Waterfall.
at King St.
Wolverhampton.
27.9.41

WEDNESBURY
WORKSHOPS;

OR SOME ACCOUNT OF

The Industries of a Black Country Town.

BY

FRED^K. WM. HACKWOOD, F.R.H.S.,

Author of "The Wednesbury Papers," "History of Darlaston," "Notes of Lessons on Moral Subjects," &c.,

WITH

AN INTRODUCTION

BY

HON. FHILIP STANHOPE, M.P.

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1889.

Much evidence of a similar nature, was given respecting the Tommy Shops of Messrs. Rose, at Moxley; of Messrs. Groucott, Bradley; and of the Darlaston Steel and Iron Company.

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The two great concerns founded in Wednesbury by the Lloyds and the Walkers were undoubtedly capable at one time of producing enormous profits. They both possessed wonderful resources in their mining properties: these two Wednesbury firms could make the very best Staffordshire iron; and the Coal they dug in the parish was exactly suited to the purpose, and at one time cost no more than 3/6 per ton, as run from their pits to their furnaces along their own tram lines.

XIII.—GAS TUBE TRADE.

PERHAPS the most reliable sketch of the growth and development of the trade was published in *The Illustrated News of the World*, July 4th, 1863. It was written by John, the son of James Russell, of the firm of James Russell & Sons, and was accompanied by two illustrations; one was a general view of the Crown Tube Works (Wednesbury) and the other was an interior view of the gas and steam tube mill. The connection between gun-barrels and wrought iron tubes is duly set forth. Wednesbury was once renowned for its gun-barrels: now it is sometimes known as "Tube Town." In the *Cyclopædia of Arts*, Vol. I. p. 817 we read—"The forging of gun-barrels varies according to the quality intended to be produced, or the use to which the barrels are to be applied. Musket or common barrels were formerly made from what are called *skelps*. The skelp is a piece of iron about 3 feet long, and 4 inches wide, but thicker and broader at one end than the other; and the barrel was formed by forging out such pieces to the proper dimensions, and then folding or bending them round into a cylindrical form until the edges overlapped, so that they could be welded together." On p. 818 of the same volume we further read—"Stub-barrels are also made from *scrap*-iron, which consists of the cuttings from various manufactories, the cuttings and punchings of sheet-iron, as well as worn-out articles in iron. These are sorted and used in preparing iron of various qualities, known as *wire*-twist, *Damascus*-twist, *stub*-twist, *charcoal*-iron, *threepenny-skelp*-iron, *twopenny*, or *Wednesbury* skelp, *sham-damn* skelp," &c.

Now in the newspaper article referred to it is stated to

be a literal fact that when the wars occasioned by the French Revolution were over, gun-makers were at a loss what to do with their gun-barrels Happily, however, about this time gas was discovered, and, originally, gas pipes were nothing more than gun barrels screwed end to end.

The transition from gun barrels to tubes is a strange story of invention in which the names of Russell and Whitehouse recur again and again.

Cornelius Whitehouse was a Wood Green man, and was one of the principal workmen at Elwell's forge. He was an ingenious mechanic, and like James Russell, set himself to solve the problem of making wrought iron tubes. Each discoverer, however, worked according to his lights. Russell was a gun-barrel maker, and took his stand point as such. He, undoubtedly was the first inventor of a process for making tubes, but his invention was merely an extension of the old idea of welding barrels Instead of welding with a hammer, he welded with a machine, which worked a lever jaw, and the process of welding his longest tube—6 feet at the utmost—necessitated heating and reheating eight or ten times. But Whitehouse had the negative advantage of possessing no preconceived ideas of how the thing was to be accomplished ; and further, the positive advantage of being intimately acquainted with the working, and capabilities of the "hollowfire." These hollow fires were used for forging in the edge tool trade, while the smith's hearth was the only method of heating with which Russell was acquainted. However, such a success as the latter accomplished, had brought a considerable amount of profit. In 1811 he had made tubes in conjunction with his brother John at Church Hill, and after the dissolution of partnership, his efforts at the Crown Tube Works continued to meet with a certain amount of financial success even before he had secured the greater advantage of Whitehouse's patent. How he secured that patent is said to have been somewhat as follows.

Cornelius Whitehouse had been experimenting a long time before he hit upon the process of drawing the red hot skelp through a pair of tongs. When, at last, he made the

valuable discovery, he knew that James Russell was the one man who knew best how to appreciate the value of that discovery. So having made and finished his first tube, he sent it by a man named Heath to James Russell. Mr. Russell was riding down the High Bullen when the messenger met him, showed him the specimen tube, and told him who had made it. Instantly the original inventor recognised the fact that the maker of that tube was the man who was indispensible to the development of the new tube trade which he himself had established. So dismounting, he told the man Heath to ride back to Elwell's Forge as fast as he could, and to bring him the greater inventor. It was thus these two men commenced their long and close connection, which has done so much for the trade which they established, and for the town of Wednesbury which their genius honoured.

But the earlier struggles of James Russell in his search after the right process are worth relating. His son writes:—

"It was about the year 1813 (according to the memorials of our family) that my father, having conceived the idea of making a parallel[o] wrought-iron tube, went to a blacksmith's shop near Moxley, and made a four-feet length with his own hands. The report of this useful piece of mechanism spread through the neighbourhood, and when the tube was seen by Samuel Fereday, well known in those parts, he spoke of it with admiration."

"His ingenious hands had now found work for his contriving brain. By day at the workshop, by night in bed, as he sat at meat, and while walking on the road, he thought, "How shall I join one tube to another, end to end for as great a length as any circumstances may require?" It is not known by what means the idea was germinated which led to the discovery of the right mode. My mother has often related in my hearing, that one morning to her great surprise, my father jumped suddenly out of bed with the joyful cry, "I've got it! I've got it! I've got it!" Scarcely staying to put on his clothes, he hastened to the

[o] *Gun-barrels were not "parallel"—they were "tapered."*

same shop at Moxley, wherein he had formed the tube, and thus put his idea into practice by making the first socket.

