THE WAY TO WHITE CITY

Architectural Investigation
Reports and Papers B/056/2001

ENGLISH HERITAGE

THE WAY TO WHITE CITY

The *Porte Monumentale* and Overhead Exhibition Halls of the Franco-British Exhibition, 1908

Uxbridge Road/Wood Lane
London Borough of Hammersmith & Fulham
Greater London

NBR No: 106797
NGR: TQ 2376 7990

September 2001

Surveyed: June and August 2001
Report by Jonathan Clarke
Photographs by Nigel Corrie

Architectural Investigation and National Monuments Record London Office: 55 Blandford Street, London W1U 7HN
Tel: 020 7208 8200 **email:** london@rchme.gov.uk

CONTENTS

PREFACE

This survey report results from building recording carried out by the Architectural Investigation (London) section of English Heritage under the framework of its emergency recording programme. The White City Arch and the series of interlinked steel-framed sheds behind it survive as the only remnants of the Franco-British Exhibition of 1908, excepting the White City Stadium. Because the unlisted arch and sheds face imminent demolition to make way for a new shopping centre and rail terminal buildings, the opportunity was taken to record them so that their significance to constructional and architectural history was not lost.

English Heritage gratefully acknowledges the assistance of Glenda Stirling of the developers, Chelsfield plc, and Mark Perkins, of Step Property, for kindly arranging access to the site. We should also like to thank Mary Thomas of The Vanderbilt Racquet Club for granting access to the (former) 'Social Economy (Sports and Physical Culture) Hall', and Alimentation and Agriculture Building', and Bill Geddes of the London Borough of Hammersmith and Fulham Housing Department for granting permission for a high-level photograph of the site to be taken from the summit of Bush Court tower block. The assistance of the staff of Hammersmith & Fulham Local Studies Library is also acknowledged.

For English Heritage Jonathan Clarke was responsible for the building recording with assistance from Joanna Smith. Jonathan Clarke was responsible for the research, writing and production of this report. The large-format photographs are by Nigel Corrie.

Fig 1 – Site plan of the Franco-British Exhibition of 1908, showing overhead exhibition halls.

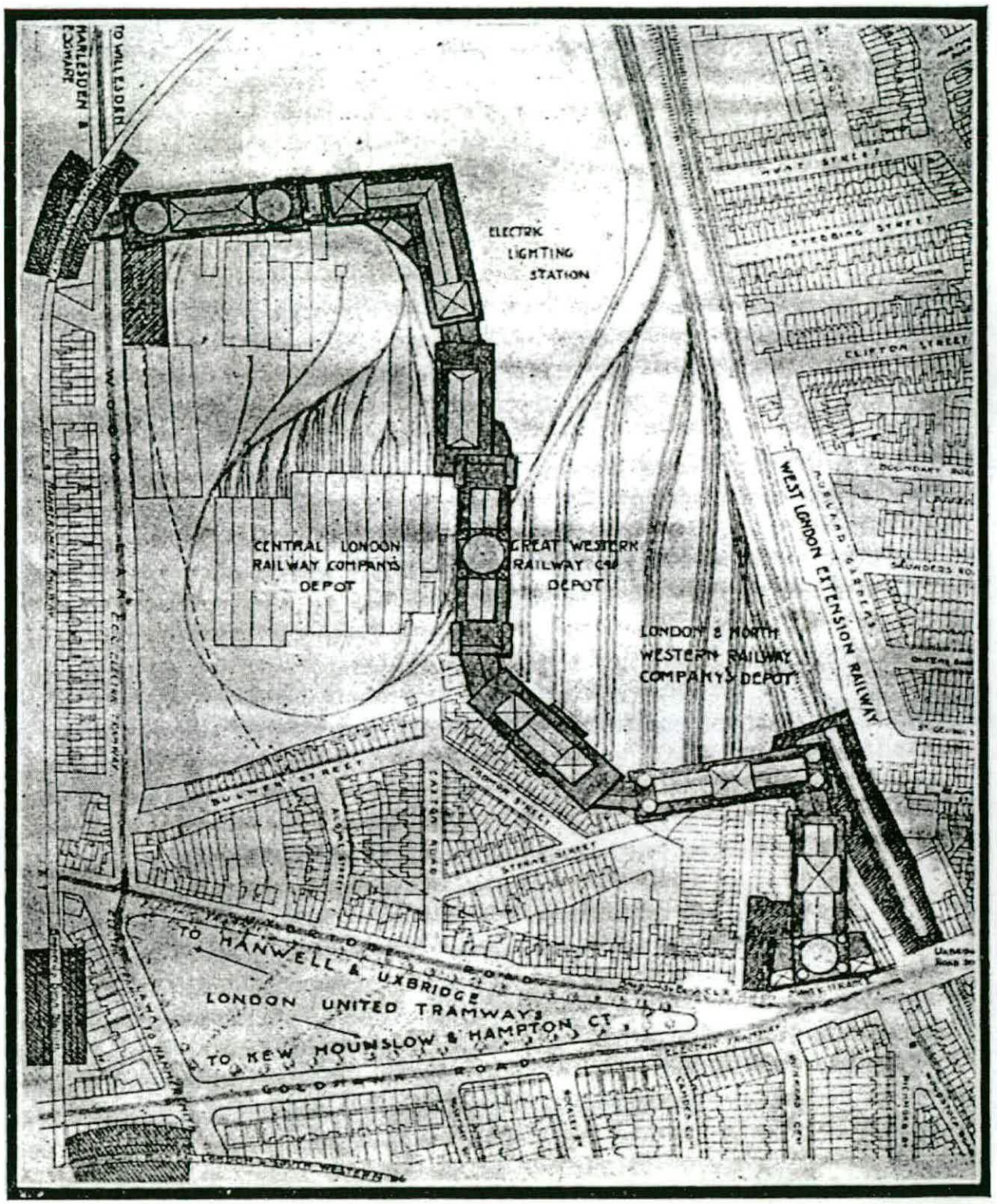

Fig 2 – The original ensemble of Overhead Halls (Nos 2 to 8) connecting the Shepherd's Bush and Wood Lane entrances in 1908.

INTRODUCTION

Hemmed in by buildings and the busy Uxbridge Road, the crumbling White City Arch survives in reduced form as the former *Porte Monumentale* of the massive, magnificent Franco-British Exhibition of 1908. In more ornate guise, this white, fibrous-plaster-clad structure formed the main entrance to a 140-acre exhibition site (some eight times the acreage of the 1851 Great Exhibition) in Shepherd's Bush that boasted one of the most ostentatious and fantastic architectural fantasies Britain had seen. To reach the exhibition grounds, visitors emerging from Shepherd's Bush Underground and Uxbridge Road stations filed through the White City Arch whereupon they were required to walk half a mile through seven steel-framed sheds, 'overhead halls' elevated some thirty feet above a sprawl of pre-existing railway sidings and goods yards. Five of these sheds survive. It was within this 'long crooked passage or Chinese bridge'[1] that the exhibition experience began, for the opportunity was taken to display in them as many British and French exhibits as possible. Indeed, these outwardly undistinguished sheds were officially designated exhibition halls, 'several of great importance',[2] complementing the many other halls, palaces and pavilions of the site proper. Emerging from the furthest shed, visitors crossed a footbridge spanning Wood Lane that led directly to a further entrance. Passing through this secondary (Wood Lane) entrance (demolished), visitors mixed with those arriving from Wood Lane Station. Beyond lay the magnificent Court of Honour and the main exhibition.

