Peregrine Phillips, the Inventor of the Contact Process for Sulphuric Acid.

By Sir ERNEST COOK, D.Sc.

IT is unfortunately the usual fate of the inventor of a novel process of chemical manufacture to find that his monetary reward is little or nothing and that even his name soon ceases to be associated with the process. But probably in few instances is there so little known about the author of an important new method as in the case of Peregrine Phillips, the inventor of the 'Contact Process' for the manufacture of sulphuric acid. Possibly this is partly due to the long period that elapsed between the publication of the patent and the successful working of the process; and yet the broad details as practised to-day were described with fair accuracy in the application for protection originally asked for.

There can be little doubt that this method of manufacturing the acid is growing in importance every day—spacious and well-appointed works, erected at considerable cost, are either already started or soon will be, in Great Britain and other countries. The chamber method, which has served for so long a period, is gradually being superseded and will probably cease to exist as a commercial proposition in a few years' time.

This development has naturally directed attention to the personality of the original patentee. Who was he? Where did he live? What else did he do in the way of scientific discovery? In these respects we are figuratively up against a blank wall. Practically all that is known about him is contained in the specification of his patent; this states that ". . . PEREGRINE PHILLIPS, Junior, of Bristol, Vinegar Maker, send greeting."

The patent was applied for in 1831 and duly granted. It cannot be said that these particulars afford an extensive history of one who has given to the world the means of making an important advance in useful practical knowledge. This is regrettable, and in order to see if other details could be discovered I have made a search of such local records as could be consulted. The result, whilst not telling us much about the scientific career of the author, throws some light upon his business activity. Collecting the facts, the story is as follows.

Since the middle of the seventeenth century there have been several families of the name of Phillips amongst the inhabitants of Bristol, but no representative combining with that surname the Christian name of Peregrine appears until 1803. In that year a Peregrine Phillips opened a tailor's shop in Milk Street in that city. Here he continued to reside and work at his trade until 1831. I think we may consider that the business was fairly successful, because we find that in 1824 he was able to join one John Thorne in starting a business for the manufacture of vinegar at what must have been fairly large works at that time, at 48 Thomas Street. At the present time 48 Thomas Street is a part of the premises of a large hauliers' business, the buildings being of modern date. In 1824 the district was partly residential, with fairly large houses with several courtyards. Messrs. Phillips, Thorne and Co. adapted this house to their requirements and equipped it with suitable apparatus. Apparently this was done very successfully, because I find that vinegar-making was carried on here until 1865—a period of more than forty years. This venture also enabled him to find an opening for his son Peregrine, junior, who became the inventor of the sulphuric acid process. I think it may be taken as certain that Peregrine Phillips, jun., was born in Milk Street, Bristol, and was the son of the tailor, but I have quite failed to find any record amongst the local church registers (the only ones kept in those days), or the newspaper announcements in existence at the time, of the actual date of his birth. The similarity of name, and the association in business, leave little doubt of the relationship of father and son.

Whether the son took a hand in his father's business is doubtful, but judging by the wording and scope of the patent, I think we may conclude that he was well educated and possessed a considerable amount of sound scientific knowledge.

Nothing further is recorded about the firm until July 1831, when there appeared in the issue of *Felix Farley's Journal* for July 11, 1831, the following notice:

> Notice is hereby given that the Partnership between the undersigned PEREGRINE PHILLIPS, the elder, JOHN THORNE, and PEREGRINE PHILLIPS, the younger, of the City of Bristol, vinegar makers, was dissolved by mutual consent on the 13th day of June last, so far as respects the said PEREGRINE PHILLIPS, the younger.
>
> PEREGRINE PHILLIPS, Senior.
> JOHN THORNE.
> PEREGRINE PHILLIPS, Junior.
>
> *Witness*—Andrew Livett, Solicitor.
>
> The above business will in future be carried on under the firm of Phillips and Thorne by whom all the affairs of the above partnership will be settled.

This notice tells its own story. From it we can conclude that the business was not sufficiently prosperous to satisfy the ambitions of the three partners. But whether the dissolution of partnership was brought about by the dissatisfaction of the younger man with his prospects, or by the dissatisfaction of the older men with the attention to the business given by Peregrine, junior, we can only conjecture. In all probability both these considerations came into the problem.

The important patent which has given Peregrine Phillips, jun., a very high place amongst the comparatively short list of those inventors who have introduced a really new process of manufacture of an article of primary importance in all kinds of industries, was applied for in the early days of the year 1831. The licence was granted on March 21, the "particular description of the nature" of the invention made known on July 15, and the patent inrolled on September 14.

The patent is numbered 6096, A.D. 1831, and consists of two parts, in the first of which the inventor describes the plan he proposes for causing the combination of "sulphurous acid gas with the oxygen of the atmosphere" by making these gases pass through hot tubes containing finely divided platinum and other

substances. In the second part he describes how he will obtain a more perfect condensation of the sulphuric acid when it is made. The whole document, obviously drawn up with the aid of those learned in the law, makes very interesting reading, and I venture to copy it in its entirety:

A.D. 1831 . . . . . *Patent No.* 6096.

