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ATTENDANCES BY THE FIRE BRIGADES AT INCIDENTS CAUSED BY LIGHTNING
IN THE UNITED KINGDOM 1948-52

by

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Summary

Incidents caused by lightning attended by the Fire Brigades in the United Kingdom, have been analysed for the five years 1948 to 1952. The estimated number of incidents per year varied between 94 and 176, except in 1952, when there was a total, estimated from a 1 in 4 random sample, of 296. The occupancies most frequently involved were houses and flats (68 per cent of the incidents in buildings) and agriculture and forestry (73 per cent of the incidents not in buildings).

The materials most commonly first ignited, were electrical insulation, (26 per cent of all incidents), structural woodwork (17 per cent) and hay (12 per cent). There were, in 1948, 1950 and 1952, a total of 36 casualties reported. Some of these were caused by fire and not directly by lightning. There were no fatal casualties in the reports examined, but the Registrar-General's statistics for the same three years show that there were 35 fatalities resulting directly from lightning. Twentyfive of the fires in these three years were serious, but they were mainly in occupancies where there was a considerable quantity of flammable material and in which any fire once started was likely to become serious whatever the original source of ignition.

There was no particularly outstanding hazard, and no particular point in buildings (such as wireless or television aeriels) at which lightning strikes were especially frequent.

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INCIDENTS CAUSED BY LIGHTNING ATTENDED BY FIRE BRIGADES, 1948-1952

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INTRODUCTION

Inquiries have been received by the Joint Fire Research Organization about the frequency of fires caused by lightning, and the fear has been expressed that television aerials may be particularly dangerous in this respect. To provide an answer to these inquiries an analysis has been made of reports of attendances by Fire Brigades at incidents caused by lightning.

There are known to be two forms of lightning strike⁽¹⁾. There may be an intense discharge of current in a short period of, say, 50 micro-seconds, a type of strike which has an explosive effect. There may also be, in some cases, an intense discharge followed by a far less intense discharge over a longer period of, say, up to 1 second. The heat caused when this "tail discharge" flows to earth is often the cause of fire. The information in the reports suggests that the Fire Brigades may be called to either type of occurrence, and to a limited extent attendance by the Fire Brigades does not necessarily mean a fire in the usual sense of the word.

FREQUENCY OF ATTENDANCE AT INCIDENTS CAUSED BY LIGHTNING

During the five years 1948 to 1952 it is estimated that 818 incidents caused by lightning were attended by Fire Brigades in the United Kingdom; reports on these have been analysed in Tables 1 and 2 in relation to the occupancy involved and to the materials involved or first ignited. It has not been possible to analyse every fire report received from the Fire Brigades and the figures for 1949 and 1952, in the tables, are from one-in-four random samples of all reports received, while those for 1950 and 1951 are from one-in-two random samples. In the sample of reports examined for the five year period there were 236 concerning lightning strikes in buildings and of these 160 (68 per cent) occurred in houses and flats. There were 125 incidents in occupancies other than buildings; 63 (50 per cent) were in agricultural occupancies, mainly ricks and stacks, and 29 (23 per cent) in trees and forests. The materials most commonly reported as "Materials involved or first ignited" were electrical insulation, which accounted for 93 incidents (26 per cent of the total); structural woodwork, 60 incidents (17 per cent); and hay, 43 incidents (12 per cent).

The estimated total numbers of incidents attended were, 140 in 1948, 176 in 1949, 94 in 1950, 112 in 1951 and 296 in 1952.

The number in 1952 is high compared with previous years. The occupancies involved, in relation to the part of the occupancy struck by lightning and to the material involved or first ignited are shown in Table 3, for one year, 1948, for which the general pattern of incidence may be regarded as typical of recent years.

The information was compiled from reports made by the Fire Brigade officers called to the incidents or the subsequent fires and the reported sequences of events may not be a complete record of what happened. The information given is, however, sufficient to show that though a particular external part of the structure of a building may be struck first, and ignited if it is of flammable material, ignition of internal structural members, fittings and contents of buildings is not infrequent. This form of ignition presumably occurs as the result of the conduction of current from the point at which the lightning strikes to more vulnerable parts of the building. A similar form of ignition applies to occupancies such as ricks, stacks and trees.

CASUALTIES

To obtain information on the casualties resulting from lightning strikes or from fires caused by lightning, at which the Fire Brigades were in attendance, reports for the years 1948, 1950 and 1952 were examined in detail.

