into the mass, and afterwards with a solution of chloride of calcium. A chemical combination immediately takes place, the chlorine combining with the soda forms chloride of sodium (common salt), which is washed away by the first rains or by other application of water, and the calcium combining with the silicic acid of the silicate, forms a tough silicate of lime, attaching itself firmly round the surface of each separate grain of the stone with which it comes in contact, producing an extremely compact deposit, not acted upon either by carbonic or dilute sulphuric acid, and identical with the material which holds together the separate grains or stones in hydraulic cements and concretes.

I found also that by substituting a solution of chloride of magnesium for the chloride of calcium, that silicate of magnesia was produced in the same manner; but

though, under some circumstances, and in treating certain materials, the silicate of magnesia may possess some advantages; yet, for general application, under ordinary conditions, the silicate of calcium will be found equally effective, whilst the cost of the materials will be less.

Accordingly, in the year 1856, I secured patents for the process throughout this kingdom and in France, and in the month of October in the same year I operated upon two of the buttresses upon the river-front of the New Houses of Parliament at Westminster, the stone of which was at that time in a rapid state of decomposition. Although this was the first application of the process that I had ever made outside the laboratory, the result has been eminently successful, and although nearly three years have passed since these portions were so treated, no indications of decay have since appeared, but, on the contrary, a small excess of silicate of lime which was inadvertently left upon the surface of the stone, through the carelessness and inexperience of the workman, is still present, and cannot even now be removed by any mechanical means, without, at the same time, destroying the face of the stone.

During the past three years, the efficiency of this process has been tested under every variety of circumstances that has been suggested, with the most satisfactory results. Masses of soft and easily decomposable stones have been treated over only portions of their surfaces, and afterwards exposed to the alternating influences of heat and cold, and wet and dry atmospheres. In no instance has decay since been visible upon any portions of the stones which had been properly treated, whilst, in almost every instance, the portions of the same stones not treated, have manifested, more or less, decay; and pieces of the same stone have been taken, some of which were treated by this process, and an equal number were left in their natural state; each was carefully dried and weighed, and then all were immersed together in a dilute solution of sulphuric acid for an equal length of time. Upon being removed from the acidulated solution, it was found that, in every instance, the stones that had not been treated by the preservative solutions were entirely broken up, falling into fragments, but that, without exception, every stone that had been so treated was entirely unacted upon, had retained all its sharpness of outline, and had not diminished a grain in weight.

The process herein described is equally applicable to bricks, cement, plaster, and even to common chalk; it renders these materials equally capable of resisting the varying and destructive influences of any climate, prevents all liability to dampness or vegetation, as also the absorption of smoke or dirt, which produces discolouration, so frequently disfiguring our finest edifices.

Many instances may be adduced as practical evidence in support of the foregoing remarks, but I need only further mention, that amongst other important buildings, this process has been applied upon the Baptist Chapel, in Bloomsbury-street, London; upon the Royal Pavilion at Brighton; the Custom-house at Greenock; and is now being used upon Craigends-house, near Paisley; and upon Lennox Castle, near Glasgow.

I regret that at this distance from home it has been impossible for me to submit larger specimens, and in greater variety, illustrative of the results obtained upon different substances under varying conditions, which I feel would have added interest to this communication, but I trust sufficient explanation has been given of the manner in which soluble silicates may be produced, and of some of the valuable purposes to which they may be applied, to justify my having intruded this paper upon your notice, and having occupied so much of the valuable time of this section of the Association.

## UNSINKABLE SHIPS.

The following has been received from the Editor of the *Mechanics' Magazine* :—

The extraordinary changes which modern ordnance has undergone, and is still undergoing, have led to many curious suggestions, and among the most curious may be mentioned a scheme first propounded by Mr. Charles Atherton, of Woolwich Dockyard, in the *Times* of Jan. 12, and the *Mechanics' Magazine* of Jan. 14, 1859, and revived by him in a recent number of the *Journal of the Society of Arts*. Mr. Atherton's object in the first instance was to make gun-boats, mortar-boats, floating-batteries, &c., invulnerable; and he asks—Why not make them up to the lines of their load displacements "solid masses" of material, of such specific gravity that they shall not sink however much they may be perforated by shot? He considered that a solid combination might be made of cork shavings, light wood sawdust, rush stems, cotton waste, flock, hemp, and other light material, by the aid of a solution of gutta-percha, or other chemical substance. This mass might be made, he thought, so tough that it could not be knocked to pieces by shot, and so light that it would be only one-half the specific gravity of water, and therefore unsinkable, however perforated by shot, and also capable of carrying an armament and naval equipment to the extent of nearly one-half the weight of its own displacement in tons. "Such vessels of light draught accompanying fleets of war as tenders to line-of-battle ships, whence they might be manned and stored as occasion might require, would, I submit," said he, "form a useful auxiliary available for shore service, or for attacking land batteries, which deep draught ships of the line cannot approach, and would be sunk if they could." The idea was first broached by him two years before as being applicable to the construction of vessels for carrying treasure.

In the interval that elapsed between the dates of Mr. Atherton's letters his ideas appear to have expanded enormously. We no longer hear of unsinkable "tenders to line-of-battle ships" only; but ships of war of all classes are to be constructed on the unsinkable principle. "I have no doubt," says Mr. Atherton, "that at a moderate cost per ton of shipping, existing vessels may be rendered unsinkable, and that a new modification of ships of war of all classes may be devised, such as may obviate the horrors which appear to be otherwise inevitable in maritime warfare under the fire of modern ordnance." It ought to be stated that Mr. Atherton's reason for renewing his proposition at the present time, and in its enlarged form, is a belief of his (founded on a paragraph in the *Times*) to the effect that iron-cased ships will be incapable of resisting the fire of modern ordnance, and that, as recent events have shown, ships of the ordinary build may be sunk by the fire "even of an extemporised Chinese fort."

