

# FIRE TESTS WITH DOORS.

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A  $2\frac{5}{8}$  IN. DOOR IN OAK, CONSTRUCTED IN  
THREE THICKNESSES.

A  $2\frac{5}{8}$  IN. DOOR OF TEAK, CONSTRUCTED IN  
THREE THICKNESSES.

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## Particulars

OF

EXPERIMENTAL FIRE TESTS.

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LONDON, 1900.

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## OBJECTS OF THE COMMITTEE.

The main objects of the Committee are :—

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

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

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

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

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

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

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

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

NOTE.

In preparing this Report on Oak and Teak Doors, constructed in three thicknesses, there is little to remark beyond saying that it should be read in connection with reports on similar doors by way of comparison.

Attention, however, is called to the construction of the doors with the aid of wood pins, and that the boards were not grooved or tongued, but simply butt-jointed.

EDWIN O. SACHS.

LONDON,

*December 31st, 1900.*

## THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

*For the Executive,*

EDWIN O. SACHS, *Chairman.*

EXPERIMENTAL FIRE TESTS  
CONDUCTED BY THE EXECUTIVE  
OF THE  
British Fire Prevention Committee.  
[FOUNDED 1897.—INCORPORATED 1899.]

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FIRE TESTS Fa & Ga.—APRIL, 11TH, 1900.

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(Fa) A  $2\frac{5}{8}$  in. Door of Oak, constructed in three thicknesses.

(Ga) A  $2\frac{5}{8}$  in. Door of Teak, constructed in three thicknesses.

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OBJECT OF TEST.

To record the effect of a fire of one hour and a quarter, gradually increasing to a temperature of  $2,000^{\circ}$  Fahr.

*Note.*—The fire was to be applied from one side, and the doors were to open inwards on to the fire side.

The door-openings were to be approximately 7 ft. by 3 ft.

SUMMARY OF EFFECT.

OAK DOOR.

In 60 minutes flame came through western corner and glow appeared at bottom of door.

In 67 minutes the boards at each side of centre joint bulged outwards  $1\frac{1}{2}$  in. and joint opened.

In 75 minutes opening in the centre widened and flames came through freely; the flames at top of door had extended across the whole width.

Two of the three thicknesses had disappeared, the outer thickness remaining in position.

## TEAK DOOR.

In 17 minutes flame appeared at western top corner.

In 36 minutes the flame had extended across two-thirds of top of door.

In 57 minutes glow appeared at bottom of door.

In 75 minutes flames had extended across the whole of the top of door and holes along bottom.

The inner thickness had disappeared; the centre thickness was charred through, but in position; the outer thickness had about 4 in. at the top burnt away.

## DESCRIPTION OF THE TESTING PLANT.

(See Figs A, B, C and D.)

The Testing Chamber used was located at the Committee's Testing Station, and was known as No. 6 Hut.

The hut was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 10 ft. internally.

The ceiling of the hut was 9 ft., 6 in. above the pavement of the chamber, and was formed of solid wood beams grouted with fire-clay. The chamber measured 10 ft. by 7 ft. 10 in.

A brick wall, 14 in. thick, was built across the hut from east to west, 13 in. to the south of the north wall, and carried up to the ceiling; there were two openings in this, 7 ft. high and 3 ft. 3 in. wide, arched over with brick arches in two half-brick rings, and the spaces between the arches and the frames were filled in with bricks. The wall was built of gauged stuff.

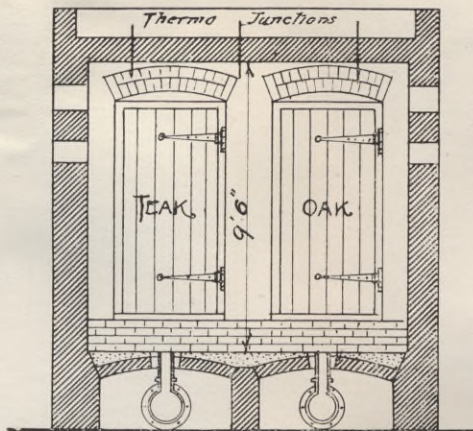
The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through two mixing chambers of fire-brick, as shown.

