IV d 1

The rust proofing of steel bridges

Der Rostschutz von Stahlbrücken

Protecção contra a ferrugem de pontes de aço

Protection contre la rouille des ponts en acier

F. A. RIVETT, M. A.
Schori Division, F. W. Berk & Co. Ltd.
London

This paper deals with metal spraying as a method of rust-proofing steel bridges. Once a bridge has been erected in a non-rust proofed condition, metal spraying is normally the only feasible method of rust-proofing it in situ. Because of the large size of bridge members it is also frequently the only way of rust-proofing before erection.

The process involves blasting with sand or chilled iron shot to remove all rust, scale and other contamination from the surface of the steel and to roughen it slightly. For blasting in situ, air blasting is always employed because it is so flexible a process. The abrasive is loaded into a pressure vessel and is then entrained in a stream of compressed air, the operating pressure normally being about 80 lbs. per square inch. The particles emerge at high speed from the blasting nozzle and readily remove all scale and contamination down to the bare steel. On some types of bridges it is possible by a suitable arrangement of tarpaulins to collect about 50 % of the abrasive for re-use. In other difficult locations it is not possible to collect any for re-use.

Figure No. 1 shows open blasting in progress on the Oddesund Bridge, Denmark.

Where it is possible for the bridge steel work to be rust-proofed before erection, there are in existence a number of factories specially equipped to do this and in some of these very large items can be handled readily. Figure No. 2 shows what is thought to be the largest blast room in Europe in a metal spraying works in London. A considerable tonnage of bridge steel work is regularly treated through this room. In such an installation all the abrasive is of course collected for re-use.