There is, of course, one great primary obstacle to the carrying out of Mr. Atherton's plan, namely, that no such material as he requires for his purpose is at present known. The singular compound mentioned in his first letter does not seem to satisfy him now, and he therefore proposes that £250 be subscribed and placed at the disposal of the Council of the Society of Arts, to be awarded in premiums of £150 and £100, "for the discovery and specification of the materials and process of manufacture most available for producing a combination of materials constituting a solidifying pulp possessing in the highest degree the properties of specific lightness, toughness, non-absorption of water, and cheapness, or a metallic cellular body having the same properties." But how a "metallic cellular body" is to answer the purpose we cannot conceive. It seems to us a very remarkable circumstance that Mr. Atherton loses sight altogether of the danger of fire, which is more likely to do injury than anything else, now that the use of shells is universal in naval warfare. His light buoyant material must be presumed to be exposed to the fire of ordnance, for its whole merit is to consist in

being unsinkable when "perforated" by shot or shell; and, consequently, unless it were unflammable as well as unsinkable, it would be of little use. Mere "lightness, toughness, non-absorption of water, and cheapness" alone will not therefore do. If we are wrong in this, we shall be glad if Mr. Atherton will show us where our error lies; but he must not forget that "liquid fire" is as veritable a means of offence as the Armstrong gun, and has proved its efficacy quite as decidedly. Of course we are aware that a solid substance would not be set fire to by the mere lodgment of a red-hot shot in it, with no other access for air save the hole by which the shot entered. But the explosion of powerful shells within such a substance would be a very different matter, and would, we think, in most cases, have the effect of setting it on fire. There can be no great harm in offering the premiums proposed by Mr. Atherton, if there is the least chance of obtaining a very light and waterproof solid material, because such a material would be useful for many purposes; we have no desire, therefore, to obstruct the action of the Society of Arts in this matter.

But, having said this, it remains for us to say further that even if such a material as we have spoken of should be produced, and placed in Mr. Atherton's hands, we should be disposed to ask wonderingly—"What will he do with it? and we think the Society of Arts should consider this question before they accept his advice respecting the premiums. With a ship solid below the water line where would he place the engines, coals, provisions, powder, and all those other stores which now are stowed in the lower parts of the ship? We know not how to conceive a plausible answer even to this question. Will Mr. Atherton kindly help us out of the difficulty? We hope he will, if possible, for his own credit's sake. It is easy enough for any man to make propositions in the form in which the present one comes before us; but it will not do for a gentleman who has taken a wrangler's degree at Cambridge, and made himself prominent in scientific discussions, to leave his proposition utterly undeveloped. It is, we think, incumbent upon Mr. Atherton to show us what the "new modification" of ships of war is to consist in, assuming that the material which he asks for is supplied. We should be heartily delighted to find that he has the design of the unsinkable war-ship in his mind. This, in our judgment, would be worth a very handsome "premium," and the Society of Arts would perhaps do well to offer one for it before they offer the others. They need not fear any very extensive competition. Of course it is quite possible to build enormous *rafts*, and call them by the new name of "unsinkable ships;" but these can hardly be what Mr. Atherton is thinking of, since he talks of rendering "existing vessels" unsinkable, and since he must know perfectly well that the time for abandoning real ships has not yet arrived. What, then, is he thinking of? We respectfully invite him to tell us.

## IRON SHIP-BUILDING.

The following letter has been addressed to the editor of the *Times* :—

SIR,—Among the many and mighty inventions and adaptations which have contributed to make this country and this age famous, a conspicuous place must be given to the application of iron to shipbuilding. Without it England's mercantile marine could scarcely have kept pace with the marvellous growth of her commerce, and oceanic steam navigation would yet have been in its infancy. Even Brunel's genius would have quailed in attempting the construction of the Great Ship in any other material; and it is scarcely too much to say that the abundance and richness of the ferruginous ores which are found in this island, and the facilities for their reduction placed in our hands by nature, compelled our naval constructors to direct their attention to the use of manufactured iron in building vessels.

The iron ship, when well built, is indeed stronger, safer, and more durable than any other, and yet if we search the records of those disasters to which all seagoing ships are exposed it will be found that the most destructive and appalling have occurred in iron bottoms. I need only call to mind the wreck of the Birkenhead, which will find a place in history as the scene where the disciplined bravery and devotion of our soldiers were nowhere more conspicuously displayed, and that awful and heart-rending catastrophe which within the last few days has carried sorrow and anguish into hundreds of homes. Yes, while the hearts of relatives are yet bleeding, and the public is stunned with the immensity and suddenness of its loss; while many would try to bury their grief in oblivion, and others would prefer to contemplate in silence such an illustration of the mysterious ends of Providence. I conceive that the lessons which the loss of the *Royal Charter* is calculated to afford ought not to be overlooked, and that the causes of a wreck so sudden and so complete should be most promptly and searchingly investigated.

I would, therefore, very earnestly and prominently bring under the notice of your readers certain general features and practices in the construction of iron vessels which in my opinion are in the last degree dangerous and reprehensible. It would seem to commend itself to the common sense of every man that in building an iron sailing or steamship which is to be subjected to all the strains and buffetings of tempest-tossed seas, which will be freighted with hundreds of human beings and the most precious cargoes, and which must run the risks of collisions and strandings, none other than the very best and strongest materials should be employed. The toughest iron, the best seasoned spars, and the stoutest planks and ropes should alone find places in such a venture. But in our ordinary every-day practice is this the case? Is not any kind of iron thought good enough to build a ship with? What is the meaning of "boat plates" being the lowest priced in any ironmaker's list? If we pay £25 or £30 a ton for the plates of which a locomotive boiler is made, why should we give only £8 10s. or £9 per ton for those of which a ship is built. If safety can only be bought at the high price in the one case, are we not courting disaster with the low price in the other? Who will draw the fine line of distinction in moral responsibility between the directors of a railway company who should take your fare, place you in a comfortable first-class carriage, and drive you at 40 miles an hour over a viaduct which was miserably insecure, and the owners of vessels who send passengers to sea in ships sheathed with plates which are as brittle as glass? The only answer to this question in the way of excuse is, I fear, that most men are really and truly ignorant of the facts. In the eyes of the merchant in London or Liverpool who orders the building of a ship, iron is iron. He probably does not know that in this material there are as many shades of quality as there are in the wines or fruits which all bear one common name, and yet I am within the mark when I say that he might, by paying £2 or £3 per ton increased price upon the plates forming the outward sheathing of his ship, immensely increase the vessel's strength and duration.

