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FIRES ASSOCIATED WITH OIL BURNING APPLIANCES IN 1959

by

R. E. Lustig

SUMMARY

An analysis has been made of reports of fires associated with oil burning appliances in 1959, to provide some up-to-date information while awaiting results of a detailed survey which will be available in about eighteen months' time.

The analysis covers fires which had been reported to the Joint Fire Research Organization by about mid April 1960; as some reports were still outstanding at that time, the information is not quite complete for the whole year, but the omissions are almost certainly of a minor nature, except possibly in the case of fatal casualties, which sometimes take longer to report. Nonetheless, the total number of fires, 4,552, was the highest recorded in any year. The method of approach was chosen to permit comparison with an earlier analysis on the 1956 figures. Special attention has been given to the type of feed. Only about one-third of the reports gave this information, but there is some indication that about two-thirds of the fires caused by space heaters in dwellings were attributable to wick feed appliances. If this estimate is correct, it would appear that drip feed heaters do not cause any more fires in relation to the number at risk than the wick type. Furthermore, a higher proportion of the fires attributed to wick heaters caused casualties. This seems to be due to the fact that wick type heaters are more liable to be overturned or dropped and it is this group of fires which is most likely to cause casualties.

A comparison has also been made of the fire hazards of space heating appliances using different fuels in dwellings. This shows that oil and solid fuel heaters have a much higher incidence rate per million appliances at risk, than either gas or electric heaters. The high rate for solid fuel may be at least partly due to the long periods during which these appliances are at risk.

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August, 1960.

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INTRODUCTION

Mounting interest in oil heaters has prompted the production of this note to supplement the information hitherto available, although a more detailed survey of fires caused by oil burning appliances in 1960/61 has already been started. The approach has been twofold: Part I is principally concerned with bringing up-to-date information contained in the paper by Fry and Hinton on "Fires Caused by Oil Burning Appliances in 1956"(1), while Part II breaks some new ground in the light of information that has come to hand since the publication of the earlier paper.

The survey covers all fires originating from oil burning appliances attended by Brigades in the United Kingdom in 1959 excluding only blow lamps and internal combustion engines. A few fires have necessarily been omitted, as reports had not reached the Joint Fire Research Organization in time to be included, but the effect of this should be only very slight, except possibly where fatal casualties are concerned. To this extent, the 1959 figure used in this report must be regarded as provisional. The investigation is based on routine reports received from Local Authority Fire Brigades, and consequently is limited to the information normally contained in them. This leaves a number of important gaps, in particular in information concerning the appliances involved, but some useful detail is nonetheless included, or can be deduced.

In all, 4552 reports have been studied. This is one-third more than the total number of oil burning appliance fires (again excluding blow lamps and engines) recorded in 1956, and is the highest annual figure ever reached, though only two per cent above the 1958 figure. On the other hand, the number of fires per 1000 tons of kerosine burning oil delivered for inland consumption has fallen further from the 1956 peak of 4.1 to 3.8, although it still remains well above the 1947 figure of 2.2, and is higher than the rate for any year prior to 1955, (see Fig. 1 and Table 1). The significance of this reversal in trend, if indeed it is a reversal, is still not clear. It may be due to an increase in the proportion of kerosine consumed in fixed installations, but no data exist to support this, nor even the assumption that fixed appliances are less fireprone, though this seems logical.

The reduction in both the number of fires and kerosine consumption in 1957 is probably associated with the Suez crisis which led to economies in the use of petroleum products in the early part of that year.

TABLE 1

FIRES AND KEROSINE DELIVERIES FOR INLAND CONSUMPTION

Year	Fires	Kerosine Deliveries tons (000's)	Fires per 1000 tons	Index 1947 = 100	
				Fires	Kerosine
1947	1340	614	2.2	100.0	100.0
1948	1576	558	2.8	117.6	90.9
1949	1764	555	3.2	131.6	90.4
1950	1790	562	3.2	133.6	91.5
1951	1872	587	3.2	139.7	95.6
1952	1900	577	3.3	141.8	94.0
1953	2000	547	3.7	149.3	89.1
1954	2206	604	3.7	164.6	98.4
1955	2764	692	4.0	206.3	112.7
1956	3412	831	4.1	254.6	135.3
1957	3189	796	4.0	238.0	129.6
1958	4464	1124	4.0	333.1	183.1
1959	4552[z]	1203	3.8[z]	339.7[z]	195.9

z Provisional

Sources:- Ministry of Power Statistical Digest - Deliveries of kerosine burning oil for inland consumption; and Fire Brigade reports.

