driver in the event of the engine stopping on a centre, but if the engine is properly handled this rarely occurs, and we have seen one of the engines we are describing worked about a yard with a load for a considerable time, stopping in and starting from awkward places without there being occasion to touch the fly-wheel at all. The flywheel is also so placed that a belt can be led off from it to a thrashing machine, &c., well clear of the leading wheels, while the crankshaft can also carry a smaller pulley, from which a mortar mill or other machine requiring a slower speed can be driven.

Of course when the engine is employed in driving a thrashing machine, &c., the road gear will be thrown out of action. This is effected in the usual way by sliding the crankshaft pinion on the crankshaft. This pinion, when the road gear is in use, drives a spur wheel on an intermediate shaft, this wheel having cast on it a pinion gearing into the main spur wheel on the driving axle.

The latter axle is driven through compensating or "jack-in-the-box" gear, this gear being made very strong, and its details being exceedingly worked out so as to give ample bearing sur-surfaces. The driving wheels and leading wheels are both of wrought iron and of neat design, the former being provided with an efficient brake. The fore carriage is all of iron, and it is situated under the cylinder, as shown on our engraving on page 000.

The boiler has fished-topped firebox casing and is without a steam dome, the steam being collected by a perforated pipe extending from end to end of the boiler, and communicating with a stop valve case fixed to the smoke-box tube plate above the tubes. This stop valve is arranged so as to be readily accessible, and the steam is led down to the cylinder by a steam pipe in the smoke-box as in an ordinary railway locomotive. The boiler exposes 129½ square feet of heating surface, while the fire-grate area is 4.9 square feet. The blast nozzle is kept low and carefully set in the proper position in relation to the chimney so as to insure a good draught with a large area of nozzle, this being a point in which ordinary portable engine practice is very defective. The boiler of the engine under notice is well stayed and the fittings are neatly arranged.

The feed water is carried into a tank at the hind end of the frames below the footplate, and the fuel in coal bunkers on each side of the footplate. The feed water is, as we have said, warmed by forcing it through a heater on its way to the boiler, this heater being traversed by the exhaust steam, and being so arranged that the pipes through which the exhaust steam passes are quite free to expand and contract, while the whole can be very readily taken apart for cleaning. A tool box is provided between the frames at the leading end.

As will be seen from our engraving the general appearance is very neat, and we thing that Messrs Marshall, Sons and Co. are decidedly to be congratulated on the results of their bold departure from ordinary practice. The details of the engines have been worked out with much care, and the proportions are good and substantial throughout. We anticipate that this engine of Messrs. Marshall's will be one of the chief novelties at the Smithfield show next week, and that it will attract considerable attention from all interested in traction engine construction.—*'Engineering.'*

Phosphor Bronze.—An American paper says that the exhibit made by the Phosphor Bronze Company of London, consists of a considerable variety of bearings and working parts of machinery, wrenches, scissors, &c., the most of which have been subjected to tests appropriate to them, and the results shown. Among these are a pair of worms, or endless screws which have been run in articulation with toothed "worm wheels" for eighteen months in a place, and under circumstances such as had, previous to the adoption of this material, destroyed them when made of brass in twelve days; and these specimens showed but slight signs of wear after such an ordeal. A large shaft bearing forming a step, which had suffered more than ordinary pressure on its collar, and which had been repeatedly replaced when made of brass, after three weeks' service, had suffered a diminution in the thickness of collar scarcely appreciable after eight months' use, the mills running night and day. An eccentric-strap which had run eighteen months was reduced in thickness at the crown ¼ inch, where the ordinary gun-metal straps had been replaced every three months. Perhaps the most striking example given of the ability of this alloy to resist wear and tear is that of an hydraulic pump plunger. This plunger had been at work for 572 days at the rate of sixty strokes per minute, under a pressure of three tons to the square inch, and showed no signs of wear; while lying by its side is a hardened steel plunger, which had been subjected to the same work during sixty days, and was worn to such an extent as to be of no further use. Specimens of wire made from this alloy are also shown, with tabulated data of experimental tests made with it, which establish that, while it is more ductile than copper, it exceeds in tenacity some of the strongest of steel.