"How were these inventions to be brought into use? After some reflections, my father, having made a tube and socket, took them to Aaron Manby, a person whom he knew very well, and an agreement was come to by which my father was engaged as superintendent for the getting-up of gas-fittings. This was about the year 1814 and the connection continued till 1816 when my father made arrangements with my uncle, John Russell, who, in consideration of my father's skill and discoveries, took him into partnership, and the firm was styled John and James Russell.

"John Russell had long been established as a manufacturer of gun barrels, and was in a far better position than his brother James, which placed the latter, in some respect, in a subordinate character. The partnership continued for about seven years. James had the entire control and representation of the business—John never interfering. My father has been known to walk sixty miles a day with patterns on his back. Many times did he set out from Wednesbury to Liverpool performing the whole journey on foot, and arriving the next morning by breakfast. He has often told the following anecdote with much glee. Calling one morning on Peel, Williams, and Peel, of Manchester, Mr. Peel said, as my father entered: "I have just received a letter from your firm, signed "S. Russell" who is this?" "My wife" was the answer. "Well then responded the other, "she writes a better business letter than you: you wrote better than any man I know, but she beats you." The fact was that during my father's absence, my mother managed the business, Mr. John Russell never taking any part in its control.

"About two years before the expiration of the term agreed upon in the partnership arrangement, my father and uncle had a serious quarrel, and for some time did not speak to each other. This disagreement was terminated by some domestic event, not needful to mention, by which a reconcilation was effected between the two brothers, and a transfer of business to my father at the dissolution of the partnership. John Russell being too ill to make any exertion for business, said to his brother: "James, the affair is your own." After this, however, his health being partially re-established, he recommenced business, and thus arose two business houses of the same name—James Russell and and Sons of which I am the only the surviving partner; John Russell and Co., of which my cousin Thomas Russell is senior partner.

"The original patents, as well as almost every existing patent in practical use, belong to the firm of James Russell and Sons excepting only two, one used very little and the other not at all."

When the father died the son succeeded to the business, and under him it reached its present unexampled height. At the works of the firm, James Russell and Sons, Wednesbury, nearly 1100 men are constantly employed. In 1858 the firm produced upwards of 100 miles of boiler, and upwards of 699 miles of gas tubes at their work—the Crown Tube Works, Wednesbury. The process is thus described:—

"See the tube in its process under my father's patent. A workman stands with a bar of iron, he rolls it to the required thinness, cuts it into lengths of four feet, and bends up, or swages, the sides of these strips, bringing them as close together as possible. Now he passes it through a blast furnace: it comes forth at welding heat, it is placed on an anvil with a semi-cylindrical recess, is operated on by a lift hammer to effect the welding, and is completed by passing through a pair of grooved rollers: behold the tube. It could be made with or without a mandril. This introduces the next great move, which brought into this world the leading principle of wrought-iron parallel tube manufacture.

"This principle dispenses with all internal support, no mandril of any kind is needed, and the tube is completed by external pressure acting on all points of the circumference. The era of this was 1825, and the place of development was found at the Crown Tube Works, Wednesbury, where the principle has had a mighty influence in facilitating, improving and cheapening the manufacture,

so that the article became capable of extensive use.

"After this various patents were taken out, and attempts were made to substitute the rolling system of welding for what may be called the drawbench mode. One, two, three, and four pairs of rollers were tried, but the old system was found to be practically the best. The patent of 1825, belonging to our house produced tubes of twelve to eighteen feet in length; and was improved, in 1836 by a patented process of my brother, Thomas Henry Russell, by which only the the ends, and not the whole length, of the piece of iron were turned up." "The patent law of England admits of much reform. The firm of James Russell have discovered this to their cost. Every step of road they have taken has been against themselves. and sometimes, we regret to write, in face of most unprincipled opposition. Action after action they have brought against the appropriators and pirates of their patents. They have vindicated their claims, it is true; but at an expense so enormous as to be almost too incredible. As they have maintained their rights, and won the day, let us hope that they may flourish for many years to come."

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The foregoing extracts tell the tale of this invention at first hand; and the reader is not asked to give credence to mere tradition or to hearsay evidence. But for the surrounding circumstances, and for the environments in which this new industry found itself during the early stages of its infancy, we must go to other sources.

In the early part of the nineteenth century, Wednesbury began to rise to eminence as a hardware centre. Indeed, Birmingham itself gained some of its celebrity at the expense of Wednesbury: for the factors and merchants of the former town obtained very considerable quantities of their wares from the many hives of industry with which the innumerable smith's hearths dotted the surface of this mineral-producing neighbourhood. The canals of 1768 had opened up communication between the manufacturing industries of Birmingham and the productive mines of Wednesbury; and again in 1826 Telford supplemented this by cutting a new one. Previous to the period of these

industrial developments, the population was chiefly rural, and the neighbourhood was extremely picturesque. It was arrayed, like the spring, in a robe of green, and was fragrant with the breath of flowers. But when the influx of trade which gave to the district that sombre piece of nomenclature.—The Black Country—arrived, fair meadows began to lose their verdure and corn fields their golden hue; streams once clear and sparkling became polluted; and thus portions of the neighbourhood which were once beautiful in their sylvan and rural scenery soon became the sites of mining and manufacturing operations. It was in 1816, as we have already noted, that those important processes in tube making. were developing themselves at the smithy of John and James Russell on Church Hill. There the most casual of observers must have had his attention arrested by the ruddy fire glowing from the blast of the bellows, and the workmen all at full tension; and had he been of an enquiring turn of mind he would have seen an iron strip about four feet in length brought from the fire almost melting hot. A brawny smith would place it on the anvil and blows would be seen to fall fast and heavily on the plastic iron. The strip was thus bent up so that the edges would overlap each other. It would then be again put into the fire until it was welding hot for a few inches in the middle and then brought out and a steel rod rapidly introduced inside it, and the iron beaten on the lapped part to weld it together. This process was repeated over and over again until the whole length of the tube was welded. This was the way in which they manufactured gun-barrels—the first class of tubes made in Wednesbury.