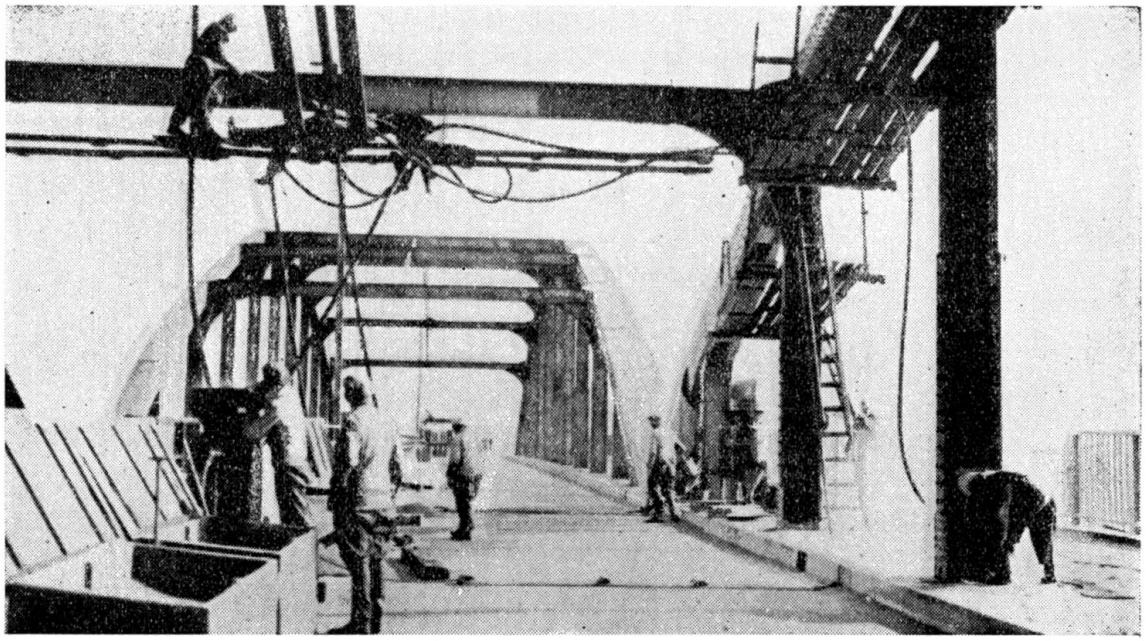

FIG. 1. Open sand blasting in progress on the Oddesund Bridge, Denmark

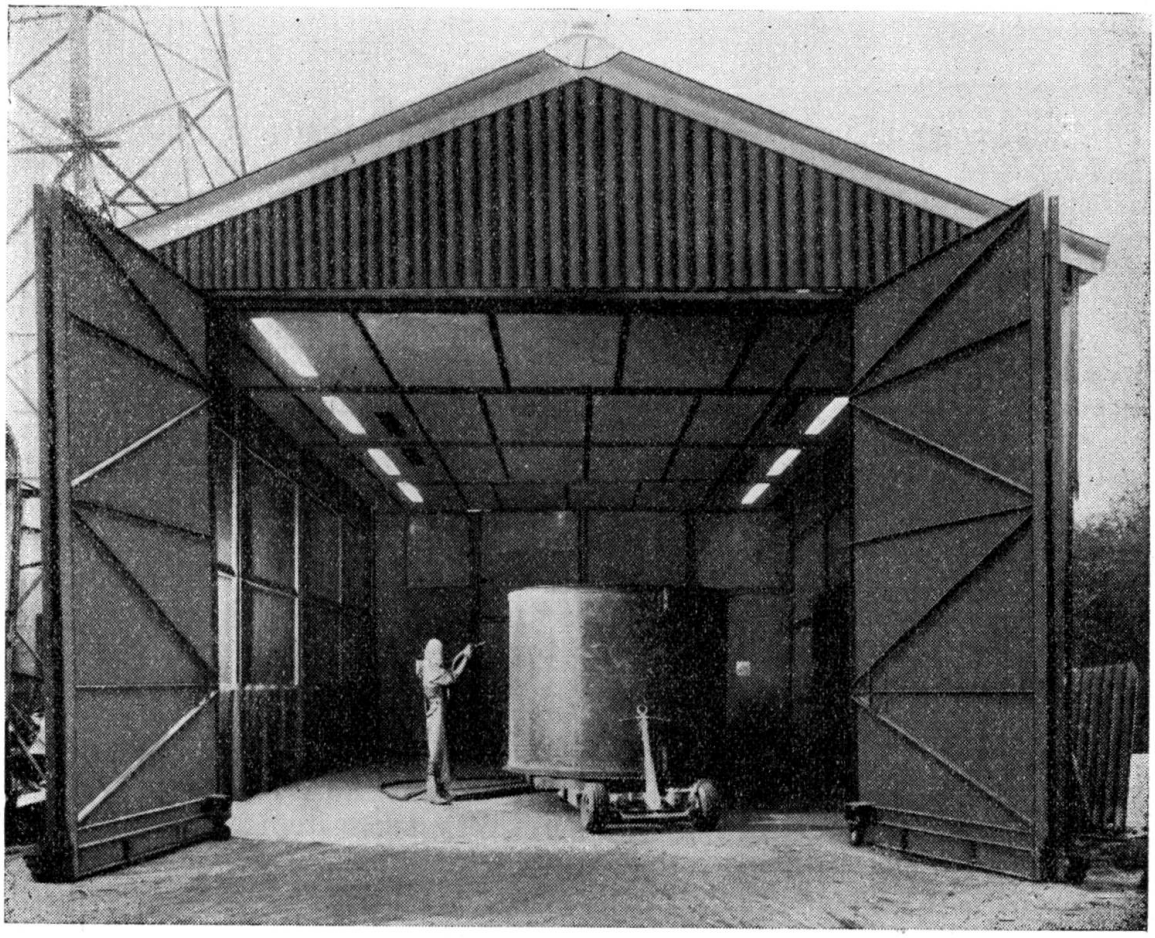

FIG. 2. A shot blast room in London, England thought to be the largest in Europe

Metal Spraying

After blasting the steel work must be metal sprayed before condensation or rust can form on the clean surface. Several types of metal spraying equipment are available. In the author's opinion the Schori gun which is also known as the Berk gun is the simplest and quickest

