

that he would have no part in such an affair." The astonishing, inexplicable thing is that Oppenheimer later gave different accounts of the incident; and that in particular he gave an egregiously untruthful account to a security agent called Boris T. Pash, in which he refused to disclose Chevalier's name while saying that several other men were involved—a cock-and-bull story that was much more injurious to himself and Chevalier than the truth, and which at his "trial" he allowed to be called "a tissue of lies". It was an incredible thing to do; and when asked why he did it, he replied: "Because I was an idiot." It did him critical harm.

What could be the explanation? Nobody among his friends or his enemies has found a credible answer by looking at the character of Oppenheimer. Is it to be found, I propose, by looking instead at the character of the incident? Is that kind of interrogation liable to induce that kind of aberration? Oppenheimer's egregious performance *vis-à-vis* Colonel Pash was recorded through a hidden microphone and it makes disturbing reading—because of the peculiar intimacy existing between interrogator and interrogated. A fulsome, ingratiating duplicity on the interrogator's side; a fulsome, yielding over-accord on the interrogated's—"God bless you," he says at the end of it. One wants to turn one's head away . . . But that would mean turning one's head away from a very serious matter, where security really on trial could well be required to prove its case. The matter at issue is not the unnaturalness of the intimacy: it is the trustworthiness of the situation—its trustworthiness not to throw a man off balance, not to produce, while he is in it, almost a personality change. Is the solution to the Oppenheimer enigma not that he was an idiot, but that such interrogations are liable to bring idiocies to a man's lips? Really on trial, security is not invulnerable. WILLIAM COOPER

Early Trains

Civil Engineering: Railways. By Bryan Morgan. Pp. xvi+176+45 Photographs. (Longman: London, April 1971.) £2.96.

THE admirable series of studies of industrial archaeology edited by Mr. L. T. C. Rolt has now reached railways. Wisely, he has decided that the subject is too big to be comprehended in a single volume, such as the one he wrote himself on *Navigable Waterways*, and that it must be treated in two. This book is therefore complemented by another on mechanical engineering, written by Mr J. H. Snell.

Mr Morgan's study is comprehensive, clearly arranged, and most pleasantly written. Within the modest limits en-

forced on him he packs a great deal of information and lively comment. He rightly stresses the importance of the early years of railway building, before the locomotive appeared and during its primitive, fitful development. He pays proper attention to the track, commenting with a severity that is well justified on the treatment usually accorded to "these unglamorous lengths of scrap iron" in museums, and taking trouble to explain the reasons that lay behind the adoption of different forms of rail, sleeper, and ballast. His illustrations and diagrams are a well integrated adjunct to his text.

The book has some faults. Its proportions may be criticized here and there. Scotland receives on the whole scanty attention. Of more than a hundred structures mentioned in the gazetteer at the end of the book, only four lie north of the border. Perhaps more serious, more than four-fifths of the text is devoted to the period before 1865. That was indeed the heroic age of railway building in this country, but notable work has been performed since, which is passed over here: for example, the extraordinary series of bridges, in Staffordshire blue brick, erected over the Midland Railway's line south of Kettering in the 1880s and 1890s, where the engineers were treating the bricks in an almost plastic way that seems to anticipate the handling of reinforced concrete in the twentieth century. And by way of a final criticism it must be said that there are rather more small mistakes here than there ought to be: obvious misprints uncorrected, names mis-spelt and places wrongly cited—Ashburton for Ashton, for example. It was not the North Midland Company that tried to reach Manchester (page 117); nor was Tite the architect of the station at Shrewsbury (page ix).

These small blemishes can be rectified when the book goes into a second edition. It deserves to be kept in print for a long time as an excellent introduction to its subject, which will not lose its value. Mr Morgan is generous in searching out distinction among his engineers and architects, whether in pioneering forms and techniques or in aesthetic sensibility, and he communicates his enthusiasm so attractively that he will inspire his readers to follow him in the direction of inquiry he has laid down. His book achieves its purpose very well indeed. JACK SIMMONS

Röntgen Revealed

The Life of Wilhelm Conrad Röntgen. By W. R. Niske. Pp. xi+355. (University of Arizona: Tucson and Arizona April 19, 1971.) \$8.50.

WHEN in 1895 Röntgen made his great discovery he was already fifty years old,

and the rest of his life was in a sense an anticlimax; it seems that he genuinely hated fame and publicity, and regretted his move from Würzburg, where he had been happy, to Munich, where he was not. After his three papers describing the phenomena of the X-rays, he played no important part in the practical development of the apparatus or in the explanation of the phenomena; in this he reminds one of Volta, who made his discovery at much the same age. It is clear from this biography that Röntgen's discovery, while unexpected, was in no sense an accident. He had been carefully trained under A. E. E. Kundt to make very accurate determinations of physical quantities; first investigating the specific heats of gases, and then studying electromagnetism, and the physical properties of crystals. His academic position—he had held a chair at Giessen before being called to Würzburg to follow Kohlrausch—and his reputation for sober accuracy ensured that his preliminary paper on X-rays was taken seriously.

The study of cathode rays was an obvious field for investigation; mercury pumps were available to give very low pressures, and it seems that others had noticed fluorescence near cathode ray tubes and fogging of photographic plates, but had not seriously investigated the matter. In November and December 1895, Röntgen investigated the X-rays in an extremely capable manner, proving that the effects could not be due to cathode rays, and taking a number of X-ray photographs. He submitted his preliminary paper on December 28, 1895; it was published with a rapidity that moderns might envy, for the offprints were ready to be sent out on new year's day 1896. Röntgen was transformed from a man with a high reputation within his field into a celebrity; and was in 1901 awarded the first Nobel Prize for Physics.

Reading this sympathetic biography, one feels that Röntgen had somehow got out of his depth; like Faraday, he had the "ability to improvise laboratory equipment, which enabled him to make observations that less skilled men were unable to do", but we find little evidence that like Faraday he was a solitary voyager in strange seas of thought. His orderly life, with the spring and summer vacations spent in Italy and Switzerland, does not have that appearance of complete devotion to the struggle with the mysteries of nature which characterizes those few scientists of the first rank. Röntgen's example can encourage us all, for he seems to have been a rather ordinary scientist who made an extraordinary discovery; and this biography is valuable in bringing before us such a man and casting light on his times. In spite of a ten-