SAORSTÁT ÉIREANN

REPORT

OF THE

Tribunal of Inquiry

INTO THE

FIRE AT PEARSE STREET, DUBLIN

DUBLIN:

PUBLISHED BY THE STATIONERY OFFICE

To be purchased directly from the
GOVERNMENT PUBLICATIONS SALE OFFICE, 5 NASSAU STREET,
DUBLIN, C2
or through any Bookseller.

Price 1s. 3*d*.

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The cost incurred in the preparation of this Report is estimated at £622, of which £36 represents the estimated cost of printing and publication.

ORDER OF APPOINTMENT

DEPARTMENT OF LOCAL GOVERNMENT AND PUBLIC HEALTH.

WHEREAS a resolution in the following terms was passed by Dáil Éireann on the 25th day of November, 1936, that is to say :—

" That it is expedient that a Tribunal be established for inquiring into the following definite matters of urgent public importance, that is to say :—

(*a*) the cause of the fire which occurred during the night of Monday, the 5th day of October, 1936, at Number 164 Pearse Street, and of the extension thereof to Number 163 Pearse Street, in the City of Dublin, and

(*b*) whether the said fire was either caused or rendered more destructive by negligence on the part of any person or persons, including negligence or unsafe methods in the carrying on of any business or in the user of any property, and, if so, the nature of such negligence or unsafe methods, and

(*c*) whether an adequate supply of water at a sufficient pressure was available for the extinguishing of the said fire, and whether the said fire was rendered more destructive by reason of the lack of provision of adequate measures for insuring the public safety on the part of any person or body of persons in relation to the management and control of other services, and

(*d*) the steps taken to extinguish the said fire and the efficiency of those steps, and if there was any lack of efficiency in relation to the extinguishing of the said fire, the nature and cause of such lack of efficiency, and

(*e*) the circumstances in which loss of life was occasioned by the said fire and the causes (including contributory causes) of such loss of life."

NOW, the Minister for Local Government and Public Health, in pursuance of the said recited resolution, and in exercise of every power in this behalf enabling him, hereby orders as follows :—

1. A tribunal is hereby appointed to inquire into, report to and make recommendations to the Minister for Local Government and Public Health upon the following matters, that is to say :—

(*a*) the cause of the fire which occurred during the night of Monday, the 5th day of October, 1936, at Number 164 Pearse Street, and of the extension thereof to Number 163 Pearse Street, in the City of Dublin, and

(*b*) whether the said fire was either caused or rendered more destructive by negligence on the part of any person or persons, including negligence or unsafe methods in the carrying on of any business or in the user of any property, and if so, the nature of such negligence or unsafe methods, and

(*c*) whether an adequate supply of water at a sufficient pressure was available for the extinguishing of the said fire, and whether the said fire was rendered more destructive by reason of the lack of provision of adequate measures for insuring the public safety on the part of any person or body of persons in relation to the management and control of other services, and

(*d*) the steps taken to extinguish the said fire and the efficiency of those steps, and if there was any lack of efficiency in relation to the extinguishing of the said fire, the nature and cause of such lack of efficiency, and

(*e*) the circumstances in which loss of life was occasioned by the said fire and the causes (including contributory causes) of such loss of life.

2. (1) The following persons are hereby nominated to be members of the tribunal appointed by this Order, that is to say:—

Martin C. Maguire, Esq., S.C.

William Ian Bloomer, Esq., Assistant Chief Engineering Adviser, Department of Local Government and Public Health.

William Maguire, Esq., Deputy Assistant Secretary, Department of Industry and Commerce.

(2) The said Martin C. Maguire is hereby nominated to be chairman of the said tribunal.

(3) Michael Lawless, Esq., an official of the Department of Local Government and Public Health, is hereby nominated to be secretary of the said tribunal.

3. The Tribunals of Inquiry (Evidence) Act, 1921 (as adapted by or under subsequent enactments) shall apply to the tribunal appointed by this Order.

L.S.

Given under the Official Seal of the Minister for Local Government and Public Health, this Fifth day of January, One Thousand Nine Hundred and Thirty-seven.

SEÁN T. O'CEALLAIGH,
Minister for Local Government and Public Health.

REPORT

OF THE

Tribunal of Inquiry into the Fire

AT

PEARSE STREET, DUBLIN

To The Minister for Local Government and Public Health :

We, the undersigned, Martin C. Maguire, S.C., William Ian Bloomer, Assistant Chief Engineering Adviser, Department of Local Government and Public Health, and William Maguire, Deputy Assistant Secretary, Department of Industry and Commerce, nominated by Order dated the fifth day of January, 1937, to be members of a Tribunal to inquire into the matters of urgent public importance set out in the Order of Appointment, beg to report as follows :—

Part I.

PRELIMINARY.

1. On the 9th January, 1937, an advertisement was inserted in the three Dublin daily Newspapers, the *Evening Herald* and *Evening Mail*, giving public notice of the first public sitting of the Tribunal and requesting all persons interested to be in attendance in person or to be represented by their counsel or solicitor. A copy of this advertisement appears in Appendix A. Notice in writing was also given to those parties who appeared to us to be interested in the proceedings.

2. The First Public Sitting of the Tribunal was held in the Hall of the Incorporated Law Society, Four Courts, Dublin, on Wednesday, January 20th, 1937. Further public sittings were held on the 21st, 22nd, 27th, 28th, 29th January, 1st, 2nd, 3rd, 4th, 5th, 6th, 9th, 10th, 11th, 12th, 13th, 15th, 16th, 18th, 19th, 20th February, 6th, 9th, 10th, 12th, 15th, 16th, 18th and 19th March. In all 30 public sittings were held.

3. The following is a list of the interests represented during the whole or part of the proceedings and the persons by whom they were represented.

Person or body interested.	*By whom represented.*
Attorney-General ..	Mr. E. J. Kelly, S.C., and Mr. D. Fawsitt, B.L., instructed by Mr. M. A. Corrigan, Chief State Solicitor.
Exide Batteries (Ireland) Ltd.	Mr. F. Fitzgibbon, K.C., and Mr. E. Robinson, B.L., instructed by Messrs. Hayes & Sons, Solicitors.
Corporation of Dublin ..	Mr. A. E. Wood, K.C., Mr. V. Rice, S.C., and Mr. T. G. Burke, B.L., instructed by Mr. I. Rice, Law Agent.
Workers' Union of Ireland ..	Mr. J. A. McCarthy, S.C., and Mr. A. Lynn, B.L., instructed by Mr. C. B. W. Boyle, Solicitor.
Next-of-Kin of Firemen Robert Malone and Peter McArdle.	Mr. B. McGuckin, S.C., and Mr. C. F. Casey, B.L., instructed by Messrs. Roger Greene & Sons, Solicitors.
Next-of-Kin of Fireman Thomas Nugent.	Mr. J. V. Nolan-Whelan, B.L., instructed by Mr. David H. Charles, Solicitor.
Wm. Preston & Co., Ltd. ..	Mr. E. Proud, Solicitor (Little, O h-Uadhaigh & Proud).
Thomas J. Kelly ..	Mr. J. Coghlan, B.L., instructed by Mr. D. Moran, Solicitor.
Mrs. Winifred Watson ..	Mr. J. Kent, B.L., instructed by Mr. P. F. O'Reilly.
Fireman Laurence Reddy and Dublin Firemen's Union.	Mr. O. Moriarty, B.L., and Mr. P. A. Sheehan, B.L., instructed by Messrs. M. Larkin & Co., Solicitors.
Alliance and Dublin Consumers' Gas Company.	Mr. T. C. Kingsmill Moore, S.C., instructed by Messrs. G. Byrne & Co., Solicitors.

4. A list of witnesses examined before the Tribunal is given in Appendix B. In all, 77 witnesses were examined.

5. A verbatim report was taken of the evidence and was made available to the parties interested during the course of the proceedings. A copy of this verbatim report of evidence is attached hereto.

6. A list of documents, exhibits, reports and references handed in and put in evidence at the public sittings of the Tribunal is set out in Appendix C.

Part II.

DESCRIPTION OF PREMISES Nos. 163 AND 164 PEARSE STREET.

(*a*) *Layout.*

7. Prior to the fire the premises Nos. 163 and 164 Pearse Street, Dublin, comprised two substantial brick buildings adjoining each other and situated on the southern side of that street about 46 yards westwards from Westland Row. Each house consisted of three storeys over a basement with sundry annexes at the rere. It is necessary to describe each separately.

8. The ground floor of No. 163 Pearse Street consisted of a barber's shop. On the eastern side of the shop, but structurally divided from it a hall and staircase with separate hall door gave access to the first and second floors.

9. The basement of No. 163 Pearse Street consisted of a large room lighted and ventilated from a covered area in front. Access to this basement was obtained by a staircase at the rere. Separate from the basement was a covered area under the footpath and outside the main building lines. Access to this covered area was gained by an unlighted passage and stairs from the barber's shop on the ground floor. At the rere of the main building and extending to a depth of 37 feet were additional buildings which were completely roofed over. The first floor portion thereof was used in conjunction with the first and second floors of the main building. The rest of the rere premises were in the occupation of Exide Batteries (Ireland) Ltd. On the eastern side of these rere premises was a laneway known as Grosvenor Lane, leading to Park View Lane and thence to the main thoroughfare, Westland Row.

10. The ground floor of No. 164 Pearse Street consisted of a shop and stock room. On the western side of the shop and structurally separated from it were a hall and staircase with separate hall door leading to the first and second floors. Beneath this hall and staircase another staircase led from the shop to the basement which was used as a store.

11. The first floor of No. 164 Pearse Street consisted of a residential flat and offices containing four rooms. The second floor was also a residential flat containing four rooms.

12. The ground floor of No. 164 Pearse Street extended 13 feet to an open yard from the rere of the main building. This extension was partly covered by a glass roof. Above the remainder was a first floor comprising a store and lavatory. The two storey portion of this extension was surmounted by a flat roof and verandah to which access was gained from a door on the second floor of the main building.

(*b*) *Tenancies and Occupiers.*

13. Both premises Nos. 163 and 164 Pearse Street were owned by William Preston & Co., Ltd. The premises had been let on the following self-contained lettings :—

(i) The shop on the ground floor of No. 163 Pearse Street together with the front covered area and the portion of the basement under the hallway were let to Mr. William McDonough, who carried on a barber's business therein.

(ii) The whole of the first and second floors and the first floor of the premises at the rere were let to Mrs. Winifred Watson who carried on therein the business of a private hotel.

(iii) The first and second floors of the premises No. 164 Pearse Street were let to Mr. Jackson Jellie, Auditor and Accountant. Mr. Jellie had died about three weeks before the fire. On the date of the fire the first floor was unoccupied. The second floor was occupied by Mr. Thomas J. Kelly, his wife and five children. Mr. Thomas J. Kelly had been caretaker for Mr. Jellie.

(iv) The rest of the premises Nos. 163 and 164 Pearse Street consisting of the ground floor and basement of No. 164, the basement of No. 163 (save for the small portion let to Mr. McDonough), the ground floor of the annexe at the rere of both premises, and the first floor of the annexe at the rere of No. 164 were let to Exide Batteries (Ireland) Ltd.

