The Brussels Exhibition fire : with some suggestions as to safeguards at future temporary exhibitions set out in the form of model regulations / by Edwin O. Sachs.

BRITISH FIRE PREVENTION COMMITTEE.—No. 154.

Edited by the Executive.

THE Brussels Exhibition Fire

with

SOME SUGGESTIONS

as to

SAFEGUARDS

at

FUTURE TEMPORARY EXHIBITIONS

set out in the form of

MODEL REGULATIONS

BY

EDWIN O. SACHS, F.R.S.Ed., F.S.S., A.Inst.M.E.

Architect;

Chairman of the British Fire Prevention Committee; Vice-President, National Fire Brigades' Union; Vice-President, International Fire Service Council, etc., etc.

1 Plan and 18 Illustrations

LONDON, 1911.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(*Founded* 1897—*Incorporated* 1899),
8 WATERLOO PLACE, PALL MALL

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Two Shillings and Sixpence

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The main objects of the Committee are:

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimizing the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods, and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

The Committee is not responsible for the views of individual authors as expressed in Papers or Notes, but only for such observations as are formally issued on behalf of the Executive.

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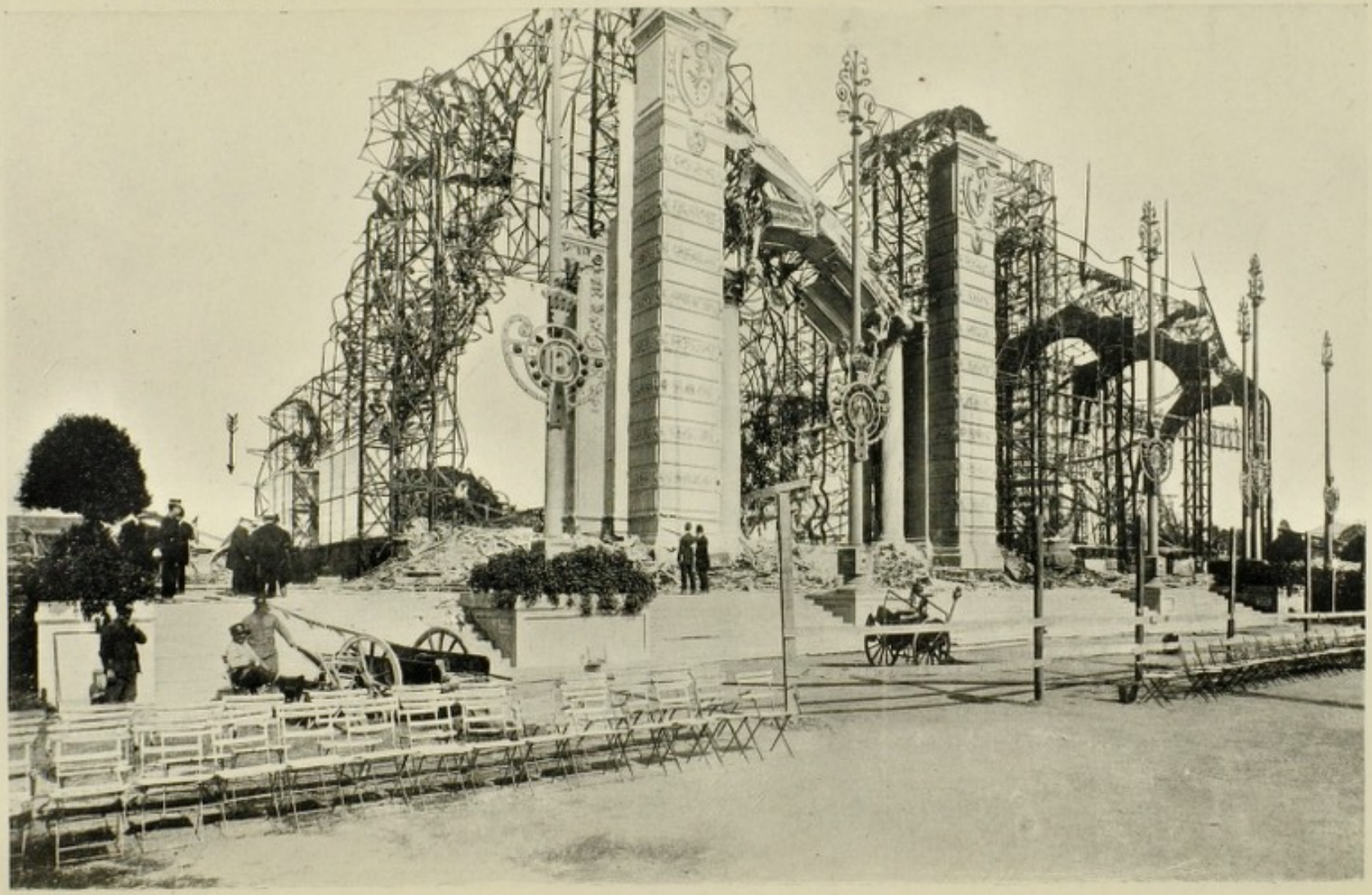
Flame first observed *Entrance No. 1*



THE BRUSSELS EXHIBITION FIRE.

VIEW OF ENTRANCE NO. 1 OF THE MAIN BUILDING AFTER THE FIRE.

NOTE

The extent of the great exhibition fire at Brussels of last year was no doubt a most serious calamity, and in certain respects matters connected with it may have given cause for complaint, but after carefully considering all the circumstances I can find nothing in this sad catastrophy that justifies the strictures largely circulated in the world's popular and technical press regarding Belgian fire preventive and fire service arrangements generally.

Not only have there been other notable exhibition fires in almost every country, but great catastrophes, such as the conflagrations in the United States, and our own great Cripplegate fire, the holocausts of the Asch Building at New York, the Paris Charity Bazaar and the Underground "Tubes,"—each with a terrible death-roll,—the many theatre and mine fires, all afford striking examples of losses that could have been prevented or limited in extent if greater forethought had been given to the subject. Thus Belgium is by no means in an exceptional position by now having to record a fire of considerable magnitude. Few countries show any true interest in fire protection and it is indeed doubtful if, given similar difficulties as those encountered in promoting the Brussels Exhibition, and some few of the identical elements of sheer misfortune that were beyond human control, many other countries would have made a much better showing. It would in fact have been a very unusual case to have found a much superior state of affairs prevailing.

There were, no doubt, grave faults in connexion with the Brussels Exhibition fire, a number of which might have been obviated if fire prevention and fire service work enjoyed the close attention they merit but rarely receive at the hands of the authorities, the technical officials or the general public anywhere. Fire protection does not happen to be a popular

subject and only enjoys favour to a moderate degree in a few exceptional localities. Thus I do not consider that Belgium has been particularly remiss in the precautionary measures observed either at the exhibition or in a general way, and in preparing my notes on the fire, I do not propose to write in the vein adopted by so many others. Quite the reverse. The picture, when considered side by side with those of other great castatrophes, is by no means as black as some people would have it painted. There are also many features in connexion with the fire that do very great credit to Belgium. Thus, to those critics who could only say unpleasant things regarding the Brussels fire and the Belgian services, I would write that " people living in glass houses should not throw stones."

* * *

Generally speaking, Belgium does its fair share of fire preventive work and its fire service arrangements have some excellent features, not least of which is the enthusiastic and voluntary character of its fire brigades for many rural district centres outside its five principal industrial cities.

The building, fire preventive and fire control regulations are much on the same lines as those to be found wherever the " Code Napoleon " prevails or serves as a basis for legislation. The technical part of the by-laws, etc., although not essentially modern, is generally practicable for present day conditions.

The fire brigades, both professional and volunteer, may not be models of organization and equipment, but they generally fulfil their purpose fairly satisfactorily and are run at very small expense. There is further now an institution in Belgium, but rarely met with elsewhere, namely a special " Technical Fire Protection Committee," constituted at the initiative of General Wouters and working under the auspices of the Ministry of Interior. The State and the Provinces are represented on this Committee. Then there is the local Royal Fire Brigades' Federation which does much for the country fire service, thanks largely to its present President and former Hon. Secretary, Captain Philips. The actual personnel of the Belgian fire service is very painstaking as a whole; the voluntary forces of which it is mainly comprised frequently do their work very well. Distinguished services have been rendered by Belgian firemen in many fires, and taken as a whole the efforts of the individual fireman at the Brussels exhibition were

praiseworthy. Like in all fire services of all countries, the Belgian service has its fair share of incompetent officers, some of whom were much in evidence at the exhibition, but these few offenders do not constitute the Belgian service, which as a whole has a highly creditable history.

Belgium also has a fire chief and well-known writer on fire subjects who, by his enthusiasm for the cause, endeavours to rouse the interest of his fellow countrymen on the subject of fire protection generally, and who, if he uses his great powers of penmanship discreetly, may eventually obtain that attention to his well-meant propaganda which all who have the subject at heart, I feel sure, most earnestly desire. I refer to Chief Officer Welsch of Ghent, who is the chairman of the above named " Technical Fire Protection Committee " and whose efforts locally cannot but be highly appreciated far afield.

The country is also well in touch with the world's fire service. The Federation has sent delegates to all the international conferences of moment during the last two decades, its officers visit foreign cities, large and small, and last year—curiously just a few weeks before the Exhibition fire—the Federation organized an International Fire Congress at Brussels and Spa where certain aspects of both the fire preventive and the fire service side of the subject were under consideration.

Belgium, too, has had its great fire lessons to learn from, notably at Antwerp where the local authorities have to deal with fire risks of great magnitude, and the results of some of those lessons have been applied from time to time.

In fact, Belgium enjoys a fair share of useful fire protective activity as compared with other nations.

* * *

The Brussels International Exhibition was obviously an enterprise of exceptional character, and a most praiseworthy example of what a small country can do when there is co-operation between the interests concerned and no lack of voluntary effort and workers. It was a well conceived exhibition, very effectively arranged, and it afforded pleasurable instruction to a very large number of people, whilst the business results for the majority of exhibitors are stated to have been satisfactory. Had the Exhibition closed its doors without the occurrence of the eventful fire of August, 1910, it would certainly have been accorded a leading position among the successful world's fairs of the last half century, and financially its

deficit would probably have been non-existent. The fire largely discounted this fine record, and the fact of the glamour of so much excellent work having been suddenly eclipsed by this fire should remind exhibition managers that all their efforts may be rudely effaced if the fire question does not receive full consideration. I do not, however, wish to infer that this exhibition management accorded the subject less attention than others have done before them. Far from it. There was nothing abnormal in the attention accorded—it was of an average character—with, if anything, a somewhat higher standard than mostly met with. Some of the features in its organization such as the isolation of the modern art exhibits away from the exhibition grounds, the fire alarm system, etc., were excellent features. Quite a lot of money was expended on hydrants, watching service, etc., and it would not be right to say the subject was neglected.

What the exhibition management obviously lacked was experience in fire protective matters, and unfortunately they do not appear to have engaged any competent officer to advise them or to act for them. The responsibility too, was not properly placed on the shoulders of any one individual. A special sub-committee on the subject no doubt existed, but " everybody's business is nobody's business " and the sub-committee in question appears to have had but limited powers, no means and perhaps also very little opportunity to display its knowledge. The responsibility for the protection of the exhibition rested with the exhibition management, i.e. a general committee working through an executive and certain administrative officers. They probably attempted to fulfil those responsibilities according to their lights, but it so happened that these lights were quite of an average character and thus a very normal state of affairs prevailed.

There was of course the Central Government as representing the State which could have stepped in, and either by advice or direct control required the exhibition management to do more in the way of fire protection, but the State had scarcely any department at the time the exhibition was planned to whom the matter could have been entrusted with confidence, for, like in many other Governments, the subject of fire protection had no clearly defined position in its offices. No department is specifically entrusted with the subject in its entirety, though some one office may have duties connected with building construction or with fire brigades. As in most other countries no skilled technical staff existed in the Govern-

ment to deal with the subject. The " Technical Committee " above referred to is a voluntary one of an advisory character and only came into operation during the early summer of 1910.

Then there were the local authorities who might have either influenced or controlled the exhibition committee, but as misfortune had it the exhibition grounds were located in two distinct municipal areas and were thus subject to dual authority and that authority was ill-defined.

To have altered that dual authority or to have re-defined its powers would have meant political and administrative changes of far reaching effect, not easily arranged for at short notice, and the raising of these questions might have even imperilled the holding of the exhibition, which was enjoying certain assistance from both the municipalities in question. The relations of Brussels and Ixelles on a matter such as the control of this exhibition was only a minor feature as compared with the problems of a future " Greater Brussels " or the holding of the Exhibition at all. Such dual authority, by-the-by, is nothing very exceptional. Far more important enterprises than the Exhibition are subject not only to an ill-defined dual authority but to conflicting multifarious authority in other countries, and the ensuing complications often mean inefficiency as well as great hardship for the parties concerned. Have English critics ever perhaps thought of the anomalous position of certain enterprises at home where lives are daily at stake?

* * *

As to the principal features of the lay-out and construction of the exhibition which are described below, they were quite normal—for they have been found in nine exhibitions out of ten throughout Europe and America, and were such as come naturally to the public, to the exhibitor, and to those conducting an enterprise of this character. An International Exhibition is generally essentially of a temporary character, and the buildings may be in use for six or nine months at the most. The fire risk is covered by insurance for that period at anything between 10s. and £2 per £100, and the insurance premiums are distributed over many exhibitors, and the loss, if any, over many underwriters. Indifference regarding the values under exhibit is not uncommon. At the most, the exit question receives the attention of the management and scruples are salved by the provision of numerous doors. Curiously too the relative number and extent of fires at exhibitions has been small compared with the number of exhibitions and the values

exhibited.There has been no great loss of life at exhibition fires during the past decade, and thus little to make the exhibition manager or the ordinary public authority take special interest in the fire question. The exhibition has to be insured in any case. Little encouragement is given in the reduction of insurance rates for better building and equipment in exhibition buildings. As a rule the exhibition manager considers the whole matter more or less a nuisance, and does as little as he can of his own free will, no matter in what country the exhibition is located.

The only thing that will force an exhibition management to take a proper view of the subject, is the requisition of a public authority, be it the State or the local council, whose powers are clearly defined, but even in such a case the public authority must have at its back a summary judicial procedure. Some few localities have this authority in a greater or less degree, but as a matter of fact only a few centres have all the requisite powers, code of regulations and judicial procedure for effective control, for where the whole enterprise is of such short duration, anything that is not clearly defined prior to the exhibition being planned or anything that leaves questions to negotiation, compromise or litigation, to appeals and counter appeals, is almost valueless.

But even where the authority exists, it has to be exercised with tact and may be with leniency so that there may be no undue hardship.