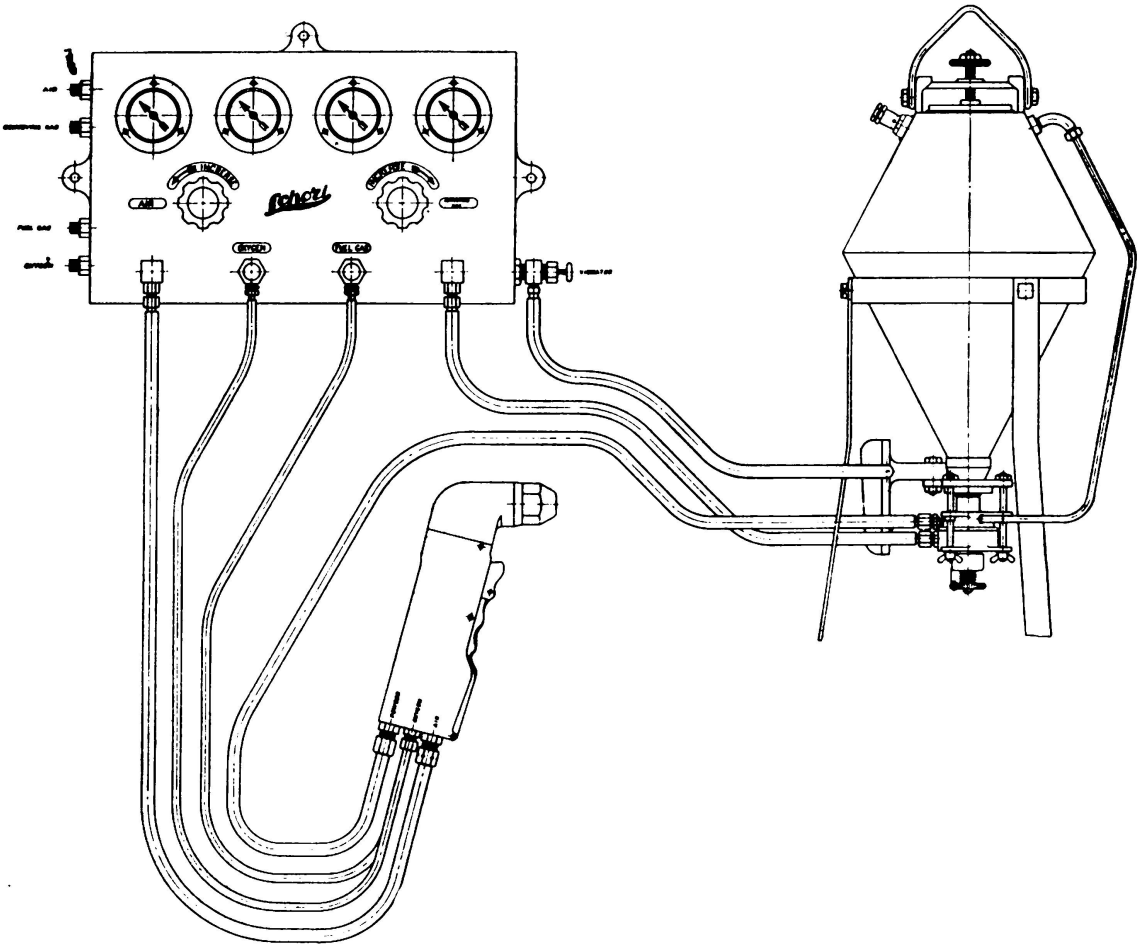

FIG. 3

as well as the most flexible equipment for spraying in awkward situations which frequently arise on bridge work. Basically the gun consists of a pressure feeding device whereby some 40 lbs. per hour of Zinc can be fed through a flame and firmly attached to the surface to be rust proofed. Figure No. 3 shows a layout of the complete equipment including the pistol, the powder feeder and the gas pressure control panel. The gun, which has no moving parts, is a very light and easily handled piece of equipment the weight being 2 $^1/_2$ lbs.

The Pistol

Figure No. 4 shows a cross section through the pistol.

Figure No. 5 shows metal spraying in progress on the Jubilee Bridge, Barrow in Furness, England owned by the Corporation of Barrow. The Consulting Engineers were Messrs. Freeman Fox & Partners, London.