But about this time a great change was imminent—gas lighting had been invented, and the use of the new illuminant was fast spreading. When the gas lighting was first introduced, it became a matter of grave consideration as to how the inventors were to convey the gas from place to place; and as wrought-iron, from its strength and durability, was found to be a capital material for the purposes, it was decided to try wrought-iron tubes. So a ready conveyance was found for the gas by using pieces of tube roughly made in the same way as gun barrels, and it thus

fell to the lot of gun-barrel makers to make them. This process continued for a few years, but as a prejudice at first existed against the use of gas for lighting purposes, the demand for tubes was necessarily small, and the gun-barrel makers were able to meet all requirements. But in the course of time prejudices disappeared, gas got to be in great demand as an improved substitute for the old-fashioned oil lamps, and consequently gas work began to spring up all over England, and it was then that orders began to press on our local smiths, who had hitherto considered the manufacture of gun-barrels as their staple trade, and who had formerly only made gas-tubes when orders for their own work were short, the former work being the most remunerative. In this branch, work could always be had, orders never being short, and the employers began to consider whether it would not be to their advantage to devote the whole of their attention to the manufacture of gas tubes, and to relinquish barrel making. They were constantly receiving orders for the latter at high rates of remuneration, which they were unable to execute unless they gave over the other branch. The two brothers, John and James Russell, seriously considered this matter, and the result was that John Russell, the owner of the smithy on Church Hill gave up gun- barrel making, and found money to start in a more extensive way the making of tubes, and taking his brother James as a working partner as previously stated.

The factory on Church Hill was taken down or enlarged and both partners applied their energies exclusively to the development of the branch of trade they had entered upon. Whilst one superintended and actually worked at the factory, the other sought for orders and the delivery of them. This trade opened up a new era for Wednesbury and its inhabitants, and as the trade developed so did the town develope. Smiths and other men came from all parts to this centre of industry, which, although even then in its infancy, offered many attractions and inducements by the high wages given to the men employed in it. "The day of small things" was not to last long, for Wednesbury was soon to become the seat of inventions and developments in

the trade which should give to it a world-wide fame. The steam engine was brought to a greater state of perfection, and its application assisted the development of almost all branches of industry. It did not, however, materially move on the march of the tube trade until the invention of that machinery, which took from the blacksmith much of the heavy labour, and turned out a superior class of work. John and James Russell had not been at work very long before their orders increased so much that, with their increased powers they found it difficult to produce from the hands of their smiths the quantity demanded, and even with using as much pressure as they could upon their men in the summer months, and over-working them in winter, they found they could barely keep their orders from gaining on them, though they certainly did manage by dint of perseverance, to carry on for a few years, and at last they dissolved partnership, and James Russell started on his own account on the site of the present Crown Tube Works. The place at this time was very small not being much larger than a good-sized blacksmith's shop. It was at this place that the first patent ever obtained for the manufacture of gas tubes was taken out by Mr. James Russell, in January 1825. This was for making a parallel tube out of a strip of iron, and was really the first tube (made otherwise than as gun barrels were made) that came into practical use. John Russell was allowed to use the patent by licence, and the firms of John and James Russell had the exclusive manufacture of tubes by this patent process. This circumstance brought to their hands more work than they could do. Gas lighting was not only adopted in our land, but it was resorted to in all parts of the continent, France being the leading place. The supply then became inadequate to the demand. Foreign orders came in thickly, and it became a matter of consideration how tubes could be manufactured cheaper, better, and in greater quantities. It was thought they might be made in greater lengths, for hitherto the old workmen could not make a tube longer than four feet without a great deal of extra trouble, six feet being about the greatest length they ever attempted, and the expense of manufacture was very heavy. The

price then paid for making tubes was 1¼l. per foot for ¾in. and 5d. per foot for 2in. tubes. It need hardly be said that at these high rates of remuneration men got high wages, but only, however, to spend the greater portion in drink at the "Cock" or the "Green Dragon" or on bull dogs and game-cocks, the smaller portion remaining only finding its way to the wife and their ignorant, illfed, and ill-clad children. Wednesbury working men of that generation compare very unfavourably with the workmen of the present day. But to return to the problem of making tubes cheaper, better, and in greater quantities. The solution was forthcoming, in the manner we have already indicated, from Cornelius Whitehouse, who, on the 26th of February, 1825, patented his invention for making the same description of tubes by an improved process and in greater lengths. In his Letters Patent he claimed the advantages of his patent over the other system to be as follows:—"That the iron is considerably improved by the operation of the hollow fire, the heat being generated differently. The length of the piece of tube thus made is likewise a great advantage, as by this means the tube may be made from two to eight feet long in one piece, whereas by the old modes the length of the tube cannot exceed four feet without considerable difficulty and consequently expense. These tubes are likewise capable of resisting greater pressure from the uniformity of heat, throughout, by which they have been welded; and lastly, both their internal and external surfaces are rendered smooth, greatly resembling drawn lead pipes" &c. To make tubes by this patent process must have been an interesting process. The workmen took a strip of iron, bent it into what they called pippin shape, then put half the length into the hollow fire till it was welding hot, when it was drawn out by means of the chain and grips and on its way out was grasped by a pair of tongs having a pippin-shaped hole in them a little less than the tube strip to be welded, and these tongs were so made that the small part of the pippin in the tongs pressed first upon the seam part of the tube closing the edges together in a downward direction thus fastening or joining the edges of the iron firmly together while in a state of fusion; then, having