An exhibition may be of far reaching industrial or political importance. To hinder it would be unwise; to control it to an extent that would practically make it impossible would be ridiculous. It is a hard thing to say, but the loss of, say, £100,000 covered by insurance, and thus distributed over a wide area, is of little moment to the economic and national importance of most great international exhibitions. I might even go so far as to say that the possibility of losing some few lives must not prevent an enterprise that may be of great national benefit. It is all a matter of degree, and therefore control should only be exercised tactfully and within reasonable limits, and only with the view of preventing a great catastrophe, rather than with the view of rendering an exhibition immune from fire.

Thus, given the special State department of technical experience to control the terms of the agreement as to fire protection entered into by the Exhibition management, or given one clearly defined local authority to control the fire preventive and fire service arrangements at the Brussels Exhibition, it is

by no means sure that it would have been practicable to do so very much more in enforcing fire protective measures. The Exhibition had to take place, it was not to be unduly hampered and thus authority—no matter how well armed with powers—could scarcely have had a free hand.

In one direction, however, the unity of local control would have been of the greatest possible benefit, no matter what the buildings were like, and that was the centralisation of command, and the uniformity of appliances of the fire service organization. In that respect the combative measures, when the fire had broken out, were handicapped to a degree scarcely to be credited, for where unity did not exist the old tradition of the fire service should have prevailed—that the brigade in whose area the fire breaks out *ipso facto* takes command, and every fireman accepts that custom, even if the home brigade only has a junior officer on the spot. In the case of the home brigade being a professional force this tradition was obviously in place. The friction that existed during the early stages of the fire between certain fire brigade officers makes unpleasant reading.

* * *

In preparing these notes I have had extensive material to go upon. In the first place there was the technical part of a popular pamphlet on the fire published by Chief Officer Welsch. Then there are the files of the local and international papers, and the contributions on the subject in the technical press to which I have been able to refer. Next there is the so-called detailed "evidence" and the "expertise" presented to the judicial authorities after the fire which the Belgian High Court at Brussels very courteously put at my disposal. Some of these documents make interesting reading, although the "conclusions" arrived at by the special technical Commission of Inquiry are somewhat elementary. Then I have the memoranda sent me by a number of the fire brigade officers present, excepting, however, most unfortunately, the Chief Officer of the Brussels fire brigade, who was prevented from doing so owing to the possibility of certain legal proceedings. Lastly, I had at my disposal the reports and notes taken on the spot—for the most part confidential—of several English and foreign members of the British Fire Prevention Committee, holding responsible positions, whose views are unbiassed, and whose style of recording data accords with

the traditions of this Committee, where "facts" are preferred to views, and unkind criticism avoided as far as possible when dealing with foreign affairs.

Mr. Welsch's contribution referred to above included his version of the time at which he thinks the fire fighting forces got to work, and although his time-table does not always coincide with the version sent me by the various parties affected, I have used them. As Mr Welsch is the Government representative and president of the "Technical Fire Protection Committee," his data on such a matter have to be accorded precedence. A sketch plan of his, showing roughly the positions occupied by the fire brigades and kindly put at the Committee's disposal, is also reproduced on his responsibility. The photographs presented are from a collection prepared for the official inquiry, except those of the buildings prior to the fire.

The delay in issuing these pages is due to the fact that it would have been unwise to write them before all available data were available, and it was not until the end of February that the inquiry was concluded and only in April did most of the authorities primarily concerned provide the necessary official information.

It is to be hoped, however, that this RED BOOK, somewhat belated though it is, will be of some slight value not merely as a record of the fire, but as a guide for those concerned with future exhibitions. That some national regulations or model code on the subject are essential for Great Britain may be gathered from the fact that whilst the local requirements in the London County area are for the most part of an appropriate character, there is nothing to prevent exhibition buildings being erected in a most unsatisfactory manner just outside the boundary.

The record of the fire and the suggestions in this RED BOOK are obviously not intended to be exhaustive. The particulars regarding the fire are merely an outline, whilst the suggestions are simply made in such a form that they could serve as a basis for a set of regulations. A few pages on the subject should be more effective than a long treatise with details, cross references, arguments and quotations. Brevity, however, means many omissions and for these I crave indulgence.

EDWIN O. SACHS.

8 *Waterloo Place,*
London, S.W.
May, 1911.

THE
Brussels Exhibition Fire
With
SOME SUGGESTIONS as to SAFEGUARDS
at
FUTURE TEMPORARY EXHIBITIONS
set out in the form of
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THE BRUSSELS INTERNATIONAL EXHIBITION.

1. ***Location of the Exhibition.***—The exhibition grounds were located on the border of the great public park known as the "Bois de Cambre" to the SE. of Brussels, just under two and three-quarter miles (*4425m.*) from the centre of the city as defined by the central fire-station at the Place de Jeu de Balles.

2. ***Access to the Exhibition.***—Vehicular access was obtained by broad thoroughfares of fair condition.

3. ***Public Thoroughfares Dividing the Exhibition.***—One of these thoroughfares—the "Avenue de Solbosch"—about 65ft. (say *20m.*) wide, cut right through the exhibition grounds (running NW. to SE.), and the two "territories" of the exhibition were joined up by three bridges across this artery.

4. ***Other Public Thoroughfares.***—Another minor thoroughfare about 40ft. (*12.192m.*) wide cut through the exhibition grounds and into the "Avenue de Solbosch" from the east corner of the grounds, but this road has little or no bearing on the subject here under review.

5. ***Boundary between Brussels and Ixelles.***—The "Avenue de Solbosch" practically forms the boundary between Brussels and the adjoining borough of Ixelles, the actual boundary stones running a few yards SE. of the thoroughfare. (*See plan, opposite p.* 28).

6. ***Administrative Relationship between Brussels and Ixelles.***—Ixelles is a community administratively entirely independent of Brussels. There are several large adjoining boroughs abutting on to Brussels like Ixelles, and each has its own independent municipal authority. There is no central County Council as in the case of the City of London and the London Boroughs. The position of Ixelles is much like that of, say, Willesden in relation to the County of London. There is, however, consider-

able friction between the governing authorities of the localities in question. A scheme of organizing a "Greater Brussels" is under consideration, but it is a matter of grave political and administrative moment and could thus not be settled off-hand for the purposes of the exhibition.

7. ***Local Control.***—To what extent the buildings or the management of the exhibition were subject to the control of the two municipalities named would be difficult to define, as the respective local regulations are not only somewhat unclear but appear to leave much to the discretion of the respective municipal councils. In practice the exhibition buildings in both territories appear to have been practically free from detailed control and regular technical inspection in our sense, i.e. as met with say in the area of the London County Council.

8. ***Government Control.***—The exhibition enterprise and the protection of the exhibition buildings and exhibits appear, however, to have been of some concern to the Belgian Government, for there was apparently an agreement of a partly financial and partly general character as between the Exhibition Committee and the central authority. In this agreement the position of the fire protective measures appears to have been defined to the extent of the promoters, i.e. the Exhibition Committee being "required and empowered to take all precautionary measures to prevent fire and to ensure a speedy clearing of the exhibition buildings in case of danger." Further, the Exhibition Committee under that agreement has "to pay for the services of watchmen and firemen and take out the necessary insurance policies." To what extent the State had the necessary administrative facilities and personnel to effectively supervise the execution of these conditions of the agreement cannot be ascertained, nor the precise extent to which any control in this direction was intended to be exercised or actually took place.

9. ***Status of the Exhibition Enterprise.***—The exhibition was undertaken by an influential national Exhibition Committee of the highest character, who for purposes of finance organized the enterprise as a commercial company. The administrative work was conducted on behalf of the Exhibition Committee by an Executive Committee, by Sub-Committees and administrative officers.

10. ***Character of the Exhibition Area and its Relation to Adjoining Property.***—The area of the exhibition was not only cut up by the thoroughfares referred to, but by the interspersion of other pieces of private property, and was thus not compact in plan. Access and levels were difficult in parts from the fire point of view, and the traffic on many of the exhibition paths heavy. The "Avenue de Solbosch" had some residential property on its SW. side between bridges Nos. 1 and 2, and there were also

Fire started.

Entrance No. 1.

Central Entrance.

Route from Exhibition Fire Station of Brussels F.B.

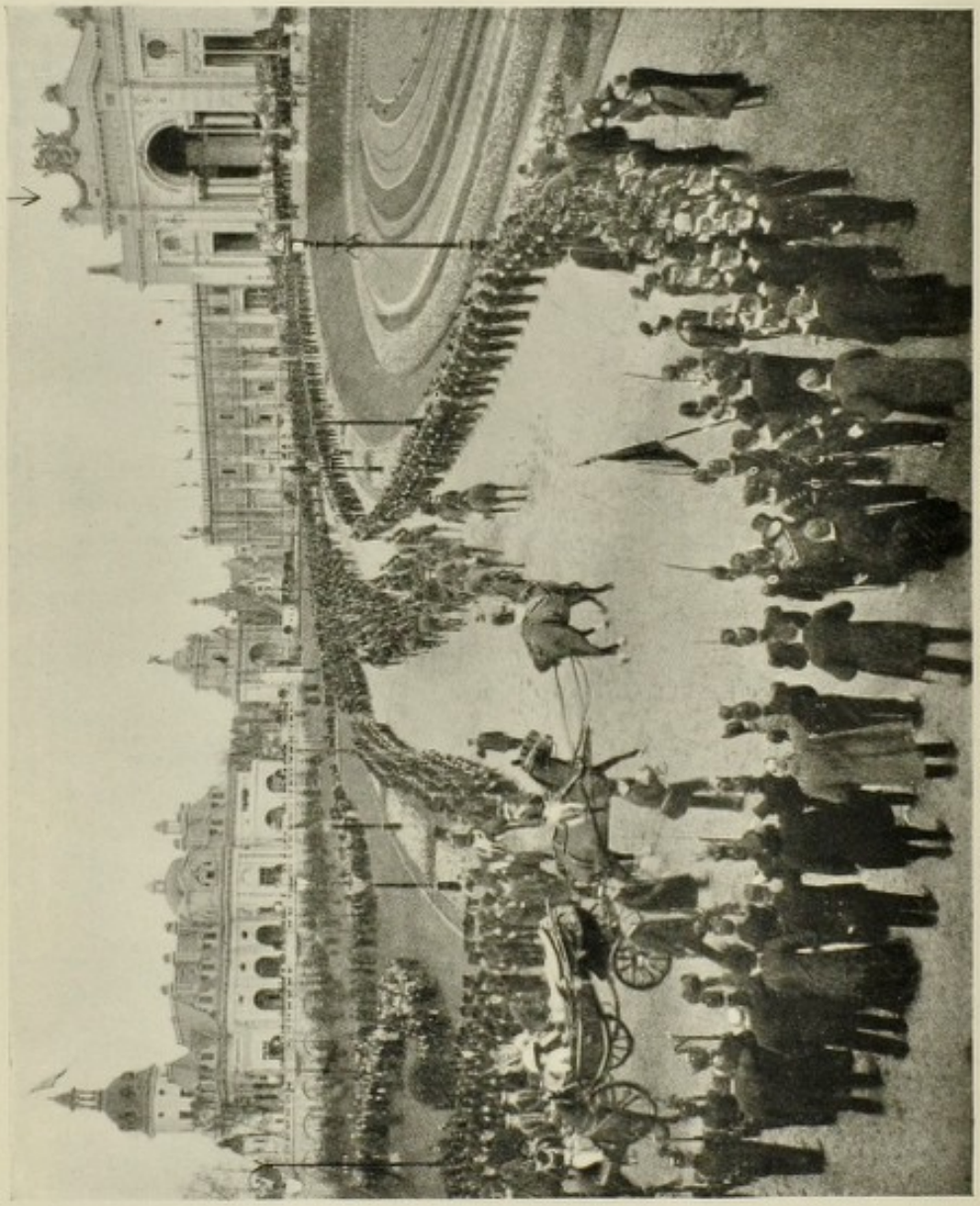
Fountain suitable for Steam Fire Engines to work from.

p. 15

THE BRUSSELS EXHIBITION FIRE.

VIEW OF MAIN BUILDING BEFORE THE FIRE.

buildings between No. 1 bridge and the "Avenue Jeanne," i.e. the exhibition was cut by a thoroughfare having a number of buildings on the SE. side of it, and most of these buildings had back gardens. Private property abutted on to the exhibition grounds in several places.



THE BRUSSELS EXHIBITION FIRE.

VIEW OF THE RESTAURANT "CHIEN VERT," KERMESSE, ADMINISTRATIVE BLOCK, AND ENTRANCE NO. 1 OF MAIN BUILDING.

11. ***Superficial Area of the Exhibition.***—The superficial area, general location of the buildings and other features of the exhibition will be seen from the plan, which, however, does not take in about one third of the area to the SE., occupied mainly

by the amusement section with its "side-shows," a number of minor exhibits, and a few larger ones like that of Canada. A general idea of its features, the relation of the buildings to the open spaces, etc., will also be seen from the views presented.

12. ***Exhibits Housed Outside the Exhibition Grounds.***—The fine art exhibits were not housed at the exhibition proper, but in buildings of a permanent character, at a considerable distance from the exhibition grounds.

13. ***Grouping of the Buildings, etc., in the Exhibition Grounds.***—The grouping of the buildings was most effective and the general arrangement very artistic. Very large areas of the exhibition buildings were, however, contiguous, i.e. practically under the same roof, notably

(a) The buildings of the Belgian and British Sections.
(b) The buildings of the French, Italian and International and the Machinery Sections.

There was no system of isolating sections or groups of sections in different buildings or blocks. It should be mentioned that Germany, however, had its own isolated group of buildings to the NE. of the grounds.

14. ***Area of the Exhibition Affected by the Fire.***—The part of the exhibition grounds of interest in this RED BOOK is the west corner, which had its approach from the "Avenue des Nations," and may be said to have formed the primary feature of the enterprise. This corner comprised the main building, containing the Belgian and British Sections, an administrative block, a group of minor buildings illustrative of an old-time fair (the Brussels "Kermesse") and a conspicuously located restaurant building (the "Chien Vert"). Beyond the corner proper there were the residences referred to above (backing on to the main building of the exhibition and facing the "Avenue de Solbosch"), the two bridges Nos. 1 and 2 over that thoroughfare and a wing of the French Section located on the NE. side of the "Avenue de Solbosch," and the corner of the main building of the French Section.

15. ***The Belgian Main Building and the British Section.***—The Belgian main building had its front on to a fine open space. The wing of that building containing the British Section served as a means of communication (*via* bridge No. 1) to the French Section. The main building and British wing both backed on to the gardens of the houses in the "Avenue de Solbosch." The British wing was separated from the Brussels "Kermesse" by a broad path. Adjoining the main building at its extreme east corner were a group of structures used as administrative offices, post office, etc., and there was a cul-de-sac pathway (a kind of back

Fire started.

