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## THE PREVENTION OF BURNING ACCIDENTS

A SURVEY OF THE PRESENT POSITION

BY

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Five years ago we presented an analysis of the records of 2,000 patients admitted to the wards of the above burns unit (Colebrook and Colebrook, 1951). It showed briefly: (a) that two-thirds of these accidents had occurred in or about the home and one-third at the place of work; (b) that 50% of the victims were children; (c) that 82% of the deaths resulted from extensive injuries caused by the ignition of the victim's clothing; (d) that women and female children were the chief victims of these clothing burns; (e) that the fabrics most frequently ignited in these accidents were raised cottons (of the flannelette and winceyette type) and rayon, both of which catch fire and propagate flame easily as compared with the closely woven woollen materials chiefly worn by men; (f) that the number of scalds was roughly equal to that of the burns, but they were much less often fatal—nearly all the victims were young children—the upsetting of teapots and other containers of scalding liquids being the most common cause; and (g) it was estimated that the in-patient treatment of burns and scalds in the whole of England and Wales was responsible for a total occupation of hospital beds amounting to about 875,000 bed-days; and that the money cost (based in 1947 on an average of 30s. a day per in-patient) amounted to possibly £1,312,000 per annum.

These findings suggested that the better guarding of coal, gas, and electric fires in homes was urgently required, and should be stimulated by Government action; that the development of safer clothing materials, especially for children, should be the object of further research; and that the severity of a high proportion of scalds might be greatly reduced if attention was paid to the better design of teapots.

In this paper it is our object to show how far these aims have been achieved; to review the national records of deaths from burning accidents, and also a further series of 1,639 cases admitted to the Birmingham Burns Unit since 1951; and, finally, to discuss what preventive steps are still required.

### ACHIEVEMENT OF AIMS

#### 1. Progress in Guarding of Fires

##### (a) Gas, Electric, and Oil-burning Space Heaters

The Heating Appliances (Fireguards) Act (1952), with its Regulations dated March 24, 1953, took effect on October 1,

1954, after a twelve-months period in which stocks of unguarded fires manufactured before October 1, 1953, could be disposed of. There is little doubt that this Act will greatly diminish the future risk of clothing burns in the home; though there is still danger that if the wire mesh of the guard is made to the full size permitted by the Regulations (and perhaps becomes slightly stretched in use) it will allow a small child's hand to pass through and touch the elements of the fire.

A much more serious consideration is that the very many gas and electric fires already in use before 1954 can continue to be used for years without any guards, and will presumably cause accidents as before. It is estimated that there are between four and five million of these in homes, offices, hospitals, doctors' and dentists' waiting-rooms, etc.

Guards which can easily be attached to most types of gas and electric fires have been designed and marketed in the past few years (Colebrook, 1953). We are informed by the two chief makers of such guards that (apart from guards intended for new fires) they have sold only some 73,000 of them—that is, for only 1.5% of the unguarded fires in use. This is partly due to the apathy of the owners of the fires and partly to the fact that the public does not know of the existence of these guards, since the makers have not been able to afford nation-wide advertisement. Two area Gas Boards (perhaps more) have notified consumers that they are prepared to supply and fit a guard to privately owned fires at a cost of 10s.; adding that they are "anxious that all gas-burning appliances should operate with efficiency and safety." If that enlightened policy was adopted by all area Gas and Electricity Boards, and if the guards were displayed for sale in their showrooms, it should greatly assist many of the public who do not know how to obtain these attachable guards.

##### (b) Open Fires (Solid Fuel)

The position has not improved substantially since we last reviewed it. There are perhaps more guards on sale in the shops, but the great majority are unsatisfactory types in that they have to be removed for refuelling, and, since they are not fixed to the fire surround, can easily be removed by a child or knocked aside by a fainting adult or epileptic. Some guards carry a spring hook for attachment to the front of the fire, but it is not always easy to engage the hook if the fire is too fierce or the fire-front is too thick. As a result the guard may often be left standing loose in the hearth.

A few of the more expensive guards carry two hooks correctly positioned to engage with eyelets in the fire-surround; but unless these eyelets are provided when the

house is built they are seldom fitted later. It would be a simple matter for the manufacturer of the fire-surround to drill holes for such eyelets, but most householders will hesitate to do this after the surround has been fitted into place (though suitable drills are now available to the handyman).

Evidently the Minister of Housing in 1949 recognized that the provision of these eyelets was a matter of importance, for in the *Housing Manual* of that year (p. 95) the provision of some fitment to take a fireguard was recommended to all local authorities. But an inquiry recently made, with the co-operation of women's organizations throughout the country, shows that very few local authorities have in fact acted on the Minister's suggestion. The great majority have taken the view that, because there are so many types of fireguard on sale requiring eyelets at different heights from the hearth, it would not be useful to supply a standard fitting. So it has happened that in the 1,700,000 or so council houses built in Great Britain since the 1939-45 war hardly any have been provided with the means of attaching a fireguard to the fire-surround. This small omission—an item costing, we are told, about 6d. a house—has undoubtedly contributed to the loss of many lives.