Manufacture of Sulphuric Acid.

Phillips' Specification:

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, PEREGRINE PHILLIPS, Junior, of Bristol, Vinegar Maker, send greeting.

WHEREAS His present most Excellent Majesty King William the Fourth, by His Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twenty-first day of March, in the first year of His reign, did, for Himself, His heirs and successors, give and grant unto me, the said Peregrine Phillips, His special licence, sole privilege and authority, that I, the said Peregrine Phillips, my exors, admors, or assigns, or such others as I, the said Peregrine Phillips, my exors, admors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales and the Town of Berwick-upon-Tweed, my Invention of "CERTAIN IMPROVEMENTS IN MANUFACTURING SULPHURIC ACID COMMONLY CALLED OIL OF VITRIOL"; in which said Letters Patent is contained a proviso that I, the said Peregrine Phillips, shall cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, to be inrolled in His said Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being hereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Peregrine Phillips, junior, do hereby declare that the nature of my said improvements are herein set forth and explained; but for the better understanding of the subject I shall first describe the present mode of manufacturing sulphuric acid, next, the improvement I propose to effect, and then the means by which those improvements are effected.

Sulphuric acid or oil of vitriol is generally manufactured at present by the combustion of sulphur or brimstone and saltpetre, either mixed together and placed in large leaded chambers or separately in ovens connected with these chambers, into which chambers more or less of atmospheric air is admitted. The sulphur at first is converted by the combustion into sulphurous acid gas, and then by the agency of nitrous gas united with oxygen from the atmospheric air in the chamber or from that liberated from the saltpetre, and is thus converted gradually into sulphuric acid, and is afterwards absorbed by the water which covers the bottom of the chamber.

The first improvement, then, which I propose to effect is, an instantaneous union of the sulphurous acid gas with the oxygen of the atmosphere, and thereby save the constant expense of saltpetre, and also the great outlay of capital in the chambers where any great quantity of sulphuric acid can be manufactured by the gradual conversion of the sulphurous acid into the sulphuric acid.

The second improvement I propose to effect is, to effect a more perfect condensation of sulphuric acid when made by an improved mode of absorbing the same. The first improvement then, namely, the instantaneous union of sulphurous acid with the oxygen of the atmosphere, I effect by drawing them in proper proportions by the action of an air pump or other mechanical means through an ignited tube or tubes of platina, porcelain, or any other material not acted on when heated by the sulphurous acid gas. In the said tubes or tube I place fine platina wire or platina in any finely-divided state, and I heat them to a strong yellow heat, and by preference in the chamber of a reverberatory furnace; and I do affirm that sulphurous gas being made to pass with a sufficient supply of atmospheric air through tubes as described, properly heated and managed, will be instantly converted into sulphuric acid gas, which will be rapidly absorbed as soon as it comes in contact with water. The sulphurous acid gas I cause to be generated by the combustion of sulphur or pyrites, or any other metallic sulphuret, in a close oven, having one or more apertures for the admission of atmospheric air, and another aperture leading to or communicating with the aforesaid tubes. The relative proportions of sulphurous gas and atmospheric air are regulated by the size and working of the air pump, which must pump out at least eighty-five cubic feet of air for every pound avoirdupois of sulphur consumed.

My second improvement, namely, a more perfect condensation of the sulphuric acid when made, I effect thus:—I cause a chamber or chambers to be erected, of any size and materials that may be thought convenient, but by preference of silicious stone in a circular form, and about eight feet in diameter and thirty feet high. This I cause to be lined nearly or throughout with lead, to be filled nearly to the top with silicious pebbles, or any substance presenting an extensive surface, and not acted upon by the sulphuric acid. Upon the pebbles or other substances I place a sheet of lead, pierced with small holes, for the better distribution of the liquor to be hereafter mentioned. The chamber is to be domed over, and rendered air-tight on the outside, except by an opening on the top, through which a quantity of water or dilute acid is let in upon the pebbles to the height of about fourteen inches. A lead pump is fixed by the side of this chamber, drawing the liquor from its bottom, and emptying its contents into a lead funnel placed in and over the aforesaid opening in the top of the dome, and which said pump is kept constantly worked by a steam engine or any other power that may be preferred. The pipe of the funnel must be of such a size as always to keep some liquor in the funnel, and never to allow any air to pass down that way into the chamber; and the pump must throw a sufficient quantity of liquor to keep all or the greater part of the pebbles moistened. A pipe leading from the ignited tube or tubes, after passing through some water for the purpose of cooling it, terminates in this chamber just above the top of the liquor, while another pipe going off from the top of the chamber leads to the air pump, so that all the air charged with sulphuric acid has to pass through the bed of moistened pebbles, which have a constant supply of water or dilute acid continually passing down them. When the liquor is considered sufficiently charged, or when it will not absorb the sulphuric acid gas, which may be known by examining, the air discharged from the air pump is to be drawn off by a pipe and cock in the bottom of the chamber, and treated in the usual way.

