



# DERBYSHIRE MISCELLANY



Memorial to Sir Joseph Whitworth in Whitworth Institute Grounds, built by public subscription (1894)

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L E T ' S   T R Y   I T

The Life of Sir Joseph Whitworth

by Ernest Paulson

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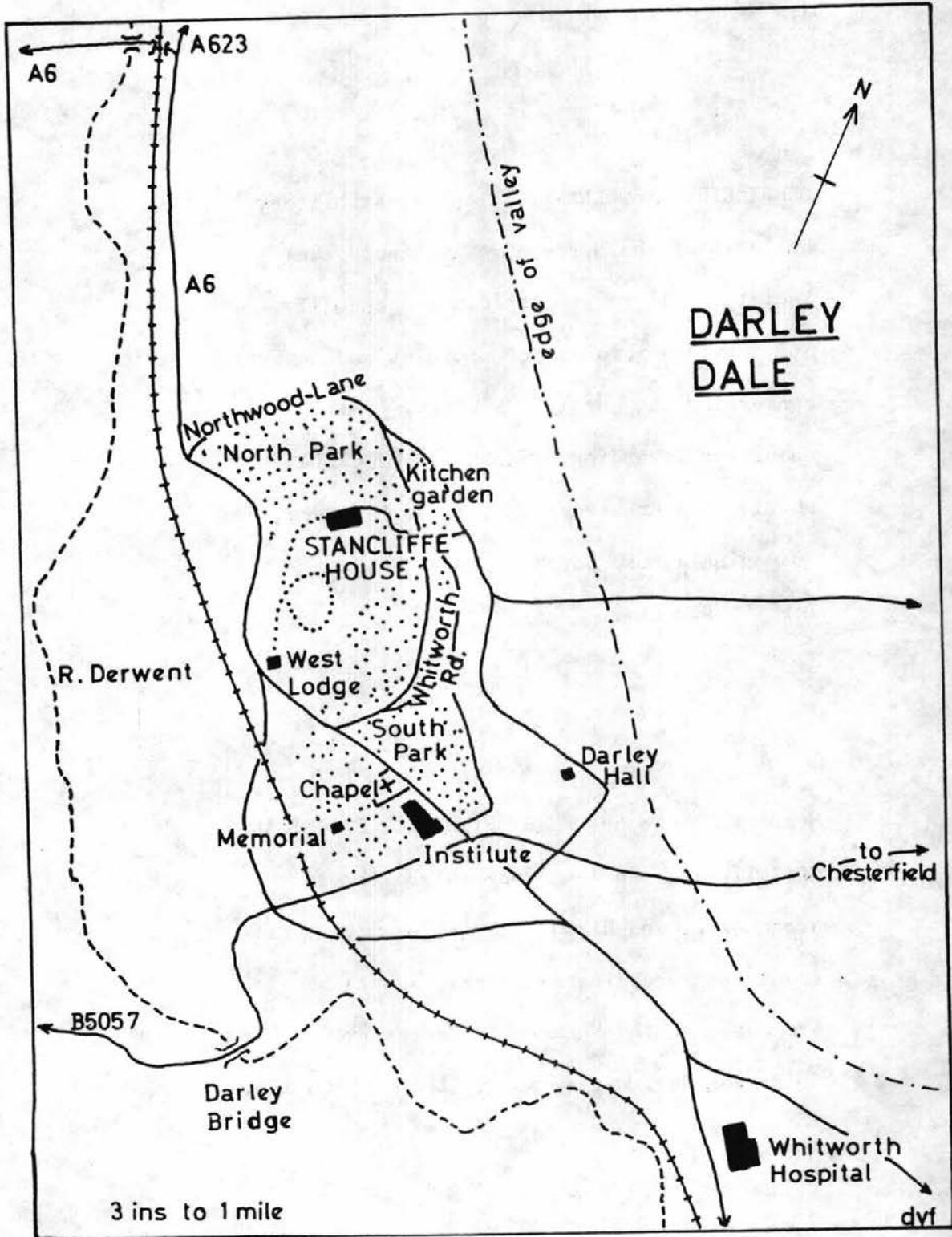
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## JOSEPH WHITWORTH, Master of Iron

### I

To industry and the industrial historian Whitworth means the first true plane surfaces, the Whitworth screw threads, the standardisation and mechanisation of engineering production, guns and armour plating, machine tools and, above all, method. To Darley it means the Whitworth Institute, the Whitworth Hospital, scholarships and Stancliffe Hall with its lovely garden which was destroyed to make a great quarry which is now worked out. The one a story of continuing, deserved success, the other of almost complete failure.

Joseph Whitworth was born in Stockport, Cheshire, on 21st December 1803, the son of Charles and Sarah Whitworth. His mother was a Stockport girl, but his father may have been of the family of Earl Whitworth, the owner of Knole Park, Kent, and an estate in Lancashire and who was a diplomat well known to Napoleon - and Jeremy Bentham, the utilitarian whose gospel was the 'greatest happiness for the greatest number'. The possibility is worth investigation.

At the time of his marriage, Charles Whitworth was a schoolmaster and reedmaker and almost certainly a Dissenter. Subsequently he became a Congregational parson at Shelley, Leeds and later at Walton, Liverpool.<sup>1</sup> The two occupations went well together for, at the beginning of the nineteenth century, church organs were few and far between and the congregational singing was led by amateur orchestras. There is a clarinet in the collection of instruments played in Baslow church in the Old House Museum at Bakewell.

The first twelve years of Joseph Whitworth's life were spent at home where he probably picked up the rudiments of his education in both the three Rs and workshop practice. When he was fourteen, both father and son went to William Vint's Academy at Idle near Leeds. The schooling the boy received there was probably spartan but thorough and it was certainly effective, for it spurred him on to great efforts and also gave him the respect for and appreciation of education which bore such effective fruit in the founding of the Whitworth Scholarships in Engineering, his interest in Manchester University, Openshaw Technical College and the Idle School Board - and his endeavour to give Darley Dale a really good school.

At the end of two years Charles Whitworth moved to Shelley as a Congregational parson, but Joseph had to start work. He was sent to Ambergate, Derbyshire as an apprentice in his uncle's spinning mill. Here an inborn aptitude for machinery enabled him to master the processes of cotton manufacture very quickly, so that in two years he was assisting in the management of the mill, but not of the business. He had little interest in the commercial side. He was thorough, accurate and painstaking and the time he spent in getting the machines to work to his satisfaction was not always acceptable to his uncle, who could see valuable time and money being lost whilst the perfectionist worked. Eventually the matter came to a head when Whitworth was eighteen and rather than become a mill manager, he braved family disapproval, left Ambergate and became a mechanic in the works of Creighton & Co., the Manchester machine makers. Later he worked for various other firms in the Manchester area, always enlarging his experience. After four years he became a journeyman, earning more than he had ever earned previously, a fact which pleased him greatly.