BELGIAN MAIN BUILDING.
View from the "Chien Vert" Pond before the Fire.

BRUSSELS "KERMESSE."
General View before the Fire.

yard) off the broad path just mentioned which appears to have been used for standing the motor cars of the administrative officers. Here was located a makeshift motor garage with a reserve of petrol, partly kept in the open and partly in store.

16. ***Main Constructional Features of the Exhibition Buildings.***—The buildings for the most part were constructed on normal exhibition lines. Steel framing was used, the vertical external surfaces being largely of plaster slab. Timber, rough boarding, etc., was, however, applied in the usual haphazard manner, and the elegant facades rendered in " plaster and stick " on the orthodox lines. The roofing was largely of tarred felting on rough boarding, each roof bay having a large top light. The top lights were generally screened by valaria of some textile, and these were apparently not rendered non-inflammable.

17. ***Floors in the Exhibition Buildings.***—The floors were boarded, and rested on joists supported by brick supports. The space below the boarding was a void largely filled with rubbish, shavings and dust. The floor boarding showed open joints and notch holes. Occasionally floor covering such as fibre matting or linoleum was used, but this was the exception.

18. ***Partitions, etc., in the Exhibition Buildings.***—Partitions, bays, screens, etc. were mainly of wood framing covered with some textile. No effort appears to have been made to render either the wood or the textiles less flammable either by paint or impregnation. Quarter-inch " match-boarding " was freely used on screens.

19. ***Exit Doors and Exit Notices.***—Doors were of ordinary construction with ordinary fastenings. They were not very ample in number, nor systematically distributed with a special view to the possibilities of panic, but they were of fair number. Many, however, were locked or bolted, and thus useless for an emergency, others were blocked by exhibits or goods. Several doors were hung to open inwards instead of outwards. Exit notices were few and far between.

20. ***Divisional Walls, Doors, Shutters, etc.***—There was an entire absence of divisional walls of a fire-resisting character, or of fire resisting doors and shutters, water curtains or the like between different sections of the exhibition. The bridges joining up the territories on either side of the Avenue Solbosch were largely of timber, and good fire carriers, likewise such covered ways as joined up, say, the French Main Building with the French Wing. Neither the isolation of fire risks or their separation appears to have had the necessary consideration.

21. ***Open Lights and Fires; Electric Lighting Power, etc.***—The general equipment with heating and lighting appliances appears to have lacked control. Open fires, cooking stoves, gas burners

THE BRITISH SECTION.
View of Some of Exhibits Prior to the Fire.

THE BELGIAN MAIN BUILDING.
The Arcade on the Main Front.

were numerous and more or less unsuitable and dangerous, especially in connexion with some of the restaurants and refreshment booths. Electric wiring with bare wires, poorly insulated wiring, and long lengths of flexible (silk-covered) wiring were a conspicuous feature. The actual exhibition halls were not lighted, but many adjoining structures and numerous compartments built into the exhibition buildings, such as restaurants and offices along the main front of the Belgian Section, the French restaurant in the French Section, etc., and these also often had cooking stoves and open lights. External electrical illumination, for which the wiring was often run inside the exhibition halls, was also a feature of the exhibition.

22. ***The Exhibition Water Supply.***—The water supply available for fire purposes had been laid down in a manner suitable for effectively combating a moderate fire on which hydrants would be used in the ordinary course. The two territories had separate services. The service for the SW. territory was from a water tower, which when full had a head of some *37 metres* (121ft. 4ins.) on the hydrants in the Belgian Section. The main entering to the grounds near the Avenue Victoria had a *30cm.* (11.811ins.) diameter, this main gradually decreasing to *25*, *20* and *15cm.* until the mains inside the Belgian and British Section were of *10cm.* (3.937ins.) diameter. Those actually fronting the main building were of *15cm.* diameter (5.906ins.). The hydrants outside the buildings were on *8cm.* (3.150ins.) ends, those inside on *4cm.* (1.575ins.) ends.

23. ***Hydrants, Hydrant Fittings, Hose and Couplings.***—The hydrants were spaced on an average *50m.* (164ft.) apart. On the line from the entrance of the main near the Avenue Victoria to the NW. corner of the main building a number of stop-valves at junction points, etc., had been fitted. With all stop-valves open, hydrants tested after the fire, showed a pressure (taken by manometer) averaging $3\frac{3}{8}$ atmospheres (49.636 lbs. per sq. in.). Thirty metres (98ft. 5ins.) of hose with a branch of *14mm.* (0.551in.) nozzle are stated to have been provided for each hydrant. Hose was not systematically flaked, stowed or rolled ready for use. Sometimes the hose and branches were coupled up, sometimes not. The position of the hydrants was frequently unsatisfactory and their position not sufficiently conspicuous. Different couplings appear to have been generally used on South-Western (Brussels) territory to those on the North-Eastern (Ixelles) territory. In several sections of the Exhibition special types of couplings had apparently been fitted. Hydrants fitted for seven types of couplings are stated to have been in existence. Hose appears to have been of all manner of make and to have varied in texture and type, i.e. partly rubber lined and partly plain and fitted with a variety of types of couplings.

24. *Fire Extinguishers.*—Extinguishers were provided on a liberal scale. They were, however, by no means conspicuously located, and often coloured to match the background instead of having a distinctive colour, such as red. There was no regular examination of the extinguishers as to their being in working order.

25. *First Aid Fire Appliances.*—The provision of ordinary first-aid appliances such as buckets and hand pumps does not appear to have been favoured, nor fittings of such handy tools as axes, preventers, knives, hand ladders, etc., particularly suitable in risks where light materials want cutting down.

26. *Hose Reserve.*—There were very few hose reels with spare hose and these apparently not in known positions.

27. *Electrical Intercommunication and Fire Alarms.*—The electrical intercommunication between the different parts of the exhibition and the fire stations was unreliable. The telephone service appears to have been run through the post-office building at the SW. corner of the building, overhead wires being used. There was, however, an ample and efficient fire-alarm system with call points running into the two fire stations named below, but the positions of the call points were frequently unsatisfactory. There was an absence of indicators or marks directing attention to their position. The fire stations had to use the ordinary telephone service to get into touch with their own brigades at Brussels and Ixelles respectively.

28. *The Exhibition Watch Service.*—The watch service as far as it concerned the general exhibition appears to have been fairly well conceived in theory, but not properly applied in practice. The personnel was unsatisfactory; it did not appear to enjoy the confidence of its employers, and thus was apparently not allowed to properly patrol the interior of the buildings when closed to the public. They were rather in the position of door-keepers stationed at the doors or mainly told off for outdoor rounds only, they were not effectively trained to their duties. As there is a consensus of opinion that these watchmen often smoked—also after the fire—the watchmen in certain respects afforded an additional risk of fire. They were not skilled in the handling of fire appliances, nor apparently instructed as to their position, etc. The duties and powers of the watchmen as to prohibiting the general public from smoking were ill-defined. Certain of the exhibitors and certain of the national sections employed private watchmen of their own. Their qualifications varied considerably. In some few cases private watchmen were fully efficient.

29. *The Inspection Service.*—Apart from the watching service the inspection service likewise appears to have been ineffective, or non-existent. There are no records available of inspections of a fire preventive character as to open lights, fires, and all the minor

risks of fire, nor of such routine matters as daily water pressure readings, daily hydrant tests, daily fire-alarm tests, etc., trial "alarms."

30. ***Exhibition Fire Station of the Brussels Fire Brigade.***—In the SW. territory of the exhibition there was a small fire station in the building of the Brazil Section at which some firemen of the Brussels Fire Brigade were stationed. The Brussels Fire Brigade headquarters were some *4350m.* (say under $2\frac{3}{4}$ miles) distant by road from the main building of the exhibition, the travelling being partly very uphill. The nearest district fire station was *4000m.* distant, say 4,374 yards.

31. ***Exhibition Fire Station of the Ixelles Fire Brigade.***—In the extreme north corner of the NE. territory of the exhibition (off the Chaussée de Boondael) there was also a fire station for the Ixelles firemen referred to below.

32. ***The Equipment of the Brussels Exhibition Fire Station.***—The fire station on the SW. territory was manned by 1 foreman and 9 or 10 men from the Brussels City Fire Brigade. Their duties did not include any fire preventive work or watching. They were equipped with a horsed steam fire engine (of *1,000l.* delivery per minute, 220 gals.), and an old-fashioned 60ft. mechanical long ladder (hand drawn) and several hose reels and hose carts. The steam fire engine was not kept under steam, nor warmed and required from 15 to 20 minutes' effective stoking to get to work off cold water. The fire fighting efficiency of a unit of 10 or 11 Brussels firemen should not be compared with that of, say, the London, Berlin or Paris fire brigades. The circumstances under which the Brussels force is organized, recruited, trained, etc., are somewhat peculiar.

33. ***The Equipment of the Ixelles Exhibition Fire Station.***—The Ixelles fire station in the NE. territory was manned by 1 foreman and 3 men of the Ixelles part professional, part retained and part volunteer fire brigade, equipped with a hose reel.

34. ***Attendance at Fires.***—The Brussels and the Ixelles squads were instructed to attend calls, but apparently not to pass on any call until they considered they required assistance from their respective brigades.

35. ***The Brussels Fire Brigade.***—The Brussels Fire Brigade is a professional force, but its character, equipment or training cannot be compared with that of other capital cities or large provincial centres for reasons that need not be considered here. A reorganisation was promised by the municipality after the exhibition fire and a preliminary credit voted for this purpose. The strength of the brigade and its equipment at the time of the fire cannot be recorded as litigation has precluded the chief officer from issuing

authoritative figures and the annual fire report does not contain them.*

36. ***The Ixelles Fire Brigade.***—The Ixelles Fire Brigade comprised a professional force of a chief officer, an adjutant, 3 sergeants, 1 engineer, 6 corporals, 13 permanent men and 13 additional men engaged on account of the Exhibition (38 all ranks).† There is a reserve of 60 retained men and a volunteer section of 15 men, the latter specially allotted to the protection of a village (Booendael) in the Ixelles area.‡ The appliances of the brigade comprised a motor fire engine, two horsed steam fire engines, two motor first-aid traps, several horsed traps, 3 long ladders (from *18m.* to *22m.*).

37. ***Co-operation of the Brussels and Ixelles Fire Brigades.***—There appears to have been no plan of co-operation or division of responsibility as to the two squads or their brigades, nor does the universal principle appear to have been recognized that "by custom," the command at a fire rests with the senior officer of the brigade serving the locality in which a fire arises, i.e. the home brigade invariably taking charge of the fire and the brigades from outside taking their instructions *ipso facto* from the senior officer of the home force.

38. ***Auxiliary Fire Brigades from Neighbouring Districts.***—Besides the Brussels City Fire Brigade and the Ixelles Brigade there were available for service the brigades of adjoining boroughs such as Etterbeck, Schaerbeck, etc., i.e. various types of professional, part professional, police, retained and voluntary organizations.

39. ***Exhibitors' Private Fire Brigades.***—At the time of the fire there were no such brigades. They were formed by some of the National Sections after the fire.

40. ***Police.***—There was provision for police. Their arrangements are, however, not under review here.

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* The Brigade is generally stated to have comprised 4 officers and 230 firemen on the day of the fire and to have been since increased. Over 100 firemen and 4 steam fire engines from the brigade attended the fire.—*See table opposite p. 29.*

† After the fire the professional brigade was increased to 58 all ranks.

‡ The retained men and the volunteer firemen receive 4s. per attendance at fires.

THE EXHIBITION FIRE.

1. ***Time of the Outbreak of Fire.***—The fire broke out on the evening of Sunday, August 14, 1910, and was first observed at about 8.45 p.m., the exhibition halls being closed at the time and the very large assembly of the public being distributed over the exhibition grounds, or in the side shows, restaurants, etc.

2. ***Position of the Outbreak of Fire.***—The position in which flames were first observed is marked with a + on the plan, and it will be noticed that this is the extreme NW. corner of the Main Building. The outbreak as first seen is generally described as having occurred in or near an artificial-silk exhibit, close to No. 1 entrance of the Belgian Main Building, practically backing on to the administrative block referred to above. The exhibit was one in which the process of silk weaving and plaiting was being demonstrated with the aid of machinery. On several photographs of the ruins illustrated herewith the spot is similarly marked.

3. ***Weather Conditions.*** — The wind was from the South-East and South-West, and is stated to have veered round several times. It was apparently of moderate velocity. The night was clear, the ground dry, and the paths and roads of normal running condition.

4. ***Condition of Exhibition Buildings.*** — The exhibition buildings are stated to have been closed at 6 p.m. The electric light power was stated to have been turned off at 6 p.m., as far as the interior exhibits were concerned. The administrative block was electrically lighted at the time of the outbreak. Some of the external electric illuminating devices on the fronts of the Main Building appear to have been alight at the time of the outbreak.

5. ***Cause of the Fire.***—The cause of the fire is officially described as "unknown."

6. ***Possible Causes of the Fire.***—The suppositions as to causes include the following possibilities:

(a) Some fault in the silk exhibit.
(b) Some electrical fault.
(c) A long smouldering spark.
(d) Some negligence in the motor garage.

None of these possible causes can be definitely controverted, for:

(a) All processes in producing artificial silk or handling it by machinery, etc., must have some element of fire risk.*

(b) The extent of the electrical service in the part of the building in which the fire started has not been ascertained, and as so much additional unsuitable wiring and tapping was done after the opening of the exhibition, the possibility of a live wire is by no means precluded by the statement that the current was supposed to be entirely off the interior of the Belgian main building.

(c) Sparks are a quite likely cause, having special regard to the absence of strict prohibition of smoking on the part of the public, and the frequent surreptitious smoking of watchmen.†

(d) The garage showed all the elements of gross negligent management, of careless petrol storage, large accumulation of sawdust, etc., and as petrol vapour travels a considerable distance and is easily lit by spark (both ordinary and electrical) or open light, this possibility of cause has been argued.

7. ***The First Effort to Extinguish the Fire.***—The two watchmen first on the scene of the outbreak are stated to have got two hydrants to work, but to have found that only a very weak stream of water of about 6—9 ft. range could be obtained, and their efforts were entirely abortive. In the findings of the official inquiry the one watchman—who first observed the outbreak and who instead of at once getting to work with some minor first-aid appliance lost time in obtaining the assistance of a second watchman—is severely censured.