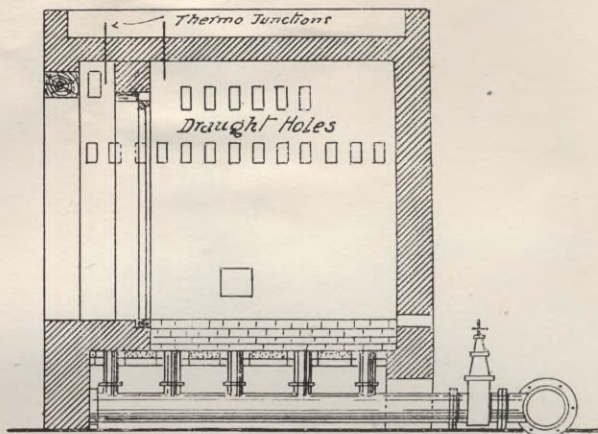
Two Roberts-Austen pyrometers were used for recording temperatures, to take four observation records from points Nos. 1, 2, 3 and 4, points Nos. 2 and 3 being outside the doors, and the others on the fire side of the



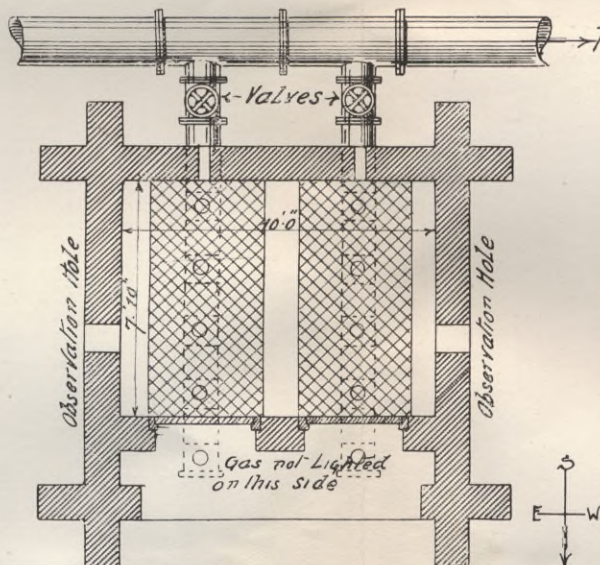




SECTION LOOKING NORTH



SECTION LOOKING EAST



1033

PLAN OF MUT

Note. Points marked 1-2-3-4-5 are Thermo Junctions attached to wires leading to Pyrometers that marked 5 is self recording



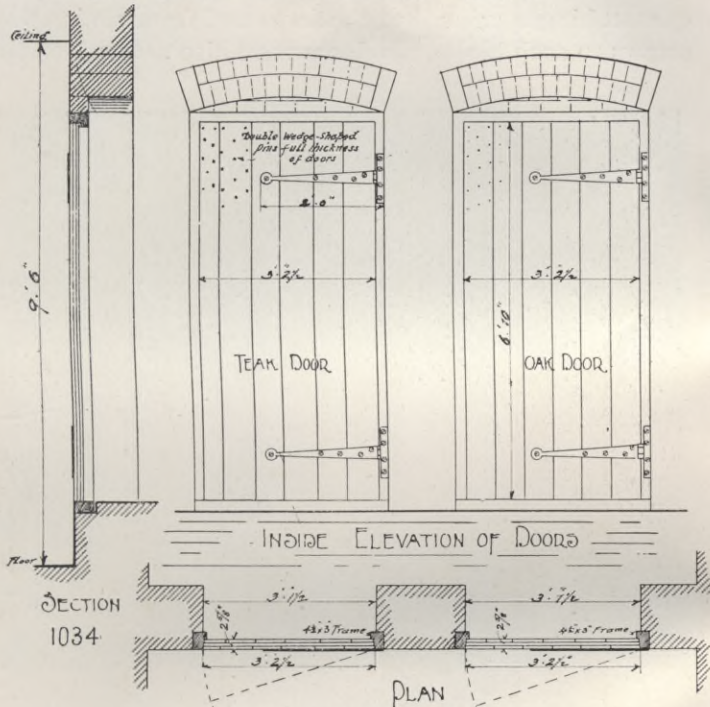
PLAN OF ROOF

doors. A continuous record was also taken from point No. 5, on the fire side.

There were observation holes on the east and west walls, closed by moveable iron shutters.

The draught holes were in the east and west walls.

The photographs were taken by daylight.



Figs. E, F. DETAILS OF DOORS.

## CONSTRUCTION OF THE DOORS.

(See Figs. E and F.)

The door on the east side was of oak, and that on the west side of teak.

The doors were of the same style and constructed in the same manner, being 6 ft. 10 in. high, by 3 ft. 2 1/2 in. wide, and formed of three thicknesses of 3/8-in. boards, between 6 in. and 7 in. wide.

The boards were not grooved or tongued, but simply butt-jointed; they were secured together by  $\frac{3}{8}$ -in. double wedge-shaped wooden pins of the same material as the doors, driven through the entire thickness of the door, there being about 240 to each door.