During his work he had come into contact with the work of the London engineers, Clement & Field, Galloway, Bramah and Maudslay and had realised that there were far greater opportunities with them than in Manchester and it was not long before he was planning a move southwards. On 15th February 1825 he married Fanny Ankers, the daughter of a Tarvin, Cheshire, farmer - Richard Ankers of Hall or Home Farm<sup>2</sup> and shortly afterwards moved to London to a post in Maudslay's works in Westminster Bridge Road. There he first encountered power tools, plane surfaces and work done to far higher standards of accuracy than he had met before. Where Manchester was satisfied with 'to a full eighth or a bare sixteenth' Maudslay demanded thirty secondths and even smaller tolerances - and got them. This spurred Whitworth on to such an extent that before long Maudslay placed him next to his best workman, John Hampson, and part of the bench equipment was a scraped plane surfaced plate.

When he had mastered the work being done at Maudslay's Whitworth moved to Holzapfell's and then to Joseph Clement where he found what he wanted. Charles Babbage's calculating machine was being built there and in helping to build it Whitworth had to contend with many identical parts and the need for a very high standard of accuracy in his work. In fulfilling those requirements, Whitworth came to realise what could be done with iron.

His work confirmed two ideas first encountered at Maudslay's - the need for the standardisation of screws and the need for true plane surfaces. He probably dreamed of boring identical holes and fitting standard nuts and bolts into them to find that the next bolt he had wouldn't fit because it was too thick and the one after that was too thin. Similarly two moving parts close together would jam when they should have passed each other. Whitworth must often have cursed the grinders as he scraped away at irregularities on a surface which should have been without them.

As he worked away, the idea of starting his own business began to grow and as a first step to its fulfilment he studied the long neglected book keeping and accounts, obtained a good grasp of business methods and came to write a clear if painstaking hand. When he was satisfied that he could learn no more in London, he and his wife moved back to Manchester, took a small house and a room in a mill in which were many small businesses, all powered by a single steam engine at the rear of the premises. A year later the sign JOSEPH WHITWORTH, TOOL MAKER FROM LONDON moved to another mill in Chorlton Street and Whitworth was able to engage more labour.

Money must have been very tight for the first few years. The mill had to be fully equipped and raw materials purchased and Whitworth would have only the best. If a tool proved to be unsatisfactory he re-designed it or made another himself. A screw cutting machine which he patented brought him more money than the rest of the miscellaneous jobs he did in his first year. Repair jobs, taps and dies and the like did not bring much in and the machine for fluting textile machine rollers brought him only £18. 0. 0. Living expenses of only £6. 0. 0. per month and a wage bill of £2.10. 0. rising to £50. 0. 0. at the year end shows that his start was not easy.

The three things he learned at Maudslay's were the rocks on which he built his business; true plane surfaces, uniform screws and accurate measurement. From the first these were evident in all that he produced and the roller fluter paved the way for a stream of machine tools for textiles, railways and the rapidly mechanising industries of Britain. Between 1834 and 1849 he took out fifteen patents for machine tools, each one superbly made to his own design and machined to a high degree of accuracy.

On 8th December 1840 Whitworth read a paper on the method of obtaining True Flat Metallic Surfaces to a Conversazione at the Royal Victoria Gallery of Practical Science in Manchester. 3 In it he said:

'It will be evident from a little consideration that a true surface cannot be obtained by grinding ..... Where a true plate is provided as a model for the work in hand ..... colouring matter such as red ochre and oil is spread over the surface plate as equally as possible. The work in hand is then applied thereto and moved slightly to fix the colour, which, adhering to the parts in contact, afterwards shows the prominences to be reduced by the scraping tool. This operation is frequently repeated and at each repetition a smaller quantity of colouring matter is used, till, at last a few particles spread out by the finger suffice for the purpose, forming a thin film over the brightness of the plate.

The latter case (where an original surface is to be prepared) is more complicated and requires considerable skill in the mechanic. Three plates are got up together and serve mutually to correct their own errors.'

In the discussion which followed Whitworth made it clear that where a planing machine would do the work sufficiently accurately, scraping was not necessary. The scraping process is subsequent to the use of the planing machine.

A demonstration of the sound made when one perfectly flat surface was allowed to fall on another showed that there was a dull, dead sound instead of the usual clang. This, said Whitworth, was due to the air preventing the plates from coming directly into contact. 4

He never tired of stressing the importance of scraping, not grinding, to secure a plane surface. As late as 1856, when his surface plates were in general use, he was still emphasising 'the vast importance of possessing a true plane as a standard of reference. All excellence of workmanship depends on this.'

The work on true planes progressed naturally to exactitude of measurement which was developed between 1840 and 1850. Two vertical, parallel plane surfaces, one fixed, one moveable by a calibrated screw were used and it was found that an iron bar, held between the two planes, fell if the distance between them was increased by a very small amount. The moveable plane was fixed to the axle of a large wheel and the axle was threaded with twenty turns to the inch. The circumference of the wheel was divided into five hundred equal parts. If the wheel was turned through one division, it moved one five hundredth (0.002") of a turn, the distance between the planes was increased by one ten thousandth (0.0001") of an inch and the bar dropped.

A later, even more accurate machine, described to the Institute of Mechanical Engineers in 1859 and depicted on the base of the obelisk in the Whitworth Park at Darley Dale worked to a millionth (0.000001") of an inch. This machine was so accurate that it could detect the difference in length of a standard iron bar warmed by the pressure of a man's hand.

This micrometer was used to produce Whitworth's standard measures and gauges which rapidly became standard equipment in factories all over the world.

He next turned his attention to the standardisation of screw threads, first suggested in 1841. Screw bolts were collected from all the major engineering works. All were different. He had noticed that at Maudslay's and Clement's whilst the bolts were uniform throughout each works, the depth, pitch and angle of the thread at Clement's were not the same as at Maudslay's. At other works each nut and bolt was unique in itself - hand cut with screwing tackle. Lose the nut and you could throw the bolt away. Having looked at them all, Whitworth proposed a compromise. He averaged them and proposed an angle of  $55^{\circ}$  for the V and a constant proportion of 0.64 between depth and pitch - and he used decimal, not vulgar fractions; he was a constant advocate of the decimal system as it was less cumbersome than vulgar fractions. When he patented his screw cutting machine, this, too, rapidly became standard engineering equipment. The Whitworth threads were not superseded until the British Association Standard thread was adopted for threads under  $\frac{1}{4}$ " diameter about 1920 and the American thread with an angle of  $60^{\circ}$  was introduced for larger screws after the Second World War. A modern introduction is the Metric thread for all sizes.