Fig 3 - The former Porte Monumentale *of the Franco-British Exhibition of 1908.*

'On paper it appears to hang to the main plan as a tail hangs to a kite' is how one contemporary described the spatial relationship between the Shepherd's Bush entrance/elevated walkway and the site-proper.[3] Today, virtually nothing remains of the exhibition grounds and buildings, the great majority of the site developed to make the present day Hammersmith Park and the BBC Television Centre. The main Uxbridge Road portal and the southern five of the original seven sheds that made up the convoy route endure as topographically incongruous survivors of 'one of the largest and most complex events in modern British cultural history'.[4]

THE FRANCO-BRITISH EXHIBITION OF 1908

Between the cutting of the first sod on 3 January 1907 and the official opening of the gates to the public on 14 May 1908, some 140 acres of land in Shepherds Bush were transformed into a colossal exhibition site - the latest of a series of international expositions initiated in England in 1851, but subsequently mainly staged in France and America. The Franco-British Exhibition was the largest exhibition held in Britain up to that date, attracting at least ten and a half million people from its opening day until the gates closed in late October. The brainchild of entrepreneurial mastermind Imre Kiralfy, it boasted some 40 acres of lustrous white-stuccoed buildings set within ornamental gardens, with courts, vistas and artificial waterways spanned by Rialto-like bridges and traversed by swan-like gondolas. The centrepiece was the magnificent Court of Honour, containing the largest machine hall ever built, surpassing even the dimensions of the celebrated Galérie des Machines at the Paris Expositions of 1889 and 1900. These buildings presented 'to an apparently eager public ... monumental displays of painting, sculpture, architecture, all the decorative arts of both nations, as well as displays of light and heavy industries, agriculture and alimentation'. Intermixed with the didacticism were frivolous displays more usually associated with the fairground; the 'Flip-Flap' (a twin-armed crane-like

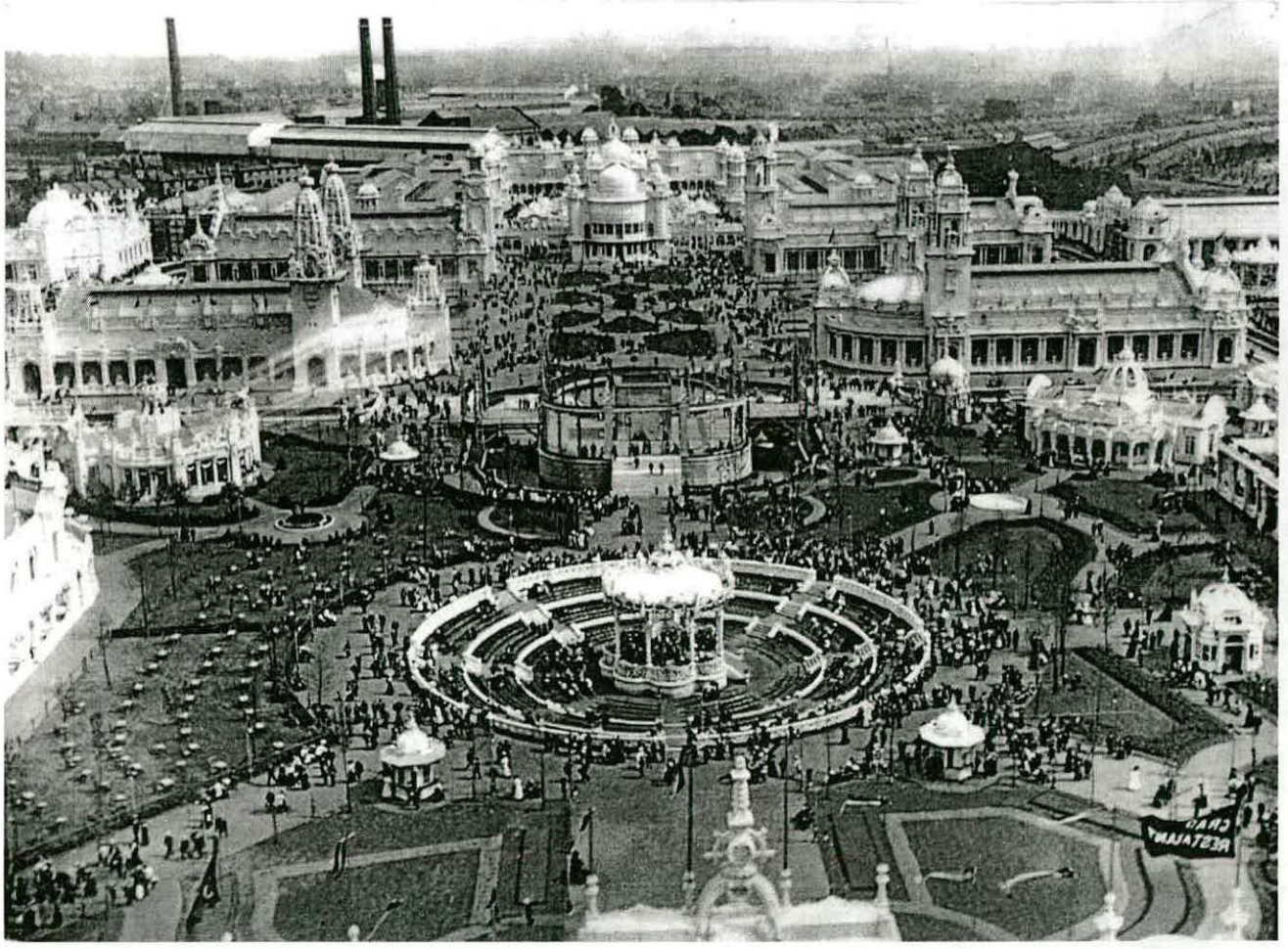

Fig 4 - The Franco-British Exhibition of 1908 from the vantage point of the 'Flip Flap', looking south east. The overhead halls can be seen snaking their way southwards next to the industrial chimneys.

device that transported passengers across the site in a scissor-like motion) and the 'Mountain Scenic Railway' were novelties designed as crowd-pullers, and they succeeded. Indeed, 'the exhibition set out to capture an audience across the social spectrum by bringing every conceivable art, high, fine and popular, on to the site in the greatest possible quantity'.[5] Ostensibly the exhibition celebrated the *Entente Cordiale* between the two nations (of growing importance to politicians either side of the channel, in view of the German threat), but underlying its physical representation – both of the architecture and exhibits, and running through its brief life-span, there were subtexts and oppositions grounded in the social and political tensions of the era. The role the exhibition played in the Edwardian socio-political situation, from the glorifying and popularisation of empire to the legitimisation of the traditional position of working-class women has been incisively covered by recent commentators.[6]

During the same summer of 1908 the 4th Olympic Games were held in a giant stadium occupying the northern portion of the site. Designed by John James Webster, this 75,000-capacity steel-framed edifice - the largest of its kind in the world - won the plaudits of contemporary architects (unlike the vast majority of the exhibition buildings), and has enjoyed a subsequent lease of life from 1926 as a venue for greyhound racing.

Following the phenomenal success of the Franco-British Exhibition, the site became the venue for further expositions before the onset of war: the Imperial International Exhibition (1909); the Japanese-British Exhibition (1910); The Coronation Exhibition (1911); the Latin-British Exhibition (1912); the National Gas Exhibition (1913); and the Anglo-American Exposition (1914). During the war the grounds and buildings were requisitioned by the Government as an Army training/medical examination site, and it was not until 1920 that the War Department vacated most of the site, although it retained possession of the Stadium and the seven entrance halls.

WHITE CITY ARCH, NO. 30 UXBRIDGE ROAD

Both the Uxbridge Road and Wood Lane Exhibition entrances were designed by the young French architect, René Patouillard-Demoriane. No. 30 Uxbridge Road – a giant white arch springing between flanking white towers – presented a fittingly imposing *Porte Monumentale* for the exhibition site; the towers of such proportions as to conceal the drab, unmistakably shed-like elevations of the 'overhead halls' behind. Despite this, contemporary architectural commentator Robert W, Carden criticised it for being too narrow, a condition he realised as probably unavoidable given the difficulty of obtaining sufficient width along this road frontage.[7] With more breadth at his disposal, Patouillard might have reproduced the more elaborate (demolished) portal he gave the Wood Lane entrance: two four-centred arches flanking a central tower. Yet Carden was even more dismayed by this larger entranceway:

> ... to see, as it were, this arch split up into two portions in order to accommodate a tower in its midst is just a little startling. Novelty of this kind should, at least, have beauty to support it; but in this case the architectural embellishments resemble nothing so much as a collection of odd casts, left over from other buildings and worked in here according to the space to be filled.[8]

The present stripped, blocky look of the Uxbridge Road arch probably dates from a 1930s overhaul when a cleaner, more modern look was desired (Fig. 5). Patouillard's original conception was a florid French 'neo-baroque' composition, vaunting highly-intricate plasterwork and towers crowned by pavilions (Fig. 4). In common with the Wood Lane entrance and the great majority of the structures erected for the 1908 Exhibition, the structure is a light steel frame clad in fire-resistant fibrous plaster. Although not named in contemporary descriptions, the engineer responsible may have been John James Webster (1845-1914), who designed the frameworks for most of the exhibition buildings, including the Machinery Hall, the Agricultural Hall, the Indian Court, the Stadium and a number of the 'overhead' exhibition halls.[9] The steel fabricating company chosen to erect the various structures was Alexander Findlay and Co., of Motherwell, near Glasgow, a well-established company with a track record of steel constructional work. Many of the steel I-sections, both in this block and in the sheds further north, bear the rolling mark 'Glengarnock Steel', showing not only that the higher quality open-hearth steel (as opposed to Bessemer) was used, but the continued penetration of this Scottish steelwork's products into the metropolitan market.[10]

Fig 5 - The White City Arch as it looked in 2001, from the southeast.