DEFINITION

Throughout this paper the term "dwelling" is used to denote private residential houses and flats; it excludes institutional dwellings, caravans, houseboats, garages, private sheds etc. even if they are on dwelling premises.

PART I - COMPARISON WITH 1956

PREMISES

As in 1956, dwellings featured prominently amongst premises in which oil burning appliance fires occurred, accounting for 55.0% of all the fires in 1959, compared with 42·8% in 1956. There is some doubt about this apparent change since the increase in the proportion of fires in dwellings is almost exactly counterbalanced by a decrease in the proportion of the fires occurring in agricultural premises; this may be due, at least in part, to a difference in classification.

About a tenth of all the fires occurred in vehicles and garages. Garages appear to have a hazard peculiar to themselves in the form of heating appliances burning waste oil. This apparently often contains water, which may cause the oil to boil over and catch fire. Although in many cases the damage was almost negligible, this seems to have been due principally to the quick action of employees, and the ready availability of suitable extinguishers, and a number of serious fires did originate from this source. A further investigation into the fire hazards of this type of appliance in such a hazardous occupancy might prove profitable.

The seasonal pattern (Table 2) is rather different from that in 1956 when the peak fire rate was reached in February for each class of premises whereas the 1959 peak was generally reached in January or December. The change may be explained by the exceptionally cold weather in February 1956 and January 1959, and the mild February of 1959. Indeed the unusually high temperatures throughout most of 1959 may be in part responsible for the reduced rate of increase in the number of fires attributed to oil burning appliances.

TABLE 2

FIRES CAUSED BY OIL BURNING APPLIANCES
UNITED KINGDOM 1959
TYPE OF PREMISES AND MONTH OF OCCURENCE

Type of premises / Month	Agricultural Buildings	Dwellings	Caravans and Boats	Industrial Buildings	Commercial Buildings and Offices	Public Service Premises	Clubs, Hotels, Restaurants	Vehicles and Garages	Other and Outdoor Hazards	TOTAL No.	TOTAL %
January	71	508	7	28	51	15	21	131	48	880	19.3
February	69	390	4	19	37	8	6	88	42	663	14.6
March	80	263	5	19	24	7	6	44	36	484	10.6
April	85	172	5	13	12	10	8	12	30	347	7.6
May	57	104	3	16	10	1	3	7	31	232	5.1
June	25	48	3	12	3	8	-	6	26	131	2.9
July	17	35	4	6	3	3	1	4	25	98	2.2
August	27	37	4	9	7	6	1	4	39	134	2.9
September	17	50	3	13	4	3	1	2	34	127	2.8
October	23	155	5	12	11	8	5	15	33	267	5.9
November	25	348	6	25	28	16	7	73	28	556	12.2
December	32	393	9	36	31	11	10	82	29	633	13.9
TOTAL No.	528	2503	58	208	221	96	69	468	401	4552	100.0
TOTAL %	11.6	55.0	1.3	4.6	4.9	2.1	1.5	10.3	8.8	100.0	
(1956 TOTAL) %	(25.6)	(42.8)	(2.5)	(4.1)	(4.4)	(2.0)	(1.3)	(10.7)	(6.7)	(100.0)	

SOURCE:- Reports from Local Authority Fire Brigades

TYPES OF APPLIANCE

Heating appliances again caused the bulk of fires in each occupancy group (Table 3) and in total were responsible for 88.0% compared with 87.2% in 1956. The number of fires caused by fixed appliances rose from 137 in 1956 to 333 in 1959. The latter figure may have been increased by the inclusion of some industrial process equipment which was excluded from the 1956 survey, but there was undoubtedly a genuine increase in the number of fires caused by fixed appliances, probably reflecting an increase in the number of fixed installations, though no estimates of the number of these are at present available. Fires caused by fixed appliances in dwellings rose by only one-third, compared with a threefold increase in general.