At the Great Exhibition of 1851 Whitworth's patented tools and inventions gained him a gold medal and recognition as the foremost mechanical constructor of his time. These advances led naturally to standardisation. Nowadays we take for granted that a new light bulb will fit the existing socket in the lamp, that a size nine shoe bought in Inverness will fit as well as one bought in Brighton - if one takes size nine - and that the right numbered ribbon will fit a typewriter. Great grandfather and his great grandfather didn't. Their boots were made by the village cordwainer and their suits by the village tailor and both were carefully preserved.

Whitworth put it rather differently. In 1855 he wrote to The Times to point out that the engines of ninety gunboats for use in Crimean waters were completed in ninety days as matching parts had been produced by many different firms by the use of standard gauges. At Stancliffe he is reputed to have said to his agent that if he could produce workmen as uniformly fitted to their work as the machined stones which were being used to build his garden wall, he could halve his staff.

This awareness of the advantages of standardisation is emphasised in the report in 'The Engineer' of 1856 which states 'Mr. Whitworth contrives to effect a considerable saving of time and labour by adapting the work to his tools.' He altered the traditional shape or form of machine parts whenever it was advantageous to do so in order that they might be produced by machine tools, so that the lathes, shaping, drilling, planing, bolt producing and nut producing machines which he showed at the Great Exhibition won him an international reputation. He carried the same idea into his works by paving both the Chorlton Street and Openshaw works with stone slabs of an exact and uniform size to save time and trouble when measuring up to erect new machinery. His defence of this exactitude was that it cut production costs and working hours to leave more time for rest, recreation and education, whilst the men could earn higher wages and so increase consumption.

## II

After his success at the Great Exhibition, Whitworth was appointed to the 1853 Royal Commission to visit the New York Industrial Exhibition. He approached this task in his usual painstaking way, but the incomplete state of the machinery department made it impossible to report upon it. He then undertook a trip through the industrial districts of the eastern United States, visiting Pittsburgh among other places and on his return published,

in conjunction with George Wallis, The Industry of the United States in Machinery, Manufactures and Useful and Ornamental Arts, (London 1854). The first twelve short chapters dealing with machinery were written by Whitworth and stated that although American machine tools were, in general, inferior to those in use in Britain, they were used with an eagerness which was in sharp contrast to the Luddite mentality prevalent in this country. There were no strikes or organised opposition to their introduction and this he attributed to the superabundant labour force here and the lack of education of the British work force. No doubt he would say the same today.

It was after this visit that he turned his attention to the semi-derelict estate at Darley Dale, on the market since 1847, and the village then dependent on agriculture (controlled by large land-owners, many of whom were absentees), frame-work knitting and work in Arkwright and Smedley's mills. He decided to purchase the estate and turn Darley into a thriving, well educated community. To what extent he was influenced by the works of Robert Owen is open to question, but Owen had been a Manchester mill manager and Whitworth was a frequent visitor to Glasgow.

One such visit was as President of the Institution of Mechanical Engineers, when he delivered a paper which emphasised his favourite projects. He deplored the cumbrous, weighty parts of machinery, the wasteful multiplication of sizes and patterns and advocated the decimalisation of weights and measures. Soon afterwards he published a book of five papers entitled Miscellaneous Papers on Mechanical Subjects, (London, 1858). He had been elected to the Royal Society in 1857 and further honours came his way in 1863 and 1868 when he was awarded an LL.D by Trinity College, Dublin and a D.C.L. by Oxford University.

In 1854 had begun a period of intense work and intense frustration with the Government and War Office Committees whose procrastination and conservatism infuriated him. The visit of the War Office representative whom he declined to see immediately belongs to this period (see below). He had been requested by the Ordnance Board to design machinery for the production of the Enfield rifle, newly adopted by the Ordnance Board for the Army. This Whitworth flatly refused to do. He knew nothing of rifles or any other gun and it was against his principles to take on anything unless he knew everything about it by trial and error. After protracted negotiations, the Board finally agreed to set up a shooting range at Fallowfield and there Whitworth began a series of ballistic tests in March 1855.

He found the 0.577 Enfield totally unsatisfactory. The rifling was inadequate, the bullet too short and the bore too large. After he had started from scratch on a long series of experiments - his favourite maxim was "Let's try it" - he produced the Whitworth rifle - 0.45 calibre, long bullet, hexagonal bore with more twists to the rifling to impart more rotation to the bullet. (The bullet was 3 to  $3\frac{1}{2}$  calibres long and there was one turn to twenty inches in the rifling). In April 1857 The Times reported that 'the rifle excelled the Enfield to a degree which hardly leaves room for comparison'. It shot more accurately, had greater penetration and carried much farther than the Enfield - and the War Office rejected it as being of too small a calibre for a military weapon! Ten years later their lordships changed their mind and said that a rifle 'with a 0.45 inch bore would appear to be most suitable for a military arm'. Had the Colt 45 anything to do with this?

Whitworth was furious. It was his first rejection. His only consolation - then - was that his rifle was adopted as the best known by the National Rifle Association and that at the 1860 meeting of the N.R.A. Queen Victoria fired one specially set up on a plane surface on a fixed stand and hit the bull within one and a quarter inches of its centre at four hundred yards. Later the rifle was adopted for the French Army and many were exported to the U.S.A. and used in the Civil War by snipers.

The Martini-Henry rifle, introduced later for the British Army, embodied many principles of the Whitworth rifle in its construction.

Whitworth next turned his attention to artillery, but his relations with the Ordnance Board were at such a low ebb that it hardly considered his rifled gun of 1862 in spite of its six mile range and 250 lb. shell. The gun was tested on Southport sands in 1863 and proved that it could pierce the hitherto invulnerable  $4\frac{1}{2}$  inch armour plate, but in 1865 the Board adopted the Woolwich cannon and Army gunnery was retarded for twenty years. A wooden model of the projectile for this gun was set up on the gable ends of the cottages Whitworth built in Green Lane, Darley. Some still survive. <sup>5</sup>

Again the gun found favour overseas and examples of it can be seen at Gettysburg today. <sup>6</sup>

This 'battle of the guns' attracted immense public attention for several years and embittered Whitworth's relationship with Government circles for the rest of his life, but was the Ordnance Board wholly to blame? Almost certainly not. It was a case of the irresistible force meeting the immovable object. Both knew they were right and neither would compromise. Whitworth never did. My great-uncle was sacked by him at a moment's notice after an incident for which he was blamed but not responsible, grudgingly re-instated on the appeal of Lady Whitworth who had seen the incident, but soon left his employment and joined the railway.