THE EXHIBITION HALLS

Five of the original seven interconnecting 'overhead' buildings linking the Uxbridge Road Entrance with that in Wood Lane still survive. Designed to provide an easily navigable, covered walkway for the hordes of visitors – many arriving from outside the metropolis, and thus unfamiliar with it, they were an adroit solution to the tricky problem of minimising interference with the pre-existing railway operations at ground level. The various railway companies who owned the swathe of land bounded by Wood Lane, Uxbridge Road, and Latimer Road agreed to lease just small plots of ground to the Exhibition Company. Steel-frame construction provided the requisite solution, for by raising a series of giant, rigidly connected halls on a minimal number of point supports or stilts, most of the space underneath could remain usable with only minor detriment to light and ventilation. Traditional brick, or indeed the emerging methods of reinforced-concrete construction would almost certainly have been too monumental in that they would have required supporting walls, piers or columns of untenable dimensions.[11] The exhibition company was clearly not granted the most direct route through this land; the three southern-most sheds were marginalized to the edges of the goods yard, hugging close to the boundary with the nineteenth-century terrace housing along Providence Place (now renamed Shepherd's Bush Place) and Tadmor Street (Figs 1 and 2). The inherent flexibility of the technique of steel-frame construction again provided the requisite degree of freedom in enabling the sheds to twist and turn around such obstacles: in places they almost touch the houses. Perhaps the chief virtue of steel construction in this context, as indeed with the exhibition as a whole, was the extreme rapidity of erection. Once the ground leases had been secured, the buildings could be easily put up in time to meet the tight, fifteen-month construction deadline.

In common with the main exhibition structures, the overhead sheds were each assigned a particular name, reflecting the nature of the themed exhibits within. Working northwards from the main entrance they comprised the 'Liberal Arts Palace (British)'; the 'Social Economy (Sports and Physical Culture) Hall (British)'; the 'Alimentation and Agriculture Building (British)'; the 'Education Building (French)'; the 'Agriculture, Horticulture and Arboriculture Palace (French)'; the 'Alimentation Hall (French)' [demolished]; and the 'Liberal Arts Palace (French)'[demolished]. The sheds, each averaging some 400ft long and 70ft wide, rest some 30ft above the ground on sturdy built-up 10in. by 12in. H-section steel stanchions, formed from back-to-back channels and plates (Fig. 6).

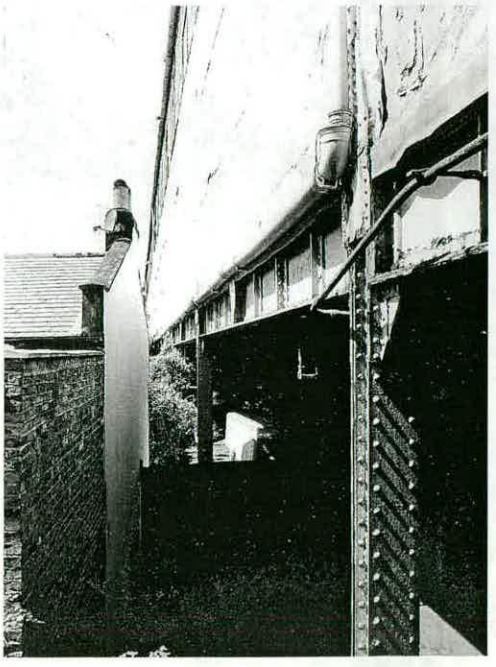

Fig 6 - Construction detail of the former 'Social Economy Hall', looking west.

Immediately encountered upon entering the Uxbridge Road *Porte Monumentale*, the interior of the former Liberal Arts Palace suggests that a conscious attempt was made to instil the visible steel superstructure of the halls

with an aesthetic that transcended the usual connotations of industrialised shed-like engineering. It consisted originally of one giant open space, the roof principals being of a conventional utilitarian form, but incorporating the shapely curvilinear lower chord so characteristic of railway station trusses of the 1890s and 1900s. Because this lower chord extends deep down the height of the lattice stanchions (rather than simply resting on the top, as is usual with simple triangulated trusses) it serves to stiffen the structure laterally while effecting a more harmonious union between the horizontal and vertical elements. Asbestos sheeting replaced the original corrugated metal roofing in the 1930s, but the original fenestration was retained, running in continuous strips either side of the roof apex. The sides of the building are formed from 3in.-thick breeze concrete panels attached to horizontal wall joists spanning between the stanchions- a relatively early application of the material in this form.[12] In the mid 1970s the former Liberal Arts Palace shed was refurbished by Hume Chadwick and Partners who inserted within the structure a lofty top-lit atrium enclosed on all sides by a double-storey gallery (Fig. 8). This dramatic alteration, converting the space to be the temporary head offices of Arrow Life Assurance Company Ltd, was accompanied by the insertion of partitions and ceilings which conceal much of the original structure.

Fig 7 - Trussed roof principals of the former 'Liberal Arts Palace', glimpsed through suspended ceiling of the 1970s.

Fig 8 - Atrium inserted within the original structure of the former 'Liberal Arts Palace'.

