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FIRES CONNECTED WITH THE PROCESS OF DRYING GRASS ATTENDED  
BY FIRE BRIGADES IN GREAT BRITAIN DURING THE YEARS 1949-1951

by

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Summary

Reports of the 85 fires connected with the process of drying grass, which were attended by Fire Brigades in Great Britain during 1951, have been analysed and the results have been compared with those of similar analyses for the years 1949 and 1950. In each of the three years the rate of incidence was about 8.5 fires per 100 grass driers at risk per year, and a large proportion (about 40 per cent each year) were attributed to overheating of the apparatus. The overheating was due to a variety of causes, but it is suggested that designers of these machines should give particular attention to the elimination of features liable to cause obstruction to the movement of material passing through. The necessity for precautions to be taken by the users of the machines is emphasised.

Introduction

An analysis, similar to those described in F.S. Notes No.108/1950 and 129/1951, has been made of the reports of fires connected with the process of drying grass attended by Fire Brigades in Great Britain during 1951. The rates of incidence have been calculated and the causes have been examined with a view to suggesting possible methods of reducing the fire hazard.

Month of occurrence and location.

During 1951 Fire Brigades attended 81 fires caused by grass drying processes in England and Wales and 4 in Scotland. Of the total of 85 incidents 57 occurred during the months of June, July and August.

Table 1 shows the frequencies of fires in each county in 1951 together with the comparable figures for the preceding two years.

In Table 2 the numbers of fires in each month are given for each of the years 1949-1951, and the total monthly frequencies for the three year period are shown in Fig. 1. It will be seen that there is a marked peak period for these fires in June and July and that the frequency falls off during the four months following this peak; as would be expected very few fires are reported during the winter months.

Supposed causes of fires and damage.

The supposed causes of outbreaks of fire directly connected with the drying plants during 1951, and the damage resulting from them, are given in Tables 3a (fires in buildings) and 3b (fires other than those in buildings). Table 4 gives the causes of fires which were only indirectly connected with the plant.

In all 70 incidents occurred in buildings, 64 of them being directly connected with the use of the grass-drying plants. Six fires were due to sparks entering the drying chambers, 27 to overheating arising from various factors, 7 to ignition of the fuel oil used for the drier and 13 to miscellaneous and unknown causes. Four fires were attributed to spontaneous combustion in stored, dried grass.

Fires in buildings resulted in the loss of 604 tons of grass, grass-meal and hay. In 32 incidents plant was damaged and in 19 the building was damaged.

There were 15 incidents in drying plants in the open, in 8 of which plant was damaged. One fire, originating from an unknown cause, destroyed 150 tons of dried grass and spread to an outbuilding causing damage to the structure and contents. Seven of these fires were attributed to overheating of the plant.

The most frequent cause of fire was overheating of the plant; this was estimated to be responsible for 40 per cent of the total number of fires in 1951, and for 41 per cent and 39 per cent of those in 1949 and 1950 respectively.

#### Rates of incidence

Information was provided by the Ministry of Agriculture and Fisheries on the numbers of grass driers in use in England and Wales in the Januarys of the years 1948, 1950 and 1952. From these figures the numbers in use in the Januarys of 1949 and 1951 were estimated, and the numbers at risk per year for the 3 years 1949-1951 were calculated on the assumption that the increase in the number of plants operating was uniform throughout each year. The rate of incidence of fire was then calculated for each year as the number of incidents per 100 grass driers at risk per year. All of these figures are given in Table 5.

It will be seen that the number of grass driers in use increased considerably during the period considered, and that the rate of incidence of fire remained remarkably constant at an average of 8.5 incidents per 100 driers at risk per year. That is to say that the number of incidents was proportioned to the number of drying plants in use and no reduction in the fire hazard of the equipment has been apparent.

#### Discussion

The material being handled in this process is extremely flammable and high working temperatures are necessary if large quantities of grass are to be dried quickly. The high rate of incidence ( $8\frac{1}{2}$  fires for each 100 driers at risk per year) is a reflection of the seriousness of the hazard, and the loss of material (758 tons in 1951) an indication of the possible value of reducing it.

About 40 per cent of the fires in each year have been attributed to overheating of the plant. The variety of reasons for this shows the difficulty of overcoming the problem, but there are some indications of possible precautions. Several of the instances of fires caused by overheating reported in 1951 were due to accumulations of grass lodging in the apparatus or to actual blockage, others were due simply to the absence or insufficiency of methods of controlling temperatures.

Another group of fires (16 per cent in 1951) was caused by flames or sparks from heaters, while a third group (approximately 12 per cent in 1951) was connected in one way or another with the use of fuel oil.