8. ***Reason for Ineffective Hydrant Work.***—The reason for the failure of the hydrants appears to have been some blockage in the mains of the Brussels territory, or an insufficiently opened stop-valve. The efficiency of the water service with clear mains was satisfactorily demonstrated after the fire. It has also been shown that a comparatively empty water reservoir at the supply-end of the Brussels service would not have involved the ineffective head on the night of the fire. An unofficial trial with an external hydrant (apparently off one of the larger mains) previous to the

*M. Welsch, who has examined the material and process from the fire point of view, does not consider the danger of the product as used at the Exhibition for purposes of demonstration to have been greater than ordinary silk, but opinions differ widely on this point, more especially regarding the risk of spontaneous combustion. Electric power was used in the exhibition stand in question, but the power is stated not to have been used after 5.45 p.m.

† The "evidence" before the Commission of Inquiry pointed to the custom of certain watchmen having taken their evening meal in the artificial silk stand and there is a probability of their having smoked after their meals, as tobacco ash was frequently found on the counter of a morning.

fire had however only shown an effective working range of 20ft. (*6.096m.*), but no notice of this unsatisfactory state of affairs was apparently taken at the time. It is stated that besides having numerous stop-valves on the line, as indicated above, there were one or more water-meters on the service.

9. ***The Fire-alarm Call.***—The nearest fire-alarm was promptly pulled, and apparently rang at 8.50 p.m.

10. ***Attendance from Brussels Exhibition Fire Station.***—A corporal from the Brussels squad who happened to be near at hand tried to get to work from an outside hydrant, but similarly obtained no proper water pressure. The Brussels steam fire engine from the Exhibition station with its crew attended promptly, but it only got to work in about a quarter of an hour after arrival and drew water from the main in front of the main building.

11. ***Attendance from the Ixelles Exhibition Fire Station.***—The Ixelles Exhibition squad also attended with their hose reel and soon after the Ixelles motor engine, of *2,400l.* delivery per minute (528 gals.) from the "Rue du Viaduc" Station, outside the exhibition grounds, to which a call had been put through by the Ixelles squad. The strength of the crew attending with this appliance is not recorded, but the number of men stated to be ready to "turn out" from the Ixelles station is stated to generally be twelve. This motor engine also drew water from the mains and was placed at the extreme East corner of the administrative block. Having regard to the condition of water supply being known by the time the two engines arrived, and having regard to the water available from lakes and ponds near the front of the main building, suction from open water would have been more appropriate.

12. ***The First Half-hour of the Fire.***—The outbreak of the fire was first observed at 8.45 p.m. and by 9.15 p.m. only about 20 firemen were at work upon it. During this first half-hour there was no cause to complain of the efforts made by the fire service in attendance, whose efforts were mainly handicapped by circumstances over which the firemen had no control. The fire made rapid headway regardless of these efforts and from about 9.15 p.m. chaos appears to have reigned in the fire service work.

13. ***Delay in Calling Up the Brussels Fire Brigade.***—The Brussels firemen appear to have been unable to give their head-quarters a prompt call, owing to the telephone wires having been affected either by breakage, or maybe the matter was at first overlooked. There is also good cause for the suggestion that the telephone exchange operators stampeded.*

14. ***The Second Half-Hour of the Fire.***— The area of the fire

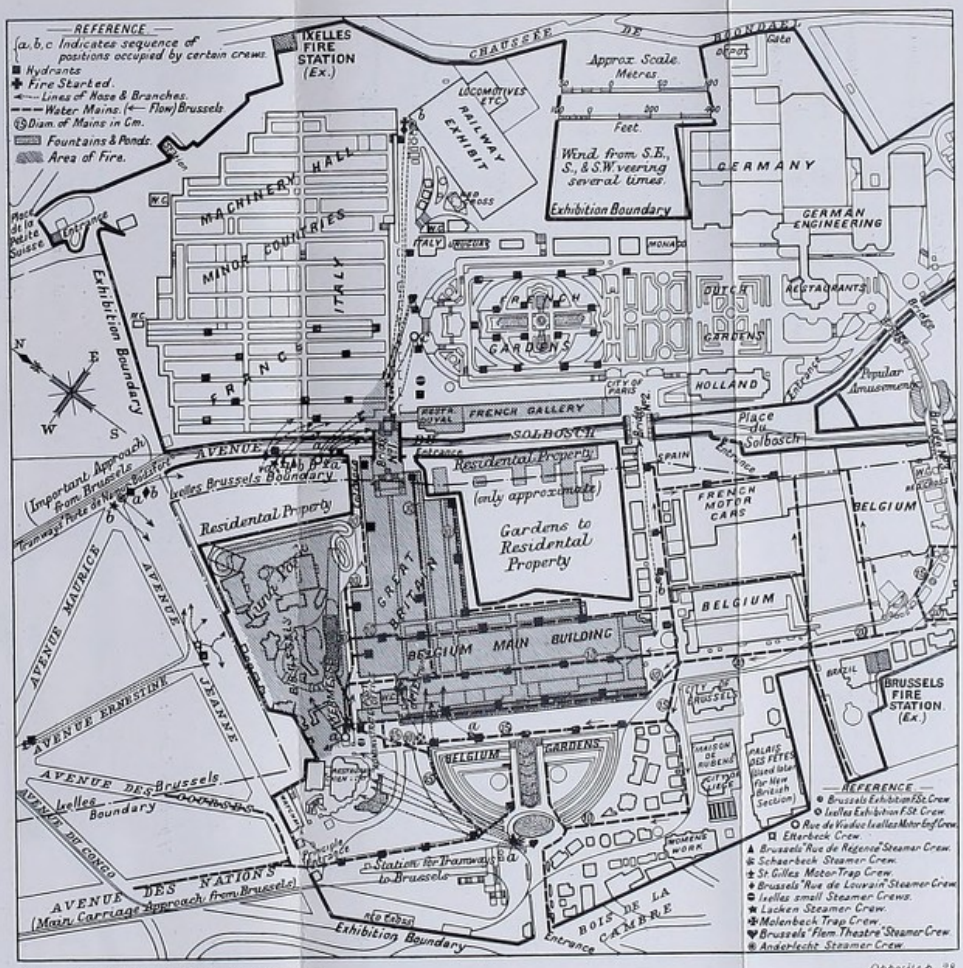
* For reasons above stated, i.e. lack of authoritative information, the time the call reached the Headquarters of the Brussels Fire Brigade cannot be stated.

was steadily and rapidly growing. Such trivial efforts as were being made to stop it were not made from what should have been the effective side. There was considerable friction between the Brussels and Ixelles firemen present. The police were only present in small force. The continued minor explosions of vessels, some being the explosions of the chemical fire extinguishers in the exhibition halls, and in one or two cases explosions of well-constructed petrol vessels were commencing to upset the nerves of many of the would-be voluntary workers, and generally, owing to the lack of skilled command, properly defined authority, and the quarrels of the firemen present, things went from bad to worse, so that the position of affairs at the end of the first hour of the fire was most regrettable.

15. ***The Progress of the Fire.***—By the time of the first fresh arrival of outside assistance (as timed in M. Welsch's version) the Belgian and British Sections were fully alight, the administrative block was practically gutted and the fire still continued to spread. The draught created by the rapidly burning highly inflammable material was considerable. An hour and a half, it would appear, elapsed before the next fire appliance from outside the exhibition grounds got to work, i.e. at 10.20 p.m., a hose reel, with 12 firemen from the neighbouring borough of Etterbeck, and at 10.25 a steam fire engine from Brussels "Rue de Régence" Station with 7 men. From 10.30 p.m. onward the fire fighting units arrived in goodly force, but the lack of water supply, the entire absence of central command and direction as to positions, combined with continued friction between the brigades, hampered anything like an effective "stop." The chief officer of the Brussels fire brigade, who was absent on leave, reached the fire after 10.30 p.m. The second officer on duty in his absence does not seem to have put in an early appearance.

16. ***The Attendance of the Fire Brigades.***—The following summary of attendances, as per Chief Officer Welsch's version, gives some idea of the time at which the fire appliances got to work and strength of the crews, but added to this must be the large force of police and military also brought up after 10.30 p.m. The responsibility for these data, however, rests with M. Welsch. The "evidence" at the inquiry scarcely covers this point, and the table is at variance with the reports of several of the chief officers of the brigades in attendance, but, failing an inquiry on British lines, the data of the Government representative on the "Technical Fire Protection Committee" must be accepted for a record of this description. In each case particulars are added as to the approximate position in which the fire appliances are stated to have been got to work, and any changes of position recorded seriatim with the prefix a, b, c. The distance the appliances had to travel to reach the fire are also given.

M. Welsch's data as applied in tabular form will be found opposite page 29.



From a sketch by C. O. Welsch (Ghent F.B.)

Opposite p. 28

ROUGH SKETCH PLAN OF EXHIBITION AREA AFFECTED WITH APPROXIMATE POSITIONS OF FIRE APPLIANCES AND CREWS AND THE DIRECTION OF THEIR OPERATIONS

THE BRUSSELS EXHIBITION FIRE

THE EXHIBITION FIRE

APPROXIMATE TIME TABLE OF FIRE BRIGADE ATTENDANCES, APPLIANCES, CREWS AND ROUGH IDEA OF POSITIONS APPARENTLY TAKEN UP

Note : Fire first observed about 8.45 p.m.

AT WORK by about:	*BRIGADES AND APPLIANCES.*	*Say,*	*POSITIONS.*
p.m. 8.55	*BRUSSELS F.B.* (Exhibition) with one steam fire engine (*1,000 l.* [220 gals.]).	11 men	(a) Main Building front, NE. end (steam fire engine, off mains). (b) Bridge No. 2 (?) and E. corner Main Building (steam fire engine off mains).
8.55	*IXELLES F.B.* (Exhibition) with hose cart.	3 men	(a) Main Building front NE. (off mains).
9.10 (*2,890 m.*) (3062.172 yds.)	*IXELLES F.B.* ("Rue de Viaduc" with one motor fire engine (*2,400 l.* [528 gals.]).	12? men	(a) W. corner Administrative block and SW. end of "Kermesse" (steam fire engine off mains). (b) "Avenue de Solbosch," No. 2 Bridge from the NW. (steam fire engine off mains). (c) French Section from the NE. (steam fire engine off mains).
10.20 (*3,000 m.*) (3280.899 yds.)	*ETTERBECK F.B.* with first aid trap and hose reel.	12 men	(a) Outside Exhibition, NW. front protecting "Avenue Jeanne" property and NW. side of "Kermesse" (off mains).
10.25 (*4,000 m.*) (4374.532 yds.)	*BRUSSELS F.B.* ("Rue de Régence") with one steam fire engine (*1,500 l.* [330 gals.]).	7 men	(a) "Chien Vert" Restaurant and SW. end of "Kermesse" (steam fire engine off fountain-pond in front of main building). (b) "Avenue de Solbosch," Bridge No. 1 (steam fire engine off mains).
10.32 (*3,000 m.*) (3280.899 yds.)	*ST. GILLES F.B.* with motor first-aid trap and hose reel.	16 men	(a) "Avenue de Solbosch," Bridge No. 1 from the NW. (off mains). (b) "Avenue de Solbosch," protecting private residence between Bridge No. 1, and "Avenue Jeanne" (off mains).
10.32 (——)	*IXELLES F.B.* with one Swedish steam fire engine (*1,800 l.* [396 gals.]).	10 ? men	(a) W. corner Administrative block and SW. end of "Kermesse" (steam fire engine off mains).
10.32 (——)	*IXELLES F.B.* with one Swedish steam fire engine (*1,200 l.* [264 gals.]).	6 ? men	(a) French Section from NE. (*did not get to work, owing to unexplained absence of steam engineer*).
10.25 (*7,100 m.*) (7764.795 yds.)	*SCHAERBECK F.B.* with steam fire engine.	39 men	(a) "Chien Vert" Restaurant and S.W. end of "Kermesse" (steam fire engine off fountain pond below main building).
10.35 (*5,000 m.*) (5468.165 yds.)	*BRUSSELS F.B.* ("Rue de Louvain" with one steam fire engine (*1,000 l.* [220 gals.]).	5 men	(a) "Avenue de Solbosch," Bridge No. 1 (steam fire engine off mains). *After friction with Ixelles F.B.* (b) "Avenue de Solbosch" corner of "Avenue Jeanne" protecting private residences. (c) French Section from the NE. (off mains at extreme NE. of grounds).
10.55 (*8,850 m.*) (9678.653 yds.)	*LAEKEN F.B.* with steam fire engine and wheeled hose reel.	21 men	(a) "Avenue de Solbosch," Bridge No. 1 (steam fire engine off mains). (b) "Avenue de Solbosch," corner of "Avenue Jeanne" protecting private residences from the NW. (off mains).
11.00 (*6,500 m.*) (7108.615 yds.)	*MOLENBECK F.B.* with steam fire engine and 2 large hose reels.	? men	(a) French Section from NE. assisting Brussels F.B. ("Rue de St. Louvain") (Steam fire engine off mains at extreme NE. end of grounds). (b) Assisting Ixelles F.B.
11.00 (*7,200 m.*) (7874.258 yds.)	*ANDERLECHT F.B.* with steam fire engine and hose reel.	40 men	(a) "Avenue de Solbosch," corner "Avenue St Jeanne" protecting private property (steam fire engine off mains). (b) French Section from the NE. (steam fire engine off mains at NE. end of grounds).
12.00 (*6,600m.*) (7217.978 yds.)	*BRUSSELS F.B.* (Flemish Theatre) with one steam fire engine.	5 men	(a) French Section from the NE. (steam fire engine off mains).
10.30 (*4,350 m.*) (4757.304 yds.)	*BRUSSELS F.B.* ("Place de Jeu de Balles") with traps, small gear, etc., in small squads.	85 men	Generally distributed.
10.30 till midnight.	*ODD MEN FROM VARIOUS BRIGADES.*	30 men	Generally distributed.

If positions changed : (a)=*position taken up on arrival* (b) (c)=*positions taken up later*

Total steam fire engines at work: 10
Total Brussels professional firemen on the ground . . . . . say 113
Total other professional, police, retained and volunteer firemen on the ground. . . . say 200

Firemen: Total over 310

Note.—No fire brigade appliances were brought to bear on the fire from the E. and SE.
The effective fire brigade resources of Brussels and the adjoining boroughs were practically exhausted with the above attendance having due regard for men and appliances left on station duty and in reserve for local calls.
The Chief Officer of the Brussels Fire Brigade was away on leave and did not reach the scene of the fire until after 10.30 p.m. There was considerable delay in the attendance of the second officer left in charge at the Brussels headquarters.
There was no attempt at centralisation of command or tactics until after 10.30 p.m. Appliances were eventually concentrated on the corner of the French Section where a good "stop" was made.
Three steamers were available to the west of the main building after 11 p.m. for work from the E., but were not thus applied.