With good, well-worked plates, where the fibre of the iron is ductible and tenacious, and where these plates are well and judiciously fastened together, no vessel, even if wrecked in such a gale as that of last Tuesday, would break to pieces so suddenly and so utterly as the *Royal Charter* seems to have done.

But built of the "boat plates" of the present day, God help the human freight of the ship that strikes upon a rocky shore!

I would therefore advise shipowners when contracting for new vessels, instead of being satisfied with a specification which provides good ordinary "boat plates" to be used, and which are, in fact, about the most rubbishing quality of iron which is made, to insist that the sheathing

should all be of best best, or double-worked quality. In a vessel of 1,000 tons it would not increase the cost £500, and the value is gained in the greater strength and durability of the ship, to say nothing of the lives that it may possibly save.

Further, I would caution all well-disposed shipowners to look with great suspicion upon the cheap offers which are constantly laid before them as temptations to order ships. To anyone conversant with a ship's value, what other construction can be put upon a contract for a vessel of 1,000 tons with the most expensive outfit for £13, or £13 10s., or even £14 per ton measurement ready for sea than that the builder means to employ bad materials and scamp his work? He begins upon such an order with a determination either to cheat his customer or cheat his creditors. But such vessels are built on the Clyde, the Tyne, and elsewhere, and I maintain that the ship-owner in buying them shares with the builder the moral responsibility of a great guiltiness, for they are deliberately launched and freighted to go to the bottom.

I am, Sir, your faithful servant,

AMICUS.

Manchester, Oct. 31.

### CHAMBERS OF COMMERCE.

The following communications have been addressed to the Secretaries of the several Chambers of Commerce in the United Kingdom, by Mr. Leone Levi, Professor of Commercial Law at King's College, London:—

10, Farrar's-buildings, Temple, London, Oct. 26, 1859.

MY DEAR SIR,—I have much pleasure in sending you my ordinary circular, which I trust you will deliver to the members of the Council. You will find in it a suggestion for a General Conference of Deputies from the Chambers of Commerce of all countries. Should you approve of the proposal, I shall be happy to give you further details of what could be undertaken by such a meeting. We would thereby open a direct correspondence and friendly intercourse with such Chambers. We would interest them in the promotion of such measures, whether legal or economical, as may best advance international commerce, and we would establish an interchange of information relative to the trade, produce, and manufactures of the different countries likely to prove permanently useful. I do not think it imperative to send the invitations to the Continental Chambers, which are supported by the State, through the Foreign Office, and it would, on the whole, be better that the entire arrangements would remain with the Chambers. The best opportunity for such a meeting is evidently the time when the next International Exhibition will be held, in 1861 or 1862. The Conferences already held between the Chambers of Commerce of the United Kingdom, have been productive of much benefit, both in suggesting and maturing several important measures of mercantile law, and in extending the influence and increasing the usefulness of the Chambers of Commerce. No attempt has as yet been made to bring together the Chambers of Commerce of Europe, America, India, and the British Colonies, though the need of such intercommunication has often been felt. I trust that the proposal may be responded to by all the Chambers in the United Kingdom, and that the happiest results may ensue from its realisation.

I remain, dear sir, your's very truly,

LEONE LEVI.

To the Secretary of the Chamber of Commerce of —

10, Farrar's-buildings, Temple, London, Oct. 26, 1859.

MY DEAR SIR,—The meeting of the Social Science Association has afforded an opportunity for discussing many questions affecting the commerce of the United Kingdom, and more especially those which are subject to legislative measures. To obtain, for any important purpose, the united action of the Chambers of Commerce,

has always seemed to me a most desirable object to accomplish.

The questions of local bearing only, are but few as compared with those of national importance, and even where a locality only is primarily affected, directly or indirectly, the influence is felt throughout the country. The project has once more been made of obtaining the incorporation of all Chambers of Commerce, or charters of incorporation for each, with the usual privileges of chartered bodies. The benefits of such a measure would mainly consist in the status thereby conferred on these voluntary associations, and in the greater influence they would acquire in their respective localities. I would object to their receiving pecuniary support from the State, as that might be purchased at the cost of independence of action, and might also produce a loss of moral weight in any representation to the State and Parliament.

Now that the Chambers of Commerce have come to a common understanding with regard to the Bankruptcy Laws, it will be easier for Parliament to legislate on the subject; yet, we may well expect considerable discussion, and much opposition, and the success of the measure will entirely depend on the Solicitor-General undertaking it on behalf of Government. The expediency of obtaining an international right on trade marks—a question of great practical importance, especially to Sheffield, deserves the serious consideration of all the Chambers, inasmuch as the abuse of British marks by foreign manufacturers has the effect of lessening the necessary confidence in British marks. The President of the Board of Trade and the Minister for Foreign Affairs should be asked to open negotiation on the subject with foreign powers. Another illustration of the want of an international Commercial Law was suggested by Mr. Danson, on the part of the Liverpool Chamber of Commerce. Whilst both the United Kingdom and the United States of America have found it necessary and beneficial to limit the liability of shipowners, the legislation of the two countries providing only for their respective subjects, wherever it happens that an American shipowner is brought before the British Courts of Law, or a British shipowner before the American Courts, no limitation of liability would be held to exist, and such shipowner would be held liable for the entire loss caused by the negligence of the master of the ship over whom he could have no control. The question of assimilating the weights, measures, and coins of all countries is also of practical importance, seeing the diversities which exist in the weights and measures of every town and county in the United Kingdom, and the practical inconvenience caused by the trade circulars of the principal shipping ports of Europe being in different denominations, not easily rendered into British measures, weights, and coins. For these and other questions of international Commercial Law, a Conference of Deputies from the principal Chambers of Commerce of Europe, America, India, &c., would be of immense utility; and it could be obtained if her Majesty's Government would co-operate with our Chambers of Commerce.