#### Recommendations

It is clear that the number of fires in grass driers would be considerably reduced if it were possible to prevent blockages and accumulations of drying material. From this it follows that the elimination of all avoidable ledges, corners and crevices should be a primary concern of designers.

The necessity of controlling drying temperatures is apparent, and the provision of automatic fuel controls operated by robust and reliable thermostats is likely to be the most effective method of achieving this. Selection of suitable working temperatures is also important and it is possible that the temperatures used are sometimes too near the ignition temperatures of the dried materials.

Users of the equipment should avoid attempting to increase the through-put by boosting temperatures or by overloading conveyor systems thus causing blockages.

The provision of efficient spark traps is an obvious precaution, but indirect heating of the air used for drying, with heaters placed at some distance from the air intake, should be adopted where possible. Operators should try to keep filters and spark traps clear, and flammable materials should not be allowed to accumulate near air intakes.

Precautions against fires connected with the use of fuel oil are simply those generally required when handling liquid fuels - avoidance of spillage, removal of spilt oil or oily materials from the neighbourhood of burners, and storage of fuel at a safe distance from burners.

The nature of the process makes it essential that normal rules of "good housekeeping" should be strictly observed where grass driers are in use. No unnecessary quantities of flammable materials (hay, dried grass, fuel, etc.) should be stored near the heating apparatus, and accumulations of grass dust, hay and similar materials should (as far as possible) be prevented in order to reduce the risk of rapid spread of fire. An adequate supply of extinguishers should be available so that small outbreaks of fire may be tackled promptly.

TABLE 1.

Location of fires connected with the process of grass drying

Reports of fires attended by Fire Brigades in Great Britain  
during the years 1949-1951.

County	No. of fires in 1949	No. of fires in 1950	No. of fires in 1951	Total No. of fires 1949-1951
<u>ENGLAND and WALES</u>				
Anglesey	-	-	2	2
Bedfordshire	-	-	1	1
Berkshire	-	1	1	2
Buckinghamshire	-	1	1	2
Cambridgeshire	-	-	1	1
Carmarthenshire and Cardiganshire	-	-	1	1
Caernarvonshire	-	-	1	1
Cheshire	3	2	3	8
Cornwall	-	-	1	1
Cumberland	1	1	2	4
Denbigh and Montgomery	-	1	-	1
Derbyshire	2	1	-	3
Devonshire	-	1	4	5
Dorsetshire	-	-	1	1
Fly, Isle of	2	-	-	2
Essex	-	1	1	2
Flintshire	-	2	-	2
Glamorganshire	-	1	-	1
Gloucestershire	2	-	2	4
Hampshire	2	-	-	2
Herefordshire	1	-	1	2
Hertfordshire	-	1	2	3
Kent	1	3	1	5
Lancashire	8	1	3	12
Leicestershire and Rutland	1	2	3	6
Lincolnshire	-	6	3	9
Monmouthshire	-	-	1	1
Norfolk	1	3	7	11
Northamptonshire	1	8	2	11
Northumberland	1	2	2	5
Nottinghamshire	2	2	3	7
Oxfordshire	-	1	-	1
Pembrokeshire	-	2	-	2
Shropshire	4	8	2	14
Somerset	2	2	4	8
Staffordshire	-	1	3	4
Suffolk	-	1	2	3
Surrey	-	1	1	2
Sussex	2	3	4	9
Warwickshire	-	1	1	2
Wiltshire	7	3	5	15
Worcestershire	1	1	5	7
Yorkshire	5	4	4	13
Total fires in England and Wales	48	68	81	197
<u>SCOTLAND</u>				
Aberdeen	-	1	2	3
Ayr	2	-	-	2
Fife	-	1	-	1
Forfarshire	-	-	1	1
Kircudbright	1	-	-	1
Perthshire	-	-	1	1
Total fires in Scotland	3	2	4	9
Total No. of fires in Great Britain	51	70	85	206

TABLE 2

Month of Occurrence of Fires Connected with the Process of  
grass drying.

Reports of fires attended by Fire Brigades in Great Britain during the years 1949-1951.

	Year	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total No. of Fires
England and Wales	1949	-	-	-	-	9	7	11	7	7	6	1	-	48
	1950	-	-	-	1	18	18	10	9	4	4	4	-	68
	1951	1	-	-	2	3	22	23	9	9	7	4	1	81
Scotland	1949	-	-	-	-	2	-	-	-	1	-	-	-	3
	1950	-	-	-	-	-	-	2	-	-	-	-	-	2
	1951	-	-	-	-	-	-	1	2	-	1	-	-	4
	Totals	1	-	-	3	32	47	47	27	21	18	9	1	206

TABLE 3a

Causes of fires occurring in buildings and directly connected with grass drying plant.

Reports of fires attended by Fire Brigades in Great Britain during 1951.