The doors were hung with two wrought iron cross garnett hinges screwed to the doors and frames, nine 1-in. screws to each hinge, the doors were also secured on the



OAK.

TEAK.

Fig. G. VIEW OF DOORS BEFORE COMMENCEMENT OF TEST.

outside with four 6-in. iron barrel bolts (two at the top and two at the bottom) to frames of the same material as the doors.

The frames were  $4\frac{1}{2}$  in. by 3 in., rebated and splayed, as shown in the drawing (*Figs. E and F*), and were secured to deal plugs driven into the walls.

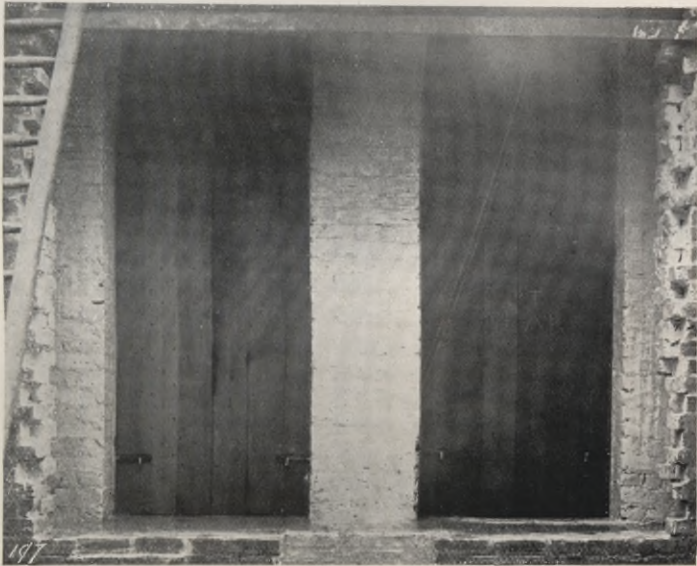
The joints of brick-work all around the frames were pointed with mortar.

## THE TEST.

(See Figs. 1 to 12, and G to P.)

On April 11th, 1900, the test was undertaken. The following being the log:—

The meteorological observations taken at 3 p.m., at the Botanical Gardens, Regent's Park, read as follows:—



OAK.

TEAK.

Fig. N. VIEW SHOWING CONDITION OF DOORS AT 5.21 P.M., AFTER THE APPLICATION OF WATER.

State of Weather, fair; Wind, W.S.W.; Barometer, 29.52 in.; Attached Thermometer, 53° Fahr.; Dry Bulb, 54° Fahr.; Wet Bulb, 48.5° Fahr. Remarks, South-westerly wind; fine afternoon.

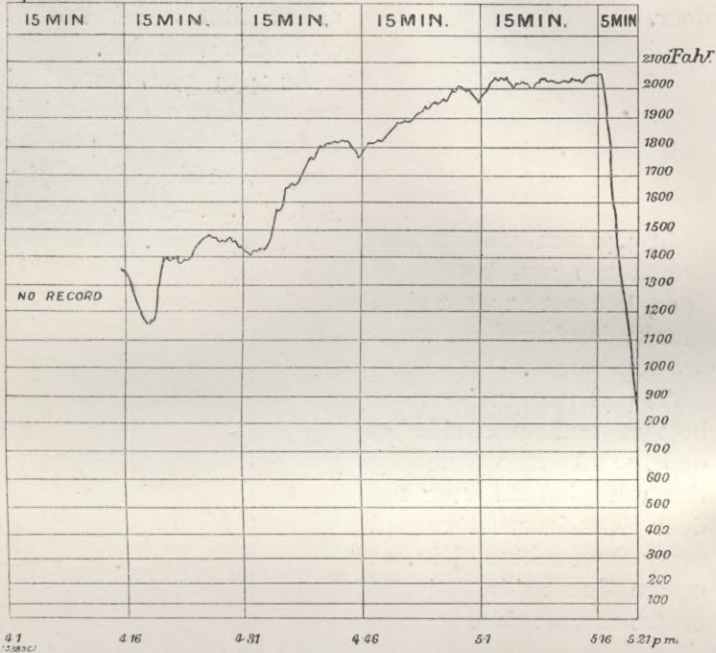
The following temperature observations were taken during the test, from points Nos. 1, 2, 3 and 4, and the diagram below shows the continuous record from point No. 5.