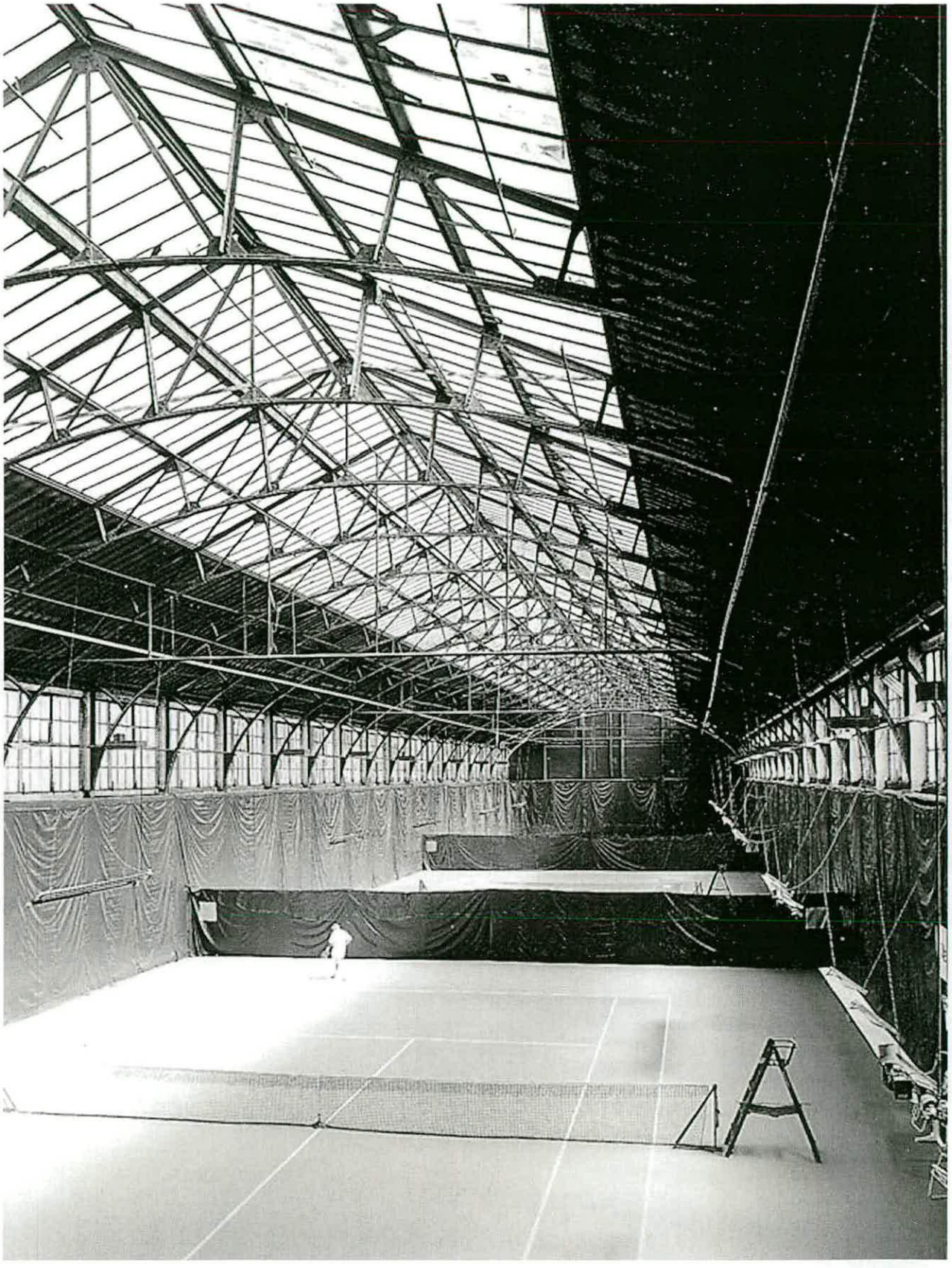

Fig 9 - the former 'Social Economy (Sports and Physical Culture) Hall (British), looking east.

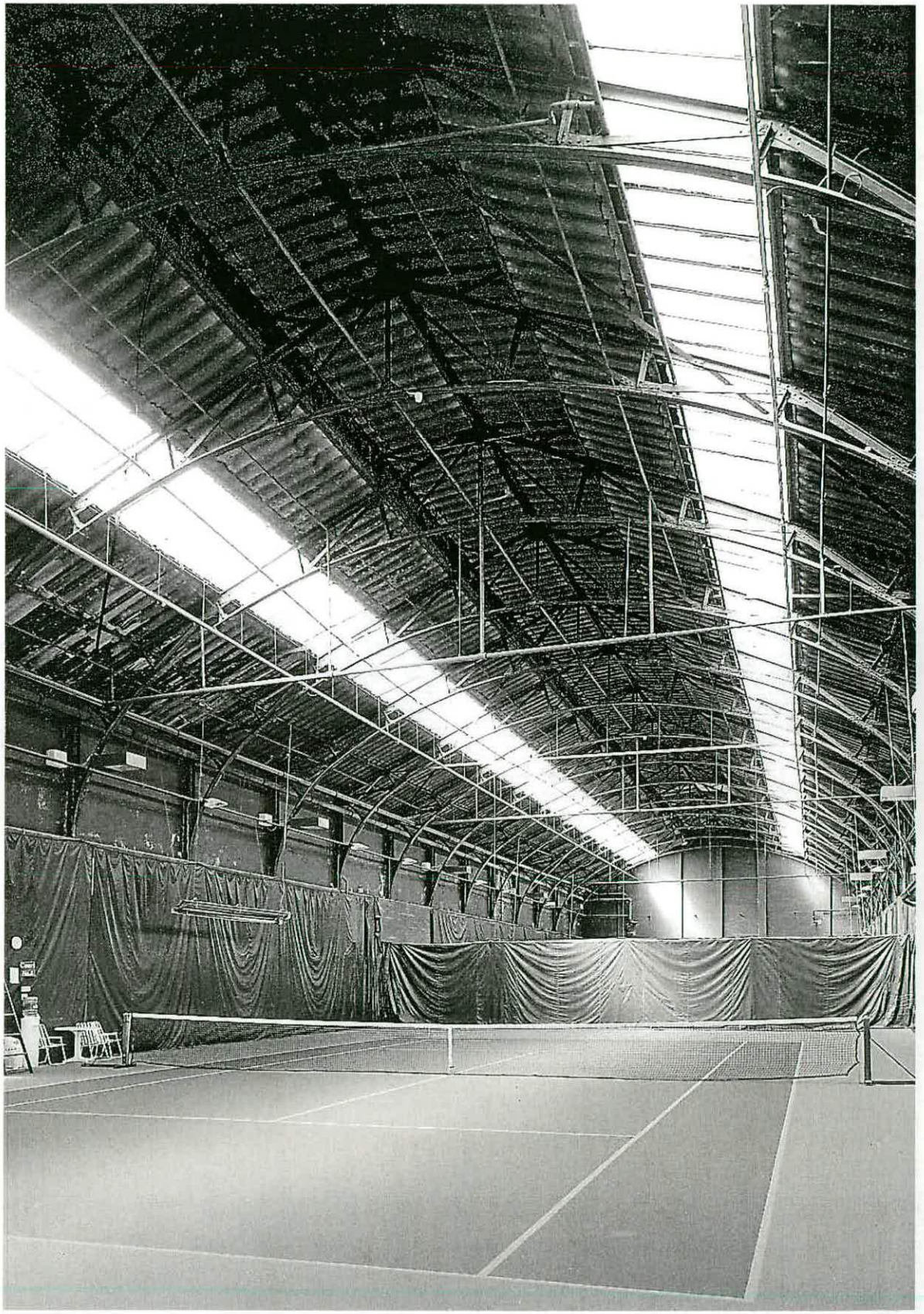

Fig 10 - the former 'Alimentation and Agriculture Building (British)', looking north

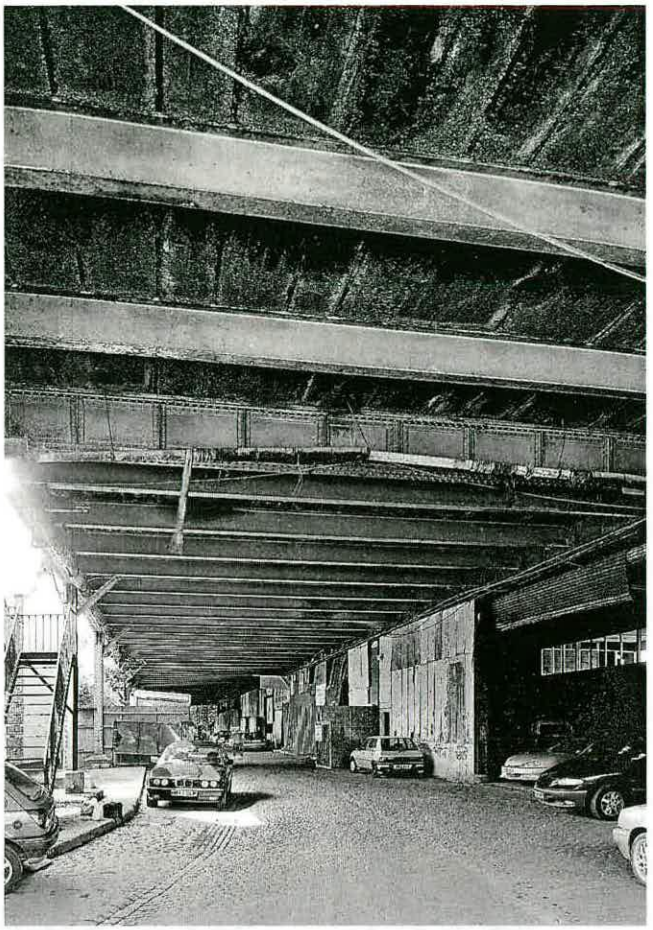

Fig 11 - Underneath the former 'Social Economy (Sports and Physical Culture) Hall', showing the cast- in-situ concrete floor.