Table compiled from M. Welsch's data and sketch.

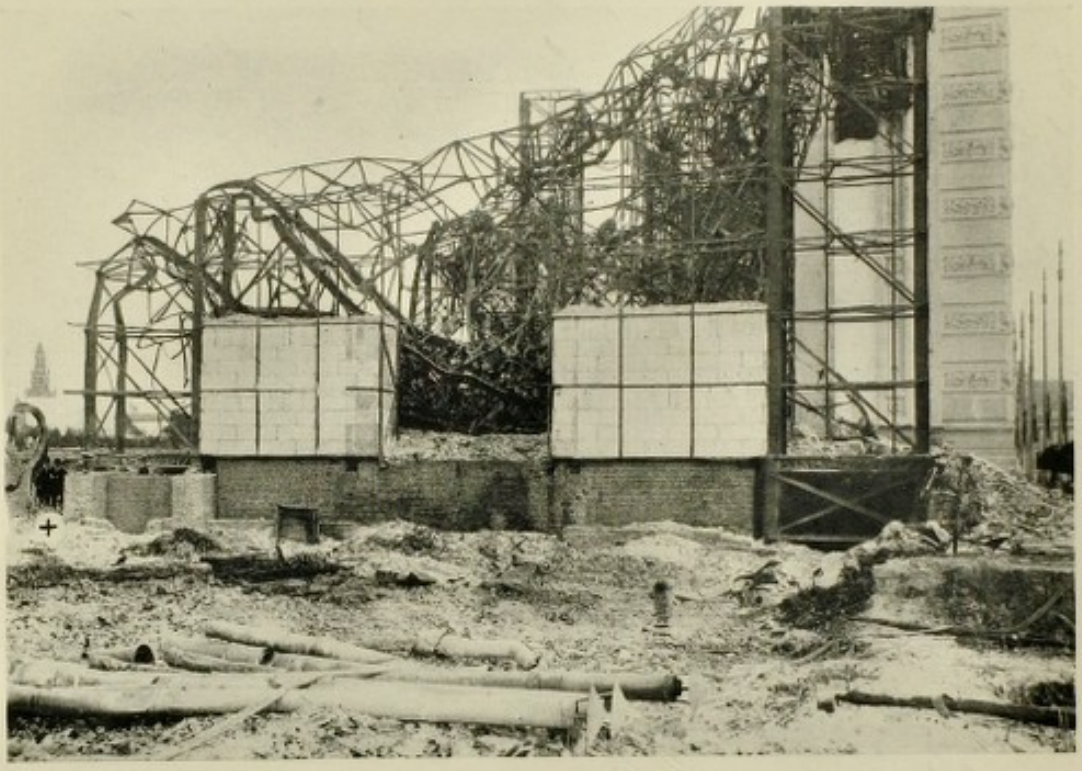
Opposite p. 29

17. ***The Conclusion of the Fire.***—Towards midnight the fire service work became more systematic; realization of the magnitude of the disaster largely put a stop to the friction between some of the brigades, and the vanities of some of those present were duly suppressed on the arrival of the military and civil heads. The ground was gradually cleared, and finally there was that excellence of fire fighting in and around the French Section, which did the greatest possible credit to all concerned, and this final successful effort about midnight can well be recorded in the annals of the fire brigades stationed on the NE. of the fire. Working under exceptional difficulties on a fire of intense temperature and great area, many individual actions of a heroic character were accomplished, and a fine spirit as well as exceptional physical endurance shown.

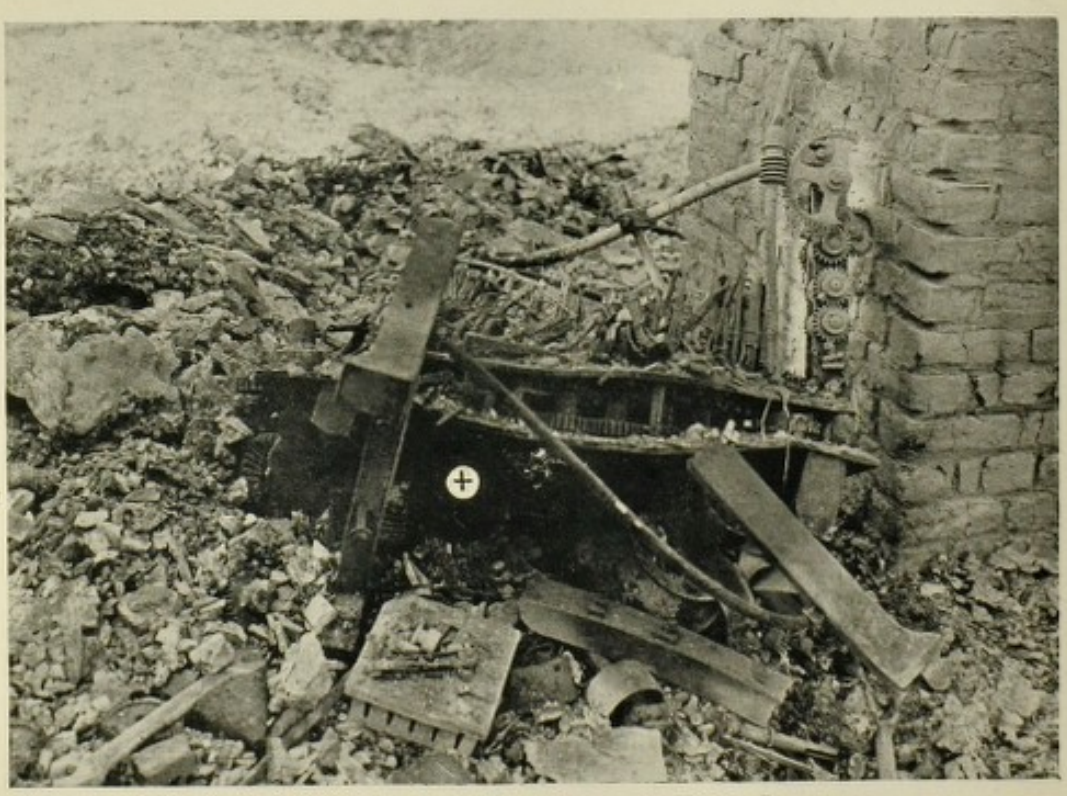
18. ***The Extinction of the Fire.***—In the early hours of the morning of Monday, August 15, about 3 a.m., the fire was in hand, and by daylight the ruins were being damped down, the area gutted comprising the administrative offices, some *21,720 sq. m.* (over 25,950 sq. yds.) of the Belgian Main Building, *14,850 sq. m.* (over 17,750 sq. yds.) of the British Section, *4,600 sq. m.* (over 5,500 sq. yds.) of the French Section and the French Restaurant, and practically the entire Brussels "Kermesse" and a number of buildings in "Avenue de Solbosch," whilst a number of adjacent structures, exhibits, etc., were damaged or soiled by fire, smoke, water or breakage.*

**Note.*—This memorable fire is described by the Chief Officer of the Brussels Fire Brigade in the following brief form in his fire report for 1910. The original French reads:—

Dates et heures	ENDROITS	DESCRIPTIONS SUCCINCTES
14 aout à 20 h. 50′	Exposition (Halles de la Section belge)	Une cause inconnue avait mis le feu à la halle principale de la Section belge de l'Exposition, après la fermeture des halles. De la Section belge le feu s'est communiqué à la Section anglaise, de là à Bruxelles Kermesse et à la Section française. L'incendie a duré de 8 h. 50′ à 3 heures du matin. Une vingtaine de lances de 45m/m et une quinzaine de lances de 65m/m alimentées par les conduites d'eau et par les pompes à vapeur, ont fonctionné. Les pompiers des faubourgs ont apporté leur concours à ceux de la ville et à ceux d'Ixelles; néanmoins une grande partie de la Section belge et de Bruxelles-Kermesse, toute la Section anglaise et une partie de la Section française ont été détruites par le feu.



CORNER OF BELGIAN MAIN BUILDING.



ARTIFICIAL SILK STAND WHERE FIRE STARTED.

THE BRUSSELS EXHIBITION FIRE

City of Brussels Building

Fire started

VIEW OF THE BRITISH SECTION AFTER THE FIRE SEEN FROM THE NW.

Fire started

CORNER OF BELGIAN SECTION AFTER THE FIRE SEEN FROM THE NW.

RUINS OF THE MAIN BUILDING SEEN FROM THE SE.

RUINS OF THE BRITISH SECTION SEEN FROM THE NW.

Bridge No. 1.

The French Wing

THE AVENUE DE SOLBOSCH. SHOWING PRIVATE RESIDENCES DESTROYED.

French Section

BRIDGE NO. 1 OVER THE AVENUE DE SOLBOSCH AFTER THE FIRE.

19. *The Appreciation of the Loss and the Criticisms.*—Then followed the full realization of the destruction wrought, the values that had disappeared, the art treasures irretrievably lost. The monetary loss on buildings and insured exhibits is stated to have exceeded £1,750,000 and many exhibits were uninsured.* It was only too obvious that the great national exhibition enterprise had been sadly crippled. The effect of the exhibition on possible buyers was sadly discounted, the prestige of the exhibition management and its efforts to attract the public reduced, and the exhibition management as such was face to face with a deficit and contingent liabilities on claims arising from the fire. Belgium was aghast, its Press lurid and full of reproaches, criticisms and exaggerations. Fresh scapegoats were invented daily for several weeks. The world's Press followed suit, and was frequently abusive where expressions of sympathy would have been more in place. But some few of the world's greatest newspapers realized that it was unwise to criticize when like, or very like, conditions might prevail in their own countries. These few—and it is pleasant to say that they were mainly British—took up the dignified attitude of letting "bygones be bygones," and devoted their great power for good to the constructive work of encouraging those in authority to continue the exhibition and to renew the exhibits wherever feasible. The revival of the British Section in a modified form within six weeks of the fire, housed in the "Salle des Fêtes," was one of the outstanding features of the attitude of the leaders of British public opinion.

20. *The Lessons of the Fire.*—As to the extent to which the lessons bore fruit for the concluding weeks of the Brussels Exhibition, this is of no concern in this "Red Book," though the strictures have been numerous. There was, however, certainly a bright spot in the improved means of protection provided for the revived British Section. This "Red Book" deals solely with the fire as it occurred, and is intended to conclude with a few hints as to possible practical safeguards in the future. The object is not to discuss "might have beens." The facts of the fire as given above are sufficiently instructive reading by themselves and give a fairly vivid picture of the circumstances of this catastrophe when supplemented by the illustrations here presented.

Criticism as to the extent of the foresight at Brussels before or after the fire is quite out of place. All that need be said has been stated in the introduction. But to repeat, there have been but few localities that have been so far able to show perfection in their fire protective arrangements for temporary exhibitions, and

**Note.*—Of the £1,750,000 a large proportion was, it is stated, insured by underwriters at Lloyd's. No individual British Insurance Company sustained a greater loss than £5,000 and only two companies to that amount. Irreparable British losses included historical loan exhibits from the Victoria and Albert Museum.

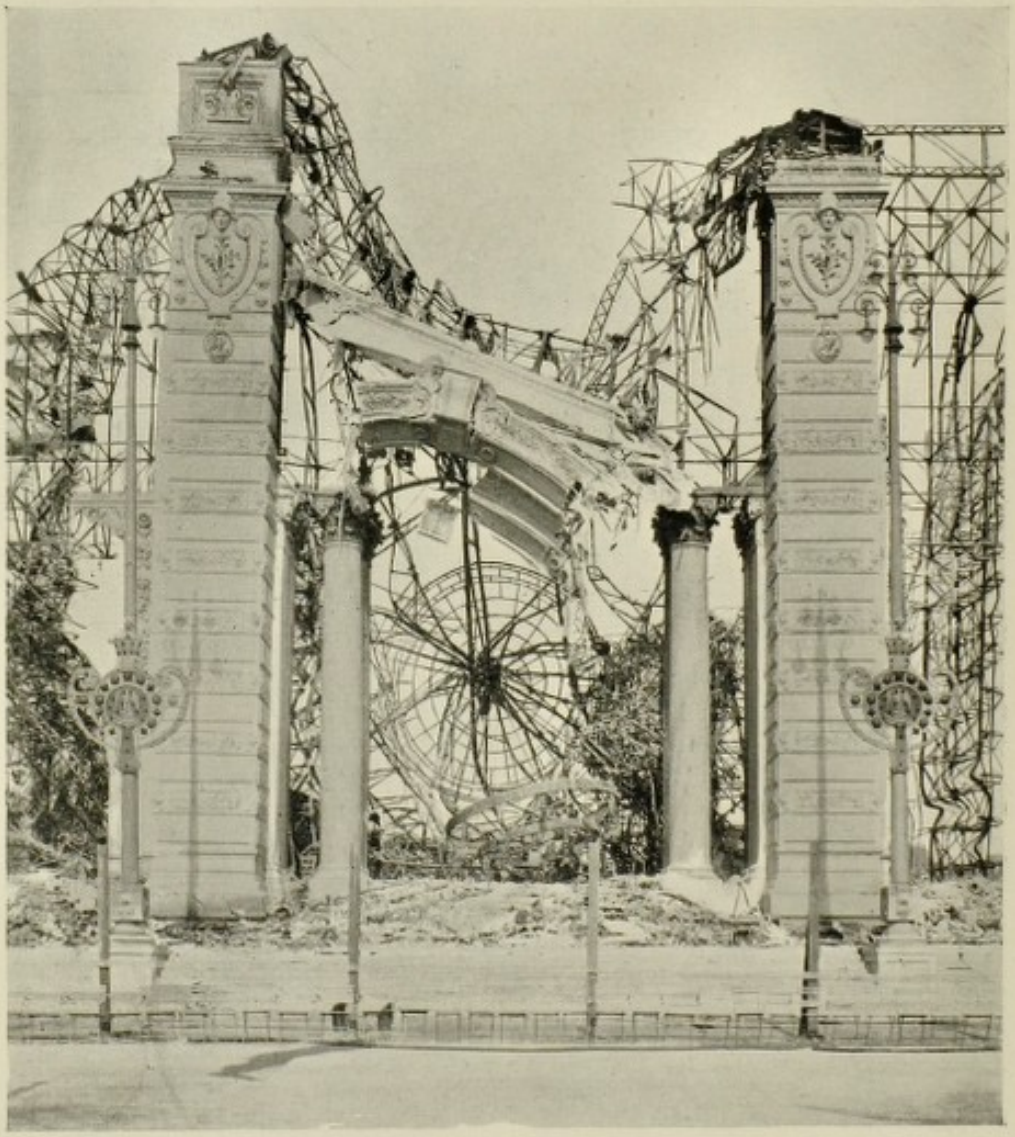
German Section

THE RUINS OF THE FRENCH WING.

