REPRODUCTIONS OF PRINTS, DRAWINGS AND PAINTINGS OF INTEREST IN THE HISTORY OF SCIENCE AND ENGINEERING

4. Richard Trevithick and the First Railway Locomotive.

By E. C. WATSON

"It has been claimed that the steam locomotive, in conjunction with the railway, has done more to promote the progress of the human race than any other single product of man's ingenuity."[1]

THE originator of the steam locomotive was, without question, Richard Trevithick, (1771-1833), *Fig. 1*, who pioneered the high-pressure non-condensing steam engine. On Christmas Eve, 1801, on Beacon Hill at Camborne in Cornwall a road locomotive, designed and built by Trevithick, carried the first load of passengers ever conveyed by steam and in 1803 another steam vehicle made by him was run in the streets of London without, strange as it now seems, attracting enough attention to lead to a single press notice. A modification of this engine was used successfully in 1804 to haul trucks on the tramway running from the Penydarran Iron Works, near Merthyr Tydvil, Wales, to Abercynon, a distance of nine miles. This was the first railway locomotive. Unfortunately its exact construction is uncertain and no authentic illustration of it exists. It is known, however, that it weighed about five tons and had a cylinder 8.25 inches in diameter by 54 inches stroke. It also discharged the exhaust steam into the chimney. When first tried on February 21, 1804, a date forever memorable in the history of the locomotive, it hauled a load of about 20 tons at a speed of five miles an hour. The performance was described by Trevithick in a letter to Davies Giddy dated Penydarran, 1804, February 22, which reads as follows:[2]

> "Yesterday we proceeded on our journey with the engine; we carry'd ten tons of Iron, five waggons, and 70 Men riding on them the whole of the journey. Its above 9 miles which we perform'd in 4 hours & 5 Mints, but we had to cut down some trees and remove some Large rocks out of the road. The engine, while working, went nearly 5 miles pr hour; there was no water put into the boiler from the time we started untill we arriv'd at our journey's end. The coal consumed was 2 Hund.[d] On our return home, abt 4 miles from the shipping place of the Iron, one of the small bolts that fastened the axel to the boiler broak, and let all of the water out of the boiler, which prevented the engine returning untill this evening. The Gentleman that bet five Hund.[d] Guineas against it, rid the whole of the journey with us and is satisfyde that he have lost the bet. We shall continue to work on the road, and shall take forty tons the next journey. The publick untill now call'd mee a schemeing fellow but now their tone is much alter'd."

A similar engine was supplied to the Wylam colliery at Newcastle in 1805, but apparently it was not used, possibly because its weight was too great for the wooden rails upon which it was to run. Drawings of this locomotive have, however, been preserved and are now in the Science Museum in London. They are reproduced in *Fig. 2*. This locomotive is believed to be almost identical with the Penydarran one and is the lineal ancestor of the Wylam and early Stephenson locomotives.

Several accounts of Trevithick's romantic career are available. The *Life of Richard Trevithick, with an Account of his Inventions,* written by his son Francis Trevithick (London, 1872, 2 vols.) is the source of nearly all that is known about him, but it is uncritical, tedious and repetitious. A more critical, readable, and up-to-date life has been provided by W. H. Dickinson and Arthur Titley in their memorial volume, *Richard Trevithick, the Engineer and the Man* (Cambridge, 1934). This excellent work contains a very complete four-page bibliography. A still more recent short account will be found in *Great Engineers* by C. Matschoss (London, 1939, pp. 154-171).

