

bearing a working transverse strain of over 400 tons. The legs are about 2 ft. 6 in. square at the bottom, having a slight taper up to the top. They are about 90 ft. long, well braced and stayed, and capable of resisting the greatest strain that they can ever be subjected to, even if a whole column of pipes were slung from the top. The foundations for the pumping-engines and pump quadrants are all in one solid block, made of concrete, of one part of best Portland cement to five parts of broken metal and sand, enough sand being used to fill up all the interstices. The portion the engines are fitted upon is 61 ft. 6 in. wide by 67 ft. 2 in. long and 20 ft. in depth; and the foundations for the pump quadrants are 12 ft. by 12 ft. and 12 ft. deep on each side of the shaft, with a wall of concrete joining these two blocks 4 ft. thick. The whole of the foundations are built in a homogeneous mass, and form one block, having a weight of about 5,891 tons. Portions of the foundations are on the solid rock, and where this could not be obtained rows of piles were driven into the ground until the rock was reached, and the concrete put on the top of them.

The foundations for the winding-engine and capstan-engine are all in one block, only the winding-engine foundation stands at a level of 4 ft. above the level of the foundation of the capstan-engine. The foundations are 5 ft. long by 26 ft. wide and 12 ft. deep on the place where the winding-engine is fixed, and 8 ft. deep where the capstan-engine is placed. This foundation is made of one block of homogeneous concrete, of the same strength as that already mentioned for the foundations of the pumping-engine, the weight of this block being about 971 tons. A concrete foundation of 16 ft. square and about 4 ft. in thickness was made to commence to build the brickwork. The stack is built in a square shape with bricks, and is 103 ft. 6 in. high, being 7 ft. 3 in. square at the top. A large flue is built of brick to connect the different boiler-flues with the stack. A concrete foundation is made for building in ten boilers 99 ft. 6 in. long by 40 ft. wide. All the flues, wherever subjected to great heat, are built of firebrick, and all the flues from the boilers connect with a main flue, which is constructed at the back end of the boilers, large enough for a man to pass through to clear them out at any time.

The pumping-engine is to consist of one pair of horizontal compound condensing engines, the high-pressure cylinder being 31 in. and the low-pressure 59 in. in diameter, both with 5 ft. stroke. Each cylinder is steam jacketed, and placed side by side with receiver and auxiliary steam-valve on low-pressure cylinder, and working on the cranks at right angles. Steam-chests are fitted at each end of both high- and low-pressure cylinders with variable expansion-valves worked direct from the crank-shaft and variable by hand, the range of cut-off being from nothing to five-eighths stroke. All glands and bushes are lined with gun-metal, and the glands and cylinder covers are polished outside. The piston-rods are carried through each cover. The cylinders and steam-chests are coated with asbestos, slag wool, and timber, and covered with planished steel plate secured by polished brass belts 2 in. wide, fixed with set screws. The cylinders are drained by a cock at each end, and the steam-chests are drained by cocks placed in suitable position. Each end of the cylinders is fitted with 2 in. spring relief-valve; also a side-feed lubricator, with a capacity of one pint (1 lb.), is fitted to each cylinder. The steam-receiver is placed between the cylinders, steam-jacketed and lagged with asbestos, slag wool, and timber, covered with sheet steel. This is drained by a cock connected to the same way-shaft as cylinder cocks. The jacket is also drained by an ejector. The throttle-valve is of double-beat type, with seatings of gun-metal. The governor is of the high-speed Porter type, controlling the supply of steam according to requirement, maintaining regularity of movement, and set so that the speed of the engine will reach thirty-four revolutions per minute. The piston bodies are made of cast iron, 8 in. deep in centre and 7½ in. at the edges. They are attached to the rods by recessed nuts screwed upon the rods, and are fitted with steel coils and cast-iron junk-rings. The piston-rods are of forged steel, and of sufficient length to project through both ends of cylinders, and are secured to front and hind cross-heads by steel cotters, having a solid collar forged on for attachment to piston, to which it is screwed, the diameter of the piston-rod being 5 in. The cross-head and gudgeon are made of hammered steel, bored taper to receive the piston-rod, to which it is cotted. The cross-head has cast-iron slipper-blocks, each 21 in. long by 6 in. wide. The gudgeon is of forged steel, 6½ in. diameter by 8 in. long in the journal, shrunk into cross-head, and fitted with steel key. The cross-head for tail-slide is also of steel, into which the piston-rod is fitted. The cross-head also receives the links actuating the air-pump and circulating pump levers. The connecting-rods are of hammered steel, polished all over; the cross-head end is made adjustable with gibs and cotters, fitted with heavy gun-metal steps; the crank-pin end is worked from the solid, fitted with gun-metal steps, adjusted by means of cotters and set-screws. The length of each connecting-rod is 13 ft. 6 in. centre to centre, being 5½ in. diameter at cross-head end, 6 in. diameter at crank-pin, tapering to 7½ in. diameter in the middle. Large gun-metal lubricators are fitted at each end of the rod. The crank-pin bearing is 7½ in. diameter and 9 in. long. The crank-shaft is made of the best hammered steel, turned and key-grooved if necessary, its bearings being 13½ in. diameter and 20 in. long. The length between centre of engine is 16 ft., and the shaft is swelled in the centre to 16 in. diameter, on which the fly-wheel and spur-pinion for driving pump gearing are placed. The cranks are also made of best hammered steel, machined and polished all over, and are also keyed on at right angles on each end of the shaft. The crank-pins are 7½ in. diameter and 9 in. long; these are forced into the crank by hydraulic pressure, and afterwards riveted over. The eccentrics for working the valve motion are made of cast iron in halves, with adjustable rods of brass, and made with clips to join the eccentric rod with butt ends. All the valve motion rods and spindles are made of the best hammered steel, and all the bearings are of gun-metal made adjustable. The fly-wheel is 15 ft. in diameter, 20 in. wide on the face, and turned on rim and edges. The two halves are bolted together, and further secured by wrought-iron hoops shrunk on the bosses, the weight of the fly-wheel being about 20 tons. This wheel can be used for belt-driving if required. It is also fitted with a spur-ring for barring purposes, and a barring-engine with a pair of cylinders 10 in. diameter is to be fitted on to plates, and bolted to foundations, with all necessary pipes, lubricators, and drain-cocks. A spur-pinion is fitted on the