(*c*) *Detailed Description of Premises of Exide Batteries (Ireland) Ltd.*

14. A detailed description of the premises in the occupation of Exide Batteries (Ireland) Ltd. is necessary. This company occupied the major portion of the basement of No. 163 Pearse Street and the entire basement of No. 164 Pearse Street. There was no direct connection between these basements. Each had a separate access, by means of staircase, from the ground floor of its own premises. The staircase to the basement of No. 163 was at the rere thereof while that of No. 164 was at the side adjoining No. 165 Pearse Street. The basement of No. 163 was ventilated by a window and gauze screen in the front wall adjoining the covered area and housed the charging department of the firm. It also contained two central heating stoves or boilers, two cupboards for glass cells, and sundry charging benches. The basement of No. 164 was unventilated except by the well of the staircase and was used as a store for boxes and lids.

15. The ground floor was divided as follows. The front portion of No. 164 Pearse Street contained the showrooms and shop. Immediately to the rere and extending as far as the end of the main building were storage racks for batteries. This latter portion of the premises was

described as a stock room. The rere main wall of the premises No. 164 was carried from the first floor level on a steel girder spanning between piers on the party walls of Nos. 163 and 165 Pearse Street, thereby leaving the whole of the ground floor open to the premises at the rere. The annexe previously mentioned extended some 13 feet to an open yard. The back wall of this annexe was timber framed and sheeted on the ground floor. Adjoining No. 165 Pearse Street was a small room containing two benches over one of which was a smoke hood and vent stack. This room was used for the assembly of batteries prior to charging. A door from this room gave access to the yard. This room also contained a helical staircase giving access to the first floor of the annexe which contained a store and lavatory accommodation. Adjoining the assembly department on the ground floor was the Secretary's Office having a timber and glass partition on three sides, the fourth side being formed by the rere wall of the annexe. Part of this office came under the two storey annexe and part under a V shaped glazed roof, the valley of which lay exactly on the dividing line between Nos. 164 and 163 Pearse Street. The party wall between these premises was removed under the valley of this V roof.

Thus the premises Nos. 163 and 164 Pearse Street were interconnected at ground floor level at the rere leaving an open space of 12 feet between the two premises.

16. The annexe at the rere of No. 163 Pearse Street was mainly used as a packing and unpacking department. On one side of the aforesaid opening a small packing office was formed by erecting glazed timber partitions on the ground floor. On the other side of the opening were offices similarly constructed of glass and timber partitions. In the front and eastern corner of the packing department was a fire-proof room used as a celluloid store and safe. This remained intact after the fire. Storage racks extended along the eastern external wall of the annexe. This wall contained a small doorway giving access to the passage which led to Park View Lane. In the south-eastern corner was a bin used for storing wood-wool. This bin was full on the night of the fire. The floor of this annexe to No. 163 Pearse Street was of timber and lay partly over the basement previously described and partly on unexcavated ground. The covering of this portion of the premises was somewhat complicated. It was formed partly by the glazed V shaped roof previously referred to, and partly by a portion of the first floor of No. 163 Pearse Street which extended some 16 feet beyond the rere main wall of the premises. All the rest of the roof to the rere was a timber and felt flat roof with three glazed skylights. The rere wall of this annexe was formed by a wall of the Grosvenor Hotel.

(d) Operations Carried out by Exide Batteries (Ireland) Ltd.

17. Exide Batteries (Ireland), Ltd. carried on in their premises the

business of battery assembly and charging of the batteries assembled by them. Re-charging was not carried on. The company carried on an extensive sale of batteries of various kinds including dry batteries, large vehicle batteries, etc.

(*e*) *Plant and Material in Premises of Exide Batteries* (*Ireland*) *Ltd.*

18. For the purpose of their business, the company made use of certain plant and employed certain processes of which a short description follows. The various component parts of batteries were grouped together into final form, filled with battery acid and charged with electricity. This grouping process was carried out in the assembly department. It consisted mainly in inserting the groups of battery plates and treated wooden separators into the battery boxes, welding the terminal connectors and sealing down the lid with a bituminous compound known as Sealex, quantities of which were stored in the stock room. This Sealex was heated in a pot on a gas ring on the bench under the smoke hood. This bench was covered with a steel plate. For the purpose of welding the terminal connectors an oxy-coal gas jet or flame was used. These gases were obtained from standard cylinders in which they were supplied at a pressure equivalent to 120 atmospheres at normal temperature.

19. When the assembly process was completed the batteries were removed to the charging department, filled with battery acid and put on charge. For this purpose two generators driven by electric motors fed from the Electricity Supply Board's system were used. These motor generators were of standard pattern with the usual safety devices and need not be further described. One motor generator had an output of 27½ amperes at 110 volts and the other had an output of 12½ amperes at 110 volts. The larger of the two motor generators supplied current to eight circuits, one 8-ampere circuit, three 6-ampere circuits, two 5-ampere circuits and two 3-ampere circuits. The smaller motor generator supplied current to three 5-ampere circuits. In addition there was a charging panel with six circuits each of which had an output of .25 amperes. This switchboard could be supplied from either motor generator by means of a change-over switch. A trickle charger in the front portion of the charging basement with a maximum output of 60 to 70 milliamperes completed the equipment. Each circuit was separately controlled by switchboard and fuses. The wiring throughout was of standard Cab Tyre Sheathed pattern. The trickle charge was used mainly for batteries in store for some time to bring them up to standard charge. On the night of the fire about two dozen celluloid wireless batteries were being treated in this manner. All the charging process was carried out in the basement of No. 163 Pearse Street save that on the ground floor of the same premises a number of large vehicle batteries were charged from one

or more of the circuits. On the night of the fire about twelve such batteries were on charge. Dry batteries were stored and retailed on the premises, but were not manufactured thereon. Fully charged batteries and batteries awaiting charges were stored on timber racks in the stock room and also in the basement of No. 163 Pearse Street.

(f) Cylinders of Coal Gas and Oxygen.

20. In order to avoid delay in obtaining a fresh supply of gas or oxygen, a spare cylinder of each type was always kept on the premises. These spare cylinders were stored under the V shaped roof in a small niche formed in the dividing wall between Nos. 163 and 164 Pearse Street exactly at the opening between the two premises. On the night of the fire there were five cylinders on the premises, namely, two spare cylinders containing respectively 100 cubic feet and 150 cubic feet of coal gas and oxygen stored as previously described, two partly used cylinders in the assembly department, the original contents of which were 40 cubic feet of coal gas and 150 cubic feet of oxygen. The fifth cylinder was an empty oxygen cylinder.

21. These cylinders of compressed gas formed the subject matter of a great volume of evidence at the Inquiry. A more detailed description of the cylinders, their use and location is necessary. They were supplied by Industrial Gases (I.F.S.) Ltd., and were of the ordinary commercial type. The coal gas cylinders were respectively of 100 cubic feet and 40 cubic feet capacity. They were made of ·42 per cent. carbon steel fitted at the ends with brass nozzles controlled by a valve. The nozzle in each case was fitted in with a lead capsule which has been variously described as a safety device and as a means of obtaining a gas-tight joint. When supplied full of gas the internal pressure of the gas in these cylinders was 1,800 lbs. per square inch (120 atmospheres) at 60° Fahrenheit. Of these two cylinders, the smaller was in use for some time prior to the 5th October and was at the time of the fire in the assembly room. The larger coal gas cylinder was stored ready for use as described in paragraph 20. The oxygen cylinders were of 150 cubic feet capacity. They were made of .42 per cent. carbon steel and were fitted with a nozzle similar to that on the coal gas cylinders. When supplied full of oxygen the internal pressure of the oxygen was 1,800 lbs. per square inch (120 atmospheres) at 60° Fahrenheit. One of these cylinders was in use for some time prior to the 5th October and was at the time of the fire in the assembly room. Another cylinder was stored ready for use beside the full coal gas cylinder, and the third was empty.

(g) Gas and Electricity Supply.

22. Gas and electricity were laid on to both premises. The gas was supplied from the mains of the Alliance and Dublin Consumers'

Gas Company by three separate service pipes. A one inch service pipe supplied the shop and hotel premises of No. 163 Pearse Street and was used for ordinary domestic purposes. A one and a quarter inch service pipe was laid on to the basement of No. 164 Pearse Street for the use of Exide Batteries (Ireland) Ltd. A one inch service pipe was laid on to the first floor of No. 164 Pearse Street to Mr. Jellie's flat and had been capped down prior to the fire. The gas supplied to Exide Batteries (Ireland) Ltd. was used for the assembly process and was connected with a gas ring used for sundry purposes.

23. The electricity from the Electricity Supply Board's mains was laid on to all the premises and was used for lighting throughout the premises. The electricity from the Electricity Supply Board's mains was also used by Exide Batteries (Ireland) Ltd., for driving a portable fan and in connection with a portable radiator. The same source of supply was used for driving the motor generators in the basement of No. 163 Pearse Street. The premises of Exide Batteries (Ireland) Ltd. were heated on the low pressure hot water system by a stove in the basement of No. 163 Pearse Street. Hot water was derived from the same source.

Part III.

NARRATIVE OF EVENTS.

(*a*) *Last Operations on Premises.*

24. On the evening of the 5th October, 1936, eight young men, employees of Exide Batteries (Ireland) Ltd., remained after the usual closing time 5.30 p.m. working overtime on the premises Nos. 163 and 164 Pearse Street. Their work consisted of opening cases and unpacking goods in the packing room at the rere of No. 163 Pearse Street, checking invoices, storing goods, preparing goods for despatch and general work on the premises. About 8.30 p.m. they ceased work. The floors were then swept down, the sweepings being placed in the basement of No. 163 Pearse Street. Shortly after 8.30 p.m. six of these employees left. About 8.40 p.m. Mr. William Rigney and Mr. Anthony Smith, the last of the employees, left the premises by the front door of the shop No. 164 Pearse Street. Mr. Anthony Smith closed and locked the front door having first gone over the premises extinguishing the lights, etc. The doors at the rere had previously been fastened on the inside and the premises were then apparently secure and in order.

(*b*) *Discovery of Fire and Notification to Fire Brigade.*

25. At 10.50 p.m. the fire was observed for the first time by Mr. Thomas J. Kelly, tenant of the flat on the upper floor of No. 164 Pearse Street. The fire appeared at that time to be in the vicinity of

the glass roofs at the rere of both premises and to be well established. At approximately the same time the fire was observed at the same place by Mr. Hugh Gorman, night porter in the Grosvenor Hotel, Westland Row. Mr. Thomas J. Kelly went at once to a front window in Pearse Street and shouted " Fire." Mr. Arthur Barry, who was passing by at the time, hearing the shouts, ran to the telephone kiosk at Westland Row and telephoned the Fire Brigade at Tara Street. At the same time Mr. Hugh Gorman notified by telephone the Fire Brigade at Tara Street.

(*c*) *Turn-out of Fire Brigade.*

26. The Fire Brigade from Tara Srteet turned out promptly and arrived at the scene of the fire within two minutes of receiving the alarm.

27. Lieutenant Howard, 11 firemen, namely, Foreman John O'Connor, Peter McArdle, Thomas Potts, John McNally, George Dowd, Thomas Nugent, Michael Kavanagh, Robert Malone, Leslie Crowe, Patrick O'Reilly, Joseph Byrne and a turncock, William Clarke, with a Merryweather fire engine, a Morris Magirus fire escape and Chief's car, formed the first turn-out.

28. A second turn-out consisting of 8 firemen, namely, M. Conroy, J. Gibney, F. Brennan, R. Murray, J. Darmon, D. Fitzpatrick, T. Mahon and J. Scully, with a Leyland fire engine and a fire escape, combination was summoned from Tara Street Station and arrived on the scene of the fire at 11.12 p.m.