Some improvement in this unsatisfactory position may be anticipated in the next few years. The British Standards Institution has appointed a committee to draw up specifications for guards intended for open fires, and we

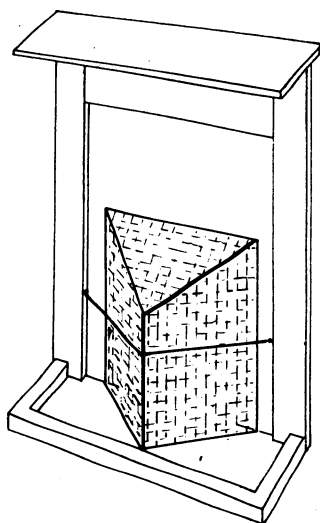


FIG. 1.—Method of attachment of expanding curtain wire to secure older pattern of fireguard.

understand that these are likely to be published shortly. It is hoped that the standard will include specific recommendations for eyelets in the fire-surround corresponding with the fixing arrangements on the guard itself, thereby ensuring fixation when in use. The adoption of these standard specifications, and the provision of eyelets in the fire-surround of council (and other) houses, should result in the rapid replacement by better types of the many unsatisfactory guards at present on sale.

In passing, it may be pointed out that the provision of eyelets would enable many householders who already have one of the older guards to make it safe by holding it to the fire-surround with an expanding curtain-wire stretched from one eyelet to the other (see Fig. 1). For householders who prefer not to drill holes in their fire-surround there is the Braddell guard designed by a member of the Women's Advisory Council on Solid Fuel (Colebrook, 1953). This guard is fitted with two strong spring hooks—one at each side near the top. They go forward to hook up under the chimney breast, holding the guard firmly to the surround. A door in the front enables the mother to refuel the fire without removing the guard. The door can be secured by a strong clip of the dog-lead type.

To encourage the use of the more effective types of guard a few local authorities have begun to rent approved designs to ratepayers, charging about 5s. a year.\* It is to be hoped that this example will spread.

\*Since the above was written we have heard that 1,750 guards have been so rented from the Edinburgh Public Health Department (through the Home Safety Committee of the Accident Prevention Council); and that there is a waiting-list of householders for more guards.

## 2. Progress Towards Safer Clothing for Women and Children

For many years the trend has been chiefly the other way. During the nineteenth century the use of woollen garments (for example, flannel), which did not catch fire and burn easily, gradually gave place to cottons, particularly those with a raised surface (for example, flannelette and winceyette), which are much more combustible. The wide adoption of these latter materials for nightwear for children and elderly women brought a very serious new hazard into the home. Evidence was given to the Home Office "Flannelette Committee" of 1908 to the effect that the number of burning accidents to children under 5 had increased by no less than 62% since the introduction of flannelette from the Continent some 30 years before (Colebrook and Colebrook, 1949).

During the present century other clothing hazards have arisen. Artificial silks (rayons), which are also readily ignited, have largely replaced natural silk, which is almost incombustible. New technical developments have favoured the production of highly flammable lacquered nets and loosely woven fabrics. Some of the finishing processes, designed to increase the attractiveness of the various fabrics, have also added to their danger. For example, a hazardous new material has recently appeared in our shops. It seems to be composed of waste fibres of any kind, bonded together with latex. It is being advertised as suitable for stand-out petticoats to wear beneath long or full skirts. But should a petticoat of this bonded material touch an unguarded fire, or even a lighted cigarette-end thrown down, it is unlikely that the wearer of the garment would escape without extensive, possibly fatal, burns.

This type of fabric was originally imported from the Continent. The attention of the Home Office was quickly called to its potential danger. We were informed that no legislation exists to prohibit the import, manufacture, or sale of any textile, no matter how serious a hazard it may obviously be. Nor does legislation exist to ensure that a warning of the danger is given to the purchaser of such a material. The fabric in question is now being manufactured in this country.

However, along with these increasing dangers there have also lately been signs of increased awareness of them. The late war brought home to many that the flammability or otherwise of soldiers' clothing could be of great importance, and much attention has been paid to this consideration since the war ended. In the U.S.A. public opinion was rudely shocked a few years ago by the death of three children whose cowboy suits of highly flammable brushed rayon caught alight while they were playing round a bonfire. (Incidentally, the litigation resulting from this incident involved those concerning in marketing the rayon in very heavy financial loss.) In order to prohibit the commercial exploitation of such highly dangerous fabrics a Federal Law was passed in 1954 to ban the importation, and transport across State frontiers, of clothing materials which do not pass the flammability test devised by the American Association of Textile Chemists and Colourists (see below). In New Zealand, too, public opinion was shocked by the death of a well-known physician's wife, whose ball dress of lacquered net touched an unguarded electric fire. Steps were taken almost at once to prohibit the importation and sale of all materials finished with this cellulose-nitrate lacquer.