After this rejection, Whitworth turned his attention to the steel from which the guns were made. <sup>7</sup> He had had several bursts in his experiments as the hard steel was not really suitable for cannon and came to the conclusion that he must use ductile steel. This, however, tended to honeycomb when made and it was not until after many experiments that he decided to try hydraulic pressure instead of the steam hammer. In 1870 he produced his first big guns made from this steel and in 1875 he described the method of manufacture in his paper given to the Society of Mechanical Engineers. The paper received wide attention and in 1883 the Gun Foundry Board of the United States government visited Openshaw. In their report they said that 'the experience enjoyed by the Board during its visit amounted to a revelation'.

This was the last of Whitworth's great discoveries and inventions although he later did some great work on stone cutting machinery whilst at Darley. At the Paris Exhibition of 1867 he was awarded a Grand Prix and Napoleon III made him a member of the Legion of Honour. He received the Albert medal of the Society of Arts for his work on instruments of measurement and standardisation and in 1869 he was created a baronet for his generosity in founding the Whitworth Scholarships of £100 each 'to be competed for upon the basis of proficiency in the theory and practice of mechanics'.

For many years he had resided at The Firs, Fallowfield, although he had bought the Stancliffe Estate at Darley in 1856. In October 1870 his first wife died and six months later he married Mary Louisa Orrell, daughter of

Daniel Broadhurst and widow of Alfred Orrell of Cheadle whom he had first met at the home of the Bower-Potters at Darley Hall. She was twenty-six years his junior and at forty-three, with a marriageable daughter, she was not prepared to stay at The Firs. Soon after the marriage the Whitworths moved to Darley.

This may have been an inconvenience to Whitworth. He had lived at The Firs since 1845 and personally supervised his works from there. He was contemplating a move from Chorlton Street to a new site at Openshaw, a move which took place in 1880, and was busy with plans. He was also converting the private business to a limited liability company. In spite of the move to Darley, the company was floated in 1874. Whitworth and 22 of his associates held 92% of the stock and £25 shares were sold to his workmen. It was a good thing for him that the railway had been extended from Rowsley to Manchester in 1872 and that he could catch the expresses at Matlock. To what extent he was responsible, directly or indirectly, for the building of the line from Rowsley to Chinley is not known, but it certainly was a great convenience.

### III

#### SIR JOSEPH AT STANCLIFFE

The move to Darley was a mistake which Whitworth must have privately regretted. His desire to live in a style befitting his baronetcy, his wife and his reputation as one of the foremost engineers of his day all conspired to keep him where he was a fish out of water. In industrial Manchester, at the head of the great engineering works he had built up, he was secure and confident of getting what he wanted done with the active co-operation of his workforce; in Darley he was uneasy, retiring and only too well aware of the active non-co-operation of the church and the other landowners and local gentlemen. Yet his pride would not permit him to go.

He bought Stonecliff in 1856.<sup>8</sup> He had bid £31,000 for it at the first sale of Mrs. Hubbersty's estate in 1847, but the properties had been withdrawn. Nine years later, after two years negotiation, he bought it for £33,850 - and an unspecified post for Philip Hubbersty.

He is supposed to have decided to buy it when, as a very young man, he had walked through Darley on his way to Manchester from his first job at Ambergate. For the next ten years he planned, scrapped and planned again in the intervals between his engineering achievements. What he had bought was not encouraging. The turnpike road ran past a working quarry, across fields belonging to Mrs. Melland the quarry owner, was joined by other lanes in front of the small manor house, ran down alongside the house to a clutter of old farm buildings and then ran across the fields to Northwood where it joined the old packhorse route from Chesterfield to run steeply downhill to Gipsy Lane and Rowsley. Dotted about the hillside were several owner-occupied cottages, each with its plot or fields and the owners were loudly assertive of their rights and privileges and very suspicious of the new owner, who was a 'furriner' and therefore condemned before he appeared. Darley Hillside had seen too many owners of Stonecliff to welcome another. Steere, Beard, Greensmith, Heathcote, Hubbersty - all held the property between 1700 and 1847. Surveying it, the new lord of the manor must have been reminded of the multitude of different screws which had led him to develop the Whitworth thread and he determined to tackle the problem in the same way. He would standardise the whole area by owning the whole area and improving it to his own satisfaction. That he could fail to do so never entered his head.

He tried; to a large extent he succeeded, but not completely. Every sale catalogue which included property in Darley was sent to him. They still came in 1897, ten years after his death, but some owners would not sell to him, others bought and sold privately, others just held out to spite him. The trouble was that he didn't understand his people. He was not one of them. Take Jakey Millward<sup>9</sup> as an example - Jacob Millward and his mother owned a field known as Taylor's Piece and a cottage with an outside staircase which overlooked the Hall from Bent Lane. Below it was a field which Sir Joseph proposed to turn into his kitchen garden, complete with an elaborate greenhouse. Ashton and Davenport who also owned land on Bent Lane, west of the Millwards, sold but the Millwards flatly refused. Already Whitworth owned the land to the east and the price he offered was fair.

Whitworth was not pleased and after one interview, took his leave inferring that they would have to sell eventually. In doing so he really offended Jakey who wanted to bargain and do better than Ashton and Davenport if possible, but Joseph Whitworth made no further offers. He'd stated his price - the rest was up to Jakey.

When he realised this, Jakey became a nuisance to Whitworth. He kept the Hall and garden under close observation and is said to have mounted a telescope at his bedroom window to see better what was going on. Not only did he watch - he commented, loudly, caustically and impolitely.

Whitworth stood it for a long time, then acted. He surrounded the kitchen garden on three sides with an eight foot high stone wall and the wall ran less than twenty yards from the front of Millward's house. Jakey could see nothing. This, however, did not deter him. Halfway up the steep slope behind the cottage was an outcrop of sandstone. Jakey walled this round and made a new lookout. Whitworth could do nothing about it. His only consolation was that he couldn't hear the comments.