29. About 11.12 p.m. Captain Connolly, Chief Officer of the Fire Brigade, arrived and took over charge of the Brigade.

30. A third turn-out consisting of a Station Officer and 4 firemen with a Leyland fire engine was summoned from Thomas Street Station and arrived at Westland Row at 11.20 p.m.

(*d*) *Events Prior to Explosions.*

31. Immediately on his arrival at the fire Lieutenant Howard entered No. 164 Pearse Street by the hall door, went upstairs, and ensured that the premises had been evacuated by all persons resident therein. At the same time Guard Supple entered the upstairs portion of No. 163 Pearse Street and saw that these premises had been evacuated also. The main buildings were still intact save for a trace of fire that was appearing in a room at the rere of the first floor of No. 164 Pearse Street. A first aid hose was run from the Merryweather engine into No. 164 Pearse Street and used on that room. Hoses and stand pipes were laid down and attached to the nearest hydrants at Pearse Street, one outside the Palace Cinema premises and the other outside Harrison's Sculptural Works. Shortly

afterwards a stand pipe and hose were laid down and attached to a hydrant at Westland Row Church. Subsequently engines were attached to the hydrants at Westland Row and Pearse Street.

32. Two lines of hose were brought into No. 164 Pearse Street through the hall door. Firemen Potts, Malone, McArdle and Nugent were in charge of a hose at the top floor of the building. Firemen Kavanagh and Crowe were in charge of a hose on the first floor. Fireman Potts who some short time earlier had taken the first aid hose from Fireman Kavanagh, went to the door on the top floor leading out to the flat roof and played it on the flames which were coming up from the glass roof on his left. This hose was totally inadequate to deal with the fire and he abandoned it. He then crossed to the side of the flat roof nearest to No. 165 Pearse Street. Firemen Malone, McArdle and Nugent were waiting for the water to be turned on in their hose, Fireman Nugent holding the nozzle and standing at the doorway.

(*e*) *Explosions.*

33. No water came from this hose at any time, and very shortly afterwards Fireman Nugent put down the nozzle and went back into the building, calling on Fireman Potts to follow him. The latter was crossing the flat roof on the annexe when an explosion occurred which he describes as coming from somewhere down in the building No. 164 Pearse Street.

34. After the explosion Fireman Potts jumped on to the roof of No. 165 Pearse Street, a two-storey building. A second explosion then occurred. Fireman Potts was subsequently rescued from this roof by means of a fire escape about 11.15 p.m.

35. The two firemen who were operating a hose in the first floor of the premises had been ordered by Foreman O'Connor to come down and play the hose on the front of the building shortly before the first explosion occurred. They were on their way down the stairs when the first explosion occurred and succeeded in reaching safety. Firemen Malone, McArdle and Nugent were not seen alive after the first explosion.

(*f*) *Effects of Explosions.*

36. Immediately after the explosions the fire developed with great rapidity. The whole of the upper floors of both houses became enveloped in flames. A detailed examination of the effects of the explosions is set out in Part V. of this Report.

(*g*) *Events Subsequent to Explosions.*

37. Several lines of hose were applied to the front of the premises in Pearse Street, the fire escapes being used with the object of

permitting the water to be played directly into the buildings. The water supply was most unsatisfactory. With the power supplied by the fire engines it was insufficient to allow the firemen to play their fire streams into the buildings. An effective stream of water could not be got into the burning buildings notwithstanding that the fire escapes were brought dangerously close to the premises. The hoses attached to the stand pipe at Westland Row were played upon the fire at the rere of the premises with good effect. The water supply from this hydrant was not in itself sufficient to combat the fire as a whole. The officers and members of the Fire Brigade appeared to be helpless in the condition of the water supply.

38. The whole of the premises No. 164 Pearse Street, including their contents, were completely destroyed. The premises No. 163 Pearse Street, including their contents, were also destroyed, save the barber's shop on the ground floor, and the basement thereunder, which were considerably damaged.

39. In effect the fire burnt itself out in the main buildings about 2 a.m. Much valuable property which ought to have been saved was destroyed.

(*h*) *Discovery of Loss of Firemen.*

40. At 12.35 a.m. on the 6th October Captain Connolly informed Inspector O'Neill, Gárda Síochána, that he thought two firemen were missing. At 1.15 a.m. he informed Inspector O'Neill there was no trace of the two missing men, and that a third man was missing.

(*i*) *Recovery of Bodies.*

41. About 2.30 a.m. on the 6th October the Fire Brigade commenced digging operations for the recovery of the bodies of the missing firemen, the premises having been cooled sufficiently for this purpose. These operations were impeded by the smouldering debris and the fall of masonry. At about 5.50 a.m. the body of Fireman Robert Malone was found. At about 7 a.m. the body of Fireman Thomas Nugent was found. At about 9.50 p.m. on the same day the body of Fireman Peter McArdle was found. The three bodies were found in the debris in the premises No. 164 Pearse Street, approximately 12 feet from the front of the shop a short distance from each other and from the party wall between Nos. 163 and 164 Pearse Street. The bodies were removed to Sir Patrick Dun's Hospital and later were submitted to post mortem examinations.

(*j*) *Medical Evidence as to Cause of Death.*

42. On the 7th October, 1936, an inquest was held. The medical evidence at the inquest and at this Inquiry established that the cause of death in each case was asphyxia following the inhalation of

carbon monoxide gas. The bodies were found in a mutiltated condition. It was established that the mutilation took place after death.

The carbon monoxide gas which caused the deaths of the firemen was produced in the process of combustion by the fire itself. It is improbable that it was caused by the explosions.

(*k*) *Failure to Operate Valves at Leeson Street Valve Control Station.*

43. It was the duty of the Fire Brigade on receipt of a fire call between the hours of 10 p.m. and 6 a.m. to notify the Valve Control Station at Lesson Street so that full pressure of water might be made available during periods of pressure restriction. It was also the duty of the Fire Brigade on turning out to a fire to notify the Waterworks Yard, Fishamble Street, the headquarters of the Waterworks Department of the Dublin Corporation, so that a second turncock would be available if another section of the Fire Brigade were called to another fire.

44. Fireman Reddy on telephone duty at Tara Street Station notified the Waterworks Yard, Fishamble Street, at 10.54 p.m. He also alleges that he notified the Valve Control Station at Lesson Street at the same time. The valves at Leeson Street ought to have been opened immediately by the turncock on duty there for the purpose of increasing the pressure to a maximum on all the mains. This was not done until 11.15 p.m. when Turncock Hughes, who was on duty at Leeson Street, commenced opening valves. He alleges he was informed of the fire by the turncock on duty at Fishamble Street at 11.12 p.m. Turncock Hughes at Leeson Street alleges this was his first notification of the fire, and that he did not receive any message from Fireman Reddy at 10.54 p.m. In the events that happened the full water pressure was not available before 11.25 p.m. by which time the fire had assumed very grave dimensions and was virtually out of control. There is a direct conflict of evidence between Turncock Hughes and Fireman Reddy, on the matter of the telephone notification of the fire by the Fire Brigade to the Leeson Street Valve Control Station. For the purpose of its conclusions the Tribunal does not consider it necessary to decide which version is correct.

(*l*) *Operations of Turncocks.*

45. A turncock is normally supplied by the Waterworks Department for night duty with the Fire Brigade between the hours of 6 p.m. and 6 a.m. It is his duty to accompany the Fire Brigade to fire calls.

46. On the night of the 5th October, Turncock William Clarke was detailed for this duty. He arrived with the first turn-out at the scene of the fire. He failed to recognise that the supply of water in Pearse

Street was inadequate. He examined the supply at Westland Row. He then proceeded in the Chief's car to examine various valves in the neighbourhood with a view to augmenting the supply of water generally. His operations failed completely to effect this purpose. About 11.45 p.m. he inspected the connecting valve at the Crampton Monument between the arterial and the service mains in that part of Pearse Street. He failed to inspect and open the valve connecting the 5 inch service main in Pearse Street with the 7½ inch service main in Westland Row. This valve is situated in Pearse Street within 40 yards of the scene of the fire and was the only valve which could effectively have increased the supply of water at the hydrants in Pearse Street which were being operated by the Fire Brigade. If he had opened this valve immediately on his arrival there would, from the commencement of operations, have been a reasonably good supply of water to combat the fire in Pearse Street. With the full pressure of water available it would have been possible for the Fire Brigade to operate usefully several lines of hose on the front of the premises in Pearse Street.

(*m*) *Notification of Fire to Electricity Supply Board.*

47. The Electricity Supply Board were notified at 10.54 p.m. by the fireman on duty at Tara Street Station. A general arrangement was in existence between the Fire Brigade and the Electricity Supply Board for this purpose. The officials of the Electricity Supply Board arrived promptly upon the scene and cut off the electrical supply without any delay when requested to do so by the Fire Brigade.

(*n*) *Notification of Fire to Alliance and Dublin Consumers' Gas Company.*

48. The Fire Brigade did not notify the Alliance and Dublin Consumers' Gas Company of the fire until 12.55 a.m. on the 6th October.

49. At about 2.15 a.m. on the 6th October officials from the Gas Company cut off the gas supply from the Exide Battery Company's premises by lifting the pavement and cutting and capping the supply pipe from the main. For some time prior to 2.15 a.m. a jet of flame about three feet long was coming from the Gas Company's 1¼ inch pipe as it entered the premises No. 164 Pearse Street. This escape of gas over a considerable period of time necessarily provided additional fuel for the fire.

There was no arrangement between the Fire Brigade and the Gas Company whereby the Gas Company should be notified immediately in the case of a fire.

(*o*) *Notification of Fire to Gárda Síochána.*

50. Station Sergeant Butler, Gárda Síochána, on duty in College Street Station, heard the Fire Brigade turning out, and immediately

afterwards received a telephone message from the Fire Brigade to the effect that the Brigade had turned out to a fire in Pearse Street opposite the Palace Cinema. He sent two Gárdaí to the scene with instructions to get in touch with him as quickly as possible and state the location and gravity of the fire. Shortly afterwards two other Gárdaí were despatched to the scene.

51 Inspector O'Neill, on patrol duty in Castle Street, heard the first explosion and having ascertained in the Dublin Castle Gárda Office the location of the fire, hastened to the scene. Additional Gárdaí had been summoned from neighbouring Stations in the meantime, and Inspector O'Neill took charge of the Gárda arrangements. Superintendent Hurley arrived on the scene about 11.20 p.m. and assumed command of the Gárdaí. Chief Superintendent Clarke arrived on the scene at 12.15 a.m. on the 6th October. The Gárdaí on duty kept back the crowds to a sufficient distance from the fire, maintained order, and prevented any interference with the Fire Brigade in the discharge of their duties.

Part IV.

DUBLIN CITY WATER SUPPLY.

(*a*) *Pressure Restriction.*

52. Having regard to the importance of the water supply in the City of Dublin, particularly in respect of emergencies, it is necessary to deal in some detail with the general question of the water supply to the City and the arrangements made to cope with the shortages which had been experienced in recent years.

53. The consumption of water in the City of Dublin and the other areas supplied has increased very considerably in recent years. In 1919 the average daily demand on the Vartry system amounted to 15,000,000 gallons. In 1936 the corresponding figure was 18,690,000 gallons. In order to supply the latter quantity, 16,590,000 gallons were drawn daily from the Reservoirs at Roundwood, the balance of 2,100,000 gallons being taken from the Rathmines and Canal sources. As the maximum capacity of the supply mains from Roundwood in their present condition is 16,700,000 gallons per diem they are now fully taxed and cannot cope with any further demand.