In 1948 there were 7 casualties. One fireman received slight burns whilst fighting a fire caused by lightning. Of the 6 other people injured, three women, who were in a tramcar which was struck, suffered shock. Two people suffered burns and shock when the chimney of their house was struck by lightning. The remaining person suffered an injury to the forearm in unspecified circumstances when or after lightning struck the house.

In the one-in-two sample for 1950 there were 3 Fire Brigade casualties, 2 of whom received cuts and the other burns to the face and forehead, in fires. There were 6 other casualties. Two people were in a house which was struck and one suffered shock and the other a slight burn to one finger. Four men were injured by lightning whilst playing golf. Three of them suffered shock while one received burns to the abdomen and legs.

In the one-in-four sample for 1952 there were 15 casualties, none of whom was a Fire Brigade member. One woman, in a house which was struck, and a man of 77 years of age who was knocked down by a lightning stroke, suffered shock. The other 13 casualties were all in a tramcar which was struck; 8 people suffered shock, and 2 received slight burns and shock. The injuries to the other three people were:- burns to the legs and shock, burns to the hips and body, and burns to the back of the head and shock.

There were no fatal casualties mentioned in the reports examined. The Registrar-General's Statistical Review of England and Wales reports the number of people killed by lightning in each of the three years under discussion as 11, 13 and 11 respectively. These figures are based on the findings of coroners' courts and refer to the primary cause of death.

SERIOUS FIRES

It was considered that some knowledge of the extent of the damage caused by fires due to lightning would be of interest and for this purpose also the reports for 1948 and those in the samples for 1950 and 1952, were examined in detail. As a basis for this assessment a serious fire was defined as one in which more than half a building and its contents, or the greater part of an occupancy was damaged. There were 13 serious fires in 1948; 3 in houses, in which the structure and contents were severely damaged; 4 in barns containing hay, in which most of the hay was burned; one in an oil store on a farm, in which cans of oil were damaged; 4 in ricks and stacks of corn, hay and flax, of between 20 and 40 tons; and one, in which a range of farm buildings was destroyed.

In the one-in-two sample of reports for 1950 there were 6 serious fires: one in a house in which the thatched roof was struck and the fire spread through the roof; one in a barn containing straw; and 4 in hay, wheat and straw stacks of between 15-50 tons.

In the 1952 sample there were also 6 serious fires: one in a barn, containing 20 tons of hay and 20 tons of dried grass; 2 in farm buildings, one containing straw and agricultural machinery and the other containing a car, a tractor, 30 pigs and some agricultural machinery; one in a cow house, containing 12 tons of hay; one in a 20 ton wheat-straw stack; and one which destroyed 40 acres of coniferous forest.

CONCLUSIONS

The reported information does not give a complete account of the physical circumstances of fires caused by lightning, but the information tabulated from the reports is sufficient to show that wireless and television aerials are not frequently struck and do not constitute a serious risk.

The probability that a house will be struck by lightning may be increased if an outside television aerial is fitted, but the risk in the United Kingdom can be regarded as small, except for isolated buildings where the building or the aerial is appreciably higher than surrounding objects such as trees. The same consideration might apply, to a lesser extent, to television aerials in roof spaces; in this case however the roof itself could have a shielding effect, if, as usually happens, the building is wet.

There appear to be several ways in which lightning can cause damage. The explosive effect of the discharge can shatter parts of buildings or outdoor occupancies; if there is a "tail discharge" as well the conduction of the current to earth may cause ignition of flammable materials. A somewhat different form of ignition may occur in buildings. The electrical insulation between various parts of an installation may be broken down by potential differences set up by the lightning strike, and the insulation ignited.

It appears that those fires started by lightning which cause serious damage do so because of the presence of highly flammable materials, such as straw and hay, and not because of any property inherent in the lightning. In other words they occur in occupancies in which fires are likely to become serious whatever the source of ignition may be.

There is no obvious danger point in buildings at which lightning strikes, while ricks and stacks and trees are most frequently struck in occupancies other than buildings. Electrical installations such as overhead power cables, tram or trolleybus standards and wiring, and in one or two cases mains supply transformers are also struck. The problem of protecting householders against risks arising from such installations is under constant review by the authorities concerned. In general it is possible to take special precautions both in buildings and elsewhere but neither the number of incidents nor the scale of damage at the present time appears to justify any elaborate precautions.

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Reference

BRUCE, C.E.R. and GOLDE, R.H. The lightning discharge. I.E.E. Journal 1941, 88 (II). 487-520.