ON THE CHIEF SYSTEMS OF SEWAGE DISPOSAL NOW IN OPERATION.

The attention of the Local Gorvernment Board having been directed to the great difficulties experieneed by sanitary authorities in devising means for the disposal of the sewage of their districts; and, having regard to the frequent applications which are made to them for advice on this subject, deemed it expedient that inquiry should be made under their direction into the practical efficiency of the chief systems of sewage disposal now in operation, and for which loans have been sanctioned by them.

So they appointed Mr. C. S. Read, M.P., one their secretaries, and Mr. Robert Rawlinson, C.B., their chief engineering inpector, in conjunction with Mr. Smith, the secretary to the late Rivers Pollution Commission, as their assistant, to visit a limited number of localities in which the processes in question are in operation, and report fully thereon to the Board.

These gentlemen accordingly visited Edinburgh, Wrexham, Chorley, Blackburn, Doncaster, Harrogate, Wolverhampton, Leamington, Warwick, Rugby, Banbury, Bedford, Crydon, Norwood, Reigate, Worthing, Aldershott, Romford, Tunbridge Wells, Cheltenham, Merthyr-Tydfil, Barking, Norwich, and Enfield; Kendal, where the downward intermittent principle is carried out · Leeds, Bolton, Conventry, Tottenham, Edmonton, and Hertford, where sewage is treated by a chemical process; Bradford, Birmingham, and Luton, where sewage-sludge is precipitated by the addition of lime; and Halifax, Rochdale, Salford, ane Manchester, where pail system is partially used for dealing with excreta. They also visited Leyden and Amsterdam, where the pneumatic system is partially in operation; Paris, where only a portion of the sewage is utilised in irrigation; and Brussels and Berlin, where the sewage is about to disposed of in irrigation, and their report is just now issued,* and contains the following:

London: Eyre & Spottiswoode. 1876.

Conclusions.

"1. That the scavenging, sewering, and cleansing of towns are necessary for comfort and health; and that, in all cases, these operations involve questions of how to remove the refuse of towns in the safest manner and at the least expense to the ratepayers.

2. That the retention for any lengthened period of refuse and excreta in privy-cesspits, or in cesspools, or at stables, cowsheds, slaughter-houses, or other places in the midst of towns, must be utterly condemned; and none of the (so-called) dry-earth or pail systems, or improved privies, can be approved, other than as palliatives for cesspit-middens, because the excreta is liable to be a nuisance during the period of its retention, and a cause of nuisance in its removal; and, moreover, when removed leaves the crude sewage, unless otherwise dealt with by filtration through land, to pollute any watercourse or river into which such sewage may flow. We have no desire, however, to condemn the dry-earth or pail systems for detached houses, or for public institutions in the country, or for villages, provided the system adopted is carefully carried out.

3. That the sewering of towns and the draining of houses must be considered a prime necessity under all conditions and circumstances, so that the sub-soil water may be lowered in wet districts, and may be preserved from pollution, and that waste-water may be removed from houses without delay; and that the surfaces and channels of streets, yards, and courts may be preserved clean.

4. That most rivers and streams are polluted by a discharge into them of crude sewage, which practice is highly objectionable.

5. That as far as we have been able to ascertain, none of the existing modes of treating town-sewage by deposition and by chemicals in tanks appear to effect much change beyond the separation of the solids, and the clarification of the liquid. That the treatment of sewage in this manner, however, effects a considerable improvement, and, when carried to its greatest perfection, may in some cases be accepted.

6. That so far as our examinations extend, none of the manufactured manures made by manipulating town refuse, with or without chemicals, pay the contingent costs of such modes of treatment; neither has any mode of dealing separately with