## OBSERVATIONS TAKEN AT POINTS NOS. 1, 2, 3 &amp; 4.

*From 4.10 p.m. to 5.19 p.m.—April 11th, 1900.*

TIME.	INSIDE.		OUTSIDE	
	NO. 1. Fahr.	NO. 4 Fahr.	NO. 2. Fahr.	NO. 3. Fahr.
4.10 p.m.	950°	900°	—	—
4.13 „	1,200°	1,300°	—	—
4.16 „	1,100°	1,150°	—	—
4.19 „	1,250°	1,400°	—	—
4.22 „	1,250°	1,380°	—	150°
4.25 „	1,350°	1,460°	—	210°
4.28 „	1,350°	1,450°	—	200°
4.31 „	1,320°	1,400°	—	175°
4.34 „	1,450°	1,520°	—	150°
4.37 „	1,600°	1,600°	—	200°
4.40 „	1,700°	1,710°	—	190°
4.43 „	1,750°	1,775°	—	190°
4.46 „	1,710°	1,750°	—	175°
4.49 „	1,800°	1,800°	—	150°
4.52 „	1,800°	1,800°	—	150°
4.55 „	1,880°	1,880°	—	140°
4.58 „	1,900°	1,900°	—	150°
5.1 „	1,900°	1,900°	—	200°
5.4 „	1,940°	1,940°	—	210°
5.7 „	1,950°	1,950°	—	250°
5.10 „	1,950°	1,960°	—	300°
5.13 „	1,950°	1,970°	—	460°
5.16 „	1,960°	1,980°	175°	600°
5.19 „	14,00°	1,500°	250°	600°

## AUTOMATIC RECORD AT POINT NO. 5.

April 11<sup>th</sup> 1900 (Doors)

Wednesday, April 11th, 1900.

## OAK DOOR.

At 4.1 p.m. gas lighted.  
*Observations from the  
 outside.*

At 4.7 p.m. smoke came  
 through the joint between  
 top of door and frame.

At 4.20 p.m. moisture ex-  
 uded along top of door, and  
 also slightly on upper part  
 of west side.

## TEAK DOOR.

At 4.1 p.m. gas lighted.  
*Observations from the  
 outside.*

At 4.7 p.m. smoke came  
 through the joint between  
 top of door and frame.

At 4.18 p.m. (17 minutes)  
 flame appeared at western  
 top corner of door. (See  
 Fig. H, 4.22 p.m., and Fig.  
 3, 4.22 p.m.—21 minutes.)

At 4.30 p.m. moisture exuded also along bottom of door.

At 4.40 p.m. more moisture at top and bottom of door, but not at west side. Smoke issuing from western top corner.

At 4.48 p.m. moisture at bottom and east side of door, and also exuding through pins all over the door. The door had warped away from rebate,  $\frac{3}{8}$  in. at centre of east side,  $1\frac{3}{8}$  in. at centre of west side.

At 5.1 p.m. flame first came through top western corner, and glow appeared at bottom of door near eastern corner. (See Fig. J, 5.1 p.m.—60 minutes, also Fig. 9, 5.2 p.m.)

At 4.30 p.m. flame continued, but not so fiercely as at first. Oil exuded down the west side.

At 4.35 p.m. flame had extended across two-thirds of top of door, and 4 inches down west side. (See Fig. 5, 4.37 p.m.—36 minutes.)

At 4.40 p.m. flame had lessened.

At 4.50 p.m. flames continued to issue from western corner. (See Figs. 6 and 7, 4.47 p.m. and 4.52 p.m.)

At 4.57 p.m. one flash of flame appeared below bolt at lower western corner.

At 4.58 p.m. glow appeared through centre of bottom of door, and at lower western corner.

At 5.1 p.m. the glow at centre had become stronger, and that at western corner had developed into a hole. (See Fig. J., 5.1 p.m.—60 minutes.)



At 5.8 p.m. flames<sup>3</sup> at top western corner; strong glow all along bottom of door.

Five holes appeared down the centre joint of outer thickness, the two centre boards bulging outwards  $1\frac{1}{2}$  ins. at centre joint.