TABLE 3

FIRES CAUSED BY OIL BURNING APPLIANCES, UNITED KINGDOM - 1959.
APPLIANCES INVOLVED IN SPECIFIED OCCUPANCIES

Premises	Type of appliance	Use of appliance				
		Heating	Cooking	Lighting	Mixed or Unknown	TOTAL
Agricultural buildings	Fixed	23	-	-	13	36
	Portable	458	2	13	11	484
	Unknown	2	-	-	6	8
	TOTAL	483	2	13	30	528
Dwellings	Fixed	47	1	-	-	48
	Portable	2335	34	36	14	2419
	Unknown	23	11	1	1	36
	TOTAL	2405	46	37	15	2503
Industrial buildings	Fixed	64	1	-	41	106
	Portable	61	1	6	4	72
	Unknown	26	-	-	4	30
	TOTAL	151	2	6	49	208
Commercial buildings and offices	Fixed	24	8	-	4	36
	Portable	173	-	6	2	181
	Unknown	3	-	-	1	4
	TOTAL	200	8	6	7	221
Vehicles and garages	Fixed	26	2	-	2	30
	Portable	333	1	28	5	367
	Unknown	69	-	-	2	71
	TOTAL	428	3	28	9	468
Other than above	Fixed	63	6	-	8	77
	Portable	255	37	190	33	515
	Unknown	20	5	1	6	32
	TOTAL	338	48	191	47	624
TOTAL	Fixed	247	18	-	68	333
	Portable	3615	75	279	69	4038
	Unknown	143	16	2	20	181
GRAND TOTAL No.		4005	109	281	157	4552
%		88.0	2.4	6.2	3.4	100.0
(1956 Grand Total) %		(87.2)	(4.0)	(8.4)	(0.3)	(100.0)

Source:- Reports from Local Authority Fire Brigades

CAUSES OF FIRES

As in 1956, some difficulty was experienced in assessing the actual cause of the fires, and allocating the fault, (Tables 4 and 5). On this occasion, less rigorous proof of fault in usage was accepted than in 1956; in particular, misuse was generally presumed when appliances were overturned or placed too close to combustible materials. Consequently the number of fires attributed to fault in usage rose from 18·9% of all fires in 1956 to 48·8% in 1959. The proportion of fires caused by faults in the appliances themselves also increased from 40.5% to 43.5%, but this was probably a genuine increase, reflecting the more than proportionate increase in fires due to overheating, flaring up, flooding and leakage, which in turn may be due to a rapid rise in the number of drip-feed heaters in use. Conversely, the number of fires caused by dropped or overturned appliances rose less steeply than the total number of fires, and those caused when combustible materials were too close to appliances actually went down in number.

TABLE 4

FIRES CAUSED BY PORTABLE OIL HEATERS IN DWELLINGS
UNITED KINGDOM - 1959.
CAUSE OF FIRE AND TYPE OF FEED

Act or defect \ Type of feed	Drip-feed		Wick		Unknown		All Types	
	No.	%	No.	%	No.	%	No.	%
Overfilled or fuel spilled	88	16.3	48	14.6	224	15.4	360	15.5
Children	3	0.6	1	0.3	14	1.0	18	0.8
Overturned or dropped	35	6.5	58	17.7	240	16.5	333	14.3
Too near combustibles	30	5.5	30	9.1	177	12.2	240	10.3
Filling while alight	24	4.4	10	3.0	51	3.5	85	3.6
Exploded	4	0.7	2	0.6	6	0.4	12	0.5
Overheated or flared up	161	29.8	94	28.7	445	30.6	701	30.1
Leakage or flooding	165	30.5	41	12.5	176	12.1	384	16.5
Turned too high	8	1.5	27	8.2	48	3.3	83	3.6
Other and unknown	23	4.3	17	5.2	72	5.0	114	4.9
TOTAL No.	541	100.0	328	100.0	1453	100.0	2330	100.0
TOTAL %	23.2		14.1		62.4		100.0	

Source:- Reports from Local Authority Fire Brigades

TABLE 5

FIRES CAUSED BY OIL BURNING APPLIANCES
UNITED KINGDOM - 1959.
CAUSE OF FIRE

Act or defect / Allocation of fault	Children playing with or handling	Over-filled or fuel spilled	Over-turned or dropped	Too near combust-ible material	Filling while alight	Exploded	Over-heated or flared up	Leakage or flooding	Turned too high	Other or unknown	TOTAL	
											No.	%
Fault in appliance	-	23	1	2	-	40	1298	550	10	57	1981	43.5
Fault in usage	35	482	588	554	121	10	173	62	115	82	2222	48.8
Both above faults	-	10	2	3	1	1	41	9	5	5	77	1.7
Not assignable and unknown	4	15	12	19	-	2	8	12	-	200	272	6.0
TOTAL No.	39	530	603	578	122	53	1520	633	130	344	4552	100.0
TOTAL %	0.9	11.6	13.2	12.7	2.7	1.2	33.4	13.9	2.9	7.6	100.0	
(1956 Total) %	(0.7)	(9.0)	(15.6)	(23.7)	(1.9)	(1.5)	(30.5)	(7.7)	(2.0)	(7.4)	(100.0)	

