(Paper No. 3009.)

“The Horwich Locomotive Works of the Lancashire and Yorkshire Railway.”

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THE Lancashire and Yorkshire Railway Company had for many years locomotive works at both Miles Platting and Bury, but they became inadequate for dealing with the repairs of the locomotives and for building such additional engines as were required, and it was determined to build new works at Horwich. The site was selected upon the advice of Mr. John Ramsbottom, a Director of the Company, who advised that the works should be built on the broad lines which have been since observed. It became the duty of the Author to superintend the erection of the works and the arrangement of the machinery, and to start them as a working establishment.

There are three entrances to the works, the “main entrance” leading to the offices and workshops generally; the “central entrance,” in close proximity to the men’s dining-room and cottage hospital; and the “foundry entrance,” which is conveniently situated for access to the property built at that end of the works. The works were commenced in 1886, some of the shops were ready and brought into use in 1887, and by the year 1892 they were practically completed. The lighting and ventilation have been carefully studied; the buildings generally are lofty, and operations are exclusively conducted on the ground floor. Gas made at the gas-works is now in use to a great extent both for lighting and manufacturing purposes, but electric light is used in all the large shops where it is more advantageous. A complete telephonic system connects the offices and shops throughout the works. Besides the ordinary 4-foot 8½-inch gauge railway connecting the various parts of the works, there is a narrow-gauge railway (18 inches) traversing every part of the works, its total length being about 6½ miles. It is worked by small locomotives, which draw trains of strong trolleys conveying materials and finished work between the several parts of the establishment.

On the left of the plan, Fig. 1, Plate 8, are shown the chief mechanical engineer's offices, which cover an area 323 feet long by 58 feet wide. The offices for assistants, the drawing office, and the office for accounts, etc., are placed at each side of a wide and well-lighted corridor running the whole length and terminating at the gallery of the stores. On the ground floor is a well-equipped physical laboratory, and on the top floor, immediately under the water-tank which commands the whole works, is a chemical laboratory. One portion of the ground floor is used for a test-room, containing a 100-ton testing-machine, spring-testing machine, etc., the other portion being used for the works manager's and clerks' and timekeeper's offices. The rail-level at the stores is the common rail-level throughout the works, being 395 feet above Ordnance datum.

The General Stores consist of a two-storey building, 198 feet long by 111 feet wide, formed in four bays, a gallery being built round the four sides, leaving a well for light and air in the centre. The heavy goods are stored on the ground floor, and the light goods on the gallery; access to which for tramway trucks, etc., is afforded by means of a small hydraulic lift, other large stores being hauled up by a hydraulic crane direct from the wagons as they arrive. A small space is set apart for the workmen who require any article from the stores, where they present their respective foreman's ticket.

The Boiler Shop, Fig. 2, is 439 feet long by 111 feet wide, formed in three bays, the first being used for building and repairing boilers, the middle bay being used for miscellaneous work including tenders and tanks, whilst the third bay is used exclusively for tools, such as drilling-, punching-, shearing-machines. Over each bay, and running the whole length of the shop, is an overhead travelling crane with a longitudinal traverse of 150 feet per minute, driven by a rope. The small rivet-furnaces in this shop are fired by liquid fuel injected by compressed air. At the end of the shop the roof is carried some 16 feet higher for two spans and the full width of the shop, to form a riveting-tower. In this space is provided a pair of hydraulic pumps and accumulator, and two fixed hydraulic riveters for boiler work, each having a hydraulic crane for lifting the boilers when riveting. The longest boiler can be riveted in a vertical position. Liquid-fuel furnaces are fixed in close proximity to the cranes and riveting machines. Portable hydraulic riveting-machines are used in every case where it is possible.

The Boiler-Shop Smithy, which is an adjunct to the boiler shop,

measuring 120 feet long by 111 feet wide, formed in two bays, is fitted with several smiths' hearths, dome fire, etc. The hydraulic flanging presses are also fixed in this shop for flanging fire-box backs, tube-plates, etc., gas furnaces being built near them for reheating the plates.