The working of the Merchant Shipping Act, the Registration of Partners, and the Tribunals of Commerce, are all questions likely to be inquired into next session; and I anticipate that much practical legislation will ensue.

I have the honour to be, dear sir,  
Your most obedient servant,

LEONE LEVI.

### Home Correspondence.

#### EXAMINATIONS AND THE YORKSHIRE INSTITUTIONS.

SIR,—Having recently visited the head-quarters of the Yorkshire Union of Institutions, I have examined

with much interest their 75 published reports of Institutions associated in that Union; and I think that a page of the *Journal* may be well occupied with a brief summary of what those Institutions say of themselves in reference to the very important subject of the systematic instruction given in their classes.

On a careful examination of the 75 reports, I find that sixteen of them are wholly silent on this subject. Forty-five represent their classes as flourishing—generally, as more flourishing than formerly; and seventeen, which appear to have partially failed in reference to their classes, ascribe their failure to causes, some of which are of an accidental character, and others may be expected to disappear when public opinion on these points is a little more improved.

Thus, Ackworth alleges "some little irregularity in the attendance of the teachers, which was partly caused by the death of a very valuable assistant." Almondbury reports "a decrease in the numbers," but "a more regular attendance, and a better appreciation of the efforts of the teachers." Brighouse says the non-increase of the classes "may be in part owing to the advanced rates of subscription." Churwell suggests religious differences and the over-fatigue of the young work-people. Dewsbury says the non-success "arises more from the want of convenient and comfortable class-rooms than from any other cause." Doncaster hopes to obtain "a building more commodious and otherwise suitable to their requirements for classes." Hartlepool speaks of "commercial depression" and change of site. Wentworth notices the ill-health of a gratuitous regular teacher, but hopes to obtain regular paid teachers in future.

On the other hand, in the reports of the 45 successful Institutions, we find encouraging remarks. Bradford says,—“The third examination by the Society of Arts took place in May last, and in pursuance of a new regulation, its encouraging influences were this year extended to all the principal Institutions in the kingdom. The number of candidates who presented themselves at the preliminary examinations held in this Institute was 22, of whom 18 satisfied the requirements of the Local Board; of the 18, 17 received certificates.” Calverly has “a far better attendance in the classes.” Halifax (Mechanics’ Institution) says, “the classes are in a most efficient condition.” “There is a marked improvement in the general behaviour of the youths attending them.” Four candidates received certificates from the Society of Arts. Halifax (Working Man’s College, Haley-hill) says, “The students in chemistry have kept up the high character they gained in the Society of Arts’ Examination, when one of their number carried off the highest certificate but three.” “The laboratory has been greatly enlarged.” “The list of certificates gained at the Society of Arts’ Examination last Whitsuntide (17 in number) shows that real and telling work has been done.” West Hartlepool reports, “The number of pupils attending the classes has largely increased.” “The Institution, being in connection with the Society of Arts, has adopted their scheme of Examination by a Special Local Committee, which has been honestly carried out, and found to answer well.” Three candidates obtained five certificates. Holbeck (Old) says: “The elementary classes are in a most flourishing condition.” Holbeck and New Wortley says: “The night classes for junior members have been much more successful during this season than last.” Keighley says: “The condition of the classes affords indications of present prosperity and bright and cheering hopes for the future.” Kirkby Malzeard, “by means of its evening classes, has done more towards advancing the cause of education than in any previous year.” Meltham has classes “very well attended,” “owing to having good teachers.” Middlesbro’ has had its classes “more numerously attended than in previous years,” though “the want of good class-rooms has been a great drawback.” New buildings are in course of erection. Northowram announces that “the classes still continue the chief feature

of the Institution," and that "a local board has been formed in connection with the Society of Arts." Otley has built a new room for its classes. At Settle, "notwithstanding the thin attendance, the committee hope that some are looking forward to the next Examination of the Society of Arts. At Sheffield there have been financial drawbacks, and a change of premises, but 32 candidates were examined, and 26 received certificates from the Society of Arts. Selby thinks that the attendance of young men and boys at its classes deserves a better building. At Undercliff "our classes are in a healthy condition, and there seems to be a general disposition for improvement." At York "the committee regard with peculiar satisfaction the progress made by the pupils in the evening classes." Six students passed the Examination of the Society of Arts.

It should be added that the Young Men's Christian Institute at Leeds, which does not belong to the Yorkshire Union, presented 37 candidates to the Society of Arts, and 29 obtained certificates, and that Selby presented 7, of whom 5 obtained certificates.

From the foregoing review it appears that the Institutions in Yorkshire, connected directly, or indirectly through the Yorkshire Union, with the Society of Arts, are doing an important work under prospects of great encouragement.

The "Local Boards" co-operating with the Society of Arts, at Bradford, Halifax, Hartlepool, Leeds, Northowram, Sheffield, Skipton, Wakefield, Wircsworth, and York, have done good service to the cause of education; and it is to be hoped that next year there may be similar boards, and not worse results, at twice or thrice as many of the towns of Yorkshire.