THE RUINS OF THE BRUSSELS "KERMESSE."

the precautions observed at Brussels and the general conditions prevailing were of a normal character for communities not particularly enthusiastic regarding the fire question.

The occurrence of the catastrophe is to be much regretted, but some few fresh lessons may be learnt therefrom. It is to be hoped that the old lessons from catastrophes of many years back may in time be properly appreciated both at home and abroad, and with them the few new lessons bought by the fire of August 14, 1910. Suggestions based upon these lessons will be found in the following chapter in such a form that they might serve as a draft for a code on the subject.



THE BRUSSELS EXHIBITION FIRE.

ENTRANCE NO. 1 OF THE MAIN BUILDING AFTER THE FIRE.

SOME SUGGESTIONS

as to

FUTURE TEMPORARY EXHIBITIONS

set out in the form of

MODEL REGULATIONS.

The following are some suggestions regarding practical measures for preventing the outbreak and spread of fire at temporary exhibitions, such as the National, Imperial or International Exhibitions of which the one at Brussels was a characteristic, and both industrially and artistically most successful, example, although so sadly marred during its concluding months by the catastrophe of August 14, 1910.

Impracticable suggestions, i.e. suggestions which would materially hamper the holding of such exhibitions have purposely been omitted, and in many respects the views expressed below may be deemed to be moderate.

To those who have to organize exhibitions, it should be mentioned that forethought and systematic work in the direction named will be found economical and time-saving; further, it will result in the absence of much friction in the conduct of the enterprise and give confidence to the public and exhibitors alike. From a national point of view, too, a demonstration of forethought and thoroughness in the precautionary measures of an exhibition are excellent advertisements for the care and precision of the work of a nation generally.

In organizing an exhibition the following should be observed from the fire point of view:

LOCATION OF AN EXHIBITION.

1. ***General Position.***—The position of the grounds should not be unduly exposed to gales, winds, etc.

2. ***Accessibility.***—The exhibition grounds should be easily accessible from not less than two sides.

3. ***Levels.***—The levels should be such that the gradients on the main roadways of the exhibition grounds are easily drivable.

4. ***Natural Water Supply.***—The position should be preferably on or near some natural source of water supply such as a river or lake.

PRIMARY PRECAUTIONARY FEATURES.

5. ***Extent of Fire.***—The primary precautionary feature for reducing the extent of the fire risk should be that of the isolation

of buildings or blocks of buildings, and the sub-division of large buildings into parts, and their construction with due regard to the relative importance of the fire risk.

6. ***Loss of Life.***—The primary precautionary feature for reducing the risk of loss of life should be the provision of exits in such a manner that the maximum distance from any point in the exterior of an exhibition building to the open shall be, say, 80ft. (*24.384m.*), that two routes of exit shall be available, and that the exits be clearly indicated.

7. ***Causes of Fire.***—The primary precautionary feature for reducing the risk of outbreak of fire should be the limitation of and control of the use of open lights and fires, smoking; the lighting, power and heating services and the use and storage of explosives, oils, spirits and other highly inflammable objects.

8. ***Control Service.***—The primary principle for obtaining an observance of the preventive requirements should be a reliable Control Service placed in responsible hands, with

(a) an inspection service, and

(b) a watching service, both services to be under the immediate direction of the exhibition executive, which should be in the position of a responsible property owner, the whole of their fire preventive work, however, to be under the supervision of either the State or one local authority having summary power or powers rapidly and easily enforceable by the local judicature.

9. ***Fire Service.***—The primary principles for obtaining effective assistance for combating an outbreak of fire should be:

(a) An extensive well-indicated fire-call system.

(b) A private well-trained fire service to be rendered by the watching service above named.

(c) A well-organized section of the public fire service (divided into self-contained units of not less than, say, 8 men per unit) with motor appliances, a unit to be within not more than, say, one thousand yards' distance from any point in the exhibition.

(d) A reliable system of rapidly obtaining additional effective assistance from the public fire service.

(e) A well-distributed and clearly indicated supply of first-aid appliances within, say, 100ft. (*30.480m.*) from any point inside an exhibition building or 200ft. (*60.959m.*) without.

(f) A water supply from two independent sources (one preferably natural) and a well-distributed hydrant system.

(g) Co-operation of the public fire service with the local police, military and ambulance services and with the technical staff of the exhibition.

SIZE AND SEPARATION OF BUILDINGS.

10. ***Maximum Cubic Contents of Buildings.***—The cubic contents of buildings should be limited as follows, namely:

(a) No one building to exceed, say, 5,000,000 cubic ft.

(b) No one part of any building to exceed 1,000,000 cubic ft. unless separated from the adjoining part by a wall of "partial" fire resistance, the openings in which are suitably fitted with doors or shutters.

11. ***Separation of Buildings.***—The buildings should be separated on the following lines:

(a) All buildings of more than 1,000,000 cubic ft. should be at least 60ft. (*18.288m.*) distant from any other such building.

(b) Buildings of 500,000 cubic ft. upwards should be at least 40ft. (*12.192m.*) away from any other building.

(c) It should be permissible for booths, small structures, etc., of under 100,000 cubic ft. to be connected up or adjoin without being separated by walls of "partial" fire resistance if the total cubic extent of these adjoining buildings in any one block does not exceed 500,000 cubic ft. and such blocks are not less than 40ft. (*12.192m.*) away from any other such block or building, but this condition should not be applicable to any building used for side-shows, theatrical purposes or a restaurant having a seating capacity of over 300 people.

(d) Small structures, booths, etc., of under 100,000 cubic ft. must be not less than 20ft. (*6.096m.*) away from any other building of any description, unless forming part of a block of 500,000 cubic ft.

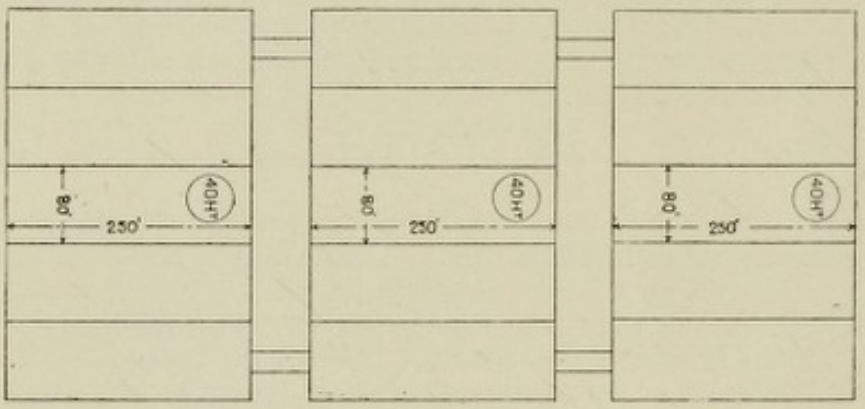
(e) Where a building contains irreplacable works of art or historical exhibits, or where it contains administrative offices, a post office, telegraph or telephone office, a police or fire station, the distance from any other building should not be less than double the distance named above, but preferably more.

12. ***Connecting up of Buildings by Covered Ways.*** — It shall be permissible to join up any three buildings of 3,000,000 to 5,000,000 cubic ft., or any five buildings of 1,000,000 to 3,000,000 cubic ft., or any equivalent of buildings to the extent of 15,000,000 cubic ft., by suitable corridors or covered ways, known as connecting links, on the following conditions:

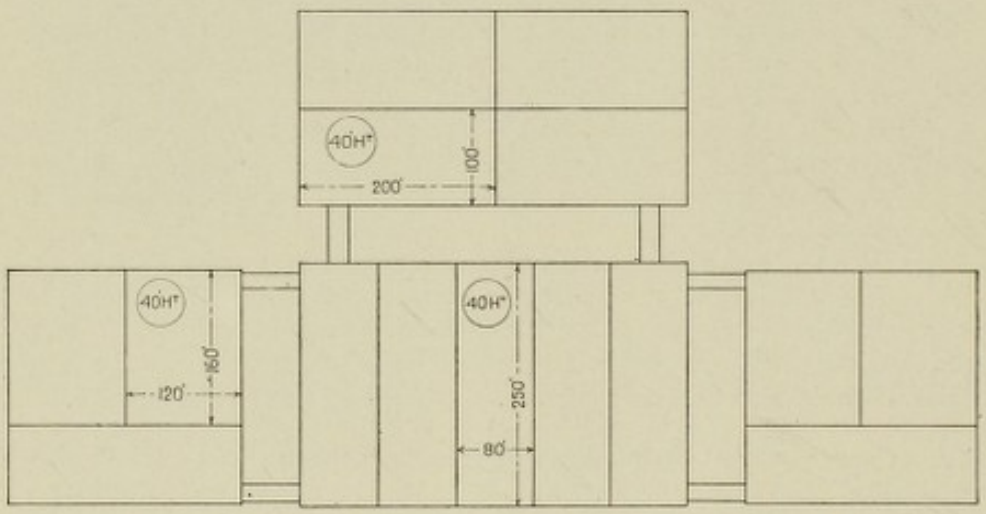
(a) that the distance between the buildings to be linked up be as aforesaid (*see Clause* 11);

(b) that the section of the connecting link shall not exceed 1,000 square ft. (*92.899 sq.m.*) with a minimum height of 20 ft. (*6.096m.*);

(c) that the material used for the connecting link shall throughout be of a "partial" fire-resisting character excepting only the glazing;



Block of 870 ft. frontage (under 15,000,000 cubic ft.)



Block of 1,000 ft. frontage (under 15,000,000 cubic ft.)

DIAGRAMATIC SKETCHES

Showing possible grouping of large temporary exhibition buildings to accord with the Suggestions Nos 10, 11 *and* 12.

(d) that it shall be possible to rapidly (i.e. within, say, 60 seconds) open up a drivable opening by doors or shutters at right angles to the connecting link, the opening to have slopes so as to make the way thus formed drivable;

(e) that no draperies or furnishings of an inflammable character be used within or on the connecting link;

(f) that the doors from the building into the connecting links be of a " partial fire-resisting " character;

(g) that no two such connecting links parallel or approximately parallel to one another shall be closer together than 200ft. (*60.959m.*) centre to centre;

(h) that not more than four connecting links run seriatim either parallel or longitudinally;

(i) that where a building contains seating accommodation for more than 300 people and is used for restaurant, theatrical or side-show purposes, it shall not be connected up with any other building.

NUMBER OF FLOORS IN BUILDINGS.

13. ***Floors.***—The number of floors permissible in individual buildings should be determined on the following lines:

A. *Ground Floor.*—No building should have a ground floor more than 4ft. (*1.219m.*) above the external ground level at or near its main entrance.

B. *First Floor.*—No building should have a first floor available to the public except on the following conditions:

(a) That in buildings of over 500,000 cubic ft. the first floor be in the form of a gallery only, of not greater than one-third the superficial area of the ground floor, which gallery must have ample staircases of easy rise and tread at each extreme end or corner.

(b) That in buildings of under 500,000 cubic ft. if complete first floors be applied, the same conditions as to staircases be compulsory, and that there be numerous suitable external casement windows, each of at least 8 sq. ft. area to at least 2 fronts.

(c) That no first floor shall be higher than 30 ft. (*9.144m.*) above the ground floor.

C. *Second Floor.*—No building shall have a second floor available to the public, or any higher floor over any part of a building accessible to the public.

D. *Basement.*—No building used by the public shall have a basement or cellar unless the cellar have an external approach only, and be separated from the rest of the building by fire-resisting construction affording " partial protection."

CONSTRUCTION OF BUILDINGS.

14. ***Construction.***—The construction of buildings should be determined on the following lines:

A. *Classification of Buildings.*—The buildings should be divided into four classes structurally, namely those affording:

1. Practically "No" fire resistance.
2. "Temporary" fire resistance.
3. "Partial" fire resistance.
4. "Full" fire resistance.

B. *Buildings for Ordinary Exhibits.*—Buildings containing replaceable exhibits, booths for the sale of goods, etc., could be of the first class, i.e., of a construction affording practically "No" fire resistance.

C. *Restaurants, Side-Shows, etc.*—The buildings intended to hold the public seated for any period exceeding five minutes, such as restaurants, cinematograph shows, displays, side-shows, etc., should be of the second class, i.e., affording "temporary" fire resistance.

D. *Buildings for Irreplaceable Exhibits, Offices, etc.*—The buildings intended to hold works of art and irreplaceable exhibits of an historical character, as also any tower of greater height than 80ft. (*24.384m.*), the general administrative offices, post office, telegraph or telephone office, police and fire stations should be of the third class, i.e., affording "partial" fire protection, but it is advisable that the highest class of permanent construction affording "full" fire resistance be adopted for housing exhibits of historical importance.

15. ***The Ordinary Form of Construction Affording Practically "No" Fire Resistance.***—For the buildings intended to house ordinary exhibits, etc., the following principles should be adopted:

A. *External Walls.*—The external walls of the buildings should be of a solid, slow-burning or incombustible material not less than 3in. (*0.076m.*) thick or of metal or of both.

B. *Floors.*—The floors of the ground floor should be of close boarded rebated or metal jointed floor boards out of not less than 1in. boarding, on suitable bearers and sleepers, the space thereunder being filled up as far as the ground floor is concerned to the underside of the boards with a dry incombustible material. For first floors the floors should be similarly constructed, but the bearers should be of a slow-burning or incombustible material, and no voids should be permissible. Where linoleum, tiling, or parquetry be used throughout the surface of a floor as a floor covering, plain jointed boarding should be permissible for the floor proper.

C. *Roofs.*—The roofs should be of metal or of some form of non-combustible roofing material throughout, except for any supporting boarding or battens which if used shall be out of not less than 1in. boarding planed, thickly whitewashed, or covered with an approved fire protective paint where exposed. The framing to skylights or lantern lights shall be of metal.

D. *Wall Coverings, etc.*—No canvas or other textile covering

shall be used on walls, ceiling, or roof soffits, unless closely pasted to the surface it is to cover throughout, or impregnated so as to be effective in not spreading flame (twelve months guarantee).

E. *Divisional Walls.*—Divisional walls between adjoining parts of a building should be constructed as follows:

(a) an independent wall,
(b) carried up 5ft. above the roofing,
(c) of " partial " fire-resisting construction,
(d) having no openings larger than 500ft. super (46.449 *sq. m.*) on the ground floor or larger than 250ft. (23.224 *sq. m.*) on the first floor fitted with "partial" fire-resisting doors or roller shutters and no openings on any one divisional wall to be nearer to another than 80ft. centre to centre, and
(e) having every door opening to be fitted with a drencher on each side.