Source: Reports from Local Authority Fire Brigades

MATERIAL FIRST IGNITED

19.5% of all the fires were confined to the appliance in which they originated, but the ratio varies with occupancy, ranging from only 2.3% in agricultural premises and 13.7% in vehicles and garages to 39.9% in industry and 40.6% in boats. The reason for the very low proportion of fires confined to the appliance of origin in agricultural buildings is probably twofold: on the one hand, the highly flammable nature of the normal contents of those premises where oil burning appliances are used - usually animal houses littered with straw - and on the other hand, the fact that fires frequently occur in premises occupied only by animals and consequently are well alight before discovery. The former is certainly borne out by the fact that 62.3% of the fires in agricultural premises first ignited agricultural produce.

In dwellings 515 (20.6%) of the fires were confined to the originating appliance and 46.9% first ignited normal domestic contents. Clothing on the person, which usually features prominently amongst the materials ignited by space heaters in dwellings, was ignited first on only thirty occasions by oil burning apparatus, twenty-six of which were heaters. Table 6 gives a comparison for different fuels in 1956.

TABLE 6

FIRES IGNITED BY HEATING APPLIANCES IN DWELLINGS GREAT BRITAIN - 1956.

Fuel	Total fires	Clothing on person ignited first		Estimated No. heaters at risk (millions)	Clothing fires per m. heaters
		No.	%		
Electricity	874	90	10.3	16	5.6
Gas	143	34	23.8	3.5	9.7
Oil	1075	16	1.5	5	3.2
Solid	9699	361	3.7	33	10.9

The low proportion of oil heater fires igniting clothing no doubt reflects the high proportion of oil heaters that are enclosed, but may also be the result of better fireguards or a higher proportion of guarded oil heaters. This in turn could be due to the fact that these appliances are on the whole newer than other heaters, and consequently a higher proportion conform to the regulations made under the Heating Appliances (Fireguards) Act 1952. No direct information is available on the age distribution of heaters, but it is known that in 1955 there were only some 3.3 million oil heaters in dwellings in England and Wales[2] so, allowing for wastage, it is most unlikely that more than a quarter of the present ones could have been acquired prior to October 1954, when the fireguard regulations came into full operation. On the other hand, less than one-third of the housewives with electric heaters in September-November 1958 had purchased one in the preceding five years[3], and less than a quarter of the gas heaters now in dwellings were purchased after 1954. Solid fuel appliances are not covered by the Act, though they do, of course, come within the fireguard provisions of the Children and Young Persons Act 1933.

EXTENT OF FIRE

In dwellings, 89.8% of all the oil burning appliance fires did not spread beyond the room of origin, which is about the same proportion as for all fires in dwellings. Occupancies other than dwellings are probably too heterogeneous to permit a meaningful measure of extent.

CASUALTIES

During the year 410 persons were killed or injured in 314 fires caused by oil burning appliances (Table 7) compared with 255 casualties in 1956. In 1959 over three-quarters of the casualties occurred in dwellings, although only 55.0% of the fires occurred in them, and in 1956, 42.8% of the fires happened in dwellings, accounting for over two-thirds of the casualties. In each year there were 36 fatal casualties, but in 1959 this is a preliminary figure and almost certainly an understatement of the final total.

TABLE 7

CASUALTIES RESULTING FROM FIRES CAUSED BY OIL BURNING APPLIANCES
UNITED KINGDOM - 1959.
NATURE OF INJURY AND PREMISES

Nature of Injury \ Premises	Agricultural premises	Dwellings	Industrial premises	Commercial premises and offices	Garages and vehicles	Other and outdoor hazards
Fatal casualties						
Burns	1	14	-	-	1	3
Shock only	-	-	-	-	-	-
Asphyxia	-	15	-	-	-	1
Other injuries	-	1	-	-	-	-
TOTAL	1	30	-	-	1	4
Non-fatal injuries						
Burns	6	190	7	5	20	40
Shock	1	80	-	2	5	4
Asphyxia	-	10	-	-	1	1
Other injuries	-	37	-	1	3	7
TOTAL persons non-fatally injured ≡	6	281	7	6	26	48

Source:- Reports from Local Authority Fire Brigades

≡ Non-fatal injuries do not add up to total persons non-fatally injured because several people sustained more than one type of injury.