The arduous work in which our Society is engaged for the benefit of the Institutions, to be thoroughly successful, requires from them the most cordial co-operation in the most generous spirit. It is no mean result that we have already established Local Boards and held Examinations at 54 different places in England, Scotland, Ireland, and Wales. Let us hope, as we have good grounds for expecting, that next year will see not only a great increase in the number of the places where "Local Boards" shall be in operation but an improvement, a more systematic organization, of those that exist. Some of them are already everything that could be desired. All of them are capable of doing their necessary work; and it is desirable that such improvements as may in a few cases be expedient shall be introduced gradually, by the natural growth of the Institution, rather than be prescribed hastily and absolutely by the Society of Arts.

I am, &c.,

HARRY CHESTER.

#### THE WESTMINSTER BELL.

SIR,—The art of bell founding may be truly called a mystery, for that business has always been confined to a few families, the members of which only communicate the secrets of their profession to those of their descendants who intend to follow the same trade. Having had occasion, however, to employ a family of bell founders for other purposes on my own premises for several years, with leave to cast bells occasionally on their own account, I gradually became acquainted with the whole of their so-called secrets.

The bell founders' scale, or diapason as some call it, is merely a table of weights for every diameter of rim or extreme breath across the mouth, by means of which they are enabled to cast a bell of proper form and sound to any given weight of metal. This table has of course been mostly the result of long practice, but it is no very difficult matter to form such a table by means of accurate geometrical calculations.

The general form of a bell, also the result of long practice, cannot, in all probability, be bettered upon any purely philosophical principles, such as that the cap or

head should be exactly one half of the diameter of the sounding bow in order to give a true octave to the fundamental note—a perfect fallacy in practice. There is, besides, every progression in the diameter of the waist, which must therefore give an infinity of discordant notes, so that the only means of producing a fine-toned bell is to give an enormous preponderance of metal to the sounding bow, and to reduce all the rest to that which may be absolutely required for strength alone. It may be observed, however, that every mass of metal hung freely in the air will give, besides the principal note, the chords of three notes properly belonging to the fundamental sound. This fact is illustrated by the familiar expedient of hanging the poker by a tape round the head or in the teeth, and striking it, an experiment which forms the very nucleus of the theory of thorough base.

Bell metal is a mixture of copper and tin, in that proportion which gives the hardest alloy, about 25 per cent. of the tin, an overdose of which produces a softer alloy and very inferior tone. But the metals should be pure, unfortunately not the case with the tin of commerce, even with the duchy seal, always adulterated more or less with lead. This circumstance is a great advantage to the founder, because a small proportion of the baser metals always ensures a good casting, though the result is a brittle crumbling alloy with a bad tone. One of the faults of the first Westminster bell was undoubtedly due to the presence of lead, but a much more serious error was committed when an immense mass of new metallic mixture was used, without first casting the whole into ingots, to be again remelted for the casting of the bell. In the first fusion the baser metals, if present, are much burnt off, and pure copper and tin more fully penetrate each other by repeated meltings. The second Westminster bell had the same faults, though perhaps in a less degree, and for some little time was able to endure the stroke of the hammer.

The application of an elastic cushion to the hammer of the Westminster clock was a fatal mistake in regard to sound, but would have produced the most beneficial result if it had been placed between the catch spring and the arm of the hammer.

In regard to hanging, it has already been observed by others, that the suspension of the bell in the Westminster clock tower, by firmly bolting it to a rigid mass of iron work, was calculated in the highest degree to promote fracture, and destroy its tone, as is well known to musical professors and instrument makers. There is only one mode of hanging a bell so as to produce the loudest and most musical tone with safety from fracture, and that is the old-fashioned way of bolting the crown of dolphins to a block of timber of suitable form and dimensions, itself freely supported upon gudgeons and brasses bearing upon a framework and joists constructed wholly of wood. It is also a matter of importance that the clapper be not shackled to the ring or staple in the crown, but suspended to it by means of a strong loop or round robbin of doubled hide; and further, all those contrivances intended to turn the bell round so as to present continually a new surface to the blow of the hammer, greatly diminish the volume of sound and are ruinous to the tone.

The ultimate distance at which the sound of a bell may be heard depends upon many circumstances, but principally on the mode of ringing and the formation of the bell chamber. The best position of the bell, if intended to be rung out, is in one of the windows, when at every return oscillation it will present its mouth to the country, and accurately represent the bell mouth of a trumpet. I will venture to assert that our bells, as usually fixed in our English church steeples, are not heard to one-quarter the distance they would if properly hung and rung out.

When too large to be rung out, they should be suspended exactly in the centre of the bell chamber, without incumbrance of any kind, or blinds, or weather boarding in



the apertures, and the level of the brim should be at about one-third of the height of the windows. In ringing large bells by the clapper, a very good imitation of ringing out may be obtained by means of two heavy beam treadles, sufficient to balance the weight of the clapper when near the brim or sounding bow. The connection with the clapper may be formed by a double rope passing over two large pulleys running freely on their bearings, or by a pair of bell-cranks. By treading on each lever alternately the bell is made to sound as if rung out with the greatest ease.

The splendid bell of St. Peter's, at Rome, is rung in this manner. It is over seventeen thousand pounds weight, or eight tons, but the fine bell of Santa Maria del Fiore, at Florence, is rung out, though little inferior in weight.

A proposition has lately been made to preserve the present cracked bell for use by drilling and sawing. This expedient is of ancient date, and has never succeeded with large bells, only producing a horrid scream, very different of course from the original note. But I very much doubt the practicability of the experiment if the metal be of the proper temper, and free from the presence of zinc or lead, when it is so hard as absolutely to resist the best Sheffield file.

The foregoing observations do not apply to small bells, which must be thin at the edge in order to sound well, as they assimilate in some degree to the nature of the Chinese gong, an extraordinary production, for it is evidently made by the hammer, yet so hard as to be pounded to powder like glass. The gong is undoubtedly made and finished in pure malleable copper with the hammer, and afterwards hardened by some unknown process of cementation with pure tin. The price in China of a first-rate gong is only about five pounds.