passed the whole of the half length it was again passed into the hollow fire and heated to a white-heat, and passed through a pair of tongs similar to the first, only having a hole in them of a shape between a pippin form and a circle; and then it was passed through a pair of tongs having a circular hole in them of a size corresponding to the outside diameter of tube required. The other half of the tube was then turned to the fire and the same process repeated. Thus were tubes made under Cornelius Whitehouse's patent, which was purchased by his employer, James Russell, who was not slow to work so valuable an invention. Smiths' hearths gave place to the hollow fire, the hand hammer gave place to the tongs, &c.; the same men who made 25 lengths of four feet tubes under the old system with the new one could make 200 lengths of 8 feet in the same time. This fact will give a good idea of the advantages of Whitehouse's patent to James Russell himself; but he allowed others to use it by license, one firm who used it being in France. Many infringements of this patent occurred, and it was only at a great cost that it could in any way be preserved. It is said that in attempting to do so he spent no less a sum than £20,000 or £25,000! A high wall with large spikes on the top was built round the works to prevent the operations being seen. Occasionally the works were besieged and several times crowds of men assailed the gates in front, and the workmen within were called upon to repell them. A row of houses standing at one time in front of the works, were hired, so that from the top of them some of the working operations inside the works could be observed. We may imagine how difficult under such circumstances, it must have been to preserve the invention which had been made at such an immense amount of trouble and expense, and it would be difficult to imagine the injuries which Mr. Russell received by the various infringements which could scarcely be prevented. Men came from all parts of England, and from France, to see the manufacture of tubes under such a wonderful process as that discovered by Mr. Whitehouse. Of course, up to this time, many firms in the country had made tubes under the old gun-barrel system, but those manufacturers who could afford

to do so now availed themselves of the opportunities of working Mr. Whitehouse's patent by license from Mr. Russell*; and those who could not do so, in consequence of monopoly from those who could, were compelled to give over tube-making, and yield to their wealthier and more fortunate neighbours. Tubes, as manufactured by Mr. Whitehouse's process, soon became the order of the day, for all gas and water purposes, and Wednesbury became celebrated all over the civilised world as being the leading place where this class of work was manufactured. Of course it has since spread to other districts—as for instance, Mr. John Brotherton, a Wednesbury man whose family were connected with the gun-trade of the town for several generations established a large Factory in Wolverhampton, of which town Mr. Brotherton has been Mayor.

At one time Wednesbury was the capital of the old Black Country, when the coal and iron industries of the locality first called into existence a recognised metropolis. Since the beginning of the Tube era its importance as an iron and coal centre has rapidly decreased, for its mines are nearly exhausted and its iron and steel are produced in a market too far distant from the sea-board.

We will now turn our attention to the various methods in which it has been sought to turn or bend strips of iron into tubes, preparatory to welding them. First in order comes the old rough mode of bending them by muscle and hammer, as practised in the old smithy on Church Hill when the trade was in its infancy, and next comes the "crocodile" machine, having a long jaw and recess, and which in consequence of its jaw and long tail, acquired the unenviable, but perhaps not altogether inappropriate, name above-mentioned. Another process was by drawing a strip of iron while hot through a cast-iron die called the "bell"; but this system was little, if any, better than the "crocodile" process. The method, however, which superseded all others was by having open dies worked with a rack and pinion, so that the strip might be squeezed into shape by the action of the dies while being drawn through. This plan is generally adapted at the present time. It has

*Mr. John Russell among them.

been sought to make rough tubes—bend and weld them—all at one heat by means of passing them through a die or series of dies, but this plan failed in practice, from the fact that the hot iron coming in contact with the cold steel dies caused the tube to chill whilst passing through, and in many cases the operation burst the iron and broke it in its course through the dies.

The process of heating tubes is more than a little interesting, and this branch of the trade is no less important than any other. Hot iron never tells one tale and means another. If heated too hot the iron "blisters" and spoils the "weld" and if it is not heated hot enough it will resist the "weld," and must be put into the furnace again to be re-heated; and it requires a somewhat skilful workman to know when the iron is heated to its exact "temper." We will briefly trace the various methods that have been tried for heating iron preparatory to welding. In the first process we see the smith's fire giving way to the hollow fire with its culvert underneath for supplying the blast, and subsequently we see this superseded but for small tubes only, by the air furnace. It has been sought, within the last few years, to heat small tubes by a furnace in which crude gas is burned, and which will produce sufficient heat to weld small tubes, but the action of the furnace is so variable that no dependence can be placed upon it, and it is so liable to become deranged in its action from many causes that we think its general adoption is far distant; and, above all, it lacks cheapness. Nevertheless, in this system, is seen a valuable principle which may be used in other branches of industry to great advantage. For instance, it has been found of the greatest utility in glass-houses, where a heating process, unattended by smoke and dust, is required. It is alleged that the tubes heated by gas were much smoother than those heated in the ordinary manner. Although, as we have seen, there has been many projects started and a variety of means used in preparing the strips ready for welding, and in welding tubes, and although better adapted machinery driven by steam power, has been brought to bear upon their manufacture, yet no method or invention has stood the test like that of Cornelius

Whitehouse, who has been spoken of as a man of active temperament always ready to try new plans, and who, from his success in tube-making, was sanguine that he would give to the world many valuable improvements. He tried experiment after experiment, none of which, however have been marked with success (excepting, of course, that of making tubes),and after many vicissitudes of fortune,he died aged 90,at Wolverhampton,in 1883, after seeing his patent in active operation, as the back bone of a trade, for more than half a century. During that time he watched manufactures, in which his patent was used, spring up in all parts of the country; he also had the satisfaction of having established by his patent, one of the largest branches of industry that has existed in this district. A good idea of the present, compared with the past position of the tube trade may be gathered from the following figures. In 1816 about ten tons a year comprised all the tubes manufactured; at the present time from 15,000 to 20,000 tons are manufactured annually. In 1824, the largest firm in Wednesbury made only 3,000 feet of tube; in 1838, 793,000 feet were turned out by the same firm. But a still greater stride was made between 1838 and 1858. In the last named year 4,228,000 feet were made but in 1865 the demand had so increased that the firm in question made no less than 5,314,000 feet. The last year in which an increase was observed, was that of 1871, when the number of feet supplied by the same firm reached the enormous figure 6,700,000. This was the progress of one firm alone.