Dropped or overturned appliances (primarily a fault in usage) caused nearly a quarter of all the casualties although they accounted for only 13.2% of all the fires. On the other hand, overheating, flaring up, leakage and flooding (primarily a fault of the appliance) which caused 47.3% of the fires, resulted in only 31.2% of the casualties. This position is further emphasised by an analysis of reports on the fatal casualty fires, which shows that only five of these, causing nine deaths, could possibly have been due to flaring up of oil heaters. In no case does the report specifically mention flaring up, but in each the wording is such as not to preclude the possibility. On the other hand, seventeen of the fires in which eighteen people lost their lives were definitely attributed to the overturning or dropping of oil burning appliances. Thus, fault in usage appears to be a more serious cause of casualties than fault in the appliance itself. (Table 8).

TABLE 8

CASUALTIES

Cause	Fires	Persons Injured			
		Fatal	Non-fatal	Total	
				No.	%
Overfilled or fuel spilled	33	2	36	38	9.3
Overturned or dropped	78	18	83	101	24.6
Too near combustibles	52	5	59	64	15.6
Filling while alight	13	-	14	14	3.4
Exploded	12	1	15	16	3.9
Overheated or flared up	65	7	82	89	21.7
Leaking or flooding	29	1	38	39	9.5
Turned too high	6	-	8	8	2.0
Other or unknown	24	2	36	38	9.3
Children playing	2	-	3	3	0.7
TOTAL	314	36	374	410	100.0

Source:- Reports from Local Authority Fire Brigades

FIRE-FIGHTING

A certain amount of controversy was started by the recommendation(4) that fires in drip-feed oil heaters should be tackled by buckets of water. Although laboratory tests had proved this method effective, it was suggested that this did not represent actual fire conditions. To cover this point, an analysis was made of fire-fighting. Whilst general conclusions on fire-fighting methods cannot be drawn from the data on the uncontrolled conditions covered by this survey, it is evident that on many occasions buckets of water were used effectively to extinguish fires started by oil burning appliances.

Of the 4552 fires analysed 1169 (25.7%) were tackled before the arrival of the Brigade by buckets of water only; 44.7% of these were extinguished by this means without the need for Fire Brigade intervention; in 1.1% the Brigade used large jets as the only method. On the other hand there was no fire-fighting before the arrival of the Brigade in 1879 fires; of these only 6.9% were out on the arrival of the Brigade; the Brigade used larger jets only, in 7.6% of the incidents.

In dwellings, where a useful measure of damage can be made, 906 (36.2%) of the fires were not tackled at all before the arrival of the Fire Brigade and 804 (32.1%) were tackled only by buckets of water. Of the former, 17.8% spread beyond the room of origin, whereas only 7.8% of the fires that were tackled by buckets of water spread beyond the room.

It certainly appears from the reports that attempted extinction by means of buckets of water is preferable to no attempt at all.

PART II - 1959 SURVEY

DOMESTIC HEATING

In the past, a full appraisal of the fire risks of various heating appliances has been hindered by lack of background data. Though this defect still exists to a large extent, the position has been alleviated in recent years by the publication of results of a number of surveys, so that some assessment of the relative dangers of space-heating appliances can now be made. Table 9 gives comparative figures for the fire hazards of the main forms of heating.

TABLE 9

FIRES ORIGINATING IN SPACE HEATERS IN DWELLINGS IN GREAT BRITAIN

Fuel	Year	Appliances at risk (millions)+	Number of fires	Fires per million appliances
Electricity	1957	16.25	747	46
	1958		928	57
Gas	1957	3.75	93	25
	1958		84	22
Oil	1957	7	1258	180
	1958	9	2128	236
	1959=	10	2335	234
Solid	1957	33	8290	251
	1958		8472	257

= United Kingdom

+ Estimates based on surveys (5), (6), (7), (8) and reports from Fire Brigades

From this it is apparent that oil and solid fuel appliances have a much worse record of fires per million appliances at risk than either gas or electricity. The high rate for solid fuelled heaters may be due to the fact that they are at risk for longer periods than the other three types which, even now, are most frequently used for ancillary heating. There is very little authoritative background information on this subject, but the available data suggest that about one-third of the solid fuel heaters are kept alight for twelve hours a day or more during the winter(2), (5). This quite certainly provides a greater risk period than for other types of heating. Similarly oil burning heaters may be used more continuously or more frequently than gas or electric heaters, but there are no data available either to support or oppose this contention, and it seems most unlikely that the difference in usage could account for the whole of the difference between the incidence rate for oil heaters on the one hand, and gas and electric heaters on the other.