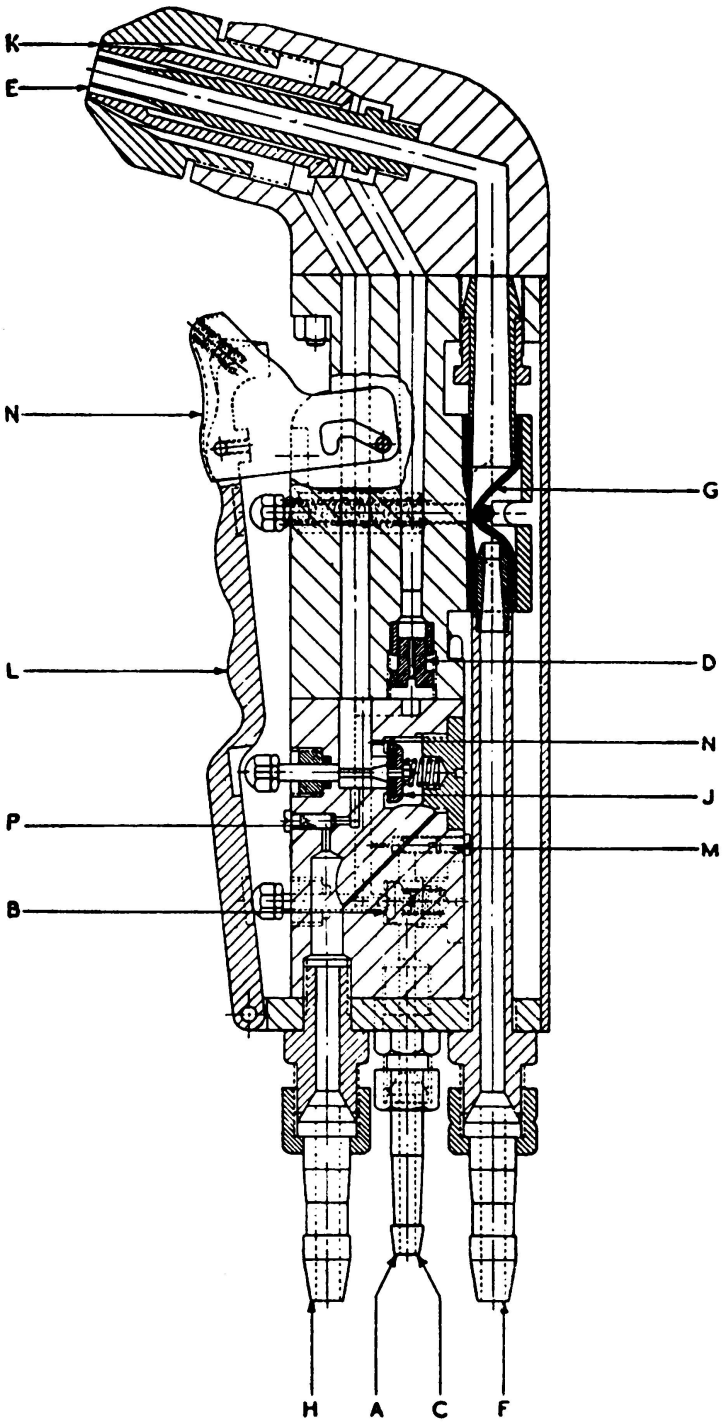

FIG. 4

Paint Systems

A sprayed metal coating is normally painted with whatever paint system is favoured by the Consulting Engineers. Zinc chromate priming paints are considered best both for sprayed Zinc and for sprayed Aluminium which is sometimes used to rust-proof bridges. The paint has to be formulated in such a manner as to incorporate small amounts of oxide to neutralize any acid which may be present in the vehicle.

Both Zinc and Aluminium which are the only sprayed metal coatings used on any large scale for rust-proofing bridges, are anodic to steel. This means that they will attract to themselves any corrosive ions which may be present thereby sacrificing themselves to protect the under-lying steel. As is well known, failure of paint systems applied to non-rust proofed bridges

normally arises through moisture penetrating the paint system and causing rusting beneath the paint which is then pushed off. Metal spraying prevents such under rusting and as a result a very long life of the paint system on the bridge is achieved. The only attack on the paint system on a rust-proofed bridge is from the effects of ultra-violet light, rain etc. on the top coat. This will ultimately become powdery and need replacing. If this is done at intervals the under-coats and the metal sprayed layer will remain intact for an indefinite period. This is