Supposed cause of fire	No. of incidents	Wt. of grass damaged (Tons)	No. of incidents in which damage occurred to plant	No. of incidents in which damage occurred to building
<b>1. <u>Flames and sparks from heater</u></b>				
Sparks from furnace drawn into plant and ignited grass inside	5	1.75	2	1
Sparks from furnace ignited grass nearby	3	4.25	-	-
Spark from chimney of grass drier ignited dust on roof	1	-	-	-
Spark from boiler ignited grass in conveyor	1	5.00	-	-
Flame of burners in oil heated drying oven ignited grass	1	2.0	1	-
Grass accumulated on end of conveyor belt fell on to burner flames	1	-	-	-
Total	12	13.00	3	1
<b>2. <u>Overheating of plant</u></b>				
Friction in fan chamber, grass ignited and passed back into drier	1	0.25	1	-
Grass lodged in drying chamber for some time became overheated and ignited	4	-	3	-
Residue from conveyor belts overheating in drying chamber	1	-	1	-
Blockage in plant; caused overheating and ignition	1	-	-	-
Thermostat failing to operate at required temperature; caused ignition of drying grass	1	0.25	-	-
Oil jets in drying oven turned too high; oven plates became over hot and ignited dried grass	1	1.00	1	-
Small foreign body overheated in drying oven became bogged and ignited contents of bag	1	9.00	-	1
Overheated piece of metal taken into grinding machine ignited grass meal	1	7.00	-	1
Overheating of plant ignited dust on exterior of plant	2	-	1	2
Overheating of grass in drying machine due to unknown cause	13	1.8	6	2
Total	26	19.3	13	6

TABLE 3a (cont.)

Supposed cause of fire	No. of incidents	Wt. of grass damaged (Tons)	No. of incidents in which damage occurred to plant	No. of incidents in which damage occurred to building
<b>3. Sparks caused by foreign matter or mechanical means</b>				
Spark from grass hammermill ignited grass dust in dust extractor	1	-	-	-
Spark from conveyor chain caused by stone lodging in chain ignited dried grass	1	25.00	1	1
Spark from brush gear of electric motor ignited grass dust nearby	1	0.25	1	-
Spark from foreign body in grinding mill ignited grass in drier	1	5.00	1	-
	1	-	-	-
Total	5	30.25	3	1
<b>4. Cause connected with the fuel oil</b>				
Ignited globules of fuel oil drawn into plant and ignited grass	1	-	-	-
Excess oil ignited in drying furnace	2	-	1	1
Fuel oil ignited; by coke brazier	1	-	1	-
by unknown cause	1	-	1	-
Waste oil on ground ignited by burning carbon from oil burner	1	-	1	-
Accumulated oil vapours ignited by flash back from oil burner	1	-	-	1
Flash back from oil burners ignited grass in drier	1	-	1	1
Total	8	-	5	3
<b>5. Miscellaneous and unknown</b>				
Heat from small petrol engine ignited dried grass	1	0.75	-	1
Backfire from engine ignited grass in drier	1	Unknown	1	-
Electrical short circuit of power to drier ignited dried grass	1	150.00	-	1
Heat from grass drying plant set fire to peatland under base	1	-	1	-
Unknown	9	343.50	6	4
Total	13	494.25	8	6
Total of fires in buildings	64			

TABLE 3b

Causes of fires, other than those in buildings, directly connected with grass drying plant.

Reports of fires attended by Fire Brigades in Great Britain during 1951.

Supposed cause of fire	No. of incidents	Wt. of grass damaged (Tons)	No. of incidents in which damage occurred to plant	No. of incidents in which damage occurred to building
<b>1. <u>Flames and sparks from heater</u></b>				
Hay in drying process ignited by spark from drying machine	1	3.00	1	-
Spark from furnace passed through spark trap and ignited grass in drier	1	0.25	1	-
Total	2	3.25	2	-
<b>2. <u>Overheating of the plant</u></b>				
Accumulation of waste under conveyor belt; ignition occurred	1	-	-	-
Carbon deposit inside drier; carbon became overheated and ignited	1	Unknown	1	-
Overheating of oil burners ignited pieces of grass in the machine. These passed out and were blown under stationary diesel engine setting fire to oil-soaked grass, engine and tyres.	1	-	1	-
Overheating due to unknown cause	4	0.10	2	-
Total	7	0.10	4	-
<b>3. <u>Cause connected with fuel oil</u></b>				
Surplus oil from feed pipe caused by grass drier stopping temporarily; ignited by naked light	1	Unknown	1	-
Back flash from oil burner ignited grass in drier	1	0.50	1	-
Total	2	0.50	2	-



TABLE 3b (cont.)