The interiors of both the former 'Social Economy (Sports and Physical Culture) Hall (British)' (Fig. 9) and the 'Alimentation and Agriculture Building (British)' (Fig. 10), now used as indoor tennis courts, give a better idea of how dramatic and lofty these exhibition spaces were. Clearly, notwithstanding minor differences in the shape and size of structural members, a standardised truss configuration was used for each of these halls, and indeed probably for all of them. The principal variation was for the fenestration, either clerestoreyed or top-lit). The walls of both these sheds were given an extra inner breeze-block 'skin', possibly when they were requisitioned by the War Department, perhaps as a precaution against bomb-blast. Although pre-cast concrete blocks are recorded as being used for the structures within the exhibition site proper, the floor and side-walls of the 'Social Economy (Sports and Physical Culture) Hall', which was closely inspected, shows in-situ casting was also used (Fig. 11).

The sheds, linked together by smaller covered walkways spanning between their gable ends, (Fig. 12) snaked through the insalubrious railway grounds outside the exhibition site. The whole point was to shield the visitors to the exhibition from this, and so no attempt was made to beautify their drab, utilitarian exteriors, which were only perhaps conspicuous to locals.

Fig 12 - Link-bridge spanning between the former 'Social Economy (Sports and Physical Culture) Hall'(right) and the former 'Alimentation and Agriculture Building (British)' (left).

Carden noted

> The visitor, however, does not see these things; he traverses a seemingly endless succession of halls filled with French and English Exhibits, and when he has given up all hopes of ever getting to the end he finds his path tending downwards into the heart of the exhibition. The architecture of these entrances does not raise the enthusiasm of the beholder.[13]

Imre Kiralfy (1845-1919)

The Commissioner-General, 'responsible for the initial conception, almost all the organization and to a considerable extent the final appearance of the [exhibition] site', Imre Kiralfy, was 'without question in this area the shrewdest entrepreneur of his generation'.[14] Achieving increasing renown in the late nineteenth century as impressario to spectacular extravaganzas in London, Paris and New York that involved huge temporary sets, artificial rivers and seas, and enormous casts of both people and animals, Kiralfy combined the qualities of popularist showman with respectable high-brow-exhibition director, having taken the role as Director-General of many exhibitions held at Earls Court in the 1890s.[15]

> His aim with the Franco-British Exhibition was to combine the extraordinary nature of his previous ventures with the cultural respectability of a Great Exhibition. He had, quite correctly, perceived many of the earlier international fairs as combinations of high and popular culture, especially the 1893 Columbian in Chicago, the 1900 in Paris and the 1904 World's Fair in St Louis, all of which he attended, and now he set about creating his own profit-making version of these. The difference between Kiralfy's exhibition and others before or after was that the site was to be permanent, and exhibitions were to be held at frequent intervals after the first one, in more or less the same facilities.[16]

John James Webster (1845-1914)

John James Webster, like many engineers involved with the design of steel-frame buildings in the 1900s gained considerable experience in building bridges and other trussed framework structures. Born in Warrington, he obtained his practical training when articled to Manchester firm E.T. Bellhouse and Company in 1861. Over the course of the next ten years with this company – during the last four of which he acted as Chief Draftsman and Assistant Manager – he erected several large road and railway bridges from the designs of Edward Woods (1814-1903) and William Martineau (1826-1915), as well as contributing many designs of his own for bridges, roofs and piers. During this apprenticeship period he also supplemented his 'hands-on' experience with taught instruction from the engineering school of Owens College, Manchester, under Professor Osborne Reynolds (1842-1912).

In 1871 he joined the Ashbury Carriage and Iron Company, working on designs for a number of bridges for India as well as a new steel-making plant for the Ashbury works. Pursuing his interest in bridges, in October of the same year he left Ashbury's for Thomas Brassey and Co., becoming chief of their Bridge Department, and over the next five years supervised the design and construction of numerous structures destined for the colonies. From 1876 until 1880 he was assistant to R.A. Marillier, engineer to the Hull Dock Company, designing and erecting hydraulic movable bridges, giant grain warehouses (five-storeys and 500ft by 50ft) and hydraulic pumping stations. In 1881 he commenced private practice in Liverpool, where he designed, among other things, a 600ft long bridge for Australia, a bridge over the Ouse at Bedford with a 200ft clear span, numerous promenade piers for various Welsh resorts, bridges for India, and cranes for the Alexandra Dock, Hull.

By the early 1890s he had established a private consulting practice at No. 39 Victoria Street, Westminster, where he designed perhaps his most renowned works, including the Great Wheel at Earl's Court (1894-5)[17], and Britain's first transporter bridge - the Widnes and Runcorn Transporter Bridge across the Mersey (1903-5), designed in conjunction with J.T. Wood, and constructed by the Arrol Bridge and Roof Company, Glasgow. In his later years he went into partnership with H.W. FitzSimons, both engineers enjoying an enviable reputation, their services in frequent demand by the Local Government Board, the Board of Trade, and Parliament.[18]

Given the established reputation of this eminent Westminster-based engineer, with his worldwide reputation for bridge and pier building, it is hardly surprising that Imre Kiralfy commissioned Webster for the design of the major exhibition structures, including the Shepherd's Bush Stadium. Almost certainly, Webster had executant responsibility for those 'minor' structures not conceived in his office. These, including some of the entrance halls to the exhibition, were probably designed to his approval by the steelwork fabricating contractors, Alexander Findlay and Co., of Motherwell.

Architects, engineers and steel-frame construction

The events surrounding the construction of the structures for the Franco-British Exhibition illustrate the changing relationship between architects and engineers in the Edwardian period. Imre Kiralfy, the Commissioner-General, assembled a team of leading British and French architects, who, under the direction of John Belcher ('honourary consulting architect') and M. Toudoire ('architect in chief'), were responsible for the great majority of the buildings on the site, ensuring that half was English designed and half was French. Yet crucially, Kiralfy engaged the services of the consulting structural engineer John James Webster to design the structures of the majority of the buildings – and all the most important ones at that – in advance of any architectural input. Architectural critic J. Horsfield Nixon was almost certainly not alone in viewing such organisational methods with some alarm, noting:

> I am informed that the block plan was devised by Imre Kiralfy, the Commissioner-General to the exhibition, and that he has not only allocated the site of the buildings, but actually ordered their steel framework, thus fixing their dimensions and general form. Then, and not until then, were architects consulted. It is due to the architects who have been engaged to point out this unfortunate example of the vulgar error of putting the wrong end of the stick before the horse.[19]

The role of the architects was thus reduced simply to designing the façades and inner screen walls, using the regulation non-combustible fibrous plaster – a material with great manipulative potential, but one hardly associated with grand, permanent architecture. This scenario had to some extent been preceded at the Glasgow International Exhibition of 1901, probably the first British exhibition initially designed to make extensive use of light-weight steel-framed exhibition spaces.[20] These elegantly framed structures were erected, and quite possibly designed, by A & J Main & Co. of Glasgow.

Architects had of course been assigned decorative, even cosmetic roles in the past, and certainly, in the context of the great exhibitions of the 19th-century, it was engineers who traditionally supplied the technical solutions to the creaton of large, well-lit spaces. Yet these projects tended

to be collaborative ventures with both professions working together from the outset.[21] The advent of steel-frame construction – a technique beyond the grasp of most non-mathematically-minded architects – polarised the functional responsibilities of architect and engineer, enabling, in this instance separation in contracts and working schedules. Nevertheless, it is interesting to