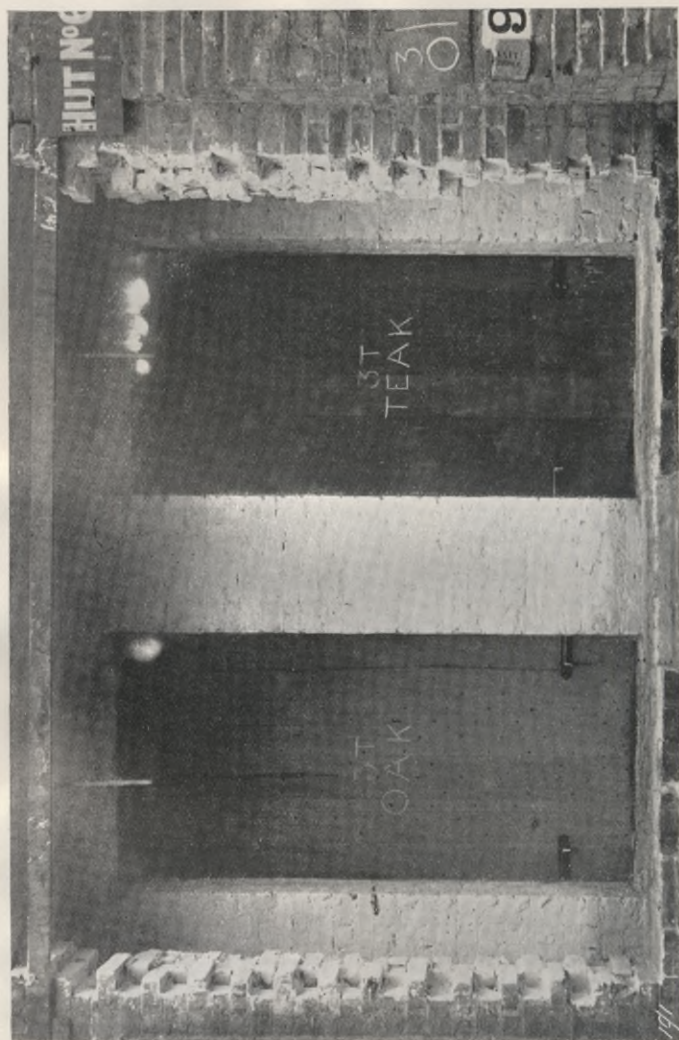
At 5.13 p.m. flames had extended half way along top, and also appeared at eastern top corner.

Flame came through parts of centre joint, the three upper holes having extended and joined; the lower two holes in centre joint remaining as a strong glow.

The glow along bottom of door had become stronger. (See Figs. K, 5.10 p.m.—69 minutes; also L, 5.13 p.m.—72 minutes; and Fig. 11, 5.12. p.m.)

At 5.10 p.m. flame at top of door had increased considerably. Both glow spots at bottom had developed into holes. (See Fig. K, 5.10 p.m.—69 minutes; also Fig. 11, 5.12. p.m)

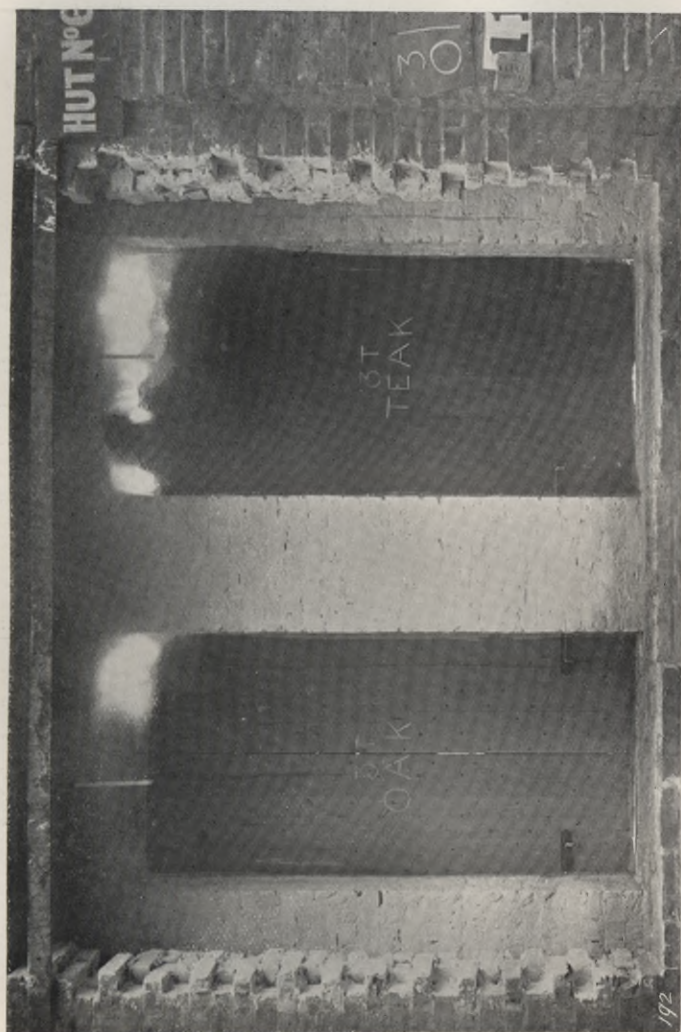
At 5.15 p.m., in addition to the above, a hole had appeared at eastern lower corner. (See Fig. M, 5.16 p.m.—75 minutes; also Fig. 12, 5.17. p.m.)