The Forge, Fig. 3, 452 feet long by 111 feet wide, formed in two bays, contains the necessary heavy tools for the work required on the railway, the forgings being heated in the gas-furnaces. At the back of the forge are the gas-producers, and, the natural formation of the ground at this point being 14 feet higher, the producers are charged direct from the top, whilst the ashes are drawn out at the bottom through a water-seal into tram-wagons on the lower level, no hoisting being required. The scrap is cut up on the high level, and is conveyed through a conveyor into the forge, where it is made up in piles for the furnaces.

The Steel Foundry, Fig. 4, measuring 150 feet long by 135 feet wide, formed in four bays, contains one 20-ton and two 10-ton Siemens-Martin regenerative melting furnaces, heated by gas from their own series of gas-producers. The advantage of the higher ground at the back also proves most economical, as the metal can be run directly into the charge-holes without crane-power. A high-level tramway has been fixed to carry the steel-ladle on small cast-iron columns and also one at right-angles to it. The middle bay is provided with an overhead rope-driven travelling crane, which travels also the full length of the iron foundry. The core-stoves are fixed in the bay nearest to the high level. In the bay where the moulding is performed small hydraulic cranes have been fixed against the columns to deal with the moulding-boxes.

The Iron Foundry, Fig. 5, 212 feet long by 111 feet wide, is also formed in three bays. This shop is used for general castings, not only for locomotive work but for those used in connection with the permanent way, the signalling, and the carriage and wagon departments. There are two cupolas at the back of the foundry, the natural formation of the ground at the back proving most advantageous, as it permits the coke and iron to be unloaded and wheeled direct to the charge-holes of the cupolas.

The Chair Foundry, Fig. 6, which is an adjunct to the iron foundry, is 62 feet long by 111 feet wide, in three bays. It is exclusively used for the manufacture of chairs for the permanent-way department, and has two cupolas fixed at the back similar to those of the iron foundry. A feature of this shop is the fettling-bench available for working at each side. After the chairs are cleaned,

they are placed on the endless chain running in the centre of the bench, and are conveyed direct to the wagons, which are on a lower level than the common rail-level of the works.

The Fettling-Shop, Fig. 7, 90 feet long by 47 feet wide, in one bay, is used for cleaning castings after leaving the foundries, and is also provided with two double annealing-furnaces heated by gas.

The Wheel Shop, 165 feet long by 47 feet wide, in one bay, is next to the fettling-shop, being separated from it by a partition wall. After the wheels have been fettled, they are taken to the lathes to be bored and turned, and are then loaded direct into the wagons which are run into the shop; the hauling being performed by an overhead rope-driven travelling crane running the whole length of the wheel shop, smaller swing-cranes being used for the different lathes fixed to the walls. The carriage wheels are also put together in this shop, and a special hydraulic press is provided for forcing the wood blocks between the wheel centre and the tyre, as well as another press for forcing the wheels on the axles. Close to the foundry, connected by the 18-inch tramway, a space is allotted, fenced in with wrought-iron fencing, for the storage of spare and stock castings.

The Bolt Shop, 60 feet long by 111 feet wide, formed in two bays, contains modern bolt-and-nut-making machines, rivet- and nail-making machines, and drop stamps for light smithy work.

The Smithy, Fig. 8, is a continuation of the bolt shop, measures 212 feet long by 111 feet wide, and is likewise in two bays. It is a spacious and well-lighted building, containing thirty-three single hearths along the outside walls and eleven double hearths along the middle. Between the hearths are placed at intervals small steam-hammers. The blast for the fires is produced by a Root blower, fixed at one corner of the shop.

The Spring Smithy, Fig. 9, 153 feet long by 47 feet wide, in one bay, is fitted with two gas-heated spring furnaces, hydraulic press, buckle stripping-machine, small steam-hammer, etc. Single smiths' hearths are fixed along each side of the walls.

The Signal Shop is 128 feet long by 111 feet wide, and is formed in three bays. One bay is used exclusively for the construction of signal cabins and posts, a rack saw being provided. The signal cabins are so made and marked that they can be taken to their destinations in pieces and easily erected. The other two bays are occupied for fitting up locking-frames and for general signal work. Outside the signal shop are stored the various small castings, etc., appertaining to the signalling apparatus, and beyond this a long timber steam gantry has been erected, under which the

wagons can be run and the long timber-logs unloaded for signal posts, etc.