F. *Partitions.*—Partition walls should be of solid slow-burning or incombustible material or hardwood not less than 2in. thick, metal or incombustible sheets of not less than $\frac{1}{8}$in. thick or both.

G. *Ceilings.*—Ceilings should be of slow-burning or incombustible material such as plaster boards of not less than 1in., incombustible sheets of not less than $\frac{1}{8}$in., plaster on metal lathing (the plastering not less than $\frac{1}{2}$in. thick), or of metal or of hard wood not less than 1in. thick.

16. ***Construction Affording " Temporary," " Partial" or " Full " Protection.***—In buildings affording " temporary " protection the same conditions should prevail as customary where a minor degree of fire-resistance is required of a permanent structure. In buildings affording "partial" or " full " protection similarly the same conditions should prevail as in permanent structures of the higher grades of fire resistance.

17. ***Doors and Shutters.***—For doors the following principles should prevail:

A. *Internal Doors.*—All interior doors should swing both ways.

B. *External Doors.*—All external doors should open outwards and be self closing.

C. *Panic Bolts.*—All doors, in portions used by the public, should be fitted with panic bolts.

D. *Plinths to Doors.*—Doors should not have projecting plinths and where leading out on to steps should have a clear 5ft. landing before the first step downwards.

E. *Shutters.*—Where shutters are used they should be of an approved type to open easily from either side.

18. ***Exhibition Stands.***—Exhibition stands in the exhibition buildings should be strictly limited in height so as to be kept to a prescribed distance from the roof soffit, ceiling of gallery floor,

etc., as the case may be. Stands comprising erection higher than 7ft. above the floor shall be subject to the same rules as the internal work of the building. All voids under exhibitors' stands or platforms should be filled up and they should be boarded as the exhibition floors. Counters and movable show-cases could, however, be regarded as furniture.

19. ***Timber in the Exhibition Halls.***—All timber used in the exhibition shall be out of not less than 1in. boarding, planed, thickly whitewashed or painted with an approved fire protective paint (one year guarantee).

20. ***Velaria, Awnings, etc.***—Velaria, awnings, shop blinds, etc., are entirely prohibited. Ordinary blinds and flags used inside the building shall be rendered non-inflammable, likewise all curtains, or draperies other than tapestry, velvets, silks, velveteens and carpets.

21.—***External Exhibition Stands, Booths, etc.***—Exhibitors own minor external buildings, booths, etc., should be limited as to height, projections; the proportion of exit facilities to floor space, etc., should be according to the local requirements and character of the exhibition.

22. ***Plans of Exhibits, Stands, etc.***—The exhibitors should submit plans of their proposed stands, stalls, booths, counters, buildings, etc., to a uniform scale, and the principles laid down as to their character from a fire point of view should be strictly observed. The administration should provide the necessary administrative machinery to enable them to notify consent, conditional consent or dissent (with reasons) within ten days of application. The conditions should be expressed in simple language. The powers of the exhibition management as to prohibition of an exhibit, right to screen it or remove it in the case of non-compliance with the rules should be precise and summary. On the other hand a tactful consideration of individual requirements and conditions must be observed. No stand should, however, be visible to the public until the conditions have been complied with and an approval ticket has been issued to that effect. Galvanized iron screens on casters 7ft. high and suitably inscribed should be available for screening any stand not complying with the conditions and shall be chargeable at a rate per diem.

23. ***Fire Protective Paint, etc.*** — Provision should be made for exhibitors to be able to obtain fire protective or non-inflammable paints, the impregnation of textiles, etc., at a tariff not exceeding by 10 per cent. the actual net cost, and a ready and practical means of testing and controlling the materials and work done either at or outside the exhibition should be arranged for, as also a regular inspection of the materials, and work as applied to the actual exhibit.

CAUSES OF FIRE.

24. ***Open Lights, etc.***—The use of all open lights should be strictly prohibited; small electrical hand lighters should be supplied where the use of lighting-up appliances is essential. The carrying of matches by any member of the watching service or the subordinate staff whilst in the exhibition grounds should be prohibited. Oil lamps necessary for watchmen, engine men, mechanics, etc., should not be supplied with mineral oil. Candle lamps should be used where possible.

25. ***Smoking.***—Smoking should be prohibited throughout the exhibition buildings other than certain offices and specified restaurants. It should also be prohibited in certain prescribed areas where there is a danger from sparking, as for instance, in the yards used for freight, package, and case storage. The penalties for smoking should be severe and easily enforceable by a summary procedure. For employees, they should be doubly severe and be supplemented by dismissal on the second occasion. For members of the watching service there should be no punishment other than dismissal, and dismissal should be immediate and involve forfeiture of any pay outstanding, and public advertisement of the misdemeanour. Suitable provision must, however, be made for the watching service and the staff generally to have reasonable time and conveniences for meals and smoking, including the provision of electrical cigar-lighters. Cigar and ash holders, as also electric cigar lighters, should be provided outside the main entrance door of each building. An ample supply of tins for cigar ends, etc., should be provided in suitable positions in the grounds.

26. ***Cleanliness, Waste Paper, Packing Materials, etc.***—Cleanliness should be rigidly enforced, the waste paper, etc., from all stands being cleared away daily by means of suitable receptacles, and either taken outside the exhibition grounds or burnt. Oily rags, dusters, etc., used on machinery in motion should be kept in metal receptacles and cleared away daily. The packing and freight stores should be isolated and under special supervision.

27. ***Lightning Conductors.***—Lightning conductors should be compulsory for buildings of a certain height, and their arrangement subject to special rules and regular inspection.

28. ***Stoves and Flues, etc.***—The construction of stoves, hearths and flues should be regulated on the same lines as for permanent structures, and where temporary iron stack-pipes are used the covering of same with insulating material and their method of fixing should be subject to special rules to meet local conditions. Boilers, gas plants, etc., should be subject to regulation.

29. ***Electric Lighting and Power.***—The following principles should be observed regarding electric lighting and power:

A. *General Rules.*—The electric lighting power and transmission rules should be laid down to accord with the local practice for permanent lighting as far as this is economically possible, a practical sub-division of circuits and effective, easily accessible cut-out and fuse system, however, being essential. Flexible wiring should be strictly limited to certain qualities of material, certain lengths and carrying capacity; bare wires entirely prohibited, and cable carrying power to certain voltage compulsorily protected by tubing. To require all the safeguards essential in a permanent building is out of the question in an exhibition of short duration, but a reasonable absence of risk can be obtained by simple precautionary measures.

B. *Special Circumstances.*—For the buildings containing irreplaceable works of art and historical exhibits all internal artificial illumination should be prohibited, as also all external illumination devices. The necessary lighting effect on the exterior of any building can be obtained from external standards placed, say, at least 20ft. (*6.096m.*) distance from the fronts or by aid of search-lights.

C. *General Exhibition Halls.*—For the general exhibition halls the exclusion of artificial illumination is advisable, but much depends on local conditions, and the primary object of the exhibition must always be borne in mind. To exclude say the electric illumination in a building in the evening and yet allow electric power in it by day is, however, senseless. It is better to close certain of the buildings from which machinery in motion is excluded at sunset, and on the other hand keep open after dark certain halls where there is machinery in motion, lighting them particularly well and artistically as an attraction. In any case machinery in motion should preferably be shown in separate buildings, parts of buildings, or wings, and not located haphazard among the general exhibits. Many exhibitions suffer financially, and also discount their effect by closing their exhibition halls entirely after dark. There is no reason why the fire question should be allowed to interfere with an enterprise to this extent if proper precautionary measures are taken. Where buildings are open to the public after dark emergency lights should be placed over all exits.

D. *Switch-boards.*—Access to the main switch board of any one building should be easy, and the board should be near an external door where it can be operated without obstructing exit. The main switch-board of the exhibition should be in a suitable building or chamber with direct access from the outside. Switch-boards should be conspicuously marked in a distinctive colour.

E. *Electrical Fittings.*—All electric fittings should be tested at short intervals, their condition recorded, and defects remedied.

30. ***Gas and Other Illuminants.***—Gas should be excluded as far as possible from the exhibition, and on no account should it be permitted in the main buildings or parts other than those in which machinery in motion is permissible. All gas mains should have an external easily accessible cock for each building, and the position of the cock should be conspicuously marked. Petrol vapour illuminants, acetylene illuminants, with their respective plants, should only be permitted as exhibits outside the exhibition buildings and preferably in prescribed isolated areas. The same applies to exhibits of fireworks, explosives, inflammable liquids, etc.

FIRE ALARMS.

31. ***The Fire Alarm System.***—The fire alarm system should be installed on the following lines:

A. *Call Points.*—Fire alarm points should be numerous, well-placed and conspicuously indicated, easy to ring and preferably also fitted with telephone communication.

B. *Fire Alarm Circuits.*—The fire alarm system should be divided into circuits for special buildings, groups of buildings or areas and run into:

(1) The exhibition fire-stations.
(2) The exhibition watch and police offices.
(3) The exhibition ambulance office.
(4) The electrical gas and water supply centres.
(5) The exhibition administration offices.

C. *Indicator Tablets.*—If feasible, additional indicator tablets and buzzers should be fitted in connection with the internal fire alarm system to notify watchmen in the building or block of buildings affected as to where a " call " has been pulled.

D. *Notification of the Fire Brigade Headquarters.*—Any call of fire should be at once automatically notified to the fire brigade headquarters. Assistance should thereupon be telephonically or telegraphically requested, or the reverse, as the case merits, but in any event a " stop " message not reaching headquarters within 15 minutes should *ipso facto* be responded to. The object of this response is to obviate the effect of a possible breakdown on the electrical service between the exhibition fire station and fire brigade headquarters.

E. *Fire Service Intercommunication.*—The electrical communication between the various fire stations in the exhibition grounds and the fire brigade headquarters should be underground except, if needs be, where they are, say, one hundred feet distant from any building.

F. *Automatic Fire Alarms.*—The expense of automatic fire alarms need not be incurred if the watching service is properly organized, or, at the most, it need be only installed in connection with exceptionally dangerous risks such as manufacturing processes in motion.

G. *Notification to the Police.*—A call for assistance reaching the fire brigade headquarters should be *ipso facto* notified by the fire brigade to the police headquarters irrespective of any message from the exhibition police.

WATER SUPPLY, HYDRANTS, ETC.

32. ***Water Supply.***—The water supply should be on the following principles:

A. *Sources of Supply.*—The water supply should comprise, if possible, one natural source (such as a river, etc.) and one artificial source, or two entirely distinct artificial sources, i.e. mains from separated reservoirs, pumping stations, or the like.

B. *Water Pressure.*—The minimum water pressure available from an artificial source should not be less than four atmospheres (58.828 lbs. per sq. in.) at any point on the ground floor level of an exhibition building.

C. *Mains.*—No external main should be under 6 in. and no internal main under 4 in.

D. *Mains for Fire Engines.*—Mains of special diameter, allowing for, say, three average steam fire engines in series to work from effectively should be laid to the points of possible danger, such as the groups of main buildings.

E. *Stopcocks.*—Stopcocks should be placed in suitable positions easily accessible and conspicuously marked.

F. *Stationary Pumps.*—It is frequently possible to obtain extra water under pressure from pumping machinery that is being exhibited, more especially if there is a natural water supply, such as a river or a lake available to draw from. In such a case if the pumping machinery is to be relied upon for fire purposes, it should be within easy reach and under its own roof, and either provided with special mains or with the suitable connections for conveniently joining up hose. Such machinery, however, not as a rule being under the full control of the exhibition management, should only be considered as a probable "reserve." If existent it should be drilled from.

G. *Provision for Steam Fire Engines to Draw from Natural Sources.*—In the case of there being a natural source of water supply, such as a river or lake, facilities must be provided at suitable points for steam fire engines to get a good position for their suctions, and the positions should be conspicuously marked. Sumps should be provided where the water is shallow.

33. ***Hydrants and First-Aid Fire Appliances.***—Fire appliances should be installed on the following lines, their location internally being near doors, but so arranged as not to interfere with routes of exit, whilst externally their position should not be too close to the buildings, i.e. not against external walls.

A. *Hydrants.*—Hydrants should be of a modern (uniform) type and conspicuously indicated.

B. *Hose.*—Hose should lie ready flaked or suitably rolled.

C. *Reserve Hose.*—Reserve hose should be on reels at accessible external points.

D. *Pressure Gauges.*—Certain hydrants in different parts of the grounds and in the principal buildings should have pressure gauges fitted and readings should be taken and recorded twice a day.

E. *Small Gear.*—Small gear should be placed conspicuously near doors, but not so as to interfere with the routes of exit. The small gear should comprise sets of (three-quarters filled) water buckets of handy size, hand pumps, preventers, hatchets, knives, boxes of sand, short ladders and cloths, and with each set should be a plan of the nearest hydrants. The small gear station and hydrants should preferably be together, and, where feasible, call-points should be placed at or close to such stations.

F. "*Extincteurs*" (*Liquid Chemical Fire Extinguishers*).—Extincteurs should be excluded from the buildings, as they frequently give a false sense of security, and much time is accorded to their use that would be better applied to the small gear and hydrants, where these are available. If, however, installed, as is frequently the case, by way of exhibits or paid advertisements, they should be placed with the small gear, examined daily and practically tested monthly.

G. *Powder Extinguishers, Hand Grenades, etc.*—Hand grenades and powder extinguishers should be prohibited.

H. *Sand.* Buckets of sand with scoops should be provided where electrical machinery is in motion.

34. ***Drenchers and Sprinklers.***—Drenchers should be fitted over dangerous exhibits, and automatic sprinklers can be recommended over machinery in motion where the process involves special fire risk, as is the case in printing, weaving, etc. (excepting electrical machinery). Such drenchers or sprinklers should be supplied from separate elevated tanks, i.e. not from the general water mains. Drenchers as indicated above should be fitted over certain doors in divisional walls. They should also be fitted between the audience and the scene of a display in such buildings where a seated audience views a theatrical performance, side-show, or the like.

CONTROL SERVICE.

35. ***Responsible Control.***—The general control of the precautionary measures at an exhibition should be in the hands of a special staff responsible directly to the executive, and the direction of this work should be entrusted to an official of high social and technical standing, supported by superior officers of absolute reliability. The principal official should be known by some suitable and thoroughly expressive name, such as "inspector-general."

36. ***Division and Direction of the Control Service.***—The general control should be divided into two distinct departments:

(1) Inspection, and

(2) Watching.

The inspector-general should have a deputy of good status, and a secretarial staff, the " inspection department " and the " watching service " being respectively placed in charge of two superior officers, i.e. each department having its own chief and deputy chief responsible to the inspector-general.