Part of the explanation for the differences in incidence rates may be found in different proportions of fixed appliances amongst the heaters. Again no background data are available, but it seems logical to suppose that the proportion of gas fires that are fixed is greater than the proportion for electric heaters which, in turn, is greater than the proportion for oil heaters. Again it seems logical to suppose that the portable variety of any particular heater is more hazardous than the fixed variety, if only because it is more liable to be misused, in that it can be knocked over, dropped, placed too close to combustible materials, or simply put in a dangerous position, all of which are virtually impossible in the case of heaters firmly attached to a wall.

This, however, is by no means the whole story. An analysis of fires in dwellings in 1956(9) (when a rather different set of criteria obtained) showed that of the fires caused by oil heaters 27.3% were attributable to faults in the appliances themselves, compared with 6.2% and 2.2% for gas and electric heaters respectively. Thus it is evident that oil heaters are more prone to develop faults, and this appears to be particularly true of the drip-feed type. This is borne out by the result of the 1959 survey when 40.1% of the fires caused by all portable oil heaters in dwellings were attributed to faults in appliances; the corresponding figures for fires known to have been caused by drip-feed and wick type heaters were 50.5% and 37.5% respectively.

TYPE OF FEED - PORTABLE OIL HEATERS

An analysis of the reports of fires in dwellings in 1959 caused by portable oil heaters shows that of the 2330 reports only 37.6% indicated the type of fuel feed used in the appliance. Of these 61.7% were drip-feed heaters, 37.4% wick-fed and eight pressure heaters. However, it was found that the different types of heaters tended to cause fires in different ways, and by analysing these differences it is possible to estimate the proportion of drip-feed and wick-feed heaters in the "unknown feed" group (see Appendix for details). From this it appears likely that approximately 90% of the "unknown" group were wick type heaters and only about 10% were drip-fed. If this analysis is correct it would appear that drip-feed heaters were responsible for about 30% of all oil heater fires in dwellings - about what might be expected if all oil heaters were equally fireprone. That is to say that the wick type oil heaters are no safer than drip-feed ones. Of course, this does not mean that all that has been said in recent months about drip-feed heaters should be unsaid, but the warnings should be extended to cover all oil heaters, though with a different emphasis. The analysis in Table 4 shows very clearly that there is a real danger that drip-feed heaters may flare up or flood, but it also shows that wick-fed heaters are more liable to be knocked over and this, as has been shown earlier, is the most serious hazard to life.

The danger from wick type heaters is emphasised by the comparative casualty rates set out in Table 10. This shows that although drip-feed heaters have a marginally higher rate of fatal casualties per 100 fires, wick-feed ones have a substantially higher proportion of fires causing casualties, a higher total casualty rate and a greater number of casualties per casualty fire.

The similarity between the rates for wick type heaters and those for heaters with an unknown feed is again noteworthy.

TABLE 10

CASUALTIES CAUSED BY PORTABLE HEATERS
FIRES IN DWELLINGS UNITED KINGDOM 1959

	Drip feed	Pressure	Wick	Unknown feed	Total
All fires	541	8	328	1453	2330
Fires causing casualties	35	-	32	151	218
% of all fires	6.5	-	9.8	10.4	9.4
Persons killed	2	-	1	24	27
per 100 fires	0.37	-	0.30	1.65	1.16
Persons injured	37	-	43	180	260
per 100 fires	6.8	-	13.1	12.4	11.2
Total killed and injured	39	-	44	204	287
per 100 fires	7.2	-	13.4	14.0	12.3
per casualty fire	1.1	-	1.4	1.4	1.3

Source:- Reports from Local Authority Fire Brigades

CONCLUSIONS

It seems fairly certain from the data available that wick type space heaters are as much fireprone as the drip-feed ones. The latter have been shown to be vulnerable to draughts[4] and tank corrosion, and remedial measures have already been proposed; but wick type heaters suffer from a rather different set of defects associated with one of their great selling points - portability. They are easily upset, and can be carried while alight even by old people and children. The incorporation of a "provision for fixing the heaters to a wall or floor to prevent overturning" required by the new British Standard[10] can only be effective insofar as use is made of it - which seems to ignore the fact that people want portable appliances really to be portable, and will evidently take considerable risks to achieve this. More satisfactory would be a device for extinguishing the flame and cutting off the fuel supply as soon as the heater is lifted or even dangerously tilted.

