

*Supplement to the **Bell's Weekly Messenger and Farmers' Journal** edition of July 13, 1863, a decade after the Long Shop was built. Bell's was a broadsheet newspaper first printed in 1796 and notable for its coverage of agricultural matters.*

## A VISIT TO THE LEISTON WORKS, SUFFOLK

If any one be desirous of fairly estimating the progress industry has made, even within the recollection of the present generation, we would advise him to take a quiet stroll through one or two of our great workshops. These may be found in almost every department of the country. These workshops are not merely the centres of limited districts, to whose supply they are mainly confined, as in preceding times; but their products are required by the most distant and diversified character of people, and their skill and industry are brought into requisition by the whole civilised world. The most striking feature, however, which your modern works exhibits, is its amazing concentration of power, and the immense superiority in this respect to that which characterized its predecessors. Capital, division of labour, and economy in their direction and appliance, are the main elements of our modern manufacturing industry; and as helpmate to these, we have our railway system, which, by furnishing an easy, certain, and rapid transit, has given them an amazingly effective expansion.

One of these first-class workshops we visited on Tuesday last; and as we saw many things with which we were only partially acquainted, and some with which we were totally unacquainted, we took a few notes of both, in order that we might extend and improve our own knowledge, and we hope, that of the reader who may do us the honour to read them. First, however, let us do justice to the principal of the establishment which we visited – one of those men to whom England and the world are so largely indebted for the progress that has been made within the last quarter of a century, or so, in manufacturing industry. Mr. Richard Garrett, the head of the firm of Messrs. Garrett and Sons, Leiston Works, Suffolk, is what, in this instance at least, may be appropriately termed the architect of his own fortune or, in other terms, perhaps still more appropriate, a man of strict integrity, indomitable energy, and of far-seeing capacity. Mr. Garrett, at an early stage of his career, was actively employed in the manufacture of agricultural implements, the principal of these being what we should now term the humble sickle. Both the father and the grandfather of this successful manufacturer excelled in the production of tools used in husbandry; but in 1806 Mr. Garrett's father ventured upon the then dangerous undertaking of making a thrashing machine, which was patented by Mr. John Ball, Hetheringsett, near Norwich, the first of its kind that was effectively applied to thrashing grain in England. This was a bold adventure, but it established the reputation of Mr. Garrett in the country. This thrashing machine, in time, though introduced through a

strong opposition, and much clamour, laid the basis of the large manufactory which we are now about to describe, and was the progenitor of the majority of thrashing machines now in practical operation. The position of Mr. R. Garrett, the more immediate subject of our present remarks, was a peculiar one. Though young, and at an age when few have either the faculty or the disposition to manage and direct business affairs, he undertook the financial controul (*sic*) of the establishment – no easy task at his age. However, he did his duty to his father, and did it well. “The boy,” in this as in many other instances of a kindred character, was “father to the man;” and in 1837 on the death of his parent, he had to bear the weight and responsibility of his suddenly devolved position.

An almost unbroken series of triumphs has marked the career of Mr. Garrett, as will be apparent at a glance when we state that he has carried off 138 distinct money prizes; 37 gold and silver medals; the Great Council and Gold Medals of Honour of the Council of the Great Exhibition of All Nations, of 1851; in Ireland the same in 1853; in Paris the same, in 1855; in Vienna the same, in 1857; and the Grand Council Medal of 1862. In addition to these laurels, Mr Garrett has received honourable commendations, almost without number, for agricultural implements, of minor note to those which received the honourable prizes just mentioned, manufactured at the Leiston Works, and exhibited at agricultural meetings, both at home and abroad. We ought, moreover, to

state, while giving a skeleton outline of his industrial career, that Mr. Garrett had the honour of assisting the late Duke of Richmond and the late William Shaw in the formation of the Royal Agricultural Society of England in 1837, of whose services to agriculture we need not say a single word. Mr. Garrett, at that time took an active part in the proceedings of the Society, and during ten years never failed to devote a portion of his time to its monthly meetings. He was one of the exhibitors of agricultural machinery at the first meeting of the society at Oxford in 1839, and was also one of two implement makers who exhibited at the Smithfield Cattle Club, when it was first held in Baker Street. We simply cite these facts to show the energy of character, and the devotedness of purpose, which Mr. Garrett displays in whatever he undertakes.