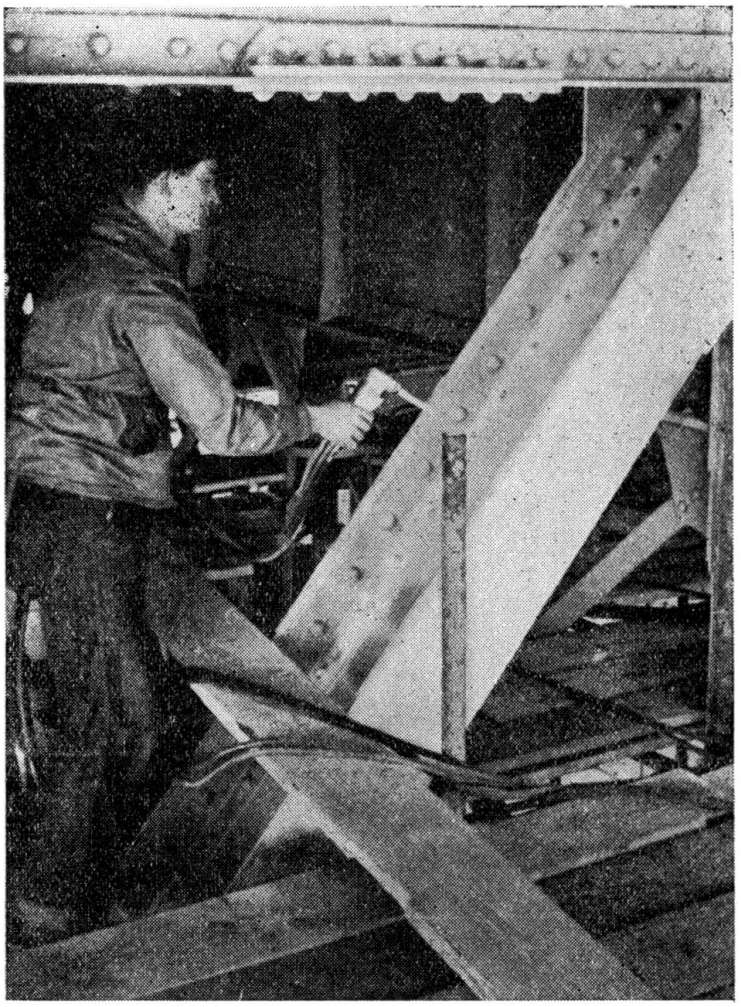

FIG. 5. Zinc spraying the previously sandlasted surface of the Jubilee Bridge, Barrow in Furness

illustrated by the excellent behaviour of the Menai Straits Bridge. Figure No. 6 shows the blasting and Zinc spraying of the suspension lengths of the Menai Bridge in progress in 1939. The Consulting Engineers were Sir Alexander Gibb & Partners and the Contractors Messrs. Dorman Long & Co. Ltd. It is exposed to severe marine conditions with high wind speeds. The paint applied to the rust-proofed links in 1939 is still in excellent condition after 17 years and provided the top coat is

replaced when necessary, the rust-proof system should have an indefinite life. The deck which was not rust-proofed has had to have very frequent attention.

Figure No. 7 shows the blasting and Aluminium spraying 0.006 inches thick of the large welded girders for the Black Bridge, Hook in the