OAK.

TEAK.

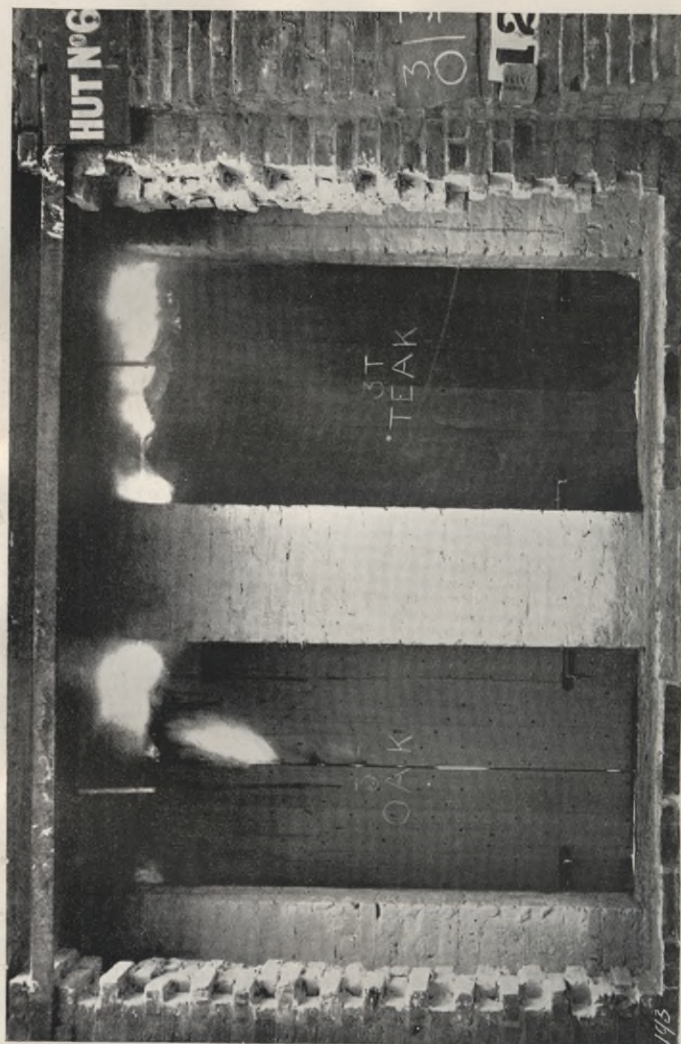
Fig. J. VIEW SHOWING CONDITION OF DOORS AFTER 60 MINUTES.



OAK.

TEAK.

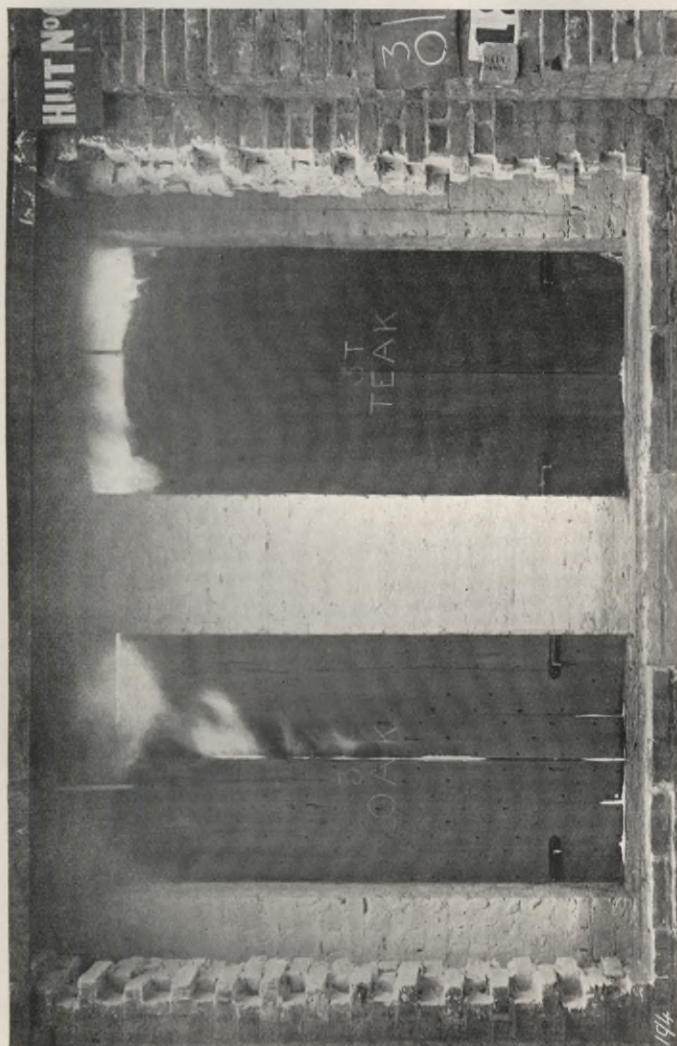
Fig. K. VIEW SHOWING CONDITION OF DOORS AFTER 69 MINUTES.