Table 1

OCCUPANCIES INVOLVED IN INCIDENTS CAUSED BY LIGHTNING

Reports of incidents attended by the Fire Brigades in the United Kingdom 1948-1952

OCCUPANCY	INCIDENTS CAUSED BY LIGHTNING					TOTAL
	No. included in all reports of fires attended in 1948	No. included in one-in-four random sample of reports 1949	No. included in one-in-two random sample of reports 1950	No. included in one-in-two random sample of reports 1951	No. included in one-in-four random sample of reports 1952	
In buildings						
Agricultural buildings ...	13	-	3	2	5	23
Industry	4	-	2	-	3	9
Houses and flats	62	18	18	30	32	160
Other buildings	12	8	9	6	9	44
Total in buildings	91	26	32	38	49	236
Not in buildings						
Crops standing on stooked	-	1	1	-	1	3
Ricks and stacks	23	6	8	11	9	57
Agricultural machinery, agricultural waste	1	-	-	1	1	3
Woods, forests, plantations	-	-	-	-	1	1
Single trees	12	7	3	2	4	28
Other outdoor hazards	13	4	3	4	9	33
Total not in buildings	49	18	15	18	25	125
Total fires	140	44	47	56	74	361

Table 2

MATERIALS INVOLVED OR FIRST IGNITED IN INCIDENTS CAUSED BY LIGHTNING

Reports of incidents attended by the Fire Brigades in the United Kingdom 1948 - 1952

MATERIAL INVOLVED OR FIRST IGNITED	INCIDENTS CAUSED BY LIGHTNING					TOTAL
	No. included in all reports of fires attended in 1948	No. included in one-in-four random sample of reports 1949	No. included in one-in-two random sample of reports 1950	No. included in one-in-two random sample of reports 1951	No. included in one-in-four random sample of reports 1952	
Hay	19	1	7	9	7	43
Tree, tree stumps, felled timber	12	7	3	2	4	28
Coal gas	11	6	1	4	3	25
Structural woodwork	20	6	6	13	15	60
Electrical insulation ...	32	11	11	12	27	93
Other materials	46	13	19	16	18	112
TOTAL	140	44	47	56	74	361

Table 3

INCIDENTS CAUSED BY LIGHTNING, 1948

Hazard involved in relation to either the part of the building struck or the material first ignited or involved
All reports of fires attended by the Fire Brigades in the United Kingdom (No lightning fires in Northern Ireland)

HAZARD INVOLVED	Part reported as being struck and/or material first ignited or involved																			TOTAL FIRES	
	England and Wales											Scotland							TOTAL		
	Crops, straw, hay, trees, felled timber	Street gas lamp, o/hd. cables, tram etc. standards	Wiring, gas or water pipe struck. Gas pipe melted, gas ignited	Chimney or roof struck	Roofing felts, thatch, first ignited.	Structural timber, building materials ignited	Electrical insulation ignited	Miscellaneous contents of buildings	Radio aerial struck igniting set	Television aerial struck	Not stated	TOTAL	Crops	Wiring struck. Gas pipe melted, gas ignited.	O/hd. cables, tram etc. standards	Oil	Structural timber ignited	Electrical insulation ignited.			Not stated
In buildings																					
Agricultural buildings	2	-	-	-	4	2	1	-	-	-	3	12	-	-	-	-	1	-	-	1	13
Industrial buildings .	-	-	-	-	-	2	-	1	-	-	-	3	-	-	-	-	-	-	1	4	
Houses and flats	-	-	7	4	2	19	15	4	4	1	4	60	-	1	-	-	-	1	-	2	62
Other buildings	-	-	2	1	1	3	4	2	-	-	2	15	-	-	-	-	-	1	-	1	16
Total in buildings	2	-	9	5	7	26	20	7	4	1	9	90	-	1	-	-	1	2	1	5	95
Not in buildings																					
Ricks and stacks	17	-	-	-	-	-	-	-	-	-	-	17	5	-	-	-	-	-	-	5	22
Agricultural machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
Woods, forests, trees	12	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	12
Tramcar	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Other outdoor hazards	-	8	-	-	-	1	-	-	-	-	-	9	-	-	2	-	-	-	-	2	11
Total not in buildings	29	8	-	-	-	2	-	-	-	-	-	39	5	-	2	1	-	-	-	8	47
TOTAL FIRES	31	8	9	5	7	28	20	7	4	1	9	129	5	1	2	1	1	2	1	13	142