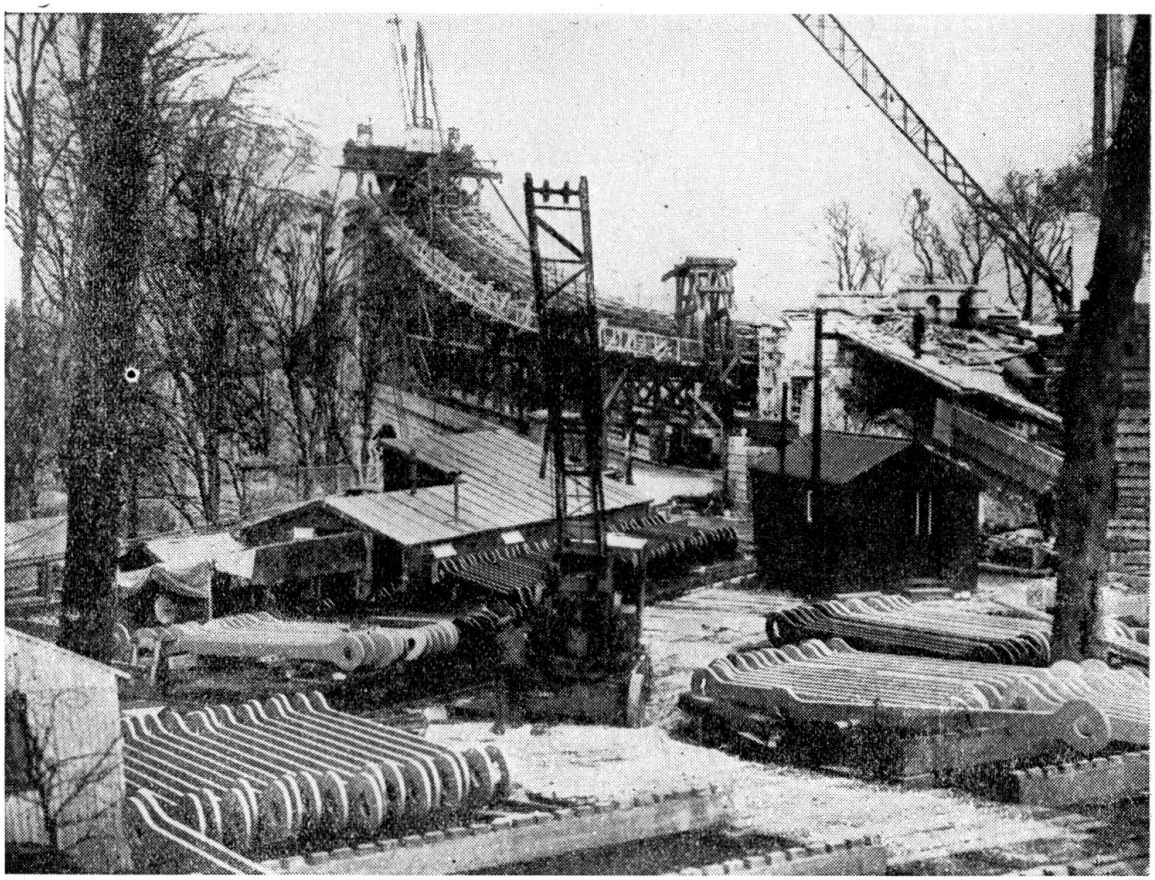

FIG. 6. The sandblasting and zinc spraying of the suspension links of the Menai Straits Bridge in 1939

workshops of The Butterley Engineering Co. Derby, England. The Consulting Engineers were Messrs. J. S. Wilson & J. Mason.

In certain conditions particularly in Chemical Works a duplex coating of sprayed Zinc followed by sprayed Aluminium has been found, after prolonged testing, to give excellent protection where a coat of Zinc or Aluminium by itself is attacked. A steel bridge in a Chemical Works in Britain is now being treated in this way.

The Economics of rust-proofing bridges

Steel bridges were always expensive structures and this is more than ever true today. They are normally expected to last a very long time and maintenance costs become of prime importance. The justifi-

cation for metal spraying is that a bridge treated in this way needs no attention for very many years and then only minor attention to replace the top paint coat. An eminent firm of Consulting Engineers has worked out that the maintenance cost of a metal sprayed bridge is less than one quarter of the maintenance cost of the same bridge non-rust proofed. Pediodic obstruction of the roadway by scaffolding is also avoided. Be-