Then came an opportunity to drive Millward out. The overflow of the spring which fed the trough at the old forge at the junction of Bent Lane and Fogg's Hill had made walling difficult and others hindered work on the kitchen garden. If he piped them away right and left of his property, reserving only a supply for his own use, the cottage would have no water and the nearest trough was two hundred yards away. Surely that would force Millward to move. The work was done, but still the Millwards refused to move. It was not until after Jakey's death in 1903 that the Stancliffe Estates secured the property and they did it by exchanging it for a house, two acres of land and a cash payment of £76.00.

The ease with which Whitworth antagonised people was his greatest defect. He was no diplomat and he could not stand inefficiency. An employee was warned once if he made a mistake. If the error was a bad one, he was sacked out of hand. At Fallowfield this produced efficiency and the works were as efficient as he could make them. The long shops were paved with uniformly-sized stone slabs, the machines each driven by a steam-powered belt were well spaced out, the tools performing related functions were placed near to each other to allow the work to flow, there was an overhead travelling crane to carry the heaviest castings and a 'friction windlass' was attached to each floor column. All this, with the adaptation of the shape and form of the parts to suit the machine tools, saved both time and labour.

In 1856 The Engineer reported that 'in designing details of the machinery, Mr. Whitworth contrives to effect a considerable saving of time and labour by adapting the work to his tools.'

It was not so in Darley. The locals resisted change, refused obstinately to comply with his wishes and behaved exactly as one would expect them to behave. This did not suit the impatient, perfectionist owner of Stancliffe. Seeing the other man's point of view was an impossibility for him. The two who opposed him most wholeheartedly and eventually beat him were Samuel Holmes of Torside and the Rector, Frederick Atkinson.

The disagreement between Holmes and Whitworth was over water and the slipping of the main Matlock to Bakewell Road. This road had been made in 1817 by Heathcote Heathcote and the Darley Dale Stone Company to do away with Northwood Road and Hillside Road. From Stancliffequarry to the boundary of Holmes' land the road was made of huge blocks of sandstone, macadamised and stable. Over Holmes' land the macadam had a foundation of smaller stones over shale. It slipped often - and is still slipping.

A statement and three letters which survived the wholesale burning of Sir Joseph's private papers after his death sum up the whole affair.

44 Chorlton St.,  
Manchester.

28 February, 1867

Dear Sir,

From the inspection which I made yesterday of your premises and the land adjoining belonging to you and to myself I feel assured that the upheaving of the land in some places and the sinking in others has been caused by the unusual quantity of rain which has fallen this winter.

The remedy will doubtless be found in cutting a deep drain through the shale in your field commencing near the wall and continuing it to the present drain which empties itself into the river.

I am sorry you objected yesterday to my men cutting a short, deep drain in your land in order to see more clearly what ought to be done. After seeing you, I instructed Mr. Dawson to have a trial hole cut on the other side of the road on my land, but as I have no outlet it can do no good except to see the state of the substratum.

In your letter of the 25th instant you state that the superincumbent weight of the earth and stone which has been deposited upon that portion of your property immediately above my premises and the letting in of so much water has very seriously damaged my dwelling house together with the out-buildings etc.

If you will see Mr. Dawson he will show you that many hundreds of tons of earth and stone have been removed from the slopes above your house and land and therefore it can only be the accumulation of water that is doing the mischief. As you are aware, a stone drain has been laid down the centre of the carriage drive, but the water percolates through and I propose to lay in this drain pipes, in order to convey the water down the dell and also to the north park.

It appears that the foundations of your walls and buildings are partly on rock and partly on the shale and which being the case, are very susceptible to injury. I observed in the outside walls several large cracks of older date from some previous settling.

I am, dear sir,

Yours truly,  
(signed) Joseph Whitworth

To: Mr. Samuel Holmes  
Darley Dale,  
Derbyshire.

Hardly the kind of letter to send to a resentful, suspicious neighbour!

The matter dragged on for another six years, Whitworth continuing to construct the carriage drive and trying to compel Holmes to allow the drain to be dug, Holmes flatly refusing to allow anything to be done although his house was becoming increasingly unstable and in 1873 Whitworth made an effort to force his neighbour's hand by appealing to the local Government Board. A statement was taken from Henry Wall and sent with an accompanying letter to the Board - of which Samuel Holmes was a member. By this time Whitworth was living at Stancliffe.

Stancliffe

18 January, 1873

#### Removal of Bank - Tor Side

Henry Wall says that he remembers the road which passes Calder Well being made and that his father was one of the contractors for the necessary work. Joseph Elliott of Rowsley was the other contractor. The Surveyor under whose direction the road was made was a Mr. Gantley of Bakewell. He thinks that the road was made in or about the year 1817. He very well remembers that there has been a slipping of the earth and the jutting of the wall all along the site of the present slip ever since the road was made. He says that the wall was never sound and that the earth had to be removed before the wall was rebuilt and remembers that in passing, his father often remarked that the wall was constantly falling down. He further remembers the wall in front of Mr. Holmes' house falling down and being rebuilt by George Stone perhaps a dozen years since.

Henry Wall says that his father was one of a party of men who were employed to repair the road between Cromford and Rowsley for several years and this is one reason why he can speak so confidently about

the slipping of the road and the falling down of the wall.

When his father gave up working upon the road, he was succeeded by a James Rawson, Thomas Bateman and others. These were succeeded by Robert Dunn and his son Thomas Dunn. After these, George Dunn, who kept the Toll bar at Two Dales. He is now dead, but his father, Henry Dunn of Matlock, would be likely to know a great deal about the roads in the neighbourhood. He is brother to William Dunn to drives Mr. Smith's horse and cart.

The letter which Sir Joseph sent to the Board with the statement was not one which the Board was likely to consider favourably.

Gentlemen,

Permit me again to call your attention to the slipping of the land that is taking place on the Turnpike Road and on both sides of it, commencing about 160 yards past Cawdor Well.

The greatest disturbance of the land is (in front of Mr. Holmes' house) on my side of his wall which separates his land from mine. Near this wall, in my land, a large body of water rises after rain which partially escapes through a drain under Mr. Holmes' wall.

I had a trench cut in the early part of last year and the flow of water was at the rate of one gallon in seven seconds, the weight being about fifty five tons in twenty four hours. I should wish to make this trench eight to ten feet deeper and carry a deep drain from it under the road and through Mr. Holmes' land into a drain which passes through my land into the river.

The low level of Mr. Holmes' land on the west side of the road opposite the trench affords every facility for getting rid of a large volume of water.

For some singular reason Mr. Holmes has hitherto refused to allow a drain to be cut through his land, but the slip has now become so serious that I consider the Board ought to take some steps in the matter.

Perhaps if the Board made representations to Mr. Holmes, he might allow the requisite drain to be made.