There is another portion of tube-making to which we have not yet referred, viz., the manufacture of lap-welded boiler tubes, which of late years have played an important part in every conceivable art and manufacture. When steam engines were being largely adopted in this country there was a variety of shapes given to steam boilers; some, perhaps many, more grotesque than useful. Bye-and-bye engineers began to consider how they could generate the greatest quantity of steam by the smallest amount of coal, and although fuel was abundant and cheap in our neighbourhood yet in other less favoured parts it was scarce and dear so that it was found necessary that

steam should be made cheaper than hitherto. Experiments were made, and in a few years it became a recognised fact that if tubes were placed in a boiler and the flame made to pass through them there would be a very great amount of heated surface, and consequently a greater production of steam. Robert Stephenson, the great engineer, was foremost in advocating this system. We cannot see a better instance of the advantages of the multitubular boiler over the old system than in a railway locomotive. The tubes which run through a locomotive boiler represent over 2,000 square feet of heating surface, so that the water in a boiler may be said to be standing between hundreds of fires, for each tube contains fire when the engine is fully in work, and the number of tubes required for one boiler is from 160 to 200. As these tubes are subjected to an outward pressure only—a pressure which is resisted at every conceivable point—they may be made both light in weight and thin in metal with perfect safety. It requires but slight force from one side to break an egg-shell, but if the pressure bears on every part it requires a very great external force to break the same shell. It is on the same principle that a boiler tube may be made so thin and yet so safe; safer it may be when it is only the one-sixteenth of an inch thick than is the boiler plate of five-eights, or even ten times the thickness, the boiler plate receiving the pressure on one side only, while the tube is surrounded on every side by the same force.

Some years ago an Englishman named Morton Jones had occasion to go to France, when he became by some means connected with experimental machinery for making wrought-iron shot, by which it was attempted to roll the solid shot for cannon It was found to be impracticable for that purpose, but the scheme was not entirely valueless, for the gentleman, Morton Jones, conceived from it the idea of rolling tubes, and gave up the attempt to roll shot, came to England, and, at Birmingham, took a part in some works. After experimenting at this place for some time, he produced a machine and essayed to roll his tubes, but at first failed. He then altered his plan, modified his patterns, and produced another machine. Still he failed to

command success, but he tried time after time, being sanguine of success. Each time, however, brought only disappointment, until at last he had spent all his own means, together with his wife's dowry, and in a little while afterwards he was so pressed by his creditors that he had to make an assignment of his property for the satisfaction of their claims upon him. He did not, however, even in these circumstances give up his darling project of rolling tubes. It is said that by some means he saved some portion of his machinery from being sold by his creditors, and continued to develope his process on the quiet. Soon afterwards the unfortunate man met with difficulties from an unexpected source, namely, a man in whom he had put implicit confidence when he attempted to "best" his creditors. The "friend" in question kept the machinery for himself. This perfidious act of his confidential neighbour appears to have made such an impression upon Jones that he seems to have given up all hopes of ever being able to mature his scheme. As his means were exhausted he was compelled to give up his project and sink almost into oblivion. The man who had Jones's machinery improved it, and continued the experiment, till by and bye he was able to produce a machine with four rollers, which, though rather roughly constructed, would produce a tube, such as it was. He lost no time in claiming the invention as entirely his own, and procured Letters Patent. But not having sufficient capital himself to embark in the manufacture of tubes on a large scale, he sold the invention to a Birmingham gentleman of large means, named Ledsam, who, in conjunction with another wealthy man named Bowers, had works erected, and the manufacture of this class of tube was carried on, and the demand for them soon became so great that the patentee, for many years, received more than £20,000 per annum royalty.

A little while prior to the time spoken of, the Messrs. Russell's of Wednesbury, had succeeded in making tubes with two rollers in a somewhat different fashion to the other patent, but Messrs. Ledsam and Bowers were desirous of laying claim exclusively to the whole of the lapweld-tube business, and, having plenty of money at their command, commenced proceedings against the Russells to debar them from rolling tubes. Trial after trial took place, enormous sums were spent on both sides, but at last judgment was declared, and in favour of the Russells, who were allowed to pursue in peace their two-roll system. It is said that at the termination of the first trial, Daniel Ledsam asking what would be the whole of the law expenses incurred, was told £70,000; he answered, "Oh, that's only a milk score; go at it again." And it has been stated that at the least computation from beginning to end these trials did not cost less than half a million of money. Soon after these trials had taken place, Ledsam and Bowers gave up their Birmingham manufactury to be worked by the firm of Selby and Hedges, the former a lawyer, the latter a London gin distiller, and it was successfully carried on by them until differences arose between them, and Hodges, who was very wealthy, thought of a plan that would in all probability rid him of his partner. He desired stock to be taken at a low valuation meaning to pay his partner Selby out, for he felt sure that Selby could not raise enough money to pay him out. But Selby was a lawyer, and was not likely to be taken unawares, so he had a stock-taking at a fair valuation, knowing that Hodges would in all probability demur to this course. Hodges felt sure that he was working the matter cleverly, and so the partners and their friends and respective lawyers met in London. The proposition was, after a lot of talk, thus put by Hodges: "Well George, either pay me out or I will pay you out." But Selby demurred to this proposal, alleging that it was unfair and unreasonable on Hodges's part, and asking how he could be expected to find so much money, and suggesting their coming to some arrangement by which they might continue as partners: but Hodges, more sure now than ever, would listen to no such proposal. He again said "No; either pay me out, or I will pay you out." Again Selby urged the unreasonableness of Hodges's demand, and was assisted by his friends and lawyers who were present, but all to no purpose. Again the wily Hodges said, "No, George, its no use," and again the third time repeated the demand, "Either pay me out, or I will pay you out." Imme-

diately, Selby replied, "Well, although you are so unreasonable in your demands, yet I will as you have asked me the third time, comply with your demand, and to which the gentlemen present bear witness!"—and suiting the action to his word, dived his hand into his pocket, drew it forth and laid down before the eyes of the astonished Hodges, £75,000 in bank notes, and said, "From this moment you are no partner of mine." It need hardly be said how chapfallen and mortified the wily gin distiller was to see himself out-witted by the cunning lawyer.* After the event referred to, tube-making was carried on by Selby for several years, but having to pay large sums of money as interest on the amount he borrowed to pay Hodges out, he found that after a time he could not meet his money engagements, and so he had to retire from tube manufacturing altogether: but by shrewd tactics he managed to give his wife the sum of £30,000, and to leave his son a quarter share in the Birmingham Patent Tube Company. The other three fourths found their way into a banker's hands, and at present or until lately the works were carried on by Sampson Hanbury, the son of a London banker.