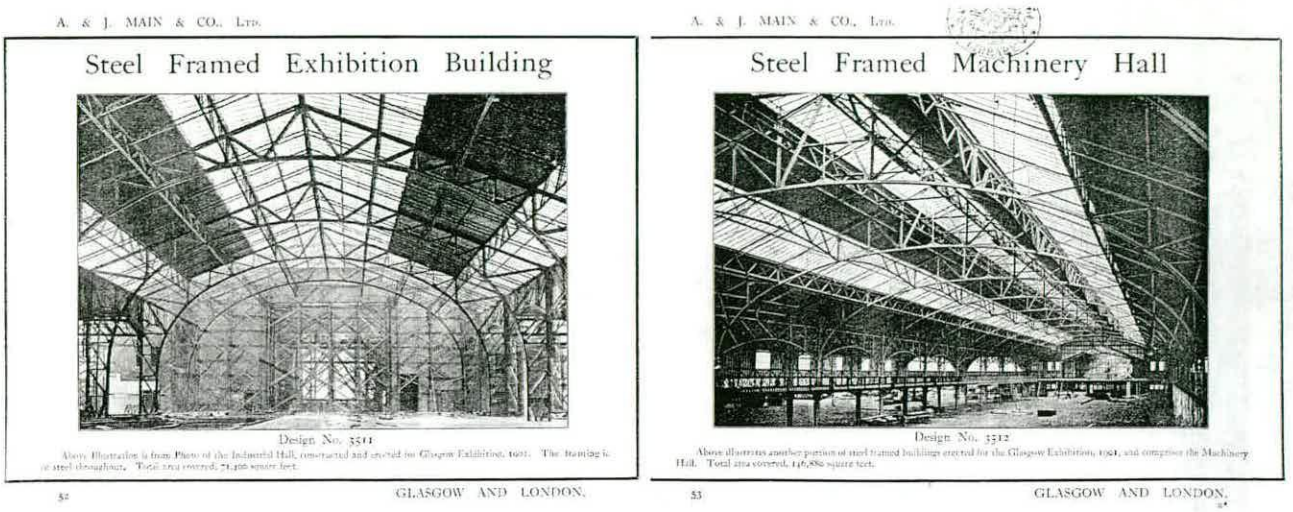

Fig 13 - Elegant, lightweight sheds erected by A & J Main & Co. for the Glasgow International Exhibition of 1901.

note that, according to one source, John Belcher (presumably in consultation with Webster) 'advised generally on the acceptance of steelwork contracts'.[22] Belcher, in common with a small number of leading Edwardian architects was already conversant with steel-frame architecture, having long-since worked alongside constructional engineer Thomas C. Cunnington on a number of projects, including Colchester Town Hall (1898-1902) and the steel-framed Electra House, 84 Moorgate, City (1901-3). Such forward-looking architects, whilst not necessarily familiar with the mathematics incumbent in steel-frame design were at least willing and able to grasp the engineers' design objectives, thus furthering the professional dialogue that was becoming increasingly requisite.[23]

The White City exhibition represented perhaps one of the largest conglomerations of steel-framed buildings in the country, possibly surpassed in total area only by the colossal sheds of Trafford Park. That this form of construction was invoked so extensively in London is remarkable, given that the London County Council did not officially sanction steel-frame building until 1909, with the passing of the LCC (General Powers) Act (known as the 'Steel Frame' or 'Engineers' Act). The White City structures were ostensibly built under the provisions of The London Building Act of 1894. This did not outlaw the erection of fully-framed buildings, but it did deter them in three critical respects: the insistence that external walls should be of loadbearing thickness; that the cubical capacity between party walls of buildings of the 'warehouse class' (which included factories, department stores, and, presumably, exhibition buildings) could not exceed certain limits[24]; and a prohibition on the riveting of beam-to-stanchion connections. In the first respect, minimum wall thicknesses of 39in. for the ground floor, 35in for the first and second floors, and further reductions thereon upwards were required. For the second clause, designed to halt the spread of fire, commercial premises had to be split

into compartments of no more than 250,000 cubic feet each, although occasionally, at the discretion of the Council, this limit could be waived to an absolute maximum of 450,000 cubic feet. In the third clause, the 1894 Building Act stipulated that bressummers could not be fixed at the ends and provision had to be made for expansion by the use of oblong holes, ostensibly preventing the rigid, moment-bearing connections required for true skeleton construction.

In effect, the London Building Act of 1894 was formulated around the exigencies of traditional bearing-wall construction, unaware or unrecognising of the potential of framed structural members of iron or steel to create large, safe, structurally stable spaces. According to one structural engineer, it was 'at least fifty years behind the most advanced architectural practice, and a century behind engineering practice'.[25]

Clearly, virtually all of the exhibition buildings, with their 3in.-thick cladding, and a significant proportion of the larger halls and palaces, with their huge, undivided spaces, would have fallen foul of the first two of these inhibitors. Certain categories of buildings, including Government buildings, County Council buildings of Middlesex and London, and buildings erected by railway, canal, dock, and gas companies were exempt, but exhibition buildings were not among these. In all probability, Kiralfy's sharp entrepreneurial skills coupled with the overwhelming Anglo-French political imperative to make the exhibition happen at all costs ensured the necessary waiver, or at least a blind eye from the LCC. Kiralfy also had the benefit of a changing milieu. By 1906, when his plans were brought before Government, imminent legislative change in favour of steel-frame construction was already afoot, with the famed Ritz Hotel (1903-5) having galvanized opinion against the restrictions of the 1894 Act. From the mid 1900s, as the practical and economic advantages of standardised steel skeleton construction for large commercial architecture became glaringly apparent, the LCC began quietly sanctioning increasing numbers of steel-framed buildings through the waiving of its cubical capacity stipulations. For a select few buildings, they also waived the beam-to-stanchion riveting prohibition. Years after the Ritz had been built, the engineer, Sven Bylander disclosed that 'This requirement was not insisted on by the authorities for the Ritz Hotel, and hence it was possible safely to erect this steel frame'.[26] White City shows that they were also prepared to overlook the wall thickness stipulation, although the fact the buildings were probably perceived (and possibly promoted by Kiralfy) as 'temporary'[27] may have had some bearing.

From an aesthetic point of view, steel-frame construction *per se* was not criticised by contemporary commentators of the exhibition; rather it was the failure to express it in a logical or rationalist manner. The only building to remain unclothed behind the ubiquitous decorative plaster was Webster's vast stadium, a building that triumphantly and explicitly demonstrated the inherent architectural potential of steel, anticipating the rational ideals of the Modernists. Carden enthused:

> It boasts no architectural features, the steel is still gaunt and unclothed, but there can be few who will deny that it runs some of our architectural "conceptions" very close. From the Stadium, with its impressive lines, we may learn that effect does not depend upon amount and dispersal of ornament. It is the rhythm of proportion of perspective that triumphs in the steel and concrete Stadium... vast, splendid, monumental. It is the great achievement of the Franco-British Exhibition, and of the engineering profession.[28]

NOTES

[1] J.Horsfield-Nixon, 'The Franco-British exhibition of science, arts and industries', *Journal of the Royal Institute of British Architects*, vol. 15 (25 July 1908), p. 551.

[2] *A Pictorial and Descriptive Guide to London and the Franco-British Exhibition, 1908* (London, 1908), p.'E'.

[3] Horsfield-Nixon, *loc. cit.*

[4] Paul Greenhalgh, 'Art, Politics and Society at the Franco-British Exhibition of 1908', *Art History* vol. 8 No. 4 (December 1985), p. 434

[5] *ibid.*

[6] See Greenhalgh, *loc. cit.*, pp. 434-52; Annie E. Coobes, 'The Franco-British Exhibition: Packaging Empire in Edwardian England' in Jane Beckett and Deborah Cherry (eds.), *The Edwardian Era* (London, 1987), pp. 152-72.

[7] Robert W. Carden, 'The Franco-British Exhibition', *The Architectural Record* vol. 24 No. 2 (August 1908), pp. 88-89; Robert W. Carden, 'The Franco-British Exhibition - I', *The Architectural Review* vol. 24 (1908), p. 35.

[8] Robert W. Carden, 'The Franco-British Exhibition', p. 89

[9] 'The Franco-British Exhibition', *The Engineer*, 29 November 1907, p. 548.

[10] The Glengarnock Iron and Steel Company, like many other leading ironworks in the late 1880s (including, most famously, Dorman, Long & Co., as well as other large concerns, like Frodingham Iron and Steel Company) began replacing their puddling furnaces with open hearth furnaces for the production of structural steel from pig iron, bypassing the increasingly discredited Bessemer process completely. The Glengarnock works appear to have won an increasing number of orders in the metropolitan market for structural sections in the 1900s, presumably as they turned their attention more to this sector as their traditional market in ship plates and rails began diminishing. Other buildings making use of their sections include the extension of the Legal and General Offices, No. 10 Fleet Street (1899-1901), and an engineering workshop for Caird & Rayner at 779-83 Commercial Road, Limehouse (*c.*1902-3).