I feel quite sure that if Mr. Holmes had consulted a competent engineer he would have been advised to cut a drain through his land for the preservation and improvement of his own property.

I remain, gentlemen,  
Yours faithfully,  
(signed) Joseph Whitworth

The Board's reply to this dictatorial missive is missing, but the Board refused to have anything to do with the affair.

In 1876 the matter flared up again, Sir Joseph was in London, so Mr. Holmes' furious letter was sent to Joseph Dawson.

Sir,

I have this morning been looking at the bank wall which you are putting in behind my house and as I understand from the men working there that it is not your intention to give and take as I perfectly understood when I saw you there, that it was to be so. I must request that you will cease any further encroachment upon my right of road.

I am willing to meet Sir Joseph and yourself in a fair and honest way in carrying out your improvements, but let justice be our guide.

If convenient, I should like to see you this morning. It might prevent any unpleasantness arising.

Sam Holmes

Mr. J. Dawson.

The wall, designed to divert the flooding water from Holmes' house was never completed. Samuel Holmes held out until his death in 1903. His son sold the land to the Stancliffe Estates and built a house on the other side of the road. The ruins of his father's house can still be seen. The road still slips.

#### IV

Although Whitworth bought Stancliffe in 1856, it took ten more years to buy out the quarry owner and the proprietors who had land which he needed to round off the estate. During this period, his representative at the Hall was Charles Lister, a Manchester lawyer. When work began on the Hall, Lister moved to the Abbey House and Whitworth embellished it with ornamental gates, a drive and inner and outer lodges. He also provided a piped water supply from Stancliffe and a high wall to separate the garden from the drive, which was a public right of way to the branch of the turnpike from Churchtown to Northwood.

Work then began on the estate. He appointed Joseph Dawson,<sup>10</sup> a landscape gardener trained by Paxton at Chatsworth, to lay out the gardens and park, and T. Roger Smith, an architect who worked in the French style, to prepare plans for the house and main lodge.

Dawson had three main tasks - to lay out the North and South Parks and to create the Dell - the beautiful gardens below the cliff through which the carriage drive wound its way.

The first requirement was privacy. That meant that the lanes crossing the park had to be closed or altered. Sandy Lane from the turnpike to Moor Lane, part of Northwood Lane from the turnpike to the northern edge of the estate and Cross Lane and Stancliffe Road where they crossed the

estate were all closed and a new road called Whitworth Road was laid out from the top of Northwood Road to Moor Lane on the eastern side of the park. This left South Park and the Dell ready for development.

Whilst Whitworth was engaged with the development of his artillery and experimenting with steel made under hydraulic pressure, Dawson set to work. He began to clear the Dell, the shallow valley leading from Moor Lane to the cliff and behind which Stancliffe Hall stands and to make sure that it was private. To ensure this privacy, he had a high bank thrown up on top of the western slope and it was this earthwork which provoked the trouble with Samuel Holmes.

When this was completed, the drive was laid out. From the gates it circled the Dell, ran up a slope to a road laid on top of the bank, crossed a bridge, ran down, circled to pass under the bridge and finally ran round the back of the cliff to the house. The drive was fully two miles long; in a straight line, the Hall is half a mile from the gates. Whitworth laid it out himself.

Work then began on the ornamental lake at the foot of the cliff, the lawns, flower beds and shrubberies and the planting of trees. Contemporaries said that Whitworth 'turfed the slope with banknotes'. Trees in full leaf were moved in enormous cast iron tubs to where he wanted them planted and such was the skill of the Darley nurserymen - Smith's Nurseries were at the height of their fame - that scarcely a leaf dropped. Other trees such as the great copper beech were planted for the best effect. The south side of Whitworth Road was fenced with ornamental iron palings so as not to spoil the view and finally the whole park was surrounded by stone walls, four feet high far from the house, but eight feet high near the house itself and a tunnel constructed under Whitworth Road so that Sir Joseph could go to the kitchen garden without being stared at. The final touch was the erection of a flagstaff on the top of the cliff to fly Whitworth's flag and the masoning of a table and chairs from sandstone. Like his Queen, Whitworth flew his flag when he was at home. Every man on the estate kept an eye on that flag. When it was up, everyone was on the 'qui vive', ready to work industriously, fade out of sight gracefully or stand still until the master had gone by. If the flagpole was bare, everyone relaxed until the bush telegraph told that Sir Joseph was on the turnpike.<sup>11</sup> Sir Joseph helped them in this. From the drive gates he constructed a mile-long dead straight road to the end of South Park to save having to make the long detour by Churchtown.

Meanwhile, work had begun on the house. Stonecliffe was originally the second house of the Columbells, who were lords of Darley from 1373 to 1721. It was sold to Sir Paul Jenkinson in about 1700 and he gave it to his daughter, Lettice, who improved it and sold it to Henry Steere of Bridgetown. In 1718 the Greensmiths, lead merchants from Wirksworth, bought it but a trusted agent ruined them in 1799 and it passed to William Heathcote of Batavia. His son, Heathcote Heathcote sold the property to Mrs. Hubbersty.

The original house was almost certainly a Derbyshire farmhouse like Nether Hall, with living quarters, stable, cowshed and cart shed all in line, but the Jenkinsons converted it into a small square house by building extensions to the front and one side and by demolishing the stable, cowshed and cart shed. Whitworth added considerably to this. The design of the additions and of West Lodge, was by T. Roger Smith<sup>12</sup> and the work was carried out in Stancliffe stone. In 1879 E.M. Barry, another architect with a reputation for his work in the style of the Loire Chateaux made further additions.

Behind the house was the North Park. There were stabled the thoroughbred hacks and coach horses. Sir Joseph also added a farm stocked with pedigree shorthorns, but as Northwood Farm was occupied by the Walls of the Fallinge, the farm had to be placed out of sight below the South Park.

The horses had to be the best. Sir Joseph travelled by carriage to Matlock to catch either the London or the Manchester expresses. The new road facilitated this, but the toll-house (tolls were not abolished until 1880) did not. Having to stop to pay was bad enough, but George Dunn was dilatory and not at all inclined to leave his bed for a carriage arriving late at night. Whitworth protested and fumed, but it did no good until one one winter night when he found the solution. When he reached Stancliffe he gave his coachman a guinea and directed him to drive from Stancliffe to Matlock and back again all night at irregular intervals. He was never delayed again.

Another annoyance when he travelled was that people would stand and stare as he passed. To this he objected strongly. The workers' houses which he built down Green Lane, each with a wooden replica of the projectile fired by his hexagon barrelled field gun mounted on the gable end and provided with a big garden and a pigsty, had no front doors and the windows facing the road were small.