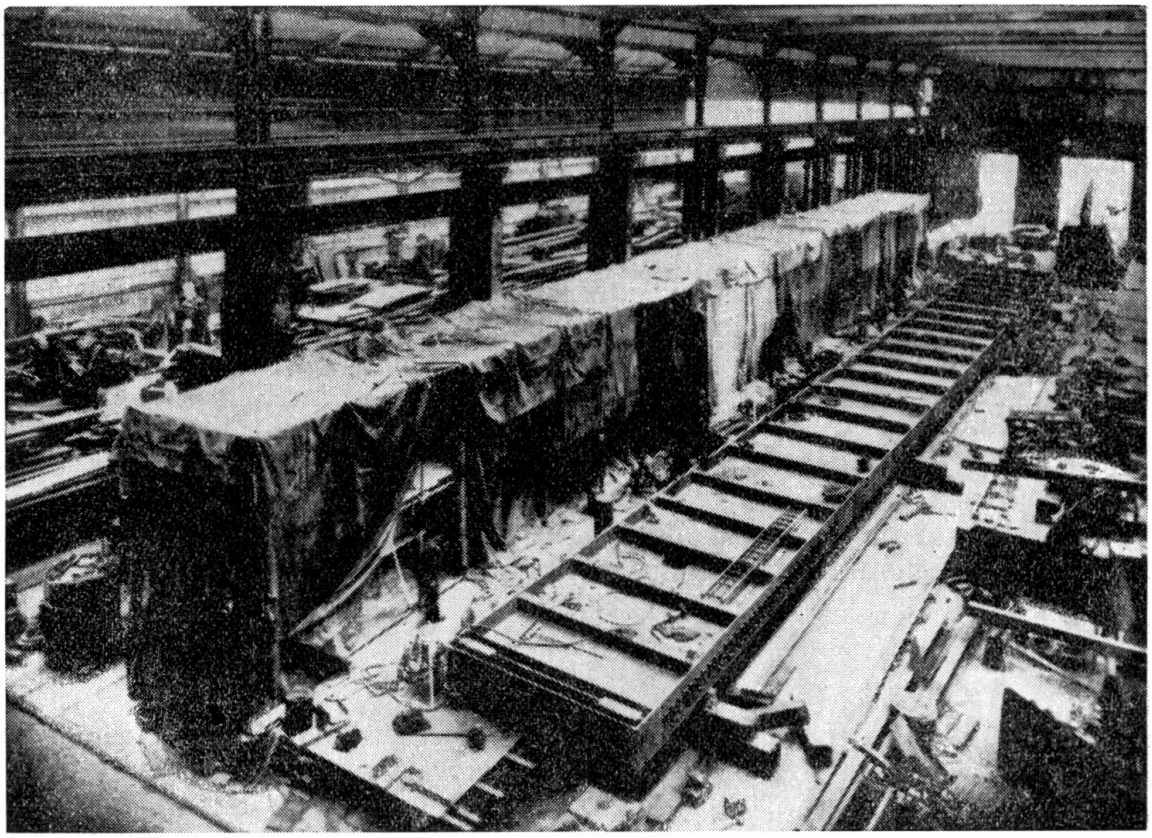

FIG. 7. The aluminium spraying of the main girders of the Black Bridge, Hook in the Works of The Butterley Engineering Co. Derby, England

cause of the good results obtained the use of the process on bridges is increasing. The mobility of the equipment allows it to be used on new or existing bridges in any part of the World.

SUMMARY

This paper describes the experience with the rust-proofing of steel bridges by sand blasting and metal spraying dating back to 1939, the Menai Straits Bridge then treated still being in excellent condition. Methods of blasting are described and a speedy, flexible and cheap method of metal spraying is detailed and work in progress on bridges in Great Britain and Scandinavia is described.

The advantages to be achieved by rust-proofing are described with the economy in the virtual absence of maintenance costs.

ZUSAMMENFASSUNG

Dieser Aufsatz beschreibt die Erfahrungen, die bei Rostschutz von Stahlbrücken durch Sandstrahlung und Metallspritzüberzug seit 1939 gesammelt wurden; in jenem Jahre wurde die Menai Straits Brücke behandelt, die sich noch immer in ausgezeichneter Verfassung befindet. Es werden Sandstrahlmethoden beschrieben und eine rasche, anpassungsfähige und billige Methode für Metallspritzverfahren wird erläutert; Bilder zeigen Arbeiten an Brücken in Grossbritanien und Skandinavien.

Die Vorteile, die durch den Rostschutz nach dem erwähnten Verfahren erreicht werden, liegen insbesondere im Wegfallen aller weitern Unterhaltskosten.

RESUMO

Descreve-se a experiência adquirida na protecção contra a ferrugem de pontes de aço por meio de jacto de areia e pulverização de metal, desde 1939, estando a ponte do estreito de Menai, que foi tratada nessa data, ainda em excelente condição. Descrevem-se métodos de limpeza por jacto e dão-se pormenores de um método de metalização barato, prático e rápido, bem como de trabalhos em curso em pontes na Grã-Bretanha e Escandinávia.

Indicam-se as vantagens que trás a protecção contra a ferrugem, incluindo a economia devida à ausência virtual de despesas de conservação.

RÉSUMÉ

Les auteurs décrivent l'expérience acquise dans le domaine de la protection contre la rouille de ponts en acier, au moyen du jet de sable et de la pulvérisation métallique depuis 1939, le pont du détroit de Menai traité à cette époque étant aujourd'hui encore en excellentes conditions. Ils décrivent les méthodes de nettoyage par jet ainsi que le détail d'une méthode économique de métallisation pratique et rapide et des ouvrages en cours sur des ponts en Grande-Bretagne et en Scandinavie.

Ils décrivent les avantages obtenus au moyen de la protection contre la rouille, dont l'économie due à l'absence virtuelle de dépenses de manutention.