[11] In this context it is worthy of note that correspondents from the recently-formed trade publication *Concrete & Constructional Engineering* visited the exhibition in the expectation of finding a 'an interesting and comprehensive show of reinforced concrete worthily representing the numerous British firms by whom that material has been taken up within recent years, and the various French firms who have employed reinforced concrete so extensively on the other side of the Channel'. They were disappointed. Apart from the stadium flooring, the only structures employing reinforced concrete were both exhibits: a bakery, erected by D.G. Somerville and Co., of Westminster, and a spiral stairway erected by the Yorkshire Hennebique Contracting Company, of Leeds, from designs by L.G. Mouchel and Partners, Ltd., of Westminster. Of the bakery, only the 6in-thick foundation slab was technically reinforced concrete, the superstructure itself – by the publication's own admission - consisting of 'a light steel frame'. They saw the cause of their material's poor showing 'as being that the majority of the structures were solely intended as temporary buildings' – an opinion at variance with Paul Greenhalgh's view that 'the site was to be permanent, and exhibitions were to be held at frequent intervals after the first one, in more or less the same facilities'. 'Reinforced Concrete at the Franco-British Exhibition', *Concrete & Constructional Engineering* vol. 3 (1908-9), pp. 279-283; Greenhalgh, *loc. cit.*, p. 442.

[12] Rapidly constructed thin, lightwight breeze-concrete partitions became more commonplace as steel and reinforced concrete construction enjoyed increasing application through the latter 1900s and 1910s, frequently supplanting the traditional brick (non loadbearing) internal wall. Besides a high degree of fire resistance, breeze concrete also had the advantage of being able to take nails or screws without cracking, unlike bricks, clay or terracotta blocks. Although the manufacturer of the breeze-concrete slabs used at the Franco-British exhibition has not been identified, it may possibly have been J.A. King & Co. An advertisement of *c.*1910 claimed this company as the 'Sole British

Manufacturers of "King" Pumice-Concrete Partition Slabs and Blocks', and that their partitions had been adopted by 'H.M. Office of Works, War Office, Admiralty, L.C.C. and Leading Architects'. Besides being a relatively early application of these book-shaped components (they had concave and convex ends, slotting into each other to ensure a tight joint without mortar), White City may have been among their earliest employment as an exterior cladding. For a discussion of British concrete blocks and partitions, see David Yeomans, *Construction Since 1900: Materials* (London, 1997), pp. 42-5.

[13] Robert W. Carden, 'The Franco-British Exhibition', p. 88.

[14] Greenhalgh, *loc. cit.*, p. 441

[15] The extravaganzas included 'Nero, or the fall of Rome' (1889, London Olympia), 'Venice, Bride of the Sea' (1891-2, London Olympia and Paris), 'Our Naval Victories, an American Naval Spectacle' (1895, New York) and 'India, a Grand Historical Spectacle' (1895, London Olympia). At Earls Court, he was Director-General of the following Exhibitions: Empire of India (1895), India and Ceylon (1896), Victorian Era (1897), Universal (1898), Greater Britain (1899), Woman's International (1900), Military (1901), Paris in London (1902) and Fire (1903). Greenhalgh, *op. cit*; Donald R. Knight, *The Exhibitions: Great White City Shepherds Bush London 70th Anniversary 1908-1978*', (Barnard & Westwood Ltd, 1978), p. 6.

[16] Greenhalgh, *loc. cit.*, p. 442

[17] Based on the celebrated Ferris Wheel of the Chicago Exhibition of 1893, this 300ft-diameter steel-wheel – a major attraction of Kiralfy's Earl's Court exhibition (1895) – may also have benefited from the input of engineer C. F. Hitchens. See Hermione Hobhouse (ed.), *Survey of London, vol. XLII: Southern Kensington: Kensington Square to Earl's Court* (1986), p. 335.

[18] Obituaries in *Minutes of the Proceedings of the Institution of Civil Engineers*, vol. 199, pp. 455-6 and *Engineering* vol. 98 (6 November 1914), p. 570.

[19] Horsfield-Nixon, *loc. cit.*, p. 550.

[20] The details of the engineering and architecture behind the designedly temporary buildings of this giant exhibition site (sprawling across some 73 acres in Kelvingrove Park in the west of the city) have not been fully researched for this report. However, the architect for the exhibition's main building, the temporary Eastern Palace, is recorded as being James Miller (1861-1947) 'who won an open competition with his design which satisfied the extravagance demanded by the public' [Glasgow University Library Website, http://special.lib.gla.ac.uk/exhibns/month/oct]. This suggests that the specification for the steel frame was worked out subsequent to Miller's design, engineering following architecture. As originally conceived, the great majority of the exhibition structures were to have been steel-framed, but 'a change was made during the progress of the works, wood largely taking the place of metal because of difficulty in getting delivery of the latter. Only the centre aisle roofs of the industrial and machinery halls, the dome, and the concert hall [were] of metal'. *The Builder*, 6 April 1901, p. 334. *The Builder* noted that for the larger sheds, the base of the eliptically arched ribs were 'contracted to a pivot at the foundation to permit contraction and expansion', indicating that they were two-hinged (or possibly three-hinged) arches: a technologically advanced design famously pioneered in an exhibition context at the Galerie des Machines (1889).

[21] Not all the collaborations had been entirely amicable however. The engineers behind the Palais de l'Industrie of 1855, Alexis Barrault and Georges Bridel, were less than happy with architect J M V Viel's proposed masonry cladding of their iron superstructure. They forced him to modify his plans accordingly. Paul Greenhalgh, *Ephemeral Vistas: The Expositions Universelles, Great Exhibitions and Worlds's Fairs*, 1851-1939 (Manchester, 1988), p. 152. For a discussion of the contribution and influence of engineering on exhibition architecture from 1851 to the turn of the century, see Greenhalgh, *ibid*, pp. 152-160.

[22] Donald R. Knight, *The Exhibitions: Great White City Shepherds Bush London 70th Anniversary 1908-1978*', (Barnard & Westwood Ltd, 1978), p. 2.

[23] See Jonathan Clarke, 'Early Structural Steel in London Buildings', English Heritage Architectural Survey Report, October 2000.

[24] For detailed discussion of these two factors and their effect on the London building world of the 1900s, see Jean Catherine Lawrence, 'Steel Frame Architecture versus the London Building Regulations: Selfridges, the Ritz, and American Technology', *Construction History*, Vol. 6 (1990), pp. 23-46.

[25] W. Noble Twelvetrees, 'Steel Skeleton Construction and the London Building Act', *Concrete and Constructional Engineering*, Vol. 1, No. 1 (March 1906), p. 17.

[26] Sven Bylander, 'Steelwork in Buildings – Thirty Years' Progress', *The Structural Engineer*, January 1937, p. 2.

[27] Regarding the temporariness or otherwise of the exhibition buildings see end of note 11.

[28] Robert W. Carden, 'The Franco-British Exhibition - I', p. 97.

APPENDIX: LIST OF FIGURES

Front Cover View of Overhead Halls, looking north (EH, AA025515).

Figure 1 Site plan of the Franco-British Exhibition of 1908, showing overhead exhibition Halls. Hammersmith & Fulham Local Studies Library, HM 606.12 Fra.

2 The original ensemble of Overhead Halls (Nos 2 to 8) connecting the Shepherd's Bush and Wood Lane entrances in 1908. From *A Pictorial and Descriptive Guide to London and the Franco-British Exhibition, 1908* (Ward, Lock & Co. Ltd, London, 1908).

3 The former Porte Monumentale of the1908 Franco-British Exhibition. Hammersmith & Fulham Local Studies Library, HP 97/397.

4 The Franco-British Exhibition of 1908 from the vantage point of the 'Flip Flap', looking south east. The overhead halls can be seen snaking their way southwards next to the industrial chimneys. Hammersmith & Fulham Local Studies Library, HP 75/1663.

5 The White City Arch as it looks today, from the southeast. (EH, AA020856).

6 Construction detail of former 'Social Economy Hall', south elevation looking west. (EH, AA020863).

7 Trussed roof principals of former Liberal Arts Palace, glimpsed through 1970s suspended ceiling. (EH, AA020869).

8 1970s atrium inserted within original structure of former Liberal Arts Palace, view from South. (EH, AA020868).