Mr. Garrett was one of the guarantors of the International exhibitions of 1851 and 1862, and was one of the first projectors of the Agricultural Hall, Islington. He also set on foot in his own county, in conjunction with the Lord Lieutenant and Sir E. Kerrison, a subscription for a memorial to the late Prince Consort, by the erection of a college for the *improved education* of the middle classes. The subscriptions amount, already, to nearly £20,000, and an appropriate building is in progress to accommodate 300 boys in board, lodging and education. The Lord Lieutenant of the county, the Earl of Stradbroke, has suitably and worthily added Mr. Garrett's name to the commissioners as a Justice of the Peace.

## THE WORKS

The works, situated at Leiston, within a mile of the German Ocean, and on the most eastern point of the county of Suffolk, occupy an area of upwards of 10 acres of ground, and the inhabitants of Leiston are mostly connected by employment with them. In time, the village has been nurtured – we may say created – by the works; for there is no industry in the place of any importance, which does not owe its rise to, and place its dependence upon, their continuance and prosperity. These works differ, in some respects, from other large establishments of a similar character. At Leiston each section of the manufacture of implements and machinery is perfectly distinct; and the workmen and their proceedings in these sections are as isolated as though they were 100 miles apart. Yet the facility of communication, transit of materials, and departmental supervision, are as complete as though the entire block of buildings was under a single roof. This arrangement of structure has certain advantages, which may readily be imagined, but which it is not necessary to mention. We shall first introduce the reader to the store rooms, which are crowded with materials ready for the manufacture, properly arranged for the facility of use, and in suitable condition for that purpose. First, however let us state that the works are in immediate connection with the Great Eastern Railway, and have tramways intersecting them in several

directions, so that the raw material, drawn up an inclined plane, is easily received for working up, and the manufactured commodities are as readily conveyed their destination. All obstructions to facility of communication with the works have been removed, everything which ingenuity could devise to make them easy of access has been adopted. Economy and efficiency, in every arrangement, have been most attentively studied. The iron store-rooms consist of an immense collection of rods, bars, sheet-iron, plate-iron, hoop-iron, zinc, &c., which are so arranged that the store-keeper can account for every piece that goes out, and to whom it has been distributed, so that a complete check is kept upon each department. Next to the metal-stores are warehouses in which a large quantity of oils, paint, and other materials are kept. The linseed oil, which improves with age, and which is necessary for hardening and making durable the paint, is kept in large quantities and for a considerable time. The forge-shop is the next in the range of buildings. This is a long, airy, and well-ventilated building and contains 100 fires; there are two hands to each forge, a man and a boy, who are constantly kept to one kind of work, and hence are perfect adepts at it. Some crank-axles, some screws, some bolts, some nuts, some drill-cups, and some are engaged on other minute portions of machines; and as the work is paid by the piece, there is every inducement to do it quickly, while strict supervision ensures its being done well. We have rarely seen such a fine body of smiths, or men who did their work with greater dexterity.

The effective machine, however, in this department, and which largely aids in the heavy work, is one of Naylor's powerful steam hammers, which we have had occasion to describe before. The furnace for heating the scrap, next to the hammer, is especially deserving of notice. Being worked by an artificial blast, which can be regulated to suit the work in hand, the heats are obtained much more rapidly, and the quality of the iron produced is very superior to that obtained by the ordinary air-furnace. The boiler for working the steam-hammer is fitted with a Gifford's Injector, which answers a very good purpose. With this arrangement of apparatus all the wrought iron scrap produced on the works is converted into good tough fibrous iron; and under the action of the hammer this iron is formed into crank-axles for steam-engines, drum-spindles for thrashing machines, shafts for corn-mills, and any other heavy forgings, which are required to be of a particularly good quality.

Here we may remark that the crank-axles are made strong at the parts where strength is really wanted—at the shoulder or the-bend—where the strain principally is; they are not bent by dies from rolled bars, which is the ordinary mode, but are beaten, heated, and fashioned by the steam-hammer, so that the fibre of the iron is preserved, and the utmost strength is obtained. In corroboration of this fact we may state that Messrs. Garrett have never yet had a crank-axle broken. The bolts and nuts made by the boys, also by the hand, with the aid of a heavy hammer worked by a treadle and the foot, are as uniform as if they had been cast, and much

stronger; the same remark may be made to the making of drill-cups, in which the strength of the top and bottom are untouched and preserved as though they came from the casting, all being precisely the same size. The six-sided nuts ought also to receive a passing notice. A man, with a boy, having dies to work upon, turns out a great number in the course of the day, all even and true to a nicety; whereas, if a blacksmith were employed upon such work, with his ordinary tools, he would make them comparatively uneven, and also knock out all the wearing virtue of the iron.