OAK,

TEAK,

Fig. L. VIEW SHOWING CONDITION OF DOORS AFTER 72 MINUTES.



OAK.

TEAK.

Fig. M. VIEW SHOWING CONDITION OF DOORS AFTER 75 MINUTES.

At 5.16 p.m. opening of centre joint widening, and flames coming through freely. (See Fig. M, 5.16 p.m. — 75 minutes; also Fig. 12, 5.17. p.m.)

At 5.16 p.m. gas shut off.

At 5.17 p.m. water applied.

At 5.16 p.m. gas shut off.

At 5.17 p.m. water applied.



Fig. 0. VIEW SHOWING CONDITION OF THE OUTSIDE OF DOORS  
AFTER TEST AND REMOVAL.

Observations on the inside.

At 4.7 p.m. door well alight, excepting at eastern lower corner.

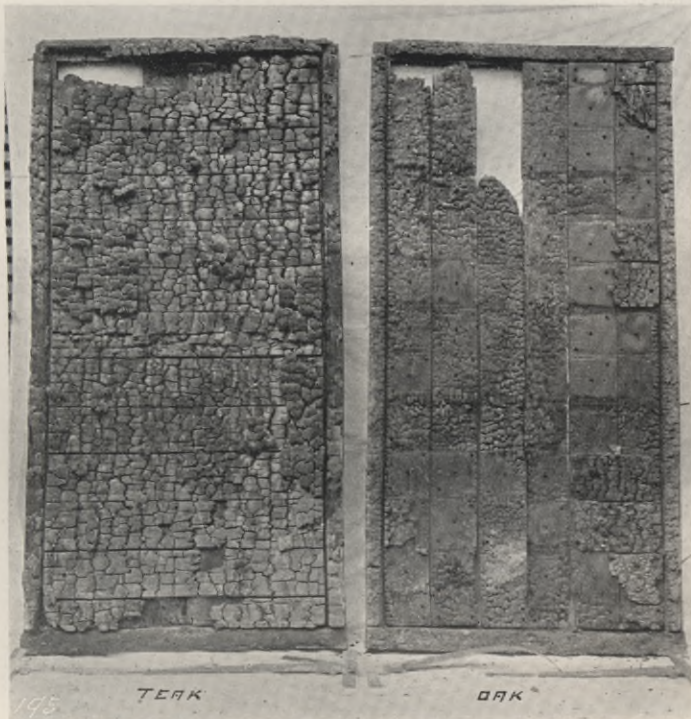
Observations on the inside.

At 4.7 p.m. door well alight, excepting at eastern lower corner.

At 4.12 p.m. blazing all over.

At 4.12 p.m. blazing all over.

*Note.*--From about 4.10 p.m. to about 4.30 p.m., at intervals, it was noticed that sometimes one door, and sometimes the other, presented a charred black appearance without any sign of ignition; these intervals were succeeded by times when the doors would become again ignited and covered with flames.



*Fig. P.* VIEW SHOWING CONDITION OF THE INSIDE OF DOORS  
AFTER TEST AND REMOVAL.

After about 4.30 p.m. this phenomenon ceased, and both doors appeared to burn continuously on the inside.

At 4.30 p.m. burning freely.

At 4.45 p.m. the inner thickness appeared to be burnt through, and the charred particles began to curl up.

At 4.48 p.m. charred particles of inner thickness began to fall off.

At 5.0 p.m. nearly all of inner thickness had disappeared, the centre thickness being much charred, but still retaining its form.

At 5.7 the lower hinge was quite detached from door.

At 5.10 lower hinge had fallen off.

*Note.*—The upper hinges of both doors fell off before conclusion of test: the inside of hut was so full of flame that the hinges were not visible after 5.10.

At 4.30 p.m. burning freely.

At 4.45 p.m. the inner thickness had the appearance of being charred through, but the surface had not begun to disintegrate.