By 1881 work on the estate was virtually complete, though he still bought land. It was then that Sir Joseph turned his attention to Darley. Lady Whitworth wanted him to build a hospital and he himself had seen that the Church schools at Churchtown and Two Dales were poor. He began to make plans and in his desire for perfection he made dozens. They were to occupy him for the rest of his life and his executors after him, but the results were only the Whitworth Scholarships, tenable at Lady Manners' School, Bakewell and the Ernest Bailey School, Matlock and Lady Whitworth founded those.

## V

Sir Joseph Whitworth was never a churchgoer. Even in his days as a journeyman engineer in London, he preferred to visit the work of other engineers and work out how much better it could have been done to going to church. When he came to Darley he did his duty as lord of the manor and no more. When he did have to go to church, he had his wife's carriage watched from the Lookout. When it reached the railway crossing he started himself, entered the churchyard by the North gate, made his way round the back of the church and entered as unobtrusively as possible just before the service started. It was a standing grievance with him that he had to walk half way

down the south aisle to reach the door in the 13th century stone screen which surrounded his pew. At the end of the service he left as unobtrusively as he had entered. If he encountered the ringers as he rounded the back of the church, the embarrassment was mutual. Neither looked at the other as he shambled past. Eventually Joseph Dawson dropped a quiet word to William Taylor, the head ringer and the band stayed in the ringing chamber for an extra minute or two on the days when Sir Joseph had to attend church.

Whitworth may not have been a churchgoer, but he knew the value of education. He also knew he could make a far better job of educating the youth of Darley than the church was doing, but his background was nonconformist. He had been at Vints' Academy, his father was a Congregational minister and he had given the land for Northwood Methodist Chapel in 1862. If he had any sympathy with any sect, then it was with the Methodists. They were educators.

What was to be a long fought, often bitter, battle opened as soon as Whitworth arrived in 1866.

Darley has had a church school for at least four hundred years. As late as 1945 attempts were made to keep Churchtown School as an aided school. The greatest of the Columbells of Darley Nether Hall (1564-1606) found a replacement for Robert Bistall who accepted a better job at Ashover in 1584 and in 1627 John Cantrell became schoolmaster. After five years he left for Stanton, but returned in 1633 before he, too, went to Ashover in 1645 only to return as schoolmaster for Darley, Winster and Elton for a year in 1655.

Others followed and from 1782 Thomas Gregory held the post of schoolmaster, clerk and general factotum until his death at the age of 93 in 1826. He was assisted by his son Thomas, a frustrated scholar, until his suicide in 1801. For the last few years of Thomas Gregory senior's life, the school was inoperative.

In 1830 Churchtown school was built, but by 1866 it was heavily in debt as many of the landowners refused to pay the parish rate to maintain it. Whitworth who had property of a rateable value of £3700, was among them. When the rate was abolished in 1867, he was asked to give voluntarily and his contribution of £10 per annum was maintained until his death in 1887. In return for this Joseph Dawson was appointed to the Church Committee, obviously to keep Whitworth informed. Only once was this sum exceeded. In 1886 £80 was given to save the school from closure.

Why was Whitworth so niggardly? The answer is that the Church refused to surrender any part of its control over the schools at Churchtown and Two Dales. At the 1884 vestry meeting a resolution to set up a School Board had been passed, but the rector, Frederick Atkinson, had refused to accept it and had insisted on a voluntary rate and special fund to maintain the school. Frederick Atkinson, formerly vicar of Long Eaton, had come to Darley determined to succeed where he had failed in his previous parish and keep schools, poor relief and all charitable work firmly in church and in his own hands. What he faced is illustrated by the report on Two Dales School by H. M. Inspector in 1884.

"I decline to recommend any merit grant. The attention of the Managers was directed last year to the necessity (there was) of providing a class room for the infants, but nothing has been done".

Atkinson immediately made a special appeal. Seventy parishioners gave £260.13s. 9d., including £32.10s.11d. in school pence and Whitworth gave 108 sq. yds. of land for the site.

Why didn't Whitworth give more? Why did he not contribute to the Two Dales Reading Room or the church alterations (1885)? This time it was due to the strained relations between the lord of the manor and the rector.

The idea for an Institute or Village College, long in his mind was being carefully planned and advocated. He had been one of the committee which established Owens Hall, later the Victoria University of Manchester and in 1868-9 the Whitworth Scholarships had been launched with the gift of £100,000. He had given generously to the Free Library and Technical School at Openshaw and was determined to establish a similar scheme in Darley.

As he planned, the scope of the scheme widened until it became what would have been an infants, primary and comprehensive school with playing fields and gardens and the emphasis would have been on technical education. Provision was also made for further education and a link with Owens Hall for outstanding pupils.

The College was to be built near West Lodge as a two-storied building round a quadrangle. The front of the Whitworth Institute today gives an idea of the planned size and appearance.

In the one plan which survived the burning of nearly all Whitworth's personal papers in 1887, but which has now disappeared, the front was to have a schoolmaster's house at one end, a billiard room, library and reading room, slipper baths and swimming baths. At each end, at right angles, were classrooms and workshops. In the fourth side, pierced by an elaborate gatehouse, were the infants and primary schools - and a kitchen.

Whitworth tinkered with this plan for years whilst the dispute raged, but it was never accepted by the Church. His executors carried on the fight. In 1893, R. D. Darbyshire, one of them, wrote to John Henry Dawson, who had succeeded his father on the Church Committee and was then Churchwarden.

"I have written you a letter which if you think fit, I cannot object to your reading (to the Committee). You must however judge whether this is desirable. It will NOT fall in with the Rector's views (F. Atkinson was still Rector) I dare say and it may be wiser to let him manage in his own way. Perhaps that will the sooner bring the inefficiency of his mode of working to a head and lead to the opening we want. Some day we may have a meeting PUBLICLY CALLED and not by circular and consider the plan of a School Board.

"I would not provoke the Rector's disapproval and on the other hand I should not be inclined to strengthen his present committee of management as any concurrences might hereafter hamper free action.

"I do not know how Mr. Henry (Dawson) looks at these things. I think he will see as well as any what prospects of improvement lie in the public interest, support and CONTROL and probably agree with me about not binding himself to a partial scheme.

"If we are driven to it, we may be obliged to open public schools and compete with the others! - though every effort must be made to make them modify their action so as to join effectively with the more open trusts".