Supposed cause of fire	No. of incidents	Wt. of grass damaged (Tons)	No. of incidents in which damage occurred to plant	No. of incidents in which damage occurred to building
4. <u>Miscellaneous and unknown</u>				
Dust in flue of drying plant ignited by flame from oil burner in heating box	1	-	-	-
Unknown substance drawn into dust extractor set fire to contents	1	-	-	-
Heat from grass drying plant set fire to peatland under concrete base	1	-	-	-
Unknown cause	1	150	-	The fire spread to an outbuilding and caused damage to its structure and contents (farm machinery)
Total	4	150.00	-	-
Total of fires not in buildings	15			

TABLE 4

Causes of fires which were indirectly connected with grass drying plant.

Reports of fires attended by Fire Brigades in Great Britain during 1951.

Supposed cause of fire	No. of incidents	Wt. of grass damaged (Tons)	No. of incidents in which damage occurred to plant	No. of incidents in which damage occurred to building
<u>Fires in buildings</u>				
Spontaneous combustion of grass and grass meal	4	47.00	-	2
Children playing with matches ignited dried grass	1	0.25	-	1
Re-ignition of burnt dried grass left smouldering	1	0.1	-	-
Total of fires in buildings	6	47.35	-	3
<u>Fires not in buildings</u>	-	-	-	-
Total of fires not in buildings	-	-	-	-

TABLE 5

Rates of incidence of fires connected with the process of drying grass  
attended by Fire Brigades in England and Wales  
during 1949, 1950 and 1951

Year	No. of grass-driers in use at beginning of year.	Estimated no. of grass-driers at risk per year.	No. of incidents per 100 driers at risk per year.
1948	319		
1949	491 (estimated)	577	8.3
1950	663	766	8.9
1951	869 (estimated)	972	8.3
1952	1,074		
			Average for 8.5 3 years

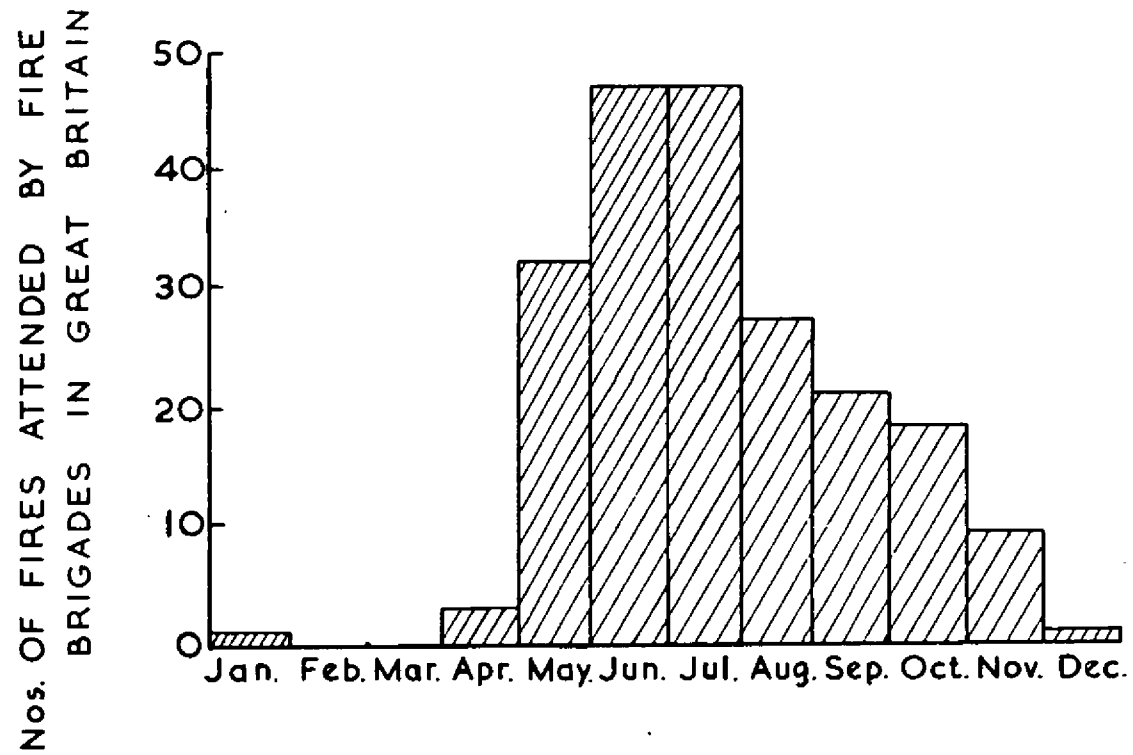


FIG.1. MONTHLY FREQUENCIES OF FIRES CONNECTED WITH THE PROCESS OF GRASS DRYING DURING THE THREE YEARS 1949 - 1951