For a short space, let us look at the progress of this kind of tube-making. We find that little alteration has taken place in the mode of welding since the time the false friend of Morton Jones obtained the patent; but one thing is plainly seen, and it is that the production and consumption has increased from a few thousands to some millions of tons a year. Indeed, the progress of this rough work has been almost as great as that of the finer gas-tube trade.

The writer has before mentioned that various kinds of tubes have played an important part in every art and manufacture known—they are used in refrigerators for freezing and in ovens for heating! But their chief uses are, of course, for the conveyance of gas, steam, water; and also for generating steam. But these are only a few of the many purposes to which they have been applied. They

For the foregoing graphic account we are indebted to an article which appeared in a Wednesbury newspaper some years ago.

play their part in urging noble vessels across the trackless ocean, in forcing the ponderous locomotive along its iron way, in giving light to the house and warmth to the office. They are also brought into requisition for ship's pillars, rollers for calico-printing, as hollow iron shafts, core bars, war rockets, cart-wheel spokes, bedsteads, fancy chairs, scythe handles, picture rods, and a thousand other purposes; but those mentioned will, perhaps, be sufficient to convey an idea of the great variety of uses to which they may be applied.

Let us, for a little while, trace the "friend" of Morton Jones who "did" his neighbour out of machinery and method, and afterwards patented, as his own, the process of lap-weld tube-making. He received for his patent an enormous sum of money, perhaps not less than £180,000; but indulging in expensive establishments, and spending money as freely and as easily as he got it, and continually trying experiments—some of them very foolish ones—he soon found that his means failed him, and on the expiration of his patent, he saw no way of recovering his former splendour, so he retired from public life to live on the wreck of what, with care, might be aptly called, a large fortune. But although he retired from the cares of business, trouble seems to have followed him, and so to have affected his mind that, one summer's morning, standing before the large looking glass in his bedroom, he cut his throat. Thus died the patentee of the lap-welded tube process, but not by any means the inventor of its theory.

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Frequent allusions has been made to the trouble and expense which Mr. Russell was put to in protecting himself and his patent from trade pirates. A few extracts of an official nature may be instructive on this point. The following is taken from THE PATENTEE'S MANUAL (*Longmans, London*) page 209:—

"Whitehouse, an ingenious mechanic, procured a patent for improvements in the manufacture of iron tubes, which he assigned to his master, Russell, who laid out £14,000 in works [in Wednesbury] to carry out the manufacture.

The tubes were in great demand, being applicable to a variety of new purposes; but, as the manufacture was simple, many expedients were resorted to to evade the patent, and Mr. Russell was involved in much litigation, in consequence of which, combined with the loss incurred by surreptitious manufacture and sale, his profits were very considerably reduced. On these grounds he applied for a prolongation of the patent, and produced evidence before the Committee to show the value and importance of the invention, the losses he had suffered from infringements, and the great reduction that would take place in the value of the premises and machinery (much of which was fitted only for the particular manufacture) if the patent were thrown open. He further showed that his life had been endangered by the anxiety of certain law proceedings. One witness stated that, if the manufacture were thrown open, it would be hardly worth following; the process was so beautifully simple, that it would almost be within the reach of any person of capital. The net profits amounted to about £13,000; but this was shown to be not much greater than the ordinary profits on stock without the protection of a patent. Taking all this into consideration, seeing that the invention was of extraordinary merit, and that Mr. Russell had suffered greatly from the annoyance and anxiety occasioned by the litigation to which he had been subjected, the Committee thought the patent ought to be extended for six years, the original patentee receiving £500 a year of the profits for that time." Then is given a reference to "Whitehouse's Patent" in *I Webster's Reports of Patent Cases*, 473. The authority is first quoted, and again giving this reference, bases this opinion upon it: "Where the invention is one of great merit, and the patentee has assigned his interest in it to another person for that which, looking at the profits likely to be derived from working the invention, appears an inadequate consideration, the Privy Council will see that the patentee receives further reward. With this view, a condition is sometimes introduced into the new patent, making it void in case a fixed annual sum, or a certain share in the profits, be not paid to the patentee by the assignee."

The Patentee's Manual also contains many references to the case of *Russell v. Cowley* (1 W.P.C. 459). Thus on page 23, and under the heading of "Infringements—Processes":—

"A mode of manufacturing differing in nothing from an old process except in the omission of a step, may also form the subject of a patent, as was decided in the case of *Russell v. Cowley*. A patent had been obtained for an invention for manufacturing iron tubes, by welding them without the use of a mandril, or internal support; and its validity being contested, it was held good. The process, from first to last, consisted of turning up the edges of a flattened metal plate until they nearly met; in heating the plate, so prepared; and in drawing it, when at a welding heat, through dies having a conical hole. In passing from the broader to the narrower end of the hole, the edges were compressed against each other, and were welded together; the tube was thus formed without having recourse to the old process, which required a mandril, whereon the overlapping edges of the metal plate were welded by means of hammers. It being contended that welding by pressure was not a new invention, Lord Lyndhurst read the specification as claiming only the manufacture of tubes without a mandril. By the new process, tubes could be made of greater length, of greater uniformity, and considerably cheaper, than before." On p. 26:—

"The making of iron gas-tubes without the use of a mandril viz., by welding them without striking them on a solid surface, seems to be a very simple invention,' said Lyndhurst in *Russell v Cowley*, 'but it has been productive of great advantages, inasmuch as it has enabled the manufacturer to construct pipes of lengths much beyond what could be done previously to this discovery, (1 W.P.C, 467). Hence the utility of the invention was apparent from the important consequences that flowed from it, and the patent was supported." Again on p. 123:—

"The patent in *Russell v. Cowley* (1 W.P.C. 459) was for a method of manufacturing iron tubes without the use of a mandril. The specification gave no directions as to

leaving out the mandril; but it was held that an intelligent workman would sufficiently understand from the purport of the specification, that a mandril was not to be used." (This is instanced under the heading of "The Complete Specification.")