54. During the winter of 1935 conditions became acute. The Stillorgan service reservoirs which have a total capacity of 180,000,000 gallons were found to contain only 50,000,000 gallons, which is equivalent to about three days' supply. In order to meet this emergency the then City Engineer adopted the following measures:—

(i) An intensive waste water detection campaign.

(ii) Reduction of pressure during the night to the average day pressure by partially closing down the valves at Leeson Street Control Station.

(iii) An additional 1,000,000 gallons per diem were obtained from Bohernabreena by laying about eight miles of new mains.

(iv) An agreement was made with the Grand Canal Company to supply water as and when required.

55. The average day pressure at Leeson Street Control Station is about 30 lbs. per square inch, while the night pressure rises to about 80 lbs. per square inch. This big increase in pressure is the cause of serious leakage and waste. The City Engineer estimates the unrestricted night flow at 66 per cent. of the day flow and has found that the equalisation of day and night pressure has resulted in a daily saving of 700,000 gallons. Careful conservation of the supply has resulted in the filling of the service reservoirs. The City Engineer stated in evidence that the night flow was unrestricted at the time of the Inquiry. He is of opinion that pressure reduction will be periodically essential until the proposed Pollaphouca scheme is completed some years hence.

56. The City Engineer stated in evidence that it was intended to clean a section of the 24-inch diameter main from Roundwood this year and thus enable it to deliver a further 500,000 gallons per diem. He believes that by taking these measures the City's demands can be adequately met until the Pollaphouca scheme becomes available.

57. In the above circumstances the equalisation of day and night pressures appears reasonable. It entails, however, that adequate means must be adopted to ensure that the full pressure is made readily available for fire fighting purposes or other emergencies. We are not satisfied that such means have been provided in the past. The system failed on the night of the 5th October, 1936. This failure was undoubtedly responsible for the loss of property, and might have contributed to an extent to the loss of life.

58. Counsel for the Attorney-General, during the course of the proceedings, referred the Tribunal to the statutory duties of the Dublin Corporation in regard to the Fire Brigade and the supply of water for fire fighting and other purposes. A list of the enactments to which reference was made is given in Appendix D.

(b) Arrangements made to Restore Pressure.

59. The pressure restriction mentioned previously is not applied to all the mains entering the City, but only to those mains which are directly controlled at the Leeson Street Control Station and which serve the low lying sections of the City. These mains were selected because the valve house is in connection with the Fire Brigade at

Tara Street by telephone. The two 27-inch mains and an 18 inch main off the left 27 inch main only are affected. These two 27 inch mains are each controlled by valves and are also cross connected by a 12 inch branch on the City side of the valves. The valve on this cross connection is normally kept open. Thus the opening of a valve on either of the 27 inch mains affects the pressure and delivery of both mains. The main control valve on each of the 27 inch mains has two slides. The small slide is one quarter of the total area, the large slide three quarters. Pressure restriction is obtained by closing the large slide and partially closing the small slide.

60. The routine practice is as follows. The valves at Leeson Street are shut down. This operation takes about 55 minutes and requires two labourers and a turncock to shut down the six valves affected. The turncock on duty then rings up the Waterworks Yard at Fishamble Street, notifies the closing down of pressure and requests the turncock on duty at Fishmable Street to check the pressure at Tara Street and Thomas Street Fire Stations, where gauges are fixed. This ensures that both Stations are aware of the pressure reduction. Tara Street Fire Station is also requested to ring up Leeson Street telephone booth which is adjacent to the Valve Control Station to ensure that the telephone is in working order. In the event of fire the Tara Street Station rings up the Leeson Street booth from which an extension bell to the pressure room warns the turncock on duty that he is required on the telephone. The City Engineer made a series of experiments which proved that within a period of four to nine minutes of receipt of a fire call 86 per cent. of the full pressure can be restored. This rapid restoration of pressure is due to the fact that it is only necessary to open one of the main valves partially in order to increase the pressure in the main. The increase in pressure registers simultaneously at Leeson Street and Tara Street. On the night of the 5th October, Turncock Hughes on duty at Leeson Street alleges that he rang up Fishamble Street about 11.12 p.m. in accordance with routine and heard then for the first time that the Fire Brigade had turned out to a fire in Pearse Street. It is clear from the foregoing that the system of valve control and fire call from the Fire Station is entirely dependent on the efficiency of the men employed and is without check.

(*c*) *Water Supply in Pearse Street.*

61. The Pearse Street area is served by the right 27 inch main which passes down Fitzwilliam Place, Fitzwilliam Square, East, Fitzwilliam Streets Upper and Lower, Merrion Square East, Holles Street, Fenian Street and hence to Pearse Street down which it passes to D'Olier Street. A network of service mains is taken off this arterial main. This network only needs description in so far as the Pearse Street area is concerned. A 7½ inch service main passing along

Westland Row loops over the 27 inch arterial main at Pearse Street junction and continues on down Lombard Street to Townsend Street. A 4 inch service main passes along Townsend Street enlarging to a 6 inch main from Tara Street to D'Olier Street where it is interconnected with the 27 inch arterial main at the Crampton Monument. The 7½ inch service main in Westland Row is connected to the 27 inch arterial main at Pearse Street Junction. These connections are controlled by valves. The 7½ inch main is directly connected to the Pearse Street service mains by a four-way junction. There is a valve on each of the four ways, that in Westland Row being above the connection to the 27 inch main. The service main in Pearse Street is 5 inches diameter from Lombard Street to Tara Street and 6 inches diameter from Tara Street to D'Olier Street where it joins the 6 inch Townsend Street main near the Crampton Monument. There are three connections between the Townsend Street service main and the Pearse Street service main, one at Tara Street and two others at streets connecting Pearse Street and Townsend Street between Tara Street and Lombard Street. The evidence shows that the 5 inch sluice valve on the Pearse Street service main at the four-way junction between the service mains in Pearse Street, Westland Row and Lombard Street was normally kept closed, and was in fact closed on the night of the 5th October, 1936. For simplicity this valve will be referred to as valve A in this Report. By reason of its being closed the water supply to Pearse Street flowed up Pearse Street from the Crampton Monument towards Westland Row. Hence the hydrants close to the premises Nos. 163 and 164 Pearse Street are the most remote from the source of supply and must suffer from severe pipe line losses when they are opened. This is established by experiments carried out by the City Engineer. Furthermore the service mains in Pearse Street are much corroded. The hydrants in the area are served by 4 inch diameter connections to the service mains.

62. The critical valves controlling the supply to the hydrants in use at the fire were :—

(i) The Leeson Street control valves on the 27 inch arterial main.

(ii) The valve on the connection from the 27 inch arterial main to the 7½ inch service main in Westland Row.

(iii) The valve on the four-way junction known as valve A, and

(iv) The valve at Crampton Monument connecting the Pearse Street service main to the 27 inch arterial main.

63. The operation of valves between Westland Row and Leeson Street could not benefit the water supply to the hydrants in Pearse Street while valve A remained closed. With valve A closed these hydrants could only be supplied from the D'Olier Street end of Pearse

Street. Experiments established that it makes no difference to the delivery of these hydrants whether the Crampton Monument valve on the Pearse Street service main be open or closed. It should also be noted that a 24 inch high pressure arterial main passes down Townsend Street within two hundred yards of Pearse Street. No connections are taken off this main in Townsend Street. The nearest hydrant on the 24 inch main is situated at the corner of Sandwith Street and Pearse Street and about 250 yards from the scene of the fire.

64. The City Engineer's evidence proves the deliveries of the various hydrants to be as follows :—

TABLE I.—Valve A shut. Pressure reduced, hydrants tested in turn.

Hydrant	Flow in gallons per minute
At Harrison's	62
At Palace Cinema (opposite No. 164 Pearse Street)	51
At Westland Row	190

TABLE II.—Valve A open. Pressure reduced, two hydrants open simultaneously.

At Harrison's	Not recorded
At Palace Cinema	185
At Westland Row	185

TABLE III.—Valve A closed. Full pressure, hydrants tested in turn.

Hydrant	Flow in gallons per minute
At Harrison's	180
At Palace Cinema	75
At Westland Row	360

TABLE IV. Valve A open. Full pressure, two hydrants open simultaneously.

At Harrison's	Not recorded
At Palace Cinema	340
At Westland Row	350

With valve A shut and Crampton Monument valve also shut, flows identical with those given in Tables I. and II. were obtained for both hydrants in Pearse Street.

65. The figures given were recorded by a mains tester which registered low up to 220 gallons per minute and somewhat high above that figure. Furthermore, the tester offers resistence to flow and showed residual pressure during tests varying from 27 lbs. in Pearse Street to 30 lbs. in Westland Row. In the case of a supply through a hydrant to a fire engine with suction hose, no such resistance would be offered and the supply would consequently be increased.

66. The Merryweather fire pump has a rated capacity of 250 gallons per minute. Valve A could have been opened in about two minutes. If Turncock Clarke had opened this valve on his arrival at Pearse Street at 10.56 p.m. enough water would have been available at the Palace Cinema hydrant to enable the fire engine pump to work at 80 per cent. full capacity even with restricted pressure.

PART V.

EXPLOSIONS.

(*a*) *Theories Advanced.*

67. The cause and effect of the explosions which occurred in the course of the fire were the subject matter of a great deal of controversy at the Inquiry. Technical evidence was given by various expert witnesses, who advanced and advocated different theories in this regard. Most of this evidence was necessarily founded on theory and inference.

68. The theories advanced were :—

(i) The explosion of carbon monoxide gas generated by a smouldering fire and augmented by water jetted on to burning timber, etc.

(ii) The ignition of hydrogen produced in the process of charging batteries.

(iii) The explosion of coal gas leaking from broken or fused lead composition gas pipes within the buildings, the gas from which may have formed in pockets in one or more rooms.

(iv) The physical explosion of the cylinders containing coal gas and oxygen stored at the rere of the building as previously described.

(v) The subsequent chemical explosion of the contents of these cylinders when admixed with one another, or by mixture of the coal gas from the ruptured cylinder with air.

(vi) Some unexplained cause or causes in the nature possibly of bombs or high explosive material on the premises.

Each of these theories is considered separately.

(i) *Carbon Monoxide Gas.*

69. Carbon monoxide gas may be generated in large quantities during the course of a fire. This gas has a wide range of explosiveness when mixed with air or oxygen. It is unlikely that the generation of carbon monoxide at a fire would be sufficiently great or sufficiently concentrated to cause a dangerous explosion. There is no record, so far as the Tribunal is aware, of a similar occurrence at any fire overground. There is also the extreme improbability of sufficient concentration to cause two separate and distinct explosions. Having considered the evidence, the Tribunal is satisfied that this theory may be rejected.

(ii) *Hydrogen.*

70. Hydrogen gas is produced in small quantities in the process of charging electrical batteries towards completion of the process, and if they are overcharged. The Tribunal considered the evidence in relation to the charging process carried out by Exide Batteries (Ireland) Ltd., and the number and capacity of the batteries on charge, and is satisfied that the rate of production of hydrogen would not be sufficient to cause either the fire or the explosions or even seriously to aggravate the former.

(iii) *Coal Gas from the Alliance and Dublin Consumers' Gas Company's Mains.*

71. The theory as to the explosion of coal gas leaking from broken or fused lead composition gas pipes depends upon the possibility of an extensive leakage or leakages of gas without ignition and the subsequent formation of explosive mixtures of gas and air formed by these leakages.