## THE FOUNDRY

The foundry next attracted our attention. It forms a large square, which is divided into four sections. The arrangement for foundry purposes is exceedingly convenient. In the largest section there are three gigantic cranes, covering a space equal to three-fourths of the area of the moulding-floor, which are brought into direct communication with the furnaces. These furnaces are of an improved construction, and deliver the metal very rapidly, with small consumption of coke. About ten tons of metal are melted daily for the castings required in the different departments of the manufacture. The ovens for drying the cores are conveniently arranged, and placed in communication with the moulding-floor by means of a tramway. The whole arrangement, in short, of the

foundry is such that the removing of the heavy moulding flasks or boxes, the conveyance of the materials to and from the furnaces, and the removal of the castings from the founder, are all effected with a very small amount of manual labour. Under the same roof with the foundry, and in a fire-proof compartment, is the extensive stock of patterns, which are the fruits of upwards of 50 years experience, and which show the progressive stages of the manufacture at the Leiston Works. The whole of the machinery connected with the foundry is worked by a 14-horse power horizontal engine, which also draws up the inclined plane the laden trucks from the railway. There are five steam engines engaged on the works, the aggregate power being about 90-horse; these are so arranged that the departments can be worked independently of each other. The construction of the boilers of these engines is such that the offal wood and refuse are consumed, thus effecting a considerable saving in coals. As regards the latter, there are vaults under the tramway, in convenient situations, into which the coal is delivered by the trucks, without any cost of manual labour. This is a very economical arrangement.

The malleable iron process is quite as advantageous to the manufacture, both as regards strength, durability, and economy, as that of the scrap, and perhaps more. At all events, few even of the first-class manufacturers have a knowledge of the secret, and therefore use it, and fewer still have the means, so that they are completely excluded from using it. Apart from certain transformations in the furnace, which we were

not entitled to enquire into, we may briefly state that cast-iron parts of machinery are converted, simply by heating with certain ingredients, into the toughness and durability of wrought-iron parts, ordinarily made by the hand. They are even tougher than wrought iron ones. This fact was proved by several experiments, first breaking the parts as castings, which was easily done, being nearly as brittle as glass; and then attempting to break similar parts, which had been cast in the same moulds, after they had undergone the annealing process, which we could not possibly do. In fact, we found, by striking the annealed parts with a hammer, that they were as tough and as bendable as wrought iron, and as certain to wear as long. This annealing process of cast iron is one of the most valuable discoveries of the day, inasmuch as it will enable those who have the knowledge and facility of using it, to construct much stronger implements, and at a more economical rate, than has hitherto been done.

## THE STEAM BOILERS

We now arrive at the department for the manufacture of steam-boilers. Our attention was first directed to the furnaces, by which the plates can be heated, whatever their dimensions, to an uniform temperature throughout; so that whether they are required to be operated upon on flanging blocks, or merely heated, for ascertaining their soundness, they are brought out in their proper condition. There is also a first-rate plant of machinery for punching, shearing, drilling, and binding the plates; the most perfect tools

for making the rivets; and a boiler, with the apparatus attached, for being proved by hydraulic pressure. As regards the boilers for portable and other engines, we remarked the total absence of all angle-iron, the necessary flanges being formed out of the plates themselves, which we conceive to be the acme of strength, combined with lightness, in the construction of boilers; and the arrangements are capable of turning out a boiler per day, or six per week, which is frequently done.