The case of *Russell v. Cowley* is also instanced on p. 235, to show that "the Court will also assist a plaintiff suing in respect of an infringement of his patent by directing the defendant to permit an inspection of the processes used or the articles made by him in alleged violation of the rights of the plaintiff."

XIV.—THE TUBE TRADE (CONTINUED).

JAMES RUSSELL AND SONS. The history of this firm at the Crown Tube Works has already been given in describing the history of the invention of the process of tube-making. It only remains to say that about 1867 Mr. John Russell (only surviving son of James) found it convenient to convert the concern into a limited liability company. Then happened one of the happiest events that can mark the career of any industrial undertaking—many of the workmen, particularly the foremen and managers, took up shares, and so became interested in the prosperity of a concern where they were both employers and employes. This kind of co-operation has acted in the most beneficial manner. Under the financial and commercial direction of the late Mr. Joseph Smith°, now so ably succeeded by Mr. G. S. Guy; and with the mechanical genius of Mr. J. C. Johnson to guide its destinies, the Crown Tube Works has made a progress almost unexampled in the history of the Black Country.

John Russell and Co. The early history of this firm is involved in that of James Russell and Sons, and has, to a great extent, been dealt with in the previous chapter. The works in Church Hill and Wellcroft Street ceased to exist in October 1878, after flourishing for three quarters of a century. Owing to deaths in the family, and consequent subdivisions of the property, the freehold of these works became vested in Mrs. Emily Russell (widow of Dr. Russell) while the claim to the possesion of the trade

°*See his Obituary in "The Midland Advertiser" of January 11th*, 1884.

name—"John Russell & Co."—was substantiated by the seniors of the firm, Mr. Edward Russell and his partner of the Alma Tube Works, Walsall. At this juncture it was thought to be wiser to re-unite these two branches for the sake of the old name. This was done by promoting a limited liability company, a task easily accomplished by Captain Harrison, brother to Mrs. Emily Russell. But the old original works were then relinquished and the place dismantled. The Church Hill site was, in the face of greater and growing competition, found to be highly unsuitable. The haulage of fuel to that elevation enhanced its price over a shilling a ton; but worse than that, was the inadequate supply and the comparative dearness of water. But to keep the old family name connected with Wednesbury, the Old Patent Tube Works, in Wednesbury Old Field, were purchased, and there a portion of the trade is now conducted although Walsall has become the head-quarters of this old firm.

WHITEHOUSE & Co. The Globe Tube Works at Wednesbury Bridge has passed through many vicissitudes. It was originally started some forty years ago by Cornelius Whitehouse after he left the Crown Tube Works. Whitehouse at first had a moneyed partner named Cudd; then the place passed into the hands of an eccentric individual named Felix Webb. Still retaining the original name, the concern was floated into a limited liability company, chiefly through the instrumentality of Mr. Caleo Bloomer and Mr. David Rose. The company eventually got into difficulties, from which even the wide experience and commercial capabilities of Mr. John Knowles its last managing director, could not, at that late period of its struggles, extricate it. The place was closed some twelve years ago, and remained void till 1882, when Mr. John Spencer came into possession; and once more the Globe Tube Works is a thriving and growing concern.

ISAAC GRIFFITHS & SONS. Isaac Griffiths at the early age of eight years entered the service of John and James Russell at their original Works on Church Hill, when the latter was little more than a commercial traveller to his wealthier brother. When the two brothers parted parted company,

Isaac Griffiths remained with John, and gradually rose in the estimation of his employer till at last he became sole manager, buying and selling everything for the works on Church Hill. Some thirty years ago he left the firm of John Russell and Co., and in conjunction with his brother and a friend, started the firm of Griffiths and Billingsley, Victoria Tube Works, Alma Street. After about ten years' partnership Isaac Griffiths left this firm, and purchasing the site of the tube works formerly conducted by Hughes, Pritchard, and Hughes in Friar Street, he erected thereon an entirely new factory, which known as the Imperial Tube Works has been carried on ever since under the style and title of Isaac Griffiths and Sons. Mr. Isaac Griffiths, the senior partner, died in 1874, and since that date the place has been carried on by his sons.

THOMAS PRITCHARD. The South Staffordshire Tube Works were established at Mesty Croft in 1856, Mr. Thomas Pritchard (like Mr. John Brotherton of Wolverhampton) being a nephew of the famous Cornelius Whitehouse, and himself an inventor. His patents are for making wrought iron spouting from a plain strip; and for making tubular ladders, barrow wheels, etc. He is also patentee of the bell for making bedstead, handrail, and other tubes of a similar character for fencing. The Works are in Friar Street and Crankhall Lane, and since 1887 (when Mr. T. Pritchard retired) they have been carried on by Mr. A. E. Pritchard.

GRIFFITHS AND BILLINGSLEY. The Victoria Tube Works, Alma Street, were founded in 1858 by Isaac Griffiths, John Griffiths, and Thomas Billingsley. In 1868 Isaac Griffiths withdrew from the firm, and in 1879 John Griffiths died. Since that period Mr. Thomas Billingsley has conducted the factory as its sole proprietor. All the usual branches of the tube trade are followed, and core bars for iron-founders are made, with various other specialities.