That letter was written when the Whitworth Institute had been open for three years. Facilities for further education in English, maths, part and choral singing, geology, drawing, shorthand, agriculture, first aid for men and nursing for women had been provided under the control of the County Council. The Rector inserted the notices of these classes in the parish magazine without comment. He was much less reserved about Lady Manners' School, Bakewell when it reopened in 1896.

Frederick Atkinson retired as rector in 1905. Under his successor, R. W. Whittington, plans for a council school were rapidly implemented and the school opened in 1911 in temporary premises at the Two Dales School and the Whitworth Institute before moving to new buildings in 1912.

After 1880 Sir Joseph's health began to deteriorate. He suffered increasingly from bronchitis and for several years wintered in the South of France. But Riviera life did not satisfy him - he was too far from his work. Finally, in an attempt to defeat the long damp Derbyshire winters, he built a large conservatory modelled on the Crystal Palace and the Great Conservatory at Chatsworth. There, in a controlled temperature and surrounded by exotics such as figs, poinsettias, passion fruit and citrus he passed the winter of 1885/6.

One memory of that winter was provided by the housekeeper at Stancliffe. One pouring wet day, when Lady Whitworth was away from home, an officer from the War Office was expected for lunch. Delayed by the weather, he arrived after Sir Joseph had had his meal and had retired for his post-prandial nap.

On no account dare the servants disturb him until half past two, so the butler lent the visitor some dry clothes, gave him lunch and entertained him in the library until the conservatory bell rang. Only then was Sir Joseph informed that the visitor had arrived and ushered into the presence.

The following winter Sir Joseph decided to go to Monte Carlo. He died there on 22nd January 1887 and was buried in Darley Churchyard. The memorial window over his pew shows not machines, but the exotics from the conservatory. There is no other memorial to him in the church.

Immediately after Sir Joseph's death his three legatees, Lady Whitworth, Chancellor Christie and Robert Dukinfield Darbyshire, sifted through the mass of plans and papers, destroyed what was not essential and proceeded to implement the plans for a cottage hospital.

"on a plot of ground fronting the high road between Darley and Matlock. The hospital is intended for the use of the district and will comprise a general hospital for six beds, with a large sitting room for convalescent patients".

The work was contracted to Messrs. Southern and Sons of Salford and by the end of 1889 the first patients had been admitted. The locals were, however, reluctant to go there and in the spring of 1890 a notice encouraging them to use the hospital was placed in the parish magazine. After that the free hospital was better used, though a hiccup occurred when the curate married the matron and departed to Hartington.

The new matron apparently tightened the rules. Patients had to bring brush and comb, towel, slippers, pocket handkerchiefs and two sets of night attire. The bringing in of food, drink and tobacco was forbidden and only two visitors were allowed each day.

The free hospital lasted until 1897. After the death of Lady Whitworth it was closed for nearly two years, then re-opened as a subscription hospital, each guinea of the subscription earning one recommendation - the notorious 'recommend' for which one had to go cap in hand to the gentry before being allowed to go into the hospital and which earned such universal dislike for the owner of Darley Hall.

After the hospital came the Institute - or rather a portion of what had been planned by Sir Joseph. The front was built, but only a single storey portion of one of the other three sides. This became a museum of natural history.

At the opening, in 1890 a letter from Lady Whitworth, who was in Cannes, was read. In it she said that Sir Joseph

"never completed his plans, for he was never satisfied that they were as perfect as he desired. Our scheme (includes) a hotel and refreshment rooms and, we hope, large and convenient school buildings. A considerable extent of land is laid out for cricket, football and other healthful recreations".

The cost of the hospital and the Institute was £105,000.

An obelisk on a stepped square base was unveiled on 1st September 1894. On the base were medallions showing the heads of Sir Joseph and Lady Whitworth, a representation of his machine to measure one millionth of an inch and an appreciation of his work. The obituaries published in the parish magazine in February and March 1887 had been perfunctory: Sir Joseph 'had been a great benefactor to the parish' and a couple of extracts from The Times and The Daily News were incorporated. The executors of his will, Lady Louisa Whitworth, Richard Dukinfield Darbyshire and Robert Copley Christie carried out the works which he had planned for so long. After provision for Lady Whitworth and Mrs. Higginbotham there was over half a million pounds to use.

By 1899 £500,000 had been expended on educational building and endowment: Owens College, Manchester (now UMIST), in spite of quarrels Whitworth had had with its management, Manchester School of Art, Manchester Technical School, Whitworth Park and Library, Openshaw Baths and Library and charities in the city all received large sums. Darley Dale received its Hospital, Institute and Park and Lady Whitworth established the scholarships which bear her name, each of £10 per annum for three years at Lady Manners' School, Bakewell, and, after it was opened in 1924, at the Ernest Bailey School, Matlock. The fund now helps adult students. Stockport received £12,000 for its Technical School and Idle an endowment for School Board scholarships.

When all this was done the residue was divided equally between the three executors. Each spent a further £100,000 on charitable work and endowments.

Lady Whitworth did not long survive her husband. In 1889 her only child, Mary Higginbotham, died suddenly in Glasgow and shortly afterwards she took up permanent residence at the Hotel Beau Séjour at Cannes, where she died in July 1896. Stepfather, mother and daughter are buried together in Darley churchyard.

Sir Joseph's 'Let's try it' and his patient, step by step investigation of every problem, the sureness with which he grasped valid conclusions, his systematic assembly of facts and his ability to take pains over trifles whilst retaining a firm grasp of essential principles made him a genius at his work. It was his misfortune that those same qualities made him an indifferent father-in-law and a difficult neighbour. Alfred Higginbotham, a large, expansive man the direct opposite of the stocky, self-contained Whitworth, went to Smedley's Hydro for the cure and was unable, according to report, to endure the water treatment and sparse diet. One day he rushed out of the Hydro in a towel, made his way to Bank Road in search of a cab, was intercepted and persuaded to return, but left immediately, ate a large meal and departed to Manchester on the next train, never to return to Matlock.<sup>13</sup>

In Darley, Sir Joseph was not appreciated by the powers-that-were and because of the long battle between them, a very great deal was lost. Lady Whitworth tried to repair the damage by supporting the victorious rector, churchwardens and church council, but no real gains were made. After Sir Joseph's death the grounds of Stancliffe Hall were opened for Sunday School treats and for the locals to walk in, cloaks were presented to girls who attended school for a year without absence, but the caps were not given to the boys as they were unpopular. Contributions were made to all funds and special appeals, but that was all. Now the only remembrances of Joseph and Louisa Whitworth are the portraits by L. Desanges which hang in the Institute ballroom, the buildings they erected, the memorial obelisk, the Trustees and the educational fund.

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