In England there have been many signs of growing public concern. Coroners have repeatedly called attention to the danger of children's flannelette and winceyette garments. Studies made in Birmingham (Colebrook and Colebrook, 1949, 1951) during the years 1945-50 revealed that the ignition of clothing, resulting in extensive burns, is by far the commonest cause of death in this type of accident. This fact (and the danger of unguarded fires) has been repeatedly stressed in the lay and medical press, radio, and television, by women's organizations and Home Accident Committees, by the Interdepartmental Committee of the Home Office, the Royal Society for the Prevention of Accidents, and the

Fire Services. Though no administrative action has so far been taken, the textile manufacturers of this country have recognized the importance of the matter, and have brought it to the notice of the industry through their trade journals (see References). And within the last few years several large firms, both here and in America, have been actively engaged on the production of safer fabrics, with considerable success.

These developments have been along two distinct lines. First, man-made yarns have been produced which are inherently safe—that is, they are of such low flammability as to make their accidental ignition unlikely. Nylon and terylene are in this category. They will burn if exposed to great heat, but with a short exposure to moderate heat (such as occurs in the majority of burning accidents) the heated portion melts and drops away like molten sealing-wax. This melted fabric can, of course, produce a small, deep, and painful burn, but it is unlikely to cause an extensive serious injury. However, it should again be pointed out that, while these fibres, together with wool and natural silk, are relatively safe, *the fabrics produced from them may not be*, because in some cases finishing processes may be applied which confer a high degree of flammability. Women shoppers have as a rule no means of knowing whether or not such a finish has been used. Happily, one well-known firm has recently taken the initiative in advertising one of its products (a nylon net) as non-flammable. This net appears to be extremely safe, and it is to be hoped that women will buy it in preference to nets not so guaranteed. (It is no more expensive than flammable nets of the same quality.) “Dynel,” another man-made material, has great future possibilities as an alternative to flannelette and winceyette for children’s wear. It is described as a staple fibre spun from a copolymer of acrylonitrile and vinyl chloride, and it can be “raised.” In addition to its extremely low flammability, this material has many other admirable qualities. Unfortunately, although it has been exhibited in this country, it has not yet been possible to market it at an economic price.

Secondly, several of the materials in common use which burn easily (for example, cotton and viscose rayon) can now be rendered relatively flame-resistant by two distinct chemical processes. Both these processes were originally developed in the U.S.A., but their application to “raised” materials seems to have been perfected in this country. With both, the proofing processes withstand repeated launderings, and the proofed fabrics retain most or all of their desirable qualities.

In one of these processes (“Erifon”) the yarn is treated with salts of antimony and titanium. In the other, the fabric is treated with a tetrakis-hydroxymethyl phosphonium compound and an amino-formaldehyde resin precondensate (T.H.P.C.). Both of these methods greatly reduce the flammability of the fabrics. In the case of Erifon-treated material exposed to flame there is some afterglow, but this is unlikely to give rise to serious burns.

#### Possible Toxic Hazards

Any textile which has been flame-proofed must also be free from toxic hazard before it can be recommended for use in clothing. Two types of toxicity need to be considered. First, the proofed textile must not damage the skin by causing a dermatitis. Knowledge of the ingredients used will help in assessing such a risk, but since many of the eligible chemicals may not otherwise be kept in contact with the skin a field trial may be required, and in view of the great individual variation in response the tests must be made on large numbers of persons. Successful trials of this type, in which pieces of fabric have been tested on the skin of large numbers of volunteers, have been made with both the Erifon and T.H.P.C. processed material.

The other important type of toxic hazard is that from ingestion. This might not seem a real danger, but some children are apt to suck their clothing, and the possibility of poisoning must therefore be considered. A reasonable standard would be that chewing of a nightdress should not

release a toxic amount of chemical. The question arises in practice where antimony is an ingredient of the flame-proofing process. Experiments show that some antimony may be released from the fabric by chewing, but it seems that the possible amounts are very unlikely to cause toxic effects. As vomiting is the usual immediate effect of acute oral antimony poisoning there is a further safeguard against serious harm.

#### Protection From Spurious Claims of Fire-resistance

The public is protected from such spurious claims by an existing law. Under the Fabrics (Misdescription) Act (1913) it is illegal to offer for sale as non-flammable any textile material, either in the piece or as made-up garments, which does not conform to a standard of non-flammability laid down by State Regulations which came into force on January 1, 1914 (see below).

#### Assessment of the Flammability Risk of Clothing Materials

In our last report we referred to the need for precise methods which would permit the grading of fabrics in terms of relative flammability, and would also facilitate the testing of methods put forward for flame-proofing