72. The gas supply pipes in the premises No. 164 Pearse Street were formed of lead composition which ordinarily fuses at a temperature of about 360°C. The jointing material used by the Alliance and

Dublin Consumers' Gas Company has a fusing temperature of about 260°C. It was proved by experiment that a source of heat of 880°C. required to be within five inches of a soldered joint in order to fuse it. A yard of composition piping placed six inches above the flame of a gas ring did not fuse, though the middle twelve inches were surrounded by the hot gases from the burner. After twenty minutes the temperature of the pipe ceased to rise and the ends of the pipe were cool. It was also proved that coal gas issuing from a tap ignited readily at a distance of twelve inches from a match flame. Therefore it may be inferred that if such fusing occurred the escaping gas would immediately ignite.

73. It was also contended that the escape of gas might be occasioned by a fracture of a pipe caused by the collapse of a floor. The escape of gas from a half inch diameter service pipe is governed by the pressure of the supply, the length of pipe through which the gas must pass and the delivery capacity of the meter. The Gas Company's Engineer stated that at fifty feet distance from the meter the maximum delivery would be 110 cubic feet of gas per hour. At shorter distances the delivery would be relatively greater. The discharge at the meter was not stated. The nominal capacity of the meter is 60 cubic feet per hour and there is no evidence that it was not in good repair. The meter was recovered after the fire and the readings on the dial showed that no undue consumption had taken place. If the meter was functioning normally and a break occurred in the gas pipe within the premises No. 164 Pearse Street it would, having regard to the cubic capacity of the basement of No. 164 Pearse Street, take a considerable time before a dangerously explosive mixture would be formed in the basement and a still longer time before a similar mixture would be formed in the ground floor or upstairs premises. It must therefore be inferred that if there was a fracture of a gas pipe it must necessarily have occurred some time before the fire was observed by Mr. Kelly. Hence the suggested fracture of a pipe by the collapse of a floor may be eliminated because there was no sign of fire in the front of the premises when the Fire Brigade arrived on the scene. There was no evidence that any floor had collapsed before the explosions.

74. None of the employees of Exide Batteries (Ireland) Ltd. noticed any smell of gas before they left the premises. The firemen who entered the premises and subsequently gave evidence stated that they observed no trace of gas when in the premises. If gas were escaping from broken or fused service pipes some one or more of these witnesses would have observed it.

75. Later in the night a gas flame was observed near the main shop entrance to No. 164. This flame was coming from the iron inlet pipe to the premises at the point where it joined the meter.

So far as any inference can be drawn from this fact it is against the escape of gas without ignition.

76. It is unlikely that two separate and distinct pockets of gas collected in such a manner as to cause two explosions in the same premises within a time interval variously estimated at from three to five minutes. It is all the more unlikely if the first explosion was in the nature of a double explosion.

77. Although town gas is laid on to many houses in Dublin, the Fire Brigade have no record of previous explosions in the course of a fire attributable to this cause.

78. The Tribunal is satisfied that the explosions were not caused by the ignition of mixtures of air and coal gas from the Alliance and Dublin Consumers' Gas Company's mains.

(iv) *Physical Explosion of the Cylinders.*

79. The evidence established that if the gas cylinders were exposed to a source of heat there would be a rise in the internal pressure of the gas and a fall in the resisting strength of the cylinder until a point is reached where the internal pressure causes stresses in the cylinder walls equal to their strength. The temperature at which this stress is reached was calculated to be about 500°C. The evidence was varied as to the length of time which it would take for this condition to be reached and also as to what would occur when it was reached.

80. The following facts were established.

(1) The cylinders were made from 0.42 per cent. carbon steel which at normal temperatures has a strength of over 40 tons per square inch.

(2) At 500°C. steel of this quality still has a strength of about 29 tons per square inch.

(3) At 500°C a very similar sample of steel broke at a stress of 28.7 tons per square inch and showed a contraction of area at the break equal to 58 per cent. of the original area. These figures are not consistent with a plastic yield of the metal.

(4) The pressure of gas contained in a cylinder which was 1,800 lbs. per square inch at normal temperatures would be approxinately 5,000 lbs. per square inch at 500°C.

(5) An internal pressure equivalent to 5,000 lbs. per square inch would produce a stress equal to 29 tons per square inch in a cylinder 8 inches diameter and 0.3 inches thick.

(6) The measured percentage reduction in area of steel in the cylinders varied from 8 per cent. to 29 per cent. This means that the metal was not plastic or in a condition of flow.

(7) Metallurgical examination of the coal gas cylinder showed that the metal had a longitudinally banded structure. This would

account for the nature of the rupture, which occurred under a severe stress, irrespective of where the cylinder was heated. The oxygen cylinder was not banded in this manner, but it would naturally yield at its weakest point. There was no evidence to prove where the cylinders were heated.

(8) The lead capsules fitted over the removable valves did not fuse, but it cannot be assumed that this proves that the cylinders were not heated at or close to the top. Neither does it mean that if they had fused the gas would have escaped harmlessly. The passages for the escape of gas would be so small and tortuous that the liberation of gas would be relatively slow and the reduction in pressure would not be appreciable unless the time interval were comparatively long.

(9) The time required to raise the temperature of the cylinders to 500°C would be short. Direct experiment showed that a heavy mass of steel exposed in a furnace to a temperature of 800°C reached a temperature of 500°C in one minute and twenty seconds. The rate of increase would certainly be slower in the conditions which pertained at the fire. The cylinders were stored at a point where the fire was raging fiercely at 10.54 p.m. Either or both of them could readily have been heated to 500°C at the time when the first explosion occurred.

81. Regard must be had to the following considerations :—

(1) If the metal in the cylinders had a resisting strength of 29 tons per square inch when broken and if the contraction in area is found to be inconsistent with plastic yield or flow, then it follows that rupture of the cylinder would be sudden and violent. This would naturally cause the gas contained within to be projected rapidly causing a wave of compression in the direction of the opening and a reaction or recoil effect on the cylinder which would project it in the opposite direction.

(2) The occurrence of two explosions within five minutes of each other is consistent with the known fact that two full cylinders of gas were stored at or close to a point which may be termed the focus of the fire prior to 11 p.m.

(3) It is extremely difficult to arrange that two or more explosions will occur simultaneously. It is, therefore, unlikely that the two cylinders ruptured at the same time.

(4) There is no evidence before the Tribunal which would indicate that the explosions were actually devastating in their nature or result. The main trend of the evidence goes to prove rather that the explosions caused a very rapid extension of the fire and indicates a general shaking of the premises leading to the collapse of portions of the structure. Nothing was seen to be blown out except glass and portion of a metal door stop.

82. The Tribunal is satisfied that the full cylinders of coal gas and oxygen were ruptured with considerable violence. The effect of the

ruptures of these cylinders must be further considered in relation to the theory of a chemical explosion of the contents of the cylinders.

(v) *Chemical Explosion of the Contents of the Cylinders.*

83. It is an established fact that when a gas is suddenly relieved of pressure, rapid cooling occurs. The evidence shows that under the conditions which existed in the cylinders when ruptured the fall in temperature of gas as it expanded would be about 600°C. Thus the escaping gas would be at or below normal temperatures and would tend to extinguish momentarily any flame or fire in its immediate vicinity. It is possible, therefore, for the gas to escape into the surrounding air without ignition, though it would rapidly regain heat.

84. The evidence accepted by the Tribunal regarding the cylinders and the escape of gas therefrom refutes the theory advanced at the Inquiry that there was a relatively slow escape of the contained coal gas seeking the nearest ventage in the form of a balloon burning at its periphery and thus prevented by a mantle of flame and burnt gases from mixing with the surrounding air.

85. The cylinders were apparently projected towards the rere of the premises No. 163 Pearse Street in a south easterly direction and the contained gas or gases must have been projected in an opposite direction i.e., diagonally across the ground floor of No. 164 Pearse Street in the direction of the staircase leading towards the upper portion of the premises. Hence the major shock would be felt in this direction. This is borne out by the evidence of firemen working inside and outside the front portion of the premises who were more affected than Firemen Potts and Dowd who were more to the rere when the explosions occurred.

86. If the coal gas escaped unignited it would inevitably mix with either the surrounding air or the liberated oxygen or a combination of both. Such mixture would in certain proportions be highly explosive.

87. The rate of diffusion of coal gas in air is rapid. The rate of expansion from the cylinder would also be rapid. Thus an explosive mixture would be formed very shortly after the gas was propelled from its container. This mixture would be readily exploded.

88. Three Gárda witnesses deposed that the first explosion was a double explosion. Such an effect might be due

(*a*) to an echo ;

(*b*) to the nearby instantaneous physical explosion of the two cylinders ;

(*c*) to the physical explosion of the coal gas cylinder followed rapidly by the chemical explosion of the contents.

(vi) *Unexplained Causes.*

89. There was no evidence before the Tribunal of the existence of bombs or high explosive material on the premises Nos. 163 or 164 Pearse Street which would account for the explosions. The Tribunal rejects this theory.

(*b*) *Conclusions with Regard to the Explosions.*

90. The Tribunal is satisfied that the explosions must be attributed to the two full cylinders of coal gas and oxygen stored in the premises No. 164 Pearse Street. These cylinders ruptured with great violence. The evidence points to a chemical explosion of the contents of the coal gas cylinder forming an explosive mixture when mixed with air. The evidence is not sufficient to determine in what order this explosion and the ruptures of the two cylinders may have taken place beyond establishing that the coal gas cylinder must have ruptured before the chemical explosion, if any, occurred. Having regard to the time which elapsed between the two major explosions and the relevant evidence at the Inquiry the Tribunal does not accept the theory that a chemical explosion was brought about by the admixture of coal gas and oxygen from the ruptured cylinders.
The results of the explosions were :—

(i) the rapid extension of the fire ;
(ii) the alteration of the character of the fire ;
(iii) the partial demolition of the premises ;
(iv) the trapping of three firemen who were then within the building thereby causing their deaths.

Part VI.

FINDINGS OF THE TRIBUNAL.

The Tribunal Finds on the Terms of Reference submitted as follows :—

(*a*) *The cause of the fire which occurred during the night of Monday, the 5th day of October,* 1936, *at Number* 164 *Pearse Street, and of the extension thereof to Number* 163 *Pearse Street, in the City of Dublin.*

91. The fire was accidental. Arson or other malicious origin can be definitely negatived. Various causes of the fire were suggested, including :—

(i) a spark from a passing train ;
(ii) arcing or sparking in the charging circuits from the dynamos to the batteries ;

(iii) fire from a stove in the basement of No. 163 Pearse Street ;
(iv) fire from a gas ring or pilot-jet in use in the assembly room at the rere of No. 164 Pearse Street ;
(v) ignition of hydrogen generated during the charging process ;
(vi) cigarette ends left behind by one or more of the employees ;
(vii) internal short circuit in one or more of the large vehicle batteries on charge at the rere of the premises No. 163 Pearse Street.

92. Owing to the absence of satisfactory evidence the Tribunal is unable definitely to assign a specific cause of the fire.

The most likely cause of the fire was either a cigarette end or ends left behind by one or more of the employees. The fire may have been caused by an internal short circuit in one or more of the large vehicle batteries.

93. The premises Nos. 163 and 164 Pearse Street were joined at the rere on the ground floor with open access between them. There was a considerable quantity of inflammable material in the internal fabric of the premises at the rere which consisted largely of wood. Furthermore the premises at the rere contained a considerable quantity of inflammable materials such as wood-wool, packing cases, cardboard, corrugated cardboard, office papers and fittings. A fire starting in the rere of either premises would spread rapidly and both premises would be affected almost immediately. The explosions caused a rapid extension of the fire in both premises, and thereby altered its nature and effect.