Secondly, it seems that "flaring up" under whatever guise (flooding, leaking, etc.) is rather less of a hazard to life than are certain other causes of fire, notably overturning or dropping. This really underlines what has been said above and emphasises the need for automatic fuel and flame cut-out when the appliance is lifted or tilted. This, of course, applies equally to existing appliances as to new ones - there are some seven million wick type heaters in the homes of this country.

The Home Secretary is already empowered by the Oil Burners (Standards) Act to make regulations covering the standard of oil heaters sold or hired, but similar regulations to deal with appliances now in the possession of their users would obviously be unenforceable.

Thirdly, it has been shown that the laboratory tests carried out to show that buckets of water can extinguish oil heater fires were not unrealistic, nor divorced from actual fire conditions. Buckets of water can be, and have been, used successfully, provided water is not poured directly onto a glass fuel container.

Finally, it is certain that more detailed information on a number of aspects of the fires is required, and it is hoped that this will be supplied, at least in part, by the special survey into fires caused by oil burning appliances in dwellings which has been arranged for 1960/61.

ACKNOWLEDGMENT

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APPENDIX

ESTIMATE OF MAKE UP OF "UNKNOWN FEED" GROUP OF SPACE HEATERS IN DWELLINGS

It is evident from Table 4 that the distribution of causes for drip-feed heaters is significantly different from that for wick type ones, and that, by and large, the distribution for the unknown feed group lies somewhere between the two. This, of course, is to be expected, as the unknown feed group must be some combination of the other two. It is possible to estimate the ratio of this combination on the assumption that the drip-feed heaters in the unknown group will tend to have the same cause distribution as those known to be drip-feed, and similarly that the wick type heaters in the unknown group have the same sort of cause distribution as those known to be wick-fed.

If this assumption is accepted it is easy to estimate the ratio of wick and drip-feed heaters in the unknown group by means of simple simultaneous equations of the form:-

$$a_n x + b_n y = c_n z$$

where a_n is the proportion of fires amongst the known drip-feed heaters that are attributed to cause n

b_n is the equivalent proportion for wick type heaters

c_n is the equivalent proportion for heaters in the unknown feed group

x is the number of drip-feed heaters among the unknown

y is the number of wick heaters among the unknown

z is the total number of unknown feed heaters

By taking two cause groups that show the greatest difference between drip-feed and wick type heaters the following equations are obtained:-

$$.065x + 177y = 240$$
for "dropped and overturned"

$$.603x + .412y = 621$$
for "overheated and flared up" and "leaked or flooded"