9 the former 'Social Economy (Sports and Physical Culture) Hall (British), looking east. (EH, AA020871).

10 the former 'Alimentation and Agriculture Building (British)', looking north. (EH, AA020874).

11 underneath the former 'Social Economy (Sports and Physical Culture) Hall', showing cast- in-situ concrete floor. (EH, AA020862).

12 Link-bridge spanning between the former 'Social Economy (Sports and Physical Culture) Hall' (right) and the former 'Alimentation and Agriculture Building (British) (left), from southwest. (EH, AA020866).

13 Elegant, lightweight sheds erected by A & J Main & Co. for the Glasgow International Exhibition of 1901. From A. & J. Main & Co. Ltd, *Catalogue No. 217* (c.1909).

Fig 14 - East side of link block connecting the Liberal Arts Palace (British) and Social Economy Hall (British), from southeast.

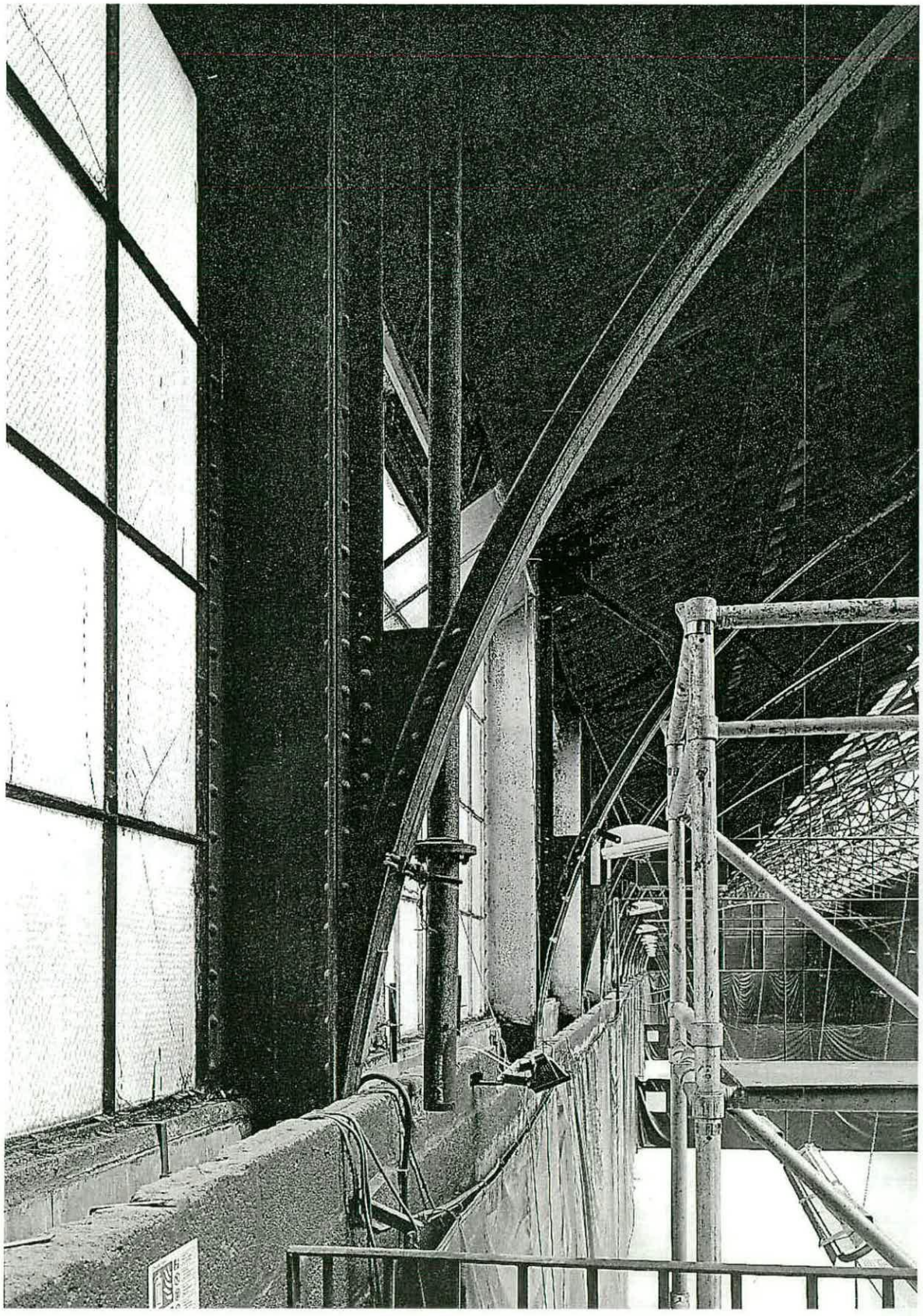

Fig 15 - Detail of stanchion/roof principle, north wall of Social Economy (Sports and Physical Culture) Hall, looking east.

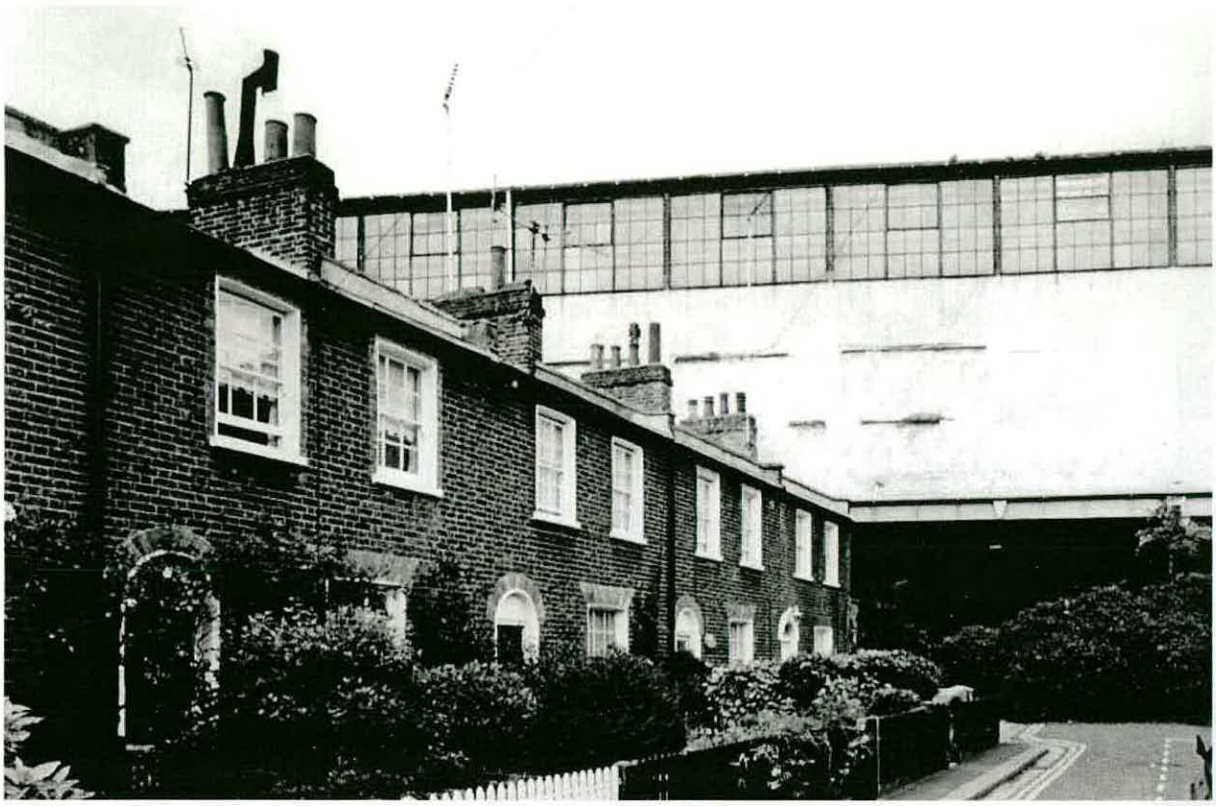

Fig 16 - South elevation of Social Economy (Sports and Physical Culture) Hall, from Shepherds Bush Place, looking North.