At 5.0 p.m. some of inner thickness had fallen, but not more than about one half.

At 5.7 the lower hinge had buckled, the end being detached from door (it fell soon afterwards).

## OBSERVATIONS AFTER TEST.

(See Figs. N, O and P.)

### OAK DOOR.

The whole of the inner thickness had disappeared.

The centre thickness had also gone, with the exception of a few pieces of charred particles on the eastern (hinge) side.

### TEAK DOOR.

The whole of the inner thickness had disappeared, excepting one small piece of charred wood on eastern (hinge) side.

The centre thickness was in position, but was almost entirely charred.



The outer thickness remained in position, most of its inner surface being charred, the outer surface being intact, excepting the upper portions of three boards. (See Figs. O and P.)

The frame was deeply charred, especially at the head, the sill being not much damaged.

The outer thickness was practically unharmed except for about 4 ins. at the top, where flames had broken through, and for small holes at eastern lower corner, and at centre of bottom of door. (See Figs. O and P.)

The frame was deeply charred, especially at the head, the sill being not much damaged.

### GENERAL ARRANGEMENTS.

The test was carried out according to the procedure laid down by the Executive for investigations of this description and conducted by a Sub-Committee of the Executive, comprising:—

Mr. Chas. E. Goad, M.Am.Soc.C.E., M.Can.Soc.C.E.  
(Directing Member).

Mr. Ellis Marsland, District Surveyor, Camberwell.

Mr. F. Hammond, F.R.I.B.A., District Surveyor,  
East Hampstead.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

The Executive was represented by:—

Mr. Edwin O. Sachs (Chairman).

Mr. Max Clarke, A.R.I.B.A.

Mr. Matt Garbutt, A.M.I.C.E., A.R.I.B.A.

The general body of members was represented by:—

Mr. F. Sizer Capon, Architect's Department, L.C.C.

Mr. T. Lewis Banks, F.R.I.B.A.

Mr. Henry Lea, M.Inst.C.E., M.I.Me.ch.E., M.I.E.E.

Mr. Harold Busbridge, M.S.I.

Mr. J. Howard Colls.

Mr. H. H. Ray.

The Fireproof Partition Syndicate was represented by:—

Mr. T. I. Cammell, Mr. H. L. Cunnah, Mr. Howard Payne, Dr. G. S. Street, Mr. George Traill.

The following visitors attended by special invitation of the Executive:—

Mr. P. Stransom, Architect's Department, L.C.C.; Mr. Robert Robertson, Architect's Department, L.C.C.; Mr. W. G. Perkins, Architect's Department, L.C.C.; Mr. P. G. Killick, Vestry Surveyor, Clerkenwell; Mr. J. Rush Dixon, Vestry Surveyor, Shoreditch; Mr. W. Busbridge; Mr. W. Buchan.

Signed,

*For the Sub-Committee conducting the Test:*

CHAS. E. GOAD (*Directing Member*).

*For the Commercial Section:*

FREDERIC R. FARROW.

*For the Executive:*

EDWIN O. SACHS (*Chairman*).

Published by the Committee  
as directed by the Executive.

H. S. TAYLOR  
(*Asst. Secretary*).

*Date—December 31st, 1900.*



LEGGED DOOR. PANELLER DOOR.

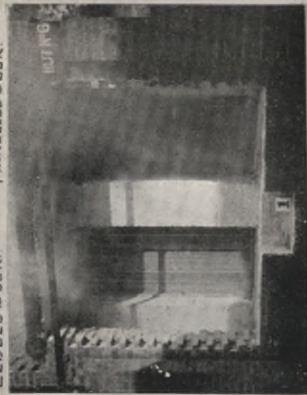


FIG. 1. TIME 4.33. TEMP 710°

LEGGED DOOR. PANELLER DOOR.

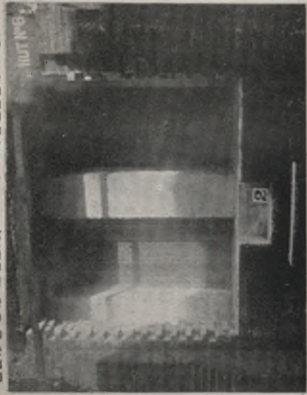


FIG. 2. TIME 4.36. TEMP 1110°

LEGGED DOOR. PANELLER DOOR.



FIG. 3. TIME 4.39. TEMP 1375°



FIG. 4. TIME 4.49. TEMP 1560°



FIG. 5. TIME 4.52. TEMP 1575°



FIG. 6. TIME 4.55. TEMP 1460°

VIEW OF DOORS DURING TEST. Figs. 1 to 6.