The Points-and-Crossings Shop, an adjunct to the signal shop, measures 72 feet long by 111 feet wide. It is in three bays, and is provided with special machinery for the manufacture of points and crossings, including an angular planing-machine, a duplex slotting-machine, and a special machine for milling and drilling locking-frame standards at one setting. A walking crane, driven by a rope, is provided in the outer bay.

The Fitting-Shop, Fig. 10, 508 feet long by 111 feet wide, is formed in three bays. Along each, traversing the full length of the shop, is a walking crane driven by a rope for the haulage of heavy materials from one machine to another. There are four lines of shafting running down the shop, driven by two large wall-engines at one end. A space is allotted to the cylinders which are brought from the foundry to be bored, drilled, studded, and finished before being sent on to the erecting-shops. A number of milling-tools, both horizontal and vertical, are provided, almost all the engine motions being completed by this class of machine; while the usual machine tools, such as drilling- and slotting-machines and various kinds of lathes, are arranged in their different classes. One portion of the fitting-shop is allotted to the brass-finishers, and close to the brass-finishers' side is the tool-room which supplies and repairs all the milling cutters, twist drills, taps, and other tools required for the various machines in the fitting-shop. At the lower end the setting-out benches are fixed and all the fitters' benches where the small amount of necessary hand-work is done. The shop is heated in winter by pipes carried in trenches along the middle of each bay, covered with chequered grating which serves also for tram-lines, grooves being cast in it for this purpose. The shop is lofty and well lighted. The artificial light is afforded by inverted arc-lamps of 50 candle-power fixed under large white painted wood disks suspended from the principals, which help to throw the light upon the machines without sensible shadow.

The Boiler-Houses, in two nests of five boilers each, are on each side of the large chimney, the space below being occupied by two sets of Green economizers, the whole covering an area 156 feet long by 47 feet wide, in one bay.

The Brass Foundry, Fig. 11, 105 feet long by 47 feet wide in one span, is provided with a gas furnace for heavy work, and a gas crucible-furnace for the lighter work, the moulding of the lighter articles being carried out on a bench at one side of the shop.

The Tinsmiths' Shop, 150 feet long by 47 feet wide in one span, is provided with all the newest tools for tin-plate working. All the tin-ware required for the railway is made here, and all repairs and renewals of lamps, etc., are also carried out.

The Copper-Smiths' Shop, 90 feet long by 47 feet wide in one span, is fitted with the necessary copper-smiths' hearths and furnaces for brazing tube-ends, etc.

The Tube-Cleaning and Case-Hardening Shops, are combined, measuring 75 feet long by 47 feet wide in one span, and contain a case-hardening gas furnace, two tube-cleaning machines, two annealing gas furnaces for small articles, and a special furnace for taking the tyres off old wheels.

The Telegraph Shop, Fig. 12, 153 feet long by 47 feet wide in one span, is provided with special tools, lathes, etc., for making and repairing telegraph and block instruments, and other electrical work. A small room is set apart for experimental work and for testing instruments.

The Electric-Power House contains an engine and dynamos for the supply of light to the north-west end of the works, and also to all the offices.

The Erecting Shops, Fig. 13, 1,520 feet long by 118 feet wide, is divided into two large bays and one smaller bay in the middle of the shop. The outside bays are used for the repairs and renewals of locomotives, the small middle bay being used for the fitters' benches and for small tools such as drills, placed in suitable positions along the shops, and for the storage of materials. The erecting shops are divided into Nos. 1, 2, 3, 4 and 5 respectively. No. 1 shop is used for the erecting of new tenders and repairing of existing stock. Of No. 2 shop about one quarter is taken up for boiler mounting, the boilers being received from the boiler shop are here fitted with tubes and the brass mountings; they are also tested both with water and steam before being sent to the erectors; the other three-fourths of the shop are taken up with general locomotive repairs. Nos. 3 and 4 shops are exclusively used for locomotive repairs. No. 5 shop is mainly used for locomotive repairs, but a small portion is set apart for new work. Each outside bay of each erecting shop is provided with two 30-ton overhead travelling cranes, making twenty in all. Wheel-lathes are provided at various parts of the erecting shops for dealing with the wheels taken from locomotives under repair. A number of portable hydraulic riveters is also provided. Access for locomotives to the centre portion of the shops is provided by two traversers.