(*b*) *Whether the said fire was either caused or rendered more destructive by negligence on the part of any person or persons, including negligence or unsafe methods in the carrying on of any business or in the user of any property, and, if so, the nature of such negligence or unsafe methods.*

94. Not being satisfied as to the cause of the fire the Tribunal is unable to decide whether the fire was caused by negligence on the part of any person or persons.

95. The fire was rendered more destructive by Exide Batteries (Ireland) Ltd., inasmuch as :—

(i) large quantities of readily inflammable material consisting of wood-wool, packing cases, cardboard and corrugated cardboard were left about on the premises without due precaution being taken to place them in a position of safety in the event of fire ;
(ii) the coal gas and oxygen cylinders ought to have been stored in a place of safety. In the position in which they were deposited these cylinders were a source of grave danger in case of fire and in the opinion of the Tribunal contributed largely towards rendering the fire more destructive.

There was no breach of statutory duty by Exide Batteries (Ireland) Ltd., either in the disposal of the inflammable material or of the cylinders, but the Tribunal is of opinion that a higher degree of care than was shown in these matters was necessary.

(*c*) *Whether an adequate supply of water at a sufficient pressure was available for the extinguishing of the said fire, and whether the said fire was rendered more destructive by reason of the lack of provision of adequate measures for insuring the public safety on the part of any person or body of persons in relation to the management and control of other services.*

96. At no time on the night of the 5th October, 1936, was there available in the hydrants in Pearse Street, in the neighbourhood of the premises involved in the fire, an adequate supply of water at a sufficient pressure for extinguishing the fire.

97. There was on said night an adequate supply of water at a sufficient pressure available from a hydrant near Westland Row Church. This was used by the Fire Brigade at the rere of the said premises and its usefulness was limited to the rere of the said premises. The supply from this hydrant at Westland Row was not in itself sufficient to combat the fire as a whole.

98. The only other services whose conduct in connection with the fire was subject to examination were the Electricity Supply Board, the Alliance and Dublin Consumers' Gas Company, and An Gárda Síochána. There was no lack of provision of adequate measures for insuring the public safety on the part of these or any of these services.

(*d*) *The steps taken to extinguish the said fire and the efficiency of those steps, and if there was any lack of efficiency in relation to the extinguishing of the said fire, the nature and cause of such lack of efficiency.*

99. The steps taken to extinguish the fire have been set out in paragraphs 25 to 39 of this Report which the Tribunal desires to incorporate herein as part of its findings. In effect the fire in the main buildings at the Pearse Street end of the premises burnt itself out.

100. The steps taken to extinguish the fire were not efficient. There was grave lack of efficiency on the part of (A) the Fire Brigade, and (B) the Waterworks Department of the Dublin Corporation.

101. As to the Fire Brigade :—

(i) Although all the officers and firemen acted throughout the fire with great gallantry and personal bravery, there was a lack of proper supervision, direction and control on the part of the two senior officers of the Fire Brigade over their own men.

(ii) Neither of the said officers exercised any control over the activities of the turncock on duty with the Brigade, nor did they make any effort to check his work with a view to obtaining a proper supply of water.

(iii) They had not an adequate knowledge of the water services, including the lay-out of the mains, valves and hydrants in the City Water Supply.

102. As to the Waterworks Department :—

(i) The system of co-ordinating the Waterworks and Fire Brigade services during hours of restricted water pressure was liable to break down and in fact broke down in connection with the fire ;

(ii) The turncocks on duty failed or neglcted to open the valves on the arterial main at Leeson Street in proper and sufficient time and failed to open the essential valve at the junction of Westland Row and Pearse Street connecting the 5 inch service main in Pearse Street with the $7\frac{1}{2}$ inch service main in Westland Row ;

(iii) The capacity of many service mains including the 5 inch main in Pearse Street is seriously diminished by incrustation. The mains relaying and cleaning programme of the Dublin Corporation has not been adequate in the past.

(*e*) *The circumstances in which loss of life was occasioned by the said fire and the causes (including contributory causes) of such loss of life.*

103. The circumstances in which Firemen Robert Malone, Peter McArdle and Thomas Nugent lost their lives are set out in paragraphs 26 to 42 of this Report which the Tribunal desires to incorporate herein as part of its findings.

104. The causes of the loss of life were :—

(i) The very unusual and unexpected nature of this fire.

(ii) The sudden and violent explosions which damaged the structure of the premises, No. 164 Pearse Street, increasing immediately the violence of the fire and creating a trap from which these men were unable to escape.

105. The Tribunal considers that it is a reasonable conclusion from the evidence that a contributory cause of the loss of life was the absence of a proper and adequate water supply from the Pearse Street hydrants. The absence of that supply may fairly be regarded as having caused the men to abandon their positions of relative safety on or adjacent to the flat roof and to re-enter the building from which their escape was cut off by the explosions.

Part VII.

RECOMMENDATIONS.

The Tribunal makes the following Recommendations :—

(i) *The use for industrial or factory purposes of premises occupied as dwellinghouses ought to be prohibited, or regulated.*

106. The family of seven persons resident on the top floor of No. 164 Pearse Street had left the premises only a few minutes before the disastrous explosions which caused the death of Firemen Robert Malone, Peter McArdle and Thomas Nugent. If the discovery of the fire had been delayed for about 10 minutes there is little doubt this family would have been involved in the result of the explosions and would have lost their lives. The occupants of the private hotel carried on in the premises No. 163 Pearse Street were also exposed to very grave danger.

107. Some exceptions would have to be made to a general prohibition of the joint user of premises for industrial or factory and dwelling purposes. The Tribunal has not sufficient information to enable it to make recommendations as to these exceptions.

(ii) *The use of basements for industrial or factory purposes should be prohibited or regulated.*

108. This is particularly necessary in the case of the basements of old dwellinghouses which were not originally constructed for industrial or factory purposes or which have not been altered on scientific and hygienic principles for industrial or factory work. An exception might be made in the case of a basement used for storage purposes only, though the fire risk in such cases cannot be overlooked.

(iii) *The storage, use and transport of compressed gas cylinders should be regulated.*

109. It is expedient in the public interest to safeguard the storage, use and transport of cylinders of compressed gases. The evidence before the Tribunal disclosed a general want of care on the part of persons using these cylinders. The occurrence of the fire at Nos. 163 and 164 Pearse Street changed the cylinders stored on those premises into instruments capable of producing very serious results.

(iv) *The water supply in Dublin City for fire-fighting should be improved.*

110. The evidence given before the Tribunal established that a number of service mains in the City are heavily incrusted and that, in consequence, the flow of water from hydrants connected with these

mains is very restricted. Steps should be taken by the Corporation to have the mains affected in this way cleaned or relaid. Hydrants should be attached wherever possible to arterial mains.

111. A general survey of the service mains should be carried out without delay. The affected mains should be specially scheduled for particular attention in case of fire to make good by valve manipulation or otherwise any deficiency in water supply.

(v) *The arrangements for full pressure on the watermains at night during periods of restricted pressure should be improved.*

112. The present method of warning the Valve Control System at Leeson Street that the Fire Brigade has turned out to a fire and that, in consequence, the full water pressure should be restored should be improved by the provision of a check to ensure that the necessary intimation has been conveyed. At present the Fire Brigade notify the Waterworks Yard at Fishamble Street and the Leeson Street Control Station of any turn out to a fire. No communication between the Waterworks Yard and the Leeson Street Control Station is arranged as a part of this routine. If this communication were arranged it would eliminate or at least reduce the danger of failure to convey the necessary information either to Leeson Street Control Station or the Waterworks Yard. A direct telephone connection between Tara Street and the Leeson Street Control Station would be an improvement on the present arrangement. If possible automatic control should be established.

(vi) *The staff of the Waterworks Department of the Dublin Corporation in so far as may be necessary for the service of fires should be improved.*

113. The evidence shows that the operations of the Turncock Staff on the night of the fire were most unsatisfactory. Provision of a staff with proper knowledge of the mains, valves and hydrants for the purpose of fire-fighting is of first importance. Arrangements should be made to employ on turncock duty in connection with fires a higher standard of employee than appears to obtain at present. This service requires a greater degree of supervision and control.

(vii) *The Dublin Fire Brigade Administration should be reorganised.*

114. The condition of the Dublin Fire Brigade as disclosed by this and a number of recent City fires calls for immediate attention. There is a complete absence of staff organisation at the headquarters of the Fire Brigade. The provision of a competent and efficient staff organisation for the service of the Fire Brigade for the control of operations from headquarters is necessary and should be provided.

115. The officers of the Fire Brigade should use a greater measure of control and organisation in connection with the operations of their men at fires. The operations of fire-fighting are left too much to the initiative and intelligence of the ordinary members of the Fire Brigade. Closer control and direction of the operations of the members of the Fire Brigade are essential. A more regular system of drills, with the officers of the Fire Brigade co-operating and taking charge of the proceedings, would help to improve the conditions of the Fire Brigade.

116. The officers of the Fire Brigade should have complete control over turncocks who attend with the Fire Brigade at fires. The two senior officers of the Fire Brigade apparently accept the supply of water provided by the operations of the turncock whether that supply is adequate or not. They do not consider themselves called upon to take any steps to ensure that the turncock has done everything that is within his power, or that the opening of the valves at Leeson Street Control Station has been carried out. The officers and men should be instructed in the lay-out of the City Water Supply and a competent knowledge of the main features of the City Water Supply in its application to the Fire Brigade should be possessed at least by the officers.

117. The senior officers of the Fire Brigade should be afforded opportunities of studying the systems in operation in other cities with a view to maintaining the highest standard in both fire-fighting equipment and method.

(viii) *Government Inspection of fire brigades.*

118. A regular system of Government inspection is desirable to ensure the maintenance of proper standards of efficiency in fire brigades.

(ix) *Closer co-operation between the Dublin Fire Brigade and the Alliance and Dublin Consumers' Gas Company should be secured.*

119. There should be a regular system providing for closer co-operation between these bodies for the purpose of ensuring the immediate cutting off of the gas supplies in premises affected by fire.

(x) *Control of "dangerous" businesses.*
Control of erection, conversion and user of premises.
Amendment of provisions of Petroleum Act, 1871.

120. Though not strictly within the scope of this Inquiry the Tribunal considers that the recommendations of the City Manager and Town Clerk in his letter of the 15th March, 1937, the relevant portions of which are set out in Appendix E of this Report have much to commend them.

CONCLUSION.

121. In conclusion we desire to express our great appreciation of the very able assistance rendered to us throughout by our Secretary, Mr. M. Lawless, of the Department of Local Government and Public Health. We cannot speak too highly of the efficient manner in which he has carried out the arduous duty of collating material for our Report and the help which he has rendered us in its preparation.

MARTIN C. MAGUIRE, *Chairman.*

WILLIAM IAN BLOOMER.

WILLIAM MAGUIRE.

MICHAEL LAWLESS, *Secretary.*

5th May, 1937.

APPENDIX A.

Notice inserted in the three Dublin daily newspapers, the *Evening Herald* and *Evening Mail* of 9th January, 1937.

PUBLIC NOTICE.

TRIBUNAL OF INQUIRY INTO THE FIRE AT PEARSE STREET, DUBLIN.

NOTICE OF FIRST PUBLIC SITTING.