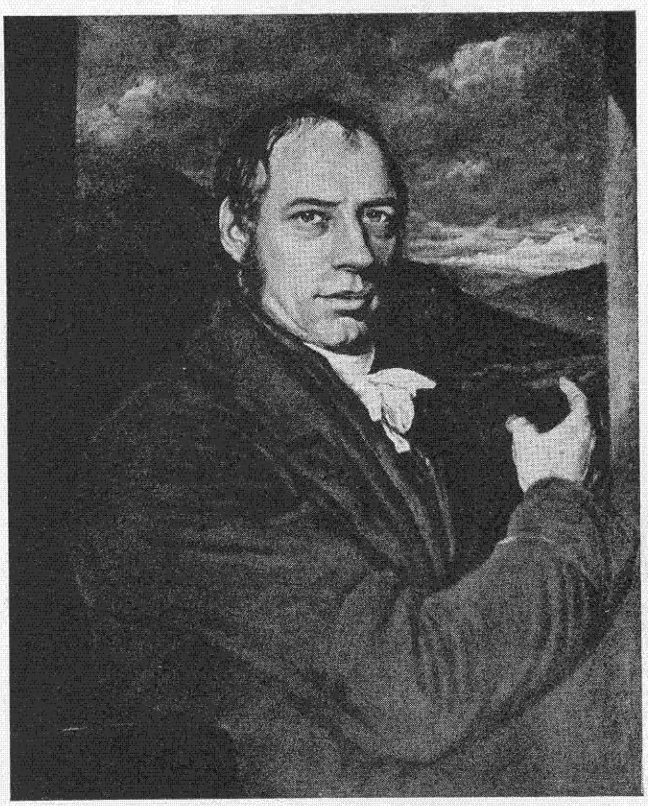

FIG. 1. Richard Trevithick (from portrait painted in 1816 by John Linnell, now in the Science Museum, London).

[1] Handbook of the Science Museum, *Land Transport. III. Railway Locomotives and Rolling Stock. Part I—Historical Review* (H.M. Stationery Office, London, 1931). The writer is greatly indebted to the Science Museum and its excellent handbooks.

[2] From the Trevithick—Giddy correspondence preserved by the Enys family at Enys and now in the possession of the Royal Institution of Cornwall at Truro, Cornwall.