I am, &c., HENRY W. REVELEY.

MEETINGS FOR THE ENSUING WEEK.

- MON. ....Royal Inst., 2. General Monthly Meeting.  
 Brit. Architects, 8. Mr. Tite, M.P., "On the Present Condition and Future Prospects of Architecture."  
 TUES. ...Syré-Egyptian, 7½. Dr. Heinrich Jolowicz, "On Manetho's History."  
 Civil Engineers, 8. Mr. Jabez James, "On the Process of Raising the Bells, in the Clock Tower, at the New Palace, Westminster."  
 Medical and Chirurg, 8½.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, October 28th, 1859.]

- Dated 29th August, 1859.  
 1968. R. Besley, Faun-street, Aldersgate-street, London—Imp. in machinery for printing and for numbering and perforating documents. (A com.)  
 Dated 13th September, 1859.  
 2084. W. B. Adams, 1, Adam-street, Adolphi—Imp. in the permanent way of railways.  
 Dated 21st September, 1859.  
 2146. G. K. Geyelin, 462, Oxford-street—Imp. in machinery for making solid, hollow, and perforated bricks, also tiles, drain and rocket pipes.  
 2150. G. D. Robinson, 15, Church-street, Islington—Imp. in apparatus for regulating the pressure of gas and other fluids.  
 Dated 26th September, 1859.  
 2176. R. Kay, Busby, Renfrew, N.B.—Imp. in preparing and bleaching textile fabrics and materials, and in the machinery or apparatus employed therein.  
 Dated 28th September, 1859.  
 2196. J. F. Stanford, 7, Denbigh-place, Pimlico—An improved apparatus for giving warmth to the lower extremities and members of invalids and others when travelling, or in churches, chapels, theatres, rooms, carriages, and other similar places, and on ship-board, and also for airing carriages.  
 Dated 29th September, 1859.  
 2204. T. Allan, Adelphi-terrace, Westminster—Imp. in applying electricity for telegraphic purposes, and in apparatus employed therein.  
 Dated 30th September, 1859.  
 2214. E. Sonneborn, 39, Finsbury-square, London—An imp. in the manufacture of cement.

- Dated 1st October, 1859.  
 2230. J. Baughan, Pimlico—Imp. in the manufacture of soap.  
 Dated 3rd October, 1859.  
 2236. R. A. Brooman, 166, Fleet-street—Imp. in treating clay, and in the manufacture of bricks, tiles, and other like articles, and in machinery employed therein. (A com.)  
 Dated 6th October, 1859.  
 2252. F. J. Dove, Studd-street, Islington—Iron clasped bonding plates for joists and other building purposes.  
 2256. W. G. S. Mockford, 67, Upper Thames-street, London—Imp. in the manufacture of starch.  
 2260. T. H. Dodd, Bessborough-place, Pimlico—Imp. in portable apparatuses for the use of smiths, carpenters, and other workmen.  
 2262. W. E. Newton, 66, Chancery-lane—Imp. in blankets used for printing calicoes and other fabrics, and in the mode of washing or cleaning the same. (A com.)  
 2264. J. Pritchard, 6, Whitehall, Middlesex—Imp. in spurs.  
 2266. J. Webster, Birmingham—An improved construction of spring for carriages and other purposes.  
 2268. J. Turpie, North Shields—Imp. in the fore and aft gaff and boom sails of ships.  
 2270. G. Long and J. Archer, Landport, Hants—Imp. in the manufacture of manure.  
 Dated 6th October, 1859.  
 2272. J. P. Scott and E. Scott, Manchester—An improved instrument for boring and drilling. (A com.)  
 2276. E. O. Tindall, Scarborough—Imp. in machinery or apparatus for crushing or reducing grain, seeds, and other substances.  
 2278. A. M. Ferry, Edinburgh—Imp. in the manufacture or production of oil, and in lamps for burning the same.  
 2280. A. Hind, 60, High-street, Poplar, and J. Loewenthal, 16, Little Tower-street—Imp. in the manufacture of pottery and china wares. (A com.)  
 2282. R. Warry, Brompton Barracks, Kent—Imp. in breech-loading ordnance, and in projectiles for the same.  
 2284. G. Gibson and J. Gibson, Southall, Middlesex—Improved machinery for raising and removing soil or earth from sewer and other excavations.  
 Dated 7th October, 1859.  
 2286. W. Brookes, 73, Chancery-lane—Imp. in securing the tyres of railway carriage and engine wheels. (A com.)  
 Dated 8th October, 1859.  
 2290. W. Dawson, Blackburn, and T. Singleton, Over Darwen, Lancashire—Imp. in apparatus applicable to looms for weaving.  
 2292. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the treatment of fatty matter. (A com.)  
 2294. P. Robertson, Sun-court, Cornhill—Imp. in preparing, boiling, and fermenting worts, and in maturing beer, spirits, and cyder.  
 2296. H. Monument, Myrtle-street, Dalston, and G. Berry, Buttessland-street, Shoreditch—Imp. in apparatus for raising and moving earth, and other matters and bodies.  
 Dated 10th October, 1859.  
 2297. J. S. Parfitt, 60, Boulevard de Strasbourg, Paris—A registering nautical velocimeter, for measuring the speed of ships, and also of currents of water.  
 2299. C. A. Shaw, Biddeford, U.S.—Imp. in machinery for shaping or bending tinned sheet iron, and other sheet metal. (A com.)  
 2300. T. Knowles and J. Knowles, Manchester, and A. Rigg, Chester—Imp. in machinery or apparatus for shaping, cutting, punching, and drilling metals, which improvements are also applicable to presses.  
 2301. G. White, 34, Dowgate-hill, Cannon-street—Imp. in frames for spinning and twisting yarn of any description of textile materials. (A com.)  
 2303. E. B. Parker, Deptford, Kent—A method of, and apparatus for, revivifying oxide of iron, and other agents, for purifying gas containing metallic particles.  
 2304. W. Martin, jun., Dundee—An improved method of damping linen and other textile fabrics.  
 Dated 11th October, 1859.  
 2305. L. J. Jeannin, Pontarlier, France—A new system of pumps.  
 2306. C. F. Beyer, Gorton Foundry, near Manchester—Imp. in machinery for boring and drilling.  
 2307. J. L. Tenting, senr., Paris—Imp. in the construction of buffers for railway and other carriages, also applicable to other purposes where springs are employed.  
 2308. J. L. Tenting, senr., Paris—Imp. in the construction of the axles of railway and other carriages.  
 2309. J. Earl, Melbourne, Derbyshire—Imp. in arranging and applying harness to the draft of carriages.  
 2310. W. D. Hart, Edinburgh—Imp. in pressure regulating apparatus for gas burners.  
 2311. J. Smith, Oldham—Imp. in breech-loading fire-arms and ordnance.  
 2312. P. G. Cunningham, Salisbury, Wiltshire—Imp. in the construction of artificial teeth and gums.  
 2313. A. Whytock, 12, Little Saint Andrew-street, Upper Saint Martin's-lane—Imp. in coating sheets of metal with other metals and other substances.  
 2314. A. V. Newton, 66, Chancery-lane—An improved mode of clarifying and defecating saccharine solutions and juices. (A com.)  
 2315. F. A. Lohage, Unna, Westphalia, Prussia—An improved construction of water wheel. (A com.)