### WOOD AND WOOD WORKS

The stock of wood, in a rough and in a prepared state for use, is surprisingly large. Pile upon pile in every suitable form, meets the eye in the wood-yard, and in the stores, and these are daily diminished and daily augmented, as the consumption on the one hand, or the necessary seasoning on the other, may demand. All these piles are dated and numbered, in order that they should be used at a proper time; and there were upwards of 100,000 pieces of ash cut for drill levers, shafts, and fellies. The principal woods used are oak, for all the scantling required for the framework of the machine, and for the spokes of the wheels; ash, for drill-levers, shafts, and poles; and elm and poplar for board where foreign wood is not sufficiently hard and tough. The timber is first sawn by a very complete set of sawing machinery, and then laid up in large piles to take the air and the weather; when it is sufficiently seasoned in this way, its condition is further improved by passing through a series of

drying houses, until it arrives at such a state that it be guaranteed to stand the effect of any climate, without shrinking or altering in form. In the same department we saw in operation a most complete set of wood-cutting machinery, where the seasoned scantling is operated upon by the most improved machines for reducing it to the required form and dimensions, and for cutting the mortices and tenons, the boards being planed, grooved, tongued, and beaded. These various operations are carried on simultaneously, and the work is executed with a rapidity and accuracy not to be attained by manual labour. The wood work for the different machines manufactured on these works, after passing through the various stages we have mentioned, is stowed in dry, airy buildings. and remains there till it is served out to the frame-makers, and, under their hands, it assumes the form of a machine.

## THE ENGINE SHOP

This shop is a fine and lofty building constructed in 1852, expressly for the manufacture of portable, fixed and traction engines. It is fitted with a large plant of engineers' tools, especially adapted for the above work, comprising lathes, planing, shaping, slotting, drilling, and boring machines, by the best makers. These machines are put in motion by a 10-horse vertical engine, and the necessary shafting is supported by two rows of columns, which also carry a gallery on each side of the shop, and form

a tramway for two powerful travelling cranes; these cranes are at the command of the workmen employed on the erecting floor, which occupies the centre of the shop from end to end. Three pairs of large folding doors provide for the exit of the engines as they are finished, and passed on to the paint shops. The store room in connection with this shop is deserving of special notice. Here we saw, arranged in the most methodical manner, fittings in cast and wrought iron, and brass, for above 100 steam-engines, by which arrangement the firm is enabled to execute orders at the shortest notice.

From this shop we passed on to another of a similar character, erected in 1860, where we also observed a large plant of engineers' tools, which are employed on work connected with the manufacture of the new patent combined thrashing machines, horse-power thrashing machines, corn mills, drills, and horse hoes. The fittings for these machines and implements are arranged in extensive stores, in the same manner and with the same result that we have described in the store connected with the engine manufactory. The shops in which the combined machines are made are very extensive, and admirably adapted for meeting the greatly increasing demand for the machines constructed on the principle recently patented by the firm.

The wheelwright's shop, where the whole of the wheels required for all the machines and implements sent out are made, next came under our notice. There we saw facilities for turning out, which is frequently the case

at the Leiston Works, from 40 to 50 pairs of wheels per week. The department devoted to the construction of drills and horse hoes, as may be imagined from the extensive trade which has been carried on for such a number of years by the firm in this branch of machinery, is unequalled in extent and completeness.

We may say in brief, that the Messrs Garrett and Sons manufacture on a large scale portable, fixed and traction engines, combined thrashing machines, horse power thrashing machines, grinding mills, drills, horse hoes, manure distributors, corn dressing machines, and steam-power chaff cutters, and steam cultivating apparatus. Every part of their engines and machines is made on the works. We have briefly and roughly described some of the principle workshops and their contents, but the immense stock of raw and finished materials, and the extent of mechanical appliances at the command of the firm must be specially inspected to be thoroughly understood and appreciated.

The number of hands generally employed at the Leiston Works is about 600, men and boys. A mutual benefit club is established on the works, which all must join; while a mechanics institute places within the reach of the workmen a good library, and a large number of newspapers and periodicals. In addition to these advantages, the workmen have a large and handsome edifice, which has recently been erected by the head of the firm in the main street of Leiston, adjoining the works. This building is placed at the disposal of the managers of the works as a dining-room for the

workmen, and is used for purposes connected with the material, moral, and social enjoyment of the workmen, and indeed we may say, of the inhabitants of the place, inasmuch as the Volunteers occasionally convert it into a drill-ground.

transcription notes

*Fellies* are the outer rim of a wheel, to which the spokes are fixed.

*Scantling* is a timber beam with a small cross section.

The *Albert Memorial College* was later renamed Framlingham College.

The *German Ocean* is now called the North Sea (even in Germany).

'*Hetheringsett, near Norwich*' should probably be 'Hethersett'.

The 'fine and lofty' Engine Shop constructed in 1852 is of course our Long Shop.