NOTICE is hereby given that the Tribunal appointed by the Minister for Local Government and Public Health by Order dated the 5th day of January, 1937, to inquire into the following matters, that is to say :—

(*a*) the cause of the fire which occurred during the night of Monday, the 5th day of October, 1936, at Number 164 Pearse Street, and of the extension thereof to Number 163 Pearse Street, in the City of Dublin, and

(*b*) whether the said fire was either caused or rendered more destructive by negligence on the part of any person or persons, including negligence or unsafe methods in the carrying on of any business or in the user of any property, and, if so, the nature of such negligence or unsafe methods, and

(*c*) whether an adequate supply of water at a sufficient pressure was available for the extinguishing of the said fire, and whether the said fire was rendered more destructive by reason of the lack of provision of adequate measures for insuring the public safety on the part of any person or body of persons in relation to the management and control of other services, and

(*d*) the steps taken to extinguish the said fire and the efficiency of those steps, and if there was any lack of efficiency in relation to the extinguishing of the said fire, the nature and cause of such lack of efficiency, and

(*e*) the circumstances in which loss of life was occasioned by the said fire and the cause (including contributory causes) of such loss of life,

will hold its first public sittings in the Hall of the Incorporated Law Society, Solicitors' Buildings, Four Courts, Dublin, on Wednesday, the 20th January, 1937, at 11 a.m.

All persons interested are requested to be in attendance at the above time and place in person or to be represented by their Counsel or Solicitor.

By Order of the Tribunal,

(Signed), M. LAWLESS,
Secretary.

Department of Local Government
and Public Health,

8th January, 1937.

APPENDIX B.

LIST OF WITNESSES EXAMINED BEFORE THE TRIBUNAL.

Name	Description	By whom called
Aitken, Samuel Warnock	Engineer and Manager, Industrial Gases (I.F.S.) Ltd.	Exide Batteries(Ireland) Ltd.
Bailey, Dr. Kenneth Claude	Professor of Physical Chemistry in University of Dublin.	Next-of-kin of Firemen Robert Malone and Peter McArdle.
Barr, Henry	Labourer, Leeson Street Valve Control Station.	Corporation of Dublin
Barry, Arthur ..	Spectator	Attorney General.
Bradshaw, William Henry	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries(Ireland) Ltd.
Brennan, Francis ..	Fireman ..	Tribunal at request of Counsel for next-of-kin of Firemen Robert Malone and Peter McArdle.
Bridger, James ..	Labourer, Leeson Street Valve Control Station.	Corporation of Dublin.
Butler, Richard ..	Station Sergeant, Gárda Siochana.	Attorney General.
Byrne, Joseph ..	Fireman	Attorney General.
Byrne, Stephen ..	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries(Ireland) Ltd.
Cannon, Noel ..	Factory Inspector, Department of Industry and Commerce.	Attorney General.
Cashell, Thomas ..	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries(Ireland) Ltd.
Chance, Norman A. ..	City Engineer ..	Corporation of Dublin.
Clarke, William ..	Turncock, Leeson Street Valve Control Station.	Corporation of Dublin
Collini, Gino	Proprietor of No. 165 Pearse Street.	Attorney General.
Connolly, Joseph ..	Chief Officer of Fire Brigade.	Corporation of Dublin.
Cooney, John J.	Chief Inspector, Distribution Department, Alliance and Dublin Consumers' Gas Co.	Attorney General.
Cotton, Henry ..	Distribution Engineer, Alliance and Dublin Consumers' Gas Co.	Alliance and Dublin Consumers' Gas Co.
Crowe, Leslie	Fireman	Attorney General.
Darmon, John ..	Fireman	Corporation of Dublin.
Davidson, John ..	Spectator.	Attorney General.
Donnchadh, D.L. ..	Spectator ..	Attorney General.
Doran, Thomas ..	Turncock, Fishamble St.	Corporation of Dublin.
Dowd, George ..	Fireman	Corporation of Dublin

Name	Description	By whom called
Dowling, Martin ..	Station Officer, Fire Brigade.	Corporation of Dublin
Doyle, Leo	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Drew, Lawrence A ..	Gárda	Attorney General.
Dunne, Peter	Sairsint, Gárda Síochána.	Attorney General.
Dunne, Thomas ..	Turncock, Fishamble St.	Corporation of Dublin
Ellis, Dr. Oliver C. de C.	Assistant Director, Fuel Department, College of Technology, Manchester.	Exide Batteries (Ireland) Ltd.
Elwin, Thomas H. ..	Sairsint, Gárda Síochána	Attorney General.
Fagan, Bernard G. ..	City Analyst	Corporation of Dublin
Farrell, Thomas ..	Labourer, Alliance and Dublin Consumers' Gas Co.	Attorney General.
Forde, Thomas ..	Detective Gárda ..	Attorney General.
Freeney, Francis ..	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Gardner, Frank ..	District Inspector, Alliance and Dublin Consumers' Gas Co.	Attorney General.
Gilleece, Richard ..	Spectator	Attorney General.
Gorman, Hugh ..	Hall Porter, Grosvenor Hotel.	Attorney General.
Grogan, Francis Joseph	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Hart, Edwin James ..	Secretary, Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Henry, Thomas ..	Gárda ..	Attorney General.
Howard, Jas. J. ..	Lieutenant, Fire Brigade	Corporation of Dublin
Hughes, William ..	Turncock, Leeson Street Valve Control Station.	Corporation of Dublin
Hurley, Denis ..	Superintendent, Gárda Siochána.	Attorney General.
Jackson, Allen K. ..	Electrician	Exide Batterles(Ireland) Ltd.
Kavanagh, Michael ..	Fireman	Attorney General.
Keane, John P. ..	City Manager and Town Clerk.	Corporation of Dublin.
Kelly, Thomas J. ..	Tenant of top flat of No. 164 Pearse Street.	Attorney General.
Lawler, Frederick ..	Detective Gárda ..	Attorney General.
McCartney, Dr. Ernest T.	House Surgeon, Sir Patrick Dun's Hospital.	Attorney General.
McDonough, William ..	Barber, No. 163 Pearse Street.	Attorney General.
MacErlean, John Francis	Chief Analytical Chemist, Alliance and Dublin Consumers' Gas Co.	Alliance and Dublin Consumer's Gas. Co.
McKinnon, Ernest Cyril	Chief Engineer, Chloride Electrical Storage Co., Ltd., England	Exide Batteries (Ireland) Ltd.

Name	Description	By whom called
McNally, John ..	Fireman	Corporation of Dublin
Moore, Patrick ..	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Moran, James ..	Sub-Station, Inspector, E.S.B.	Attorney General.
Murray, Richard ..	Fireman	Corporation of Dublin.
Nolan, Dr. John J. ..	Professor of Experimental Physics, University College, Dublin.	Attorney General.
Norman, Owen ..	Motor Van Driver, E.S.B.	Attorney General.
O'Brien, Thomas ..	Turncock, Fishamble St.	Corporation of Dublin
O'Connor, John ..	Foreman Fireman ..	Corporation of Dublin
O'Farrell, Joseph ..	Chief Engineer, Consumers' Dept., E.S.B.	Attorney General.
O'Neill, John ..	Inspector, Gárda Síochána	Attorney General.
O'Reilly, Patrick ..	Fireman	Corporation of Dublin
Poole, Dr. J. H. J. ..	Professor of Geophysics and Lecturer in Physics and Electrical Engineering in University of Dublin.	Exide Batteries (Ireland) Ltd.
Potts, Thomas ..	Fireman	Attorney-General.
Power, Mrs. Josephine ..	Employed as cleaner by Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Price, Sydney Louis R.	Former Chief Engineer and Manager, Pembroke Urban District Council Electricity Undertaking.	Exide Batteries (Ireland) Ltd.
Reddy, Laurence ..	Fireman	Firemen Laurence Reddy and Dublin Firemen's Union.
Rigney, William ..	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland Ltd.
Robinson, Henry ..	Manager S. T. Robinson, Motor Engineers and Electricians, King Street, Dublin.	Exide Batteries (Ireland) Ltd.
Scally, Vincent ..	Foreman, . Waterworks Department.	Tribunal at request of Counsel for next-of-kin of Fireman Robert Malone and Peter McArdle.
Smith, Anthony Patrick	Employee of Exide Batteries (Ireland) Ltd.	Exide Batteries (Ireland) Ltd.
Supple, Michael ..	Gárda	Attorney General.
Taylor, Dr. John ..	Professor of Mechanical Engineering, University College, Dublin.	Next-of-kin of Fireman Robert Malone and Peter McArdle.
Wall, Michael P. ..	Detective Officer ..	Attorney General
Williams, Patrick ..	Service-layer, Alliance and Dublin Consumers' Gas Co.	Attorney General

APPENDIX C.

LIST OF DOCUMENTS, EXHIBITS, REPORTS AND REFERENCES PUT IN EVIDENCE AT THE PUBLIC SITTINGS OF THE TRIBUNAL AND THE PARTIES BY WHOM THEY WERE PUT IN EVIDENCE.

ATTORNEY-GENERAL.

1. Ordnance Map (marked A) of area in neighbourhood of Pearse Srteet and plans marked B, C and D of the premises Nos. 163 and 164 Pearse Street as they were after the fire.

2. "Geographia" Large Scale Plan of Dublin.

3. Photographs (4) of premises Nos. 163 and 164 Pearse Street and ruptured oxygen and coal gas cylinders.

4. Two oxygen cylinders numbered I.207 and I.213. The former was empty prior to the fire. The latter contained oxygen prior to the fire. It was of 150 cubic feet capacity. The valve was loose and the oxygen had apparently escaped.

5. Ruptured oxygen cylinder (150 cubic feet capacity) numbered I.771.

6. Coal gas cylinder (40 cubic feet capacity) numbered BSS 400. The nozzle had been either broken or burnt off during the fire.

7. Ruptured coal gas cylinder (100 cubic feet capacity) numbered 21188.

8. Part of metal automatic door stop found in red hot condition near premises on night of fire by Mr. John Davidson.

9. Copy of Instructions regarding duties of police at fires.

*10. Copy of printed report (1935—No. 61) of the City Manager and Town Clerk to the Dublin City Council under date 24th October, 1935, with reference to recent city fires.

*11. Copy of typed letter under date 6th December, 1935, from the City Manager and Town Clerk to the General Purposes Committee of the Dublin Corporation with reference to recent city fires and Report No. 61—1935.

12. Copy of abstract of inspection of premises of Exide Batteries (Ireland) Ltd., carried out under the Factory and Workshop Acts by Noel Cannon, Department of Industry and Commerce.

13. Statement regarding electricity supply to Nos. 163 and 164 Pearse Street.

*14. Report of Royal Commission on Fire Brigades and Fire Prevention, 1923 (Cmd. 1945).

*15. Report of the Departmental Committee on Fire Brigade Services, 1936 (Cmd. 5224).

*16. Factories Bill, 1937 (England) and Memorandum showing the extent to which the Bill differs from the existing Law.

17. Copy of report of Captain Connolly to the City Manager under date 6th October, 1936.

18. Letter dated 6th March, 1937 (ref. C. R. 7628) to Chief State Solicitor regarding the valuation of Nos. 163 and 164 Pearse Street.

CORPORATION OF DUBLIN.

1. Maps of premises Nos. 163 and 164 Pearse Street.

2. Maps of City Water Mains (Nos. 25 and 88) in the Pearse Street Area.

3. Plan showing arrangement of Mains and Valves in the vicinity of Leeson Street Valve Control Station.

4. Map of Area of Distribution of City Water Mains.

5. Plan of Leeson Street Valve Control Station.

*6. Minutes of evidence of Inquiry held by the City Manager and Town Clerk in the City Hall on 7th and 9th October, 1936.