- Dated 12th October, 1859.*
2316. J. Skertchly, Ashby-de-la-Zouch, Leicestershire—Imp. in the manufacture of mosaic and other ornamental tiles and slabs, and in apparatus connected therewith.
2317. G. Scott, 3, Priory cottages, Peckham, Surrey—Imp. in generating elastic fluids and in the apparatus for that purpose.
2318. W. Day, Burton Latimer, near Wellingborough, Northamptonshire—A direct-action rotary steam engine.
2319. A. A. De Reginald Heley, 2, Park-village West, Regent's park—Certain imp. in the manufacture of tobacco for smoking purposes.
2320. J. Carrick, Glasgow—Imp. in commodes, water closets, and other sanitary appliances.
2321. Z. Nuttall, Stockport—Imp. in looms for weaving.
2322. J. Thomson, Nottingham-hill, Middlesex—An improved form of hydraulic valve and apparatus to be used in the manufacture of gas.
2323. T. Rothwell, Manchester—Imp. applicable to warehouses and other buildings in which "well-holes" are constructed for the purposes of light and ventilation.
2324. E. H. Baron and J. Wheeler, Lee Mill, near Bacup, and L. Tatley, Crawshaw Booth, Lancashire—Certain imp. in carding engines for carding cotton, wool, or other fibrous materials.
2325. J. Tangye, Birmingham—A new or improved method of actuating certain kinds of motive-power engines, and in the distribution of motive-power.
2326. E. H. Taylor, Rubicon Works, Saltney, Chester—Imp. in apparatus applicable to the permanent way of railways.
2327. C. H. Southall, Blackburn—An improved apparatus for making and finishing boots and shoes.
2328. C. P. Moody, Corton Denham, Somersetshire—A method of, and apparatus for, raising grass and other crops on to stacks, which apparatus is also applicable to raising and transferring weights.
2329. T. B. Daft, Tottenham, Middlesex—Imp. in flexible valves.
2330. H. Bright, Sandwich-street, Burton-crescent, Middlesex—Imp. in machinery or apparatus for navigating the air.
2331. T. Twells, Nottingham—Imp. in machinery and apparatus connected therewith for embroidering or ornamenting woven, looped, or lace fabrics.
- Dated 13th October, 1859.*
2333. J. Rhone, Leman-street, Whitechapel—An indicating meter tap.
2335. J. Hunter, Kilmahumag, N.B.—Imp. in machinery or apparatus for ploughing or cultivating land.
2337. L. H. Rous-eau, 29, Boulevard St. Martin, Paris—Imp. in steam engines.
- Dated 14th October, 1859.*
2341. F. Levick, Monmouth—An imp. or imps. in the manufacture of iron.
2345. J. Jack, Liverpool—Certain imp. in steam engines and boilers for marine and land purposes.
2347. T. Robinson, St. Helen's, Lancashire—Imp. in annealing or softening wire.
- Dated 15th October, 1859.*
2349. W. E. Newton, 66, Chancery-lane—An imp. in the mode of applying india-rubber, gutta-percha, or other elastic substances to give elasticity between the tires or outer rims, and the hubs or naves of railway or other wheels, and between other metallic bodies. (A com.)
2351. F. A. Leigh, Manchester—Imp. in machinery or apparatus for the manufacture of screws, bolts, and nuts. (A com.)
2353. R. Bate, Castle Mills, Stalybridge, Lancashire—Imp. in engines for carding cotton and other fibrous substances. (A com.)
2355. J. Echard, Paris—Imp. in machines and apparatus for ploughing and sowing. (A com.)
2357. J. H. Brown, Abbey Mill House, Romsey, Hants—Imp. in the preparation of gunpowder for loading ordnance and fire-arms.
- Dated 17th October, 1859.*
2361. G. Berry, 19, Buttesland-street, Middlesex—Imp. in the construction of glass and earthenware vessels for containing fluids, particularly such vessels as are intended to contain fluids which may exert dynamic force on the stoppers of such vessels.
2363. L. Vidie, Paris—Imp. in transmitting the motion of steam engines.
2365. G. W. Reynolds and E. Darce, Birmingham—A new or improved manufacture of baskets and other articles usually made of wicker work, and new or improved machinery to be employed in the said manufacture.
2367. W. E. Newton, 66, Chancery-lane—Imp. in preserving and disinfecting organic substances. (A com.)
2369. J. Bernard, Albany, Piccadilly—Imp. in the manufacture or production of boots and shoes, and other coverings for the feet, and in the machinery, apparatus, and means connected with such manufacture.
2371. D. Jones, Bassaleg, Monmouthshire—Imp. in self-acting breaks to be used on railways.
2373. W. Hall and A. Wells, Erith, Kent—Imp. in the manufacture of ropes and cords.
- Dated 18th October, 1859.*
2375. G. Canouit, 93, Curtain-road, Shoreditch—Cartridge's paper, chemically prepared for percussion fire-arm.
2377. J. Reynolds, 21, Bull and Mouth-street, London—Imp. in the manufacture of wrought nails. (A com.)
2379. G. T. Bousfield, Loughborough-park, Brixton—Imp. in machinery for steering vessels. (A com.)
2381. C. Hill, Cheddar, Somersetshire—An improved fastening for stays and other purposes.
2383. W. E. Newton, 66, Chancery-lane—An improved method of making combs or gills employed in the preparation of fibrous substances. (A com.)
2385. A. S. Rott, Thann, France—The preparation of certain substances for fixing colours in dyeing and printing, and for other purposes.
- Dated 19th October, 1859.*
2387. G. Worsam, 3, Oakley-crescent, City-road—An imp. in non-condensing steam engines.
2389. J. Gordon, 3, Railway-place, Fenchurch-street, London—Imp. in machinery or apparatus for pulping coffee.
2391. T. Spencer, 192, Euston-road, Euston square, Middlesex—Imp. in the manufacture of carbonate of soda.
2398. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in photographing on uneven surfaces, and in apparatus for that purpose. (A com.)
2395. J. J. Bowen, 136, Great Dover-street, Southwark—Imp. in manufacturing the pots for containing liquids used by publicans and others.
2397. W. Warne, J. A. Jaques, and J. A. Fanshawe, Tottenham, Middlesex—Imp. in the manufacture of elastic hoops or bands and other analogous elastic articles, applicable to various parts of ladies' and gentlemen's wearing apparel, and in the machinery employed in such manufacture.
2399. J. R. Palmer, Newport-cottage, Old Ford, Bow—Imp. in the manufacture of printing-ink and paints and varnishes, and also in the manufacture of lacquers, japans, and blacking.