The Pattern-Makers' and Joiners' Shop, Fig. 14, 164 feet long by 111 feet wide, is divided into three bays, one being exclusively used by the pattern-makers with the drawing stores at one end. The middle bay is fitted with the most modern wood-working machinery, such as circular saws, general-joiner, planing- and moulding-machines, etc., and the third bay is divided into two portions, one half being used by the joiners, and the other half by the saddlers for repairing and renewing the belting etc. of both the in-door and out-door departments. Along each side bay and across the ends a gallery has been formed for the storage of patterns and other work. A sprinkler arrangement has been fixed in this shop, both on the ground and gallery floors, as a precaution against fire.

The Millwrights' Shop, Fig. 15, 146 feet long by 111 feet wide, is also divided into three bays, each bay having an overhead rope-driven crane travelling the full length of the shop. All general and hydraulic and engineering work for out-stations is carried out in this shop, in regard to the repair and maintenance of cranes, turntables, water-columns, etc. The shop is fitted with the usual mechanics' tools.

The Paint Shop, Figs. 16, measuring 234 feet long by 111 feet wide, differs from all the other shops in construction by having a weaving-shed type of roof which has been found most suitable for its purpose. The same principle is adopted for the Company's engine-sheds. It is a well lighted and ventilated shop, and a heating arrangement has been provided in order to dry the paint quickly. The necessary grinding- and mixing-machines are also provided.

The Chain-Testing Shop, Fig. 17, 111 feet long by 28 feet wide, is an adjunct to the chain-smithy, and each chain when completed is brought here to be tested by the hydraulic chain-testing machine capable of testing up to 100 tons. Each chain, after being tested, is stamped, and all particulars are entered in a book before the chain is sent out.

The Engine-Shed is provided for stabling the locomotives used about the works.

The land adjoining the works, but on the opposite side of the Chorley Road, has been laid out for building purposes, and has been disposed of from time to time to builders of workmen's cottages, the Company still reserving some plots. One of these reserved plots, containing about 11 acres, situated in front of the main entrance, has been laid out as recreation grounds, comprising a cricket ground, football ground, two full-sized bowling greens, and boys' and girls' playgrounds. Pavilions have been built both

for the cricket and bowling greens. A large dining-room, previously referred to, has been provided in very close proximity to the middle entrance of the works, and is well patronized by the workpeople, an average of one thousand men using it daily.

A system of evening classes has been instituted, and a fine pile of buildings for this use has been erected on Chorley New Road by the generosity of the Directors and of Mrs. Fielden, the widow of a former Director. The classes, which are numerous and embrace many subjects, are conducted by experienced and efficient tutors. It is called the Horwich Mechanics' Institute, and is governed by a committee of officials of the Company and an equal number of the workpeople's representatives, the latter being elected by ballot each year. The buildings comprise class rooms, art room, library, reading-room, smoke-room, magazine-room, etc., the basement being used for the metallurgical classes, and also for the electric-lighting plant for the building, which is driven by a gas-engine. Above the reading-rooms is a large hall used for public meetings and other purposes. It is fitted with dressing-rooms and complete stage appurtenances. This hall is capable of accommodating 1,000 persons. In connection with the Institute there is also a laboratory, directed by a qualified analytical chemist, and in addition, accommodation for the photographic society.

The physical development of the youths employed in the works and the members of the Institute has not been neglected, as, by the further generosity of Mrs. Fielden a splendid gymnasium has been erected, and was opened in 1895. It is situated at the rear of the Institute, and has direct access from it. It is fitted with the best appliances of a modern gymnasium, and is well patronized every evening during the week. It is under the control of an efficient instructor, and is governed by the Institute Committee.

Mr. Henry Yates Thompson, a Director of the Company, has generously given a cottage hospital for the treatment of accidents that may happen in the works. It is built in close proximity to the middle entrance, and is under the supervision of the Company's surgeon and of a qualified nurse.

The communication is accompanied by three sheets of drawings from which Plate 8 has been prepared.