7. Copy of printed report (1935—No. 61) of the City Manager and Town Clerk to the Dublin City Council under date 24th October, 1935, with reference to recent city fires.

8. Copy of typed letter under date 6th December, 1935, from the City Manager and Town Clerk to the General Purposes Committee of the Dublin Corporation with reference to recent city fires and Report No. 61—1935.

9. Copy of letter dated 12th December, 1935, from City Manager and Town Clerk to the Secretary, Department of Industry and Commerce regarding legislation for improved fire extinguishing procedure in Dublin.

10. Copy of reply to above letter dated 20th January, 1936, (ref. G.I.F. 106/4/3) from Department of Industry and Commerce.

11. Copy of report dated 6th October, 1936, from Captain Connolly to the City Manager and Town Clerk.

12. Copy of report dated 13th October, 1936, from the City Manager and Town Clerk to the General Purposes Committee of the Corporation regarding the fire at Nos. 163 and 164 Pearse Street.

13. Copy of letter dated 13th October, 1936, from City Manager and Town Clerk to the City Engineer requesting the submission of a report.

14. Copy of reports of City Engineer to City Manager and Town Clerk dated 21st and 23rd October, 1936.

15. Copy of letter dated 29th October, 1936, requesting information as to control of buildings in which inflammable materials are stored and information as to fire-fighting equipment sent by City Manager and Town Clerk to the Clerk to the London County Council and the Town Clerks of Birmingham, Manchester, Liverpool, Coventry, Glasgow, Edinburgh, Leeds, Bristol, Sheffield and Wrexham.

*16. Particulars re fire-fighting equipment in other cities, compiled from replies received to above letter.

*17. Particulars re powers to control manufacture or storage of combustible materials in other cities.

*18. Reply dated 10th December, 1936, from Clerk to the London County Council to letter of City Manager and Town Clerk dated 29th October, 1936.

*19. London Building Act, 1930.

20. Copies of letters under various dates from Waterworks Engineer to Captain Connolly regarding closing of valves.

21. Proof of evidence of Mr. N. A. Chance, City Engineer with tables.

22. Log book in use at Leeson Street Valve Control Station on night of fire.

23. Log book and diary in use in Central Fire Station, Tara Street, on night of fire.

24. Chart of the pressure gauge at Leeson Street Valve Control Station.

*25. Booklet entitled " Byelaws made under the Public Health (Ireland) Act, 1878, and the Public Health Acts Amendment Act, 1890," being byelaws made on the 7th October, 1901, and the 27th January, 1919, by the Dublin Corporation with respect to I. New Streets and Sewerage thereof, and II. New Buildings.

26. Electricity Regulations, Statutory Rules and Orders, No. 7, 1932 (Saorstát Éireann).

*27. Factory and Workshop, Dangerous and Unhealthy Industries Regulations Statutory Rules and Orders, No. 1825, 1921.

*28. Factory, and Workshop, Dangerous and Unhealthy Industries Regulations, Statutory Rules and Orders No. 14, 1923 (Saorstát Éireann).

*29. The Petroleum (Compressed Gases) Order, Statutory Rules and Orders, No. 34, 1930 (England).

*30. The Gas Cylinders (Conveyance) Regulations, Statutory Rules and Orders, No. 679, 1931 (England).

31. Letter dated 15th March, 1937, from City Engineer to Secretary of the Tribunal as to tests of hydrants near scene of fire.

32. Letter dated 15th March, 1937, from City Manager and Town Clerk to Secretary of the Tribunal, containing recommendations arising out of the circumstances of the fire.

33. Report on tests made on 17th March, 1937, on Merryweather and Leyland fire pumps using 1,500 feet unlined canvas hose.

NEXT-OF-KIN OF FIREMEN ROBERT MALONE AND PETER McARDLE.

*1. Report of the Committee appointed to inquire into the Causes of the Explosion and the Precautions required to ensure the Safety of Cylinders of Compressed Gas, published by H. M. Stationery Office in 1896 (Reference No. C.—7952).

2. Pamphlet entitled " Hints on oxygen metal cutting " published in 1926 by the British Oxygen Co. Ltd.

3. Photographs (5) of portions of metal compressed gas cylinders.

4. Metal tap of compressed gas cylinder.

5. Metal bars (3) with an indication of breaking load and breaking stress at different temperatures.

6. Letter from Messrs. Roger Greene and Sons, dated 13th February, 1937, to City Manager and Town Clerk regarding compensation for next-of-kin of Firemen Robert Malone and Peter McArdle.

7. Reply to above dated 3rd March, 1937, from Law Agent, City Hall.

*8. Report of His Majesty's Inspectors of Explosives for the year 1933 and Vol. XIII. of Home Office pamphlet entitled " Description of Certain Industrial Accidents."

EXIDE BATTERIES (IRELAND) LTD.

1. Blue print showing lay-out of basement and ground floor of premises Nos. 163 and 164 Pearse Street.

2. Letter from Samuel Warnock Aitken, Engineer and Manager, Industrial Gases (I.F.S.) Ltd., to Messrs, Hayes and Sons, Solicitors, under date 10th February, 1937, with particulars of compressed gases supplied to Exide Batteries (Ireland) Ltd.

3. Report of the Vulcan Boiler and General Insurance Co., Ltd., on Inspection of Electrical plant carried out on 17th August, 1936.

4. Receipt and invoice for work carried out by the Bullarch Ignition Co.

5. Policy of insurance of stock of Exide Batteries (Ireland) Ltd., insured with the Fine Art and General Insurance Co.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

1. Average analysis of Company's gas.

2. Maps and plans of the various floors of Nos. 163 and 164 Pearse Street showing the pipes and meters the property of the Company.

3. Further plans (prepared by direction of the Tribunal) showing as far as possible the gas fittings and appliances in Nos. 163 and 164 Pearse Street the property of the various tenants of the premises.

4. Reference to Taylor's Medical Jurisprudence Vol. II. 9th Ed., page 57.

FIREMAN LAURENCE REDDY AND DUBLIN FIREMEN'S UNION.

*1. Letter dated 8th March, 1937, from the Chief Officer of the London Fire Brigade to Messrs. M. Larkin and Co., Solicitors regarding breathing apparatus in use in the London Fire Brigade.

*2. Handbook for "The Proto" breathing apparatus, issued by Siebe Gorman and Co., Ltd., London, S.E.1., March, 1933.

*3. Copy of London Sphere of 13th February, 1937, containing photograph, of breathing apparatus in use in London Fire Brigade.

(NOTE.—The reports and documents marked * are indicated for reference purposes)

APPENDIX D.

LEGISLATION IN REGARD TO DUBLIN CITY WATER SUPPLY AND FIRE BRIGADE REFERRED TO DURING PROCEEDINGS.

Waterworks Clauses Act, 1847 (Sections 35, 38, 39, 41, 42).
Dublin Corporation Waterworks Act, 1861 (Sections 4, 43, 44, 55, 56).
Dublin Corporation Fire Brigade Act, 1862 (Preamble and Section 6).
Public Health (Ireland) Act, 1878 (Section 76).
Liffey Reservoir Act, 1936 (Article 3 of the Scheduled Agreement).

APPENDIX E.

EXTRACT FROM A LETTER DATED 15TH MARCH, 1937, TO THE SECRETARY OF THE TRIBUNAL FROM THE CITY MANAGER AND TOWN CLERK, DUBLIN, CONTAINING HIS RECOMMENDATIONS ON (*a*) CONTROL OF "DANGEROUS" BUSINESSES, (*b*) CONTROL OF ERECTION, CONVERSION AND USER OF PREMISES, AND (*c*) AMENDMENT OF PROVISIONS OF PETROLEUM ACT, 1871.

(a) *Control of "Dangerous" Businesses.*

As I have already initmated to your Tribunal in the course of my cross-examination, immediately following the fire at 164 Pearse Street I sought the advice of the Corporation Law Agent as to the Corporation's powers, if any, in regard to the control of the manufacture or storage of combustible or explosive materials. On receipt of his reply—which intimated that there was no procedure available to the Corporation for dealing with a case of the kind under consideration—I wrote to the Department of Local Government and Public Health enclosing a copy of the Law Agent's opinion, and requested that the correspondence be brought to the attention of the Minister for Local Government and Public Health with a view to his communicating with the Minister for Industry and Commerce. At the same time I instructed the Medical Officer of Health, the City Architect (in charge of the Dangerous Buildings Department) and the Housing Department, to direct all members of their staffs to report any cases coming under their notice in the course of inspection in which trades of a dangerous nature were being carried out in private or tenement dwellings.

In view of the very definite limitations in the Corporation's powers to control either the manufacture, storage or sale of commodities of a dangerous nature or the premises in which such may take place, I think it advisable to suggest the following points for consideration.

I would recommend that where any building or part of a building is used for making, storing or selling any articles connected with any trade or business or manufacture and such user is, in the opinion of the Corporation, dangerous to the persons residing in the said building or any part thereof or in any adjoining building, the Corporation should be empowered to make an order prohibiting the user of the said building or any part thereof for the purpose of the said trade, business or manufacture ; such order to become effective within twenty-one days from the date of service of the said order on the person carrying on the said trade,

business or manufacture ; and non-compliance with said Order to incur a penalty of £100, and £20 a day, with right of appeal to the Minister for Industry and Commerce from the said Order within seven days from the service thereof. This power should be, I suggest, in addition to any other statutory powers possessed by the Corporation.

In making this recmomendation regard has been had to Sections 99 and 143 of the London Building Act, 1930, and the definition of " dangerous business " therein, and also to the Glasgow Building Regulations Act, 1900, Section 108, and Bye-Law 54 made therein, and also the Factory and Workshop Act, 1901, Section 112. It appears to the advisers of the Corporation that the powers in this connection possessed by other municipal bodies, so far as it has been possible to obtain information in regard to them, are inadequate.

(b) *Control of Erection, Conversion and User of Premises.*

I also recommend that all persons about to erect a new building, or convert or use an existing building or any part thereof for the purpose of carrying on a business which is, in the opinion of the Corporation, dangerous to persons using or who may reside in the said building or any part thereof, or any adjoining building, or for making, storing or selling any substance to which the Explosives Acts or the Petroleum Acts apply, should be required, before so doing, to give notice to the Corporation of his intention so to do, and should lodge plans in regard to such proposed erection, conversion or alteration. If, in the opinion of the Corporation, the said business or the making or storing or selling of materials of the nature referred to is a business of the nature above referred to, the Corporation, I recommend, should be empowered to make an order prohibiting the erection, conversion or use of the building or any part of the building for the purpose proposed, and that thereupon any erection, conversion or use of such building shall be unlawful, and any person contravening these provisions should be liable to a penalty of £100, and a daily penalty of £20, an appeal to be permitted to the Minister for Industry and Commerce.

Supplemental to these provisions, I suggest that analagous provisions to those contained in Sections 99 and 143 of the London Building Act, 1930, should be enacted.

(c) *Amendment of Provisions of Petroleum Act*, 1871.

I further recommend that the provisions of Section 3 of the Petroleum Act, 1871, as amended by Section 2 of 42 and 43 Victoria, Chapter 47, be further amended so as to include cellulose solutions and liquids used with them, and to provide that such are included, I recommend that Section 2 above be amended so as to include all liquids giving off an inflammable vapour at a temperature less than 90 degrees of Fahrenheit's thermometer, or such temperature as shall on closer examination, be found to be the most suitable.

(555).P2618.Wt.1351/836.4.6.250.7/37.W.P.W.Ltd.2.

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THE WOOD PRINTING WORKS, LTD.,
STAFFORD STREET, DUBLIN