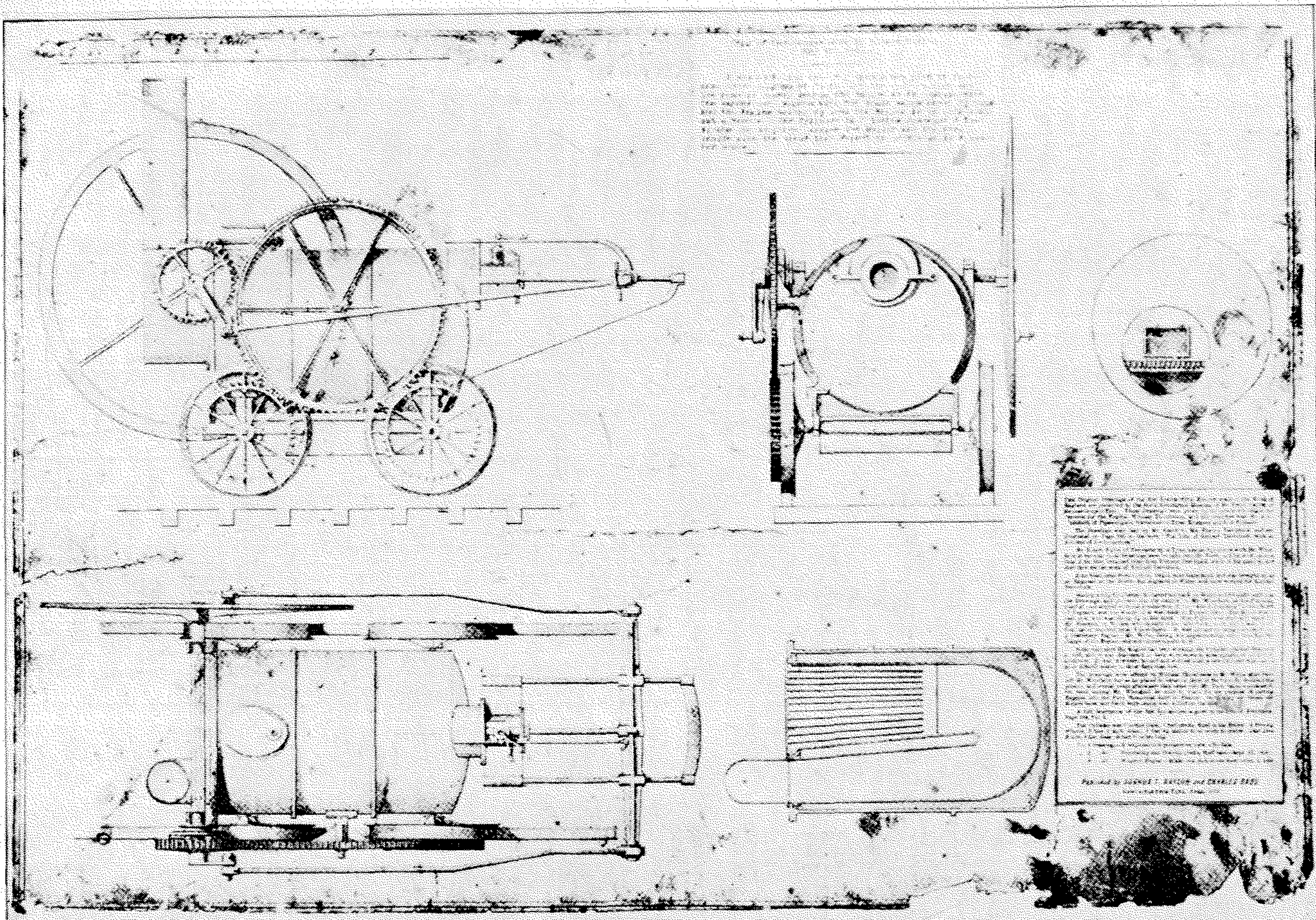

FIG. 2. Trevithick's Newcastle locomotive, 1805. (From the original drawing in the Science Museum, London).

Turning Them Around

(Continued from Page 11)

problems to cope with that he can no longer concern himself with the details of servicing individual airplanes. Similarly, the shop superintendent, charged with the responsibility of supervising more than 20 different shops and crews which may number as much as 1,000 men, finds his time occupied to a large degree by personnel matters whose ramifications can be and sometimes are quite complex. He, too, therefore, must restrict his activities to those dealing with the over-all picture.

Hence, the creation of a work-scheduling and planning organization. It is the planning supervisor, assisted by his staff, who schedules the many aircraft maintenance projects requested by various individuals or groups within the airline organization, plans all jobs within the shops, coordinates with the purchasing department in the procurement of supplies, keeps detailed records on engine, instrument, and accessory times, sees that job orders are issued when cost accumulation on a particular undertaking is desired, and develops work analyses leading to job simplification and standardization. Finally, it is the planning group that releases the aircraft to the operations department for scheduled operation.

THE END IN SIGHT

This release is accomplished in two steps. There is first the test flight. Although new installations on the aircraft may have a previous shop test—propellers and engines on a run-up stand, instruments inside pressure chambers and on wobbling mounts that simulate all types of flight conditions—there is always a test flight to make certain that items which functioned separately satisfactorily will perform just as correctly on the airplane. The plane goes into the water; its engines are run up and thoroughly checked by qualified mechanics; and inspectors commence a survey of the ship which lasts for the duration of the flight. Next the flight crew comes aboard and makes a second check of the entire airplane before the actual flight test begins. When all is in readiness, engines are started, the ship is taxied to the take-off area, and a carefully controlled and observed take-off is made. The flight test is under way.

During the test flight, each functioning system of the aircraft is carefully checked for proper operation. If any irregularities are noted, they are recorded and must be corrected before scheduled flight operation is resumed. In addition to routine checks, there may also be special engineering tests or investigations to be made. For example, engine tests may be run, not only for the purpose of testing the particular airplane involved, but to obtain data that may be useful to the entire aircraft industry, or an instrument calibration of some nature may be required. Normally, it is here that the performance engineer steps into the limelight, gathering his data for subsequent reduction and application toward more efficient or safer flight operation of the aircraft. On some occasions, where a number of diverse tests and checks are being made simultaneously, the inside of the plane resembles the main intersection of a metropolitan community, such is the bustle of engineers, flight per-