Hence:-

$$x \triangleq 143$$

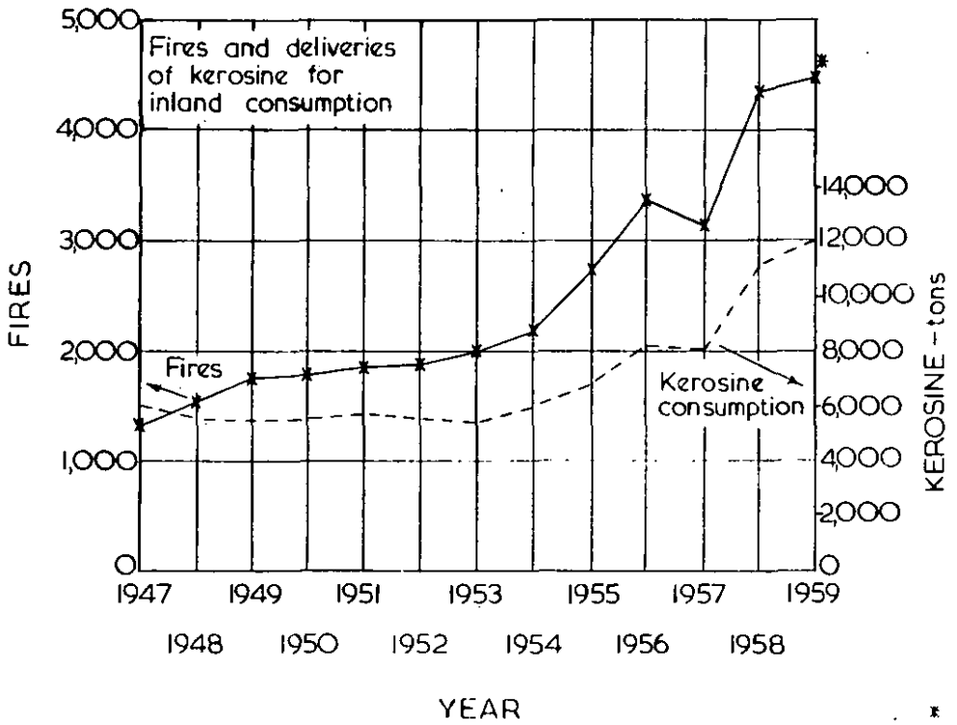
$$y \triangleq 1305$$

That is to say, approximately 89% of the unknown feed group were wick type heaters if the assumption holds good.

The accuracy of this can be checked by applying the calculated drip-feed/wick ratio to the remaining causes and applying the χ^2 test of the hypothesis that the expected values calculated on the basis of this ratio are not different from those actually observed in the unknown feed group.

Cause	Expected	Observed	$\lvert O-E \rvert$	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Dropped or overturned	239.3	240	0.7	.49	.00
Overheated, flared up, leaked or flooded	629.7	621	8.7	75.69	.12
Other	584.0	592	8.0	64.00	.11
					$\chi^2 = .23$

The difference is not significant, and it may be assumed that the calculated ratio is a fair assessment of the actual composition of the unknown feed group, although, of course, it cannot be finally verified until the results of the more detailed survey are available. A χ^2 test of the hypothesis that the ratio of drip-feed to wick type heaters in the unknown feed group is the same as that between the known drip-feed and wick types (i.e. approximately 62% and 37% respectively) shows a very significant difference, and the hypothesis is shown to be a most unlikely one.



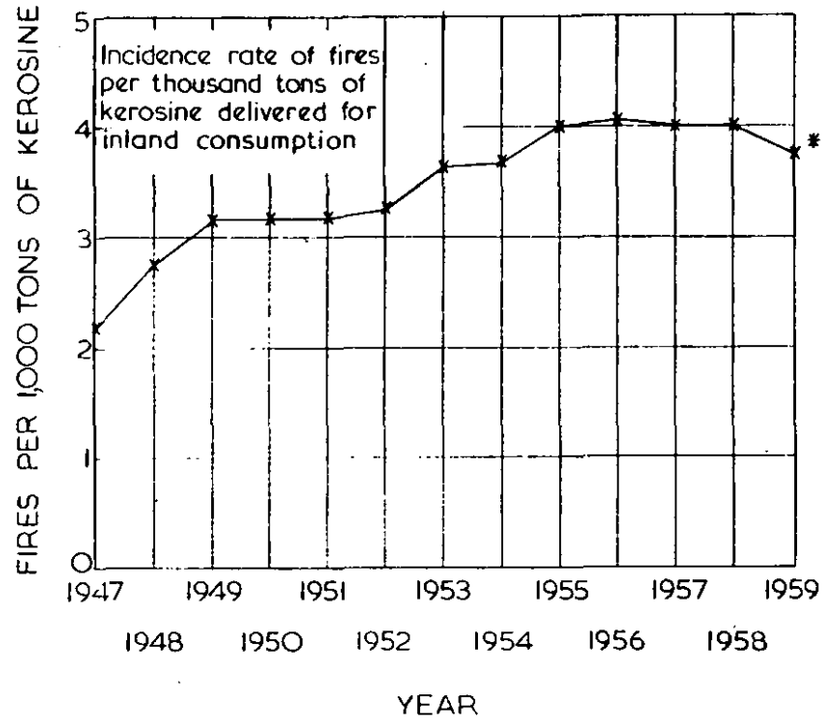


FIG. 1. FIRES CAUSED BY OIL BURNING APPLIANCES (EXCLUDING BLOW LAMPS AND INTERNAL COMBUSTION ENGINES) IN THE UNITED KINGDOM