EDWARD SMITH. The Brunswick Tube Works in Potters Lane is perhaps the most considerable in the town after Russell's. It possesses its own foundry and is a thoroughly equipped establishment.

JOB EDWARDS. The Eagle Tube Works in Portway Road are of recent date, as compared with Mr. Edwards fitting-making establishment, known as the Junction Works, in Potters Lane.

RATCLIFF AND FOSTER. These are new works at Lea Brook. The junior partner is the son of Mr. T. Foster, well known in the Wednesbury tube trade, who for many year was at the Crown Tube Work, and who with his colleagues Mr. Lambton Brown and Mr. John Cuxson erected the Old Tube Work in Wednesbury Old Field, and which was carried on as Brown and Co., for a few years.

JAMES MCDOUGALL. The Hope Tube Works in Elwell Street were established some sixteen years ago. Mr. McDougall, who patented a process for making bedstead tubes[°] by an extremely expeditious method, has kept almost entirely to this branch of the trade. Since he died (last year) the place has been conducted on the same lines by his sons.

[°]*Iron bedsteads were invented by Dr. Church, an ingenious gentleman connected with the Wednesbury district many years ago. He also invented a new kind of cannon which were first cast at Wednesbury Oak Works* (*See page* 34).

XV.—THE TUBE FITTING TRADE.

THE first gas tube was merely a length of several gun-barrels screwed together. Consequently the first "fitting" called into existence was a socket, screwed inside, into which the screwed ends of the tube or "barrel" were fitted. From the simple straight socket, sprang the angular fittings; the diminished and the enlarged fitting, with male and female screws; and so on, as necessity called each variety into existence.

It may be noted before proceeding further, that previous to the invention of the wrought-iron tube, gas was first laid on by means of brass pipes,[°] jointed together with copper "fittings"; and the earliest form of gas bracket, gas standard, or gas pendant, was in exact imitation of the candle-stick or candelabrum which had preceded it in the provision of artificial light.

When coal gas was first introduced to the notice of the public with any measure of success (as it was in 1798 at the Soho Foundry) a problem that occupied many active and ingenious minds was—How is the new illuminant to be conveyed? An answer, practical and complete, was soon forthcoming from a Wednesbury inventor. Cornelius Whitehouse crowned the efforts of Murdoch as completely as Stephenson developed the ideas of James Watt.

Many are the anecdotes told about William Murdoch in connection with his discovery, towards the close of last

[°]*Specimens of these earlier gas pipes were taken out of the White Horse Hotel, Bridge Street, during recent alterations to the premises.*

century, of combustible air or gas. So little was the invention understood and believed in by those who had not seen it in use, that even great and wise men laughed at the idea. "How could there be light without a wick?" said a member of Parliament, when the subject was brought before the House. Sir Humphry Davy ridiculed the idea of lighting towns by gas, and asked one of the proprietors if he meant to take the dome of St. Paul's for a gas meter. Sir Walter Scott made himself merry over the idea of illuminating London by smoke, though he was glad enough not so long after, to make his own house at Abbotsford light and cheerful on wintry nights by the use of that very smoke. When the House of Commons was lighted by gas the architect imagined that the gas ran on fire through the pipes, and therefore he insisted on their being placed several inches from the wall for fear of the building taking fire. The members might be observed carefully touching the pipes with their gloved hands, and wondering why they did not feel warm. The first shop lighted in London by this new method was Mr. Ackerman's, in the Strand, in 1810; and one lady of rank was so delighted with the brilliancy of the gas lamp on the counter that she asked to be allowed to take it home in her carriage.

It was at one time attempted to join wrought gas-tubes together as cast-iron tubes are; being made a little wider at one end than at the other, the narrow end was inserted in the wider one and "packed." The real solution of the problem was discovered, as recorded on p. 84, the year previous to the registration of Cornelius Whitehouse's patent. This was a "forged" socket; but tools and swages for any other fitting than a plain socket were not yet thought of.

Wrought-iron gas tubes were therefore at first "fitted" together by cast-iron "fittings;" great quantities of these were made at Blakemore's Foundry in Union Street, particularly *Tees* and *Elbows*—as the two joints one in the shape of a letter T, and the other of an elbow crooked at right-angles, were called. The first wrought-iron fitting was forged at James Russell and Sons' Works, by a workman named Willetts, who used an ordinary blacksmiths swage on his anvil for

the purpose. The early attempts were confined to the forging of plain sockets, tees, and elbows; but with the gradual development of better tools and newer swages came the easy and rapid forging of crosses, diminished sockets, and other fittings for complicated joints. An expert forger of fittings, when working on large sizes, could earn many pounds per week; while the forging of small fittings was a very remunerative employment. This gave rise to the growth of a number of out-workers' shops all over Wednesbury; but with the decline of trade after the year 1875, the extinction of these gradually set in, and at the present time very few fitting-makers' smithies are to be found, the tube-manufacturers generally preferring to employ their own fitting-makers to work on the ground. The fitting factory of any considerable importance in the town is that of John Knowles, Walsall Street Works, who does a very large continental trade, and makes every description of fitting (and in every size, too, which makes the number of separate productions run into a large figure —the pigeon-holes in the warehouse number 500). Besides those already mentioned, there are fittings known as flanges, caps, plugs, backnuts, nipples, union bends, cocks, spanners syphon-boxes, tuyere coils, &c., &c.

Another establishment is that of Joo Edwards, Junction Works, Potter's Lane. At this establishment were produced, in considerable quantities, the bicycle in its original form, with the hickory wheels. This was in 1868; but this new trade was allowed to die out when the invention of the spider wheel came up.

James Russell and Sons, Limited, have a separate fitting factory in Walsall Street, next the Baths. Most of the tube manufacturers in the town make their own fittings on the ground. In fact several tube makers started life merely as "fitting" makers. There are no other separate factories, except small out-workers, and very few of these.