## INVENTION WITH COMPLETE SPECIFICATION FILED.

2413. J. Avery, Essex-street, Middlesex—Imp. in rail-road weighlocks and other platform scales. (A com.)—22nd October, 1859.

## WEEKLY LIST OF PATENTS SEALED.

[From Gazette, October 28th, 1859.]

<i>October 27th.</i>	1157. J. Ramsbottom.
1053. G. Pearson.	1174. M. Henry.
1058. R. J. Laing.	1176. W. O. Bourne.
1061. T. Lacey.	1185. W. Spence.
1064. N. Libotte.	1188. J. B. Lyall and F. W. Campin.
1069. N. J. Holmes.	1193. T. R. Oswald.
1070. E. Lardenois.	1223. J. Brown, jun.
1071. F. Clarke.	1237. J. H. Johnson.
1072. J. Whiat.	1239. J. Childs.
1076. W. Corbett & W. Carmont.	1242. R. Wilson.
1077. J. W. Welch.	1257. W. H. Perkin & M. Gray.
1081. T. Smith.	1305. W. H. Nevill.
1082. W. Winstanley & J. Kelly.	1308. J. C. Bent.
1084. J. Darlington.	1320. W. H. Graveley.
1085. E. Francis.	1327. E. Breffit.
1087. W. Clark.	1419. A. V. Newton.
1091. J. Souquiere (called Emile)	1440. S. Levy.
1092. T. H. Arrowsmith.	1540. A. V. Newton.
1095. W. Bayliss.	1560. J. Lawson and S. Cotton.
1096. R. A. Brooman.	1628. J. H. Johnson.
1097. J. Basford.	1661. J. Coombe.
1101. W. Gossage.	1731. W. F. Newton.
1103. F. W. Emerson.	1742. J. Davies.
1106. T. W. Miller.	1812. W. R. Drake.
1107. W. Clark.	1836. J. Cannon.
1114. E. W. Scale.	1840. G. T. Bousfield.
1115. R. Mushet.	1860. W. De la Rue and Dr. H. Muller.
1116. W. H. Kingston.	1919. Hon. W. Talbot.
1123. J. F. Allender and D. Rowley.	1930. T. Richardson.
1140. S. Wright.	1965. D. Todd.
1146. G. T. Bousfield.	2001. W. Brown and S. Bathgate.
1148. A. C. Bamlett.	2032. J. J. Sieber.
1149. M. Henry.	
1150. R. Mushet.	
1151. R. Mushet.	

## PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[From Gazette, October 28th, 1859.]

<i>October 25th.</i>	<i>October 26th.</i>
2557. J. Lawson.	2650. W. Clark.
[From Gazette, November 1st, 1859.]	
<i>October 27th.</i>	<i>October 28th.</i>
2527. W. S. Losh.	2530. J. Armstrong.
2539. T. C. Salt.	2541. T. S. Henszell.
2578. S. Middleton.	2547. J. T. Way.
	2569. J. C. Sinclair.

## PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[From Gazette, October 28th, 1859.]

<i>October 25th.</i>	<i>October 26th.</i>
519. M. Fitzpatrick.	572. H. Brinsmead.
525. M. Myers, M. Myers, and W. Hill.	552. G. Hattersley.
543. J. Norton.	756. F. M. Jennings.
[From Gazette, November 1st, 1859.]	
<i>October 28th.</i>	
579. A. V. Newton.	710. J. Noble.