Note, I do not claim a right to any mode by which sulphur or sulphurets may be converted directly into sulphuric acid by the action of heat or otherwise, if

such method ever has been or ever shall be discovered; but I claim an exclusive right to any plan by which sulphurous gas and atmospheric air, either alone or mixed with any other gas or gases, shall be either forced or drawn by an air pump or anyother mechanical means through an ignited tube or tubes.

I also claim the exclusive right to the use of platina in any finely-divided state, for the purpose of assisting the action of heat in combining sulphurous gas with oxygen in the manufacture of sulphuric acid.

I likewise claim an exclusive right to every mode by which chambers used in the manufacture of sulphuric acid can be charged with silicious pebbles or other substances for the purpose of exposing extensive surfaces, and which surfaces can be either constantly or occasionally moistened by the liquor pumped or drawn from below them.

IN WITNESS WHEREOF, I, the said PEREGRINE PHILLIPS, have hereunto set my hand and seal, this Fifteenth day of July, in the year of our Lord One thousand eight hundred and thirty-one.

PEREGRINE (L.S.) PHILLIPS, Junr.

Signed, sealed and delivered in the presence of

JAMES LIVETT, Solr., Bristol.
RICHD. HOWELL, His Clerk.

AND BE IT REMEMBERED that on the Fifteenth day of July, in the year of our Lord, 1831, the aforesaid Peregrine Phillips came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Fourteenth day of September, in the year of our Lord One thousand eight hundred and thirty-one.

When we remember the time, and the absence of institutions for acquiring scientific knowledge, I think we may conclude that the author of the process had acquired a considerable amount of accurate information which he was able to apply to practical use. Moreover, this invention was no lucky or momentary inspiration. The knowledge displayed could only have been acquired by steady and continuous work.

Peregrine Phillips, jun., was a young man who had made good use of his youth in acquiring valuable knowledge. It is noteworthy that although nearly a hundred years have elapsed since this young Bristolian made his experiments and gradually improved his apparatus, yet the essential details are the same to-day as they were when first made known.

The necessary protection having been obtained by the grant of the patent, the next point to inquire about is as to the author's success in working the process. But here my records absolutely fail me. Both directories and newspapers give no information. We may therefore conclude that no works for making sulphuric acid by this process were established in Bristol. Moreover, the name of Peregrine Phillips, jun., disappears from every local record after 1831, and his late private residence is occupied by another. In all probability this means that directly after the dissolution of partnership in June, he left Bristol to seek his fortune elsewhere.

Possibly in that elsewhere he tried to work his invention, but probably without commercial success. This is not to be wondered at when we remember the large amount of plant employed in modern works using the method.

In these works engineering skill and chemical knowledge, which were not even thought of in 1831, are made to assist, and the combined results are highly satisfactory. But the poor inventor had none of these things, and his reward was probably nil. It was not until nearly fifty years after that the Badische Anilin und Soda Fabrik successfully worked the process on the large scale in Germany.

The youngest partner having left the vinegar business, its subsequent history is soon told. In the notice of dissolution quoted above it is stated that the business will in future be carried on under the name of Phillips and Thorne. But it did not last long. In 1831 the elder Phillips gave up his business of tailor and went to live at the vinegar works in Thomas Street. But in 1832 the works were abandoned. No notice of any bankruptcy can be traced, so we may conclude that trade had gradually declined so much that it was not worth while carrying on any longer.

In the *Bristol Journal* for October 5, 1832, appears the notice of a sale by auction on the premises, 48 Thomas Street, of the "entire vinegar plant, stock in trade, complete apparatus, &c. &c.," of the "late firm of Phillips and Thorne, they having dissolved partnership." Full details are given, and it is obvious that the works were fairly extensive and well equipped.

Immediately after this the father seems to have left Bristol, for no other record later than the date of this sale can be found. The name of Peregrine Phillips, either senior or junior, entirely disappears from Bristol records. Parish registers, as well as the official records, have been searched, but no notice of the deaths of either of our worthies can be discovered. Undoubtedly they left Bristol finally in 1832.

The discovery of Peregrine Phillips, jun., was undoubtedly of first-rate importance, and the young man must have been of far more than ordinary intelligence; yet it is quite easy, if not probable, that the history recorded above reveals a note of tragedy. As thus: Peregrine the elder was probably an industrious and prosperous tradesman, and was making a good income. He was blest with a clever son whose future was dear to him. Money was freely spent on his son's education, and when he became of age the savings of his father were used to start him in a business of far greater possibilities than that in which his father had done so well. So great was the father's confidence in his son's ability that he left the conduct of the business to him and his partner whilst he himself continued to work at his trade in Milk Street. But the genius of the son was not suited to the humdrum of business details. He was experimenting on bigger things than vinegar making, and as a result of his work he introduced the process which has benefited succeeding generations but not himself. The result was inevitable. The business did not pay and a rupture ensued. The son left, and the old father, in order to save his money which he had invested in the business, gave up his tailoring to try to save his capital; but without much success. Possibly the old man, having lost most of his money, left the city where he had held an honourable position for so many years.