37. ***The Inspection Department.***—The Inspection Department should practically act on the same lines as a well-managed survey and public control department, it should examine all plans from a fire point of view, supervise the execution of buildings, stands, etc., test materials, examine all installations such as water, electric lighting, heating, etc., and keep a close record of their efficiency or defects. The staff of the Inspection Department should comprise architects and engineers of good standing, receiving good pay. If some of the senior men can be temporarily borrowed from existing official staffs this is an advantage.

38. ***The Watching Service.***—The watching service should essentially do the work implied by its name, and its organization should be on the following lines:

A. *Strength.*—The watching service should be manned on a liberal scale, with a suitable number of reliefs. The force should be gradually organized and trained during the year preceding the opening of the exhibition, growing with the growth of the exhibition itself, two months immediately prior to the opening of the exhibition, which is a particularly hazardous one, already requiring the full strength of the service, and likewise the month directly following upon its closing.

B. *Personnel.*—Only men of first-class character should be engaged. On engagement they should be first trained for a full six weeks in observation, exhibition rules, handling of first-aid fire appliances and the use of the general telephones and the fire-alarm service. If suitable men cannot be obtained for the short engagement of an exhibition (which with organization and demolition rarely exceeds two years) arrangements should be made to borrow men temporarily from the public services, etc., in different parts of the country. The police, the fire services, the corps of commissionaires, etc., would in many cases be ready to lend men for the short period required, much as they are lent for other special occasions of short duration. The advantage of having as watchmen men who have a stake—maybe a pension—to lose is obvious.

C. *Division into Squads.*—The force should be preferably grouped in squads of eight (each including a foreman), the squads being under the command of the two reliable superior

officers named above, who in turn should be supported by a suitable number of superintendents, warrant officers or colour sergeants' rank, distributed according to the extent and area of the enterprise. The division into squads of eight will be found convenient for giving each man one day of rest to every four, irrespective of whether the squad be on day or night duty. The squads should take alternate spells of day and night duty respectively, and having regard to the relative strength of the staffs on duty by day and by night, it will be probably found convenient to assign to each squad in turn two weeks of day duty to one of night duty.

D. *Drill, Discipline, etc.*—The squads should be drilled and exercised in turn on the exhibition buildings and occasionally with the public fire brigade. The exhibition authorities will do well to offer prizes for smartness at drills. Discipline should be rigidly enforced, but, on the other hand, encouraged by bonuses for good service at the end of the engagement, good service records being kept by marks and referred to the inspector-general at intervals. Every watchman should wear an approved uniform and have a number conspicuously shown in two places. The stations of the squads should be changed occasionally, to prevent staleness, say after each week's spell of night duty, i.e. every three weeks.

E. *Watchmen's Clocks.*—Mechanical supervision of watchmen's rounds should be obtained by watchmen's clocks and calls on the exhibition telephone or call system.

F. *Watchmen as Private Firemen.*—The watchmen service occupies the place of a private fire brigade, and thus in the event of fire the squads should take their orders from the regular force.

39. ***Auxiliary or Sectional Watchmen.***—There is no objection to any body of exhibitors engaging additional watchmen, or any section, city or country represented having its own private fire brigade, but all watchmen must satisfy the inspector-general as to their ability and credentials, be licensed by him, must be subservient to the general and any special regulations authorized by him, and be formed into duly recognized squads, the head of which would be responsible for his men. The conditions under which exhibitors are permitted to engage auxiliary watchmen should include the following points:

(a) Appliances, hose connections, watch-clocks, etc., used must be of the uniform pattern used throughout the exhibition.

(b) Any auxiliary service must be considered as a supplementary one and in no way diminish the general responsibility or authority of the Exhibition management and their watching service.

(c) In case the Exhibition management directly or through their watching service call for the assistance of any auxiliary watchmen, it must be given promptly on demand and the orders of the senior member of the general watching service on the spot must be accepted.

(d) The personnel of the auxiliary service must be clothed in an approved uniform and wear the number of their license conspicuously on two places.

THE FIRE SERVICE.

40. ***The Fire Service.***—The exhibition fire brigade section should comprise officers and men of the local fire brigade, which should, if necessary, have been gradually strengthened to meet the exhibition requirements during the half year preceding the exhibition, either by the inclusion of recruits or by the addition of men borrowed from other public or private fire brigades. A part of the section intended for the protection of the exhibition should take up its duties prior to the opening, the section being gradually increased until the full strength is installed, say some weeks prior to the opening, i.e. during the specially hazardous period. The full strength should similarly remain on duty for some days after the closing of the exhibition and then be decreased as the risks at stake are gradually reduced. The following principles should be observed in the fire service arrangements:

A. *Fire Stations.*—The force stationed at the exhibition should be divided into squads of, say, eight men and equipped with first-aid fire appliances. The number of squads and their distribution depends on the character and area of the exhibition, but at one central point (at least) there should be two special squads of eight men with two horsed (or motor) steam fire engines of good capacity (one practically under steam and one fairly warmed), and there should also be one squad of eight men with two horsed (or motor) 80ft. mechanically-raised long ladders. There should further be at the exhibition not less than one reserve steam fire engine and one additional 80ft. mechanically-raised long ladder. There should further be at the exhibition not less than one reserve steam fire and one additional 80ft. long ladder, so that the probability of there being less than two of either of these appliances in working order at the exhibition would become remote. Provision should be made for drafting additional firemen (or off-duty firemen) into the exhibition for special occasions such as fetes at which large crowds are expected, or to act as " firewatches " at important theatrical entertainments or similar displays.*

* Regarding the necessary strength of the fire service at an exhibition, the following data are presented from exhibitions where effective organization were provided and records kept of the fires occurring and damage done.

Leipsic, 1897.—At the Saxon National Exhibition held at Leipsic in 1897 the insured value of which was 11,191,800 marks (say £559,500), the precautionary measures included the provision of an exhibition fire station and two small supplementary stations manned by 1 foreman, 1 engineer and 12 firemen from the local professional fire brigade, the duties of part of which were started well in advance of the opening of the exhibition and continued until the removal of the exhibits after closing of the exhibition. The nearest fire brigade station was situated about 1,400 yards and the headquarters fire station 1,600 yards

B. *Command.*—Each squad should be under an experienced foreman and the whole force at the exhibition under two superior fire brigade officers, who in turn would be responsible to the chief officer of the local fire brigade.

from the exhibition grounds. The appliances provided for the exhibition fire station included a steam fire engine.

The number of fires recorded comprise 7 before opening of the exhibition, 29 during the exhibition and 1 after the closing of the exhibition. The seven include 1 chimney fire and the 29 include 5 chimney fires. The total number of fires for a period of about 10 months was thus 37, of which six were chimney fires. The fire brigade was able to get to work so promptly that the total insurance moneys paid was 74.15 marks (say £3 14s. 0d.).

Berlin, 1897.—At the Berlin Industrial Exhibition held in one of the distant suburbs of Berlin in 1897 the insured value of which was 21,193,725 marks (say £1,296,800), the precautionary measures included the provision of an exhibition fire station and five small supplementary stations manned by 1 superior officer, 1 warrant officer, 1 engineer, 8 foremen and 62 firemen, from the Berlin Royal Police Fire Brigade. Additional firemen were drafted into the exhibition from the brigade for certain duties such as a theatre watch during performances (1 foreman and 6 firemen), a watch on firework nights (3 foremen and 18 firemen) fete nights, etc. A section of the firemen was stationed at the exhibition some 3 months before it was opened, the section commencing with 1 foreman and 9 firemen and being gradually increased as the exhibition neared its opening day. Similarly a section was stationed at the exhibition for one month after the close of the exhibition, its strength being gradually decreased as the exhibits were cleared away. First aid ambulance service was rendered at the exhibition fire station and the supplementary stations, some 213 cases being handled by the firemen on duty. During the exhibition there were 52 fires (including three chimney fires and one serious fire). The total insurance moneys paid amounted to 11,906 marks (say £595).

Paris, 1900.—At the great Paris International Exhibition held on the Champs de Mars, the Esplanade des Invalides and the banks of the Seine, in 1900, an area of 110 hectares (272 acres) was employed. The Exhibition buildings covered an area of 438,100 *sq. m.* (523,982 sq.yds.) and the buildings used by concessionaires 52,000 *sq. m.* (62,194 sq. yds.).A considerable proportion of the buildings had galleries or first floors. Of these buildings only two, i.e., the Fine Arts buildings, were erected as permanent structures. The others were temporary buildings affording little or no fire resistance. The insured value is not recorded.

The exhibition territory was divided into 10 districts for fire service purposes, each district having a small fire station manned by one corporal and three firemen from the Paris Fire Brigade (Regiment) by day, an additional fireman coming on duty at night to do watchman's rounds. These stations each had a hose cart. They were telephonically linked up to the nearest Paris fire stations, of which four were within effective working distance, each fire station having not less than one steam fire engine, one long ladder and four other appliances, with one superior officer and 30 men available for a " turn out." One of these stations was very centrally situated so as to be able to easily reach the various sections of the exhibition. On illumination nights additional men were drafted in from the brigade, comprising together 4 foremen, 5 corporals, and 15 firemen, who were suitably distributed. There were also a number of special duty men in charge of special risks, whilst a number of superior officers and men were temporarily charged with specific test, inspection and watch duties. The supervision of the firemen stationed at the exhibition was in the hands of the superior officers of the nearest city fire stations, the fire districts of the exhibition being inspected at intervals. Upon an exhibition fire station calling up the nearest city fire station at least three city fire stations " turned out " *ipso facto*, or five a second call.

During the exhibition there were 61 fires, of which, however, 14 were insignificant. Of the 61 fires one required 14 branches. In a number of cases the firemen assisted at building accidents, explosions, water damage, etc. There is no record of the amounts paid on fire losses.

C. *Routine Duties.*—Of each squad one man should be on station duty, and one man should be off-duty, the provision of squads of eight allowing for a convenient leisure of one full day and night in every week. One man should attend to hydrant and fire-call test work daily every morning, before the exhibition opens. The foreman and four men should drill daily for not less than one hour in order to keep in physical condition. The squads should be freely " turned out " for trial alarms and in the morning before the exhibition opens two or more squads should be invariably drilled and exercised together twice a week on the actual exhibition building, and not less frequently than once a week together with squads of the watch-service for combined manœuvres. The exhibition authorities should offer prizes for smartness and drills, both one man drill and squad drills to be competed for publicly. The sporting element is an important feature where there is tendency towards staleness and apathy as in the case of exhibition work.

D. *Staleness.*—The squads should alternately revert to their regular duties at their local fire stations, say every four weeks for the duration of one week, so as not to get stale, and their position in the Exhibition should be changed about from time to time so that their environment may be varied.

41. ***Attendance at Fires.***—The attendance at fires should be arranged on the following lines:

A. *First Calls.*—The procedure as to action at fires should be clearly laid down by the chief officer of the local fire brigade after consultation with the Inspector General of the Control Service, the police, etc., and suitable signals should be arranged for clearing any part of the grounds, stopping admission, etc. The " turning-out " to a fire call should include for the attendance of not less than the following:

(a) The nearest 2 squads of firemen with first aid gear, 1 squad with steam fire engine and half a squad with a mechanical long ladder, the whole under one superior officer.
(b) The squad of the watch service in whose area the outbreak occurs, the foreman and 3 men from the four nearest squads and the chief or deputy chief of the Exhibition watch service.
(c) The chief (or deputy chief) of the inspection department with 2 assistants.
(d) Two officials from the exhibition administration office.
(e) A suitable contingent of local police.
(f) An ambulance section from the exhibition ambulance service.
(g) Two men from the electrical dept. (with tools).
(h) Two men from the water dept. (with tools).
(i) Two men from the gas dept. (with tools).
(j) Two telephone linesmen.
(k) Two gate-keepers.

B. *Calls for Assistance.*—A simple system for calling up assistance should be instituted, much as some brigades issue a " district " or a " brigade " call and others a " middle " or a

" serious " call. A second, i.e. district, call should bring two-thirds of the exhibition fire brigade force on to the spot and the foreman and three men from say two-thirds of all the squads in the watch service, it should also mean a " district call " for the local fire brigade. A third call, i.e. brigade call, should bring the whole of the exhibition fire brigade except men on station duty, the foreman and three men from every squad in the watch service including those of any auxiliary watch service and such additional assistance from the local fire brigade as may have been previously decided upon. In each case the call should mean a proportionate addition from the various technical staffs, police, ambulance, etc., with their principal officers, the closing of specific, prearranged areas to the general public and the warning of the military and other public services.

C. *Forethought.*—Everything that can be arranged in advance should be decided upon and come into operation either automatically or upon the issue of simple instructions. Trials of the various operations above-named should be made before and soon after the opening of the exhibition. Any weak spots in the scheme are best found in trials where the actual distances, etc., have to be covered.

D. *Command at a Fire.*—The command regarding the combating of the fire and the direction of the general arrangements would rest with the senior officer present in charge of the local fire brigade, who would be assisted by the officers of the Exhibition, watch service and inspection department, and by the officer in charge of the police. This command should only be subject to the control of the leading authority of the State, such as the Military Governor or Civil Governor, Lord Lieutenant or the Minister of State or the Sovereign in person, and given suitable superior fire brigade officers, interference from any leading authority is as a rule inadvisable. The command should not be in any way subject to the wishes of the exhibition management or local authority. The undivided responsibility should thus rest with one man, i.e., the senior fire brigade officer present, supported by suitable responsible assistants, and not with any corporate body such as an exhibition executive, a city council, or their titular heads. The views say of the Exhibition Manager, or the Mayor, may be considered by the officer in command, but should not be dealt with as wishes or instructions. The work of the police at a fire is solely to keep the ground and its approaches clear for those working on the fire, not as some police chiefs think, to direct the fire brigade, even if the brigade in its legal status is subservient to police authority.*

* The Chief Officer of the London Fire Brigade, or his deputy, have full charge of any fire in the County area, this position being clearly defined by Act of Parliament.

E. *Resident Officials.*—Provision should be made for not less than three administrative officials, three superior officials of the control service, three men each of the electrical, gas, water, etc., departments to sleep (in turn) at the Exhibition. Arrangements should also be made by laying on the telephone service or otherwise, for the principal officers of the administrative watch service and inspection department as also certain of the engineers and mechanics to be at all times, day and night, within call when required.

F. *Inquiry into Fires.*—Provision should be made for prompt inquiry and report on any fire (no matter how small) that occurs at the exhibition, and the result should be placed in the hands of the exhibition management, the local authority and the State. Inefficiency in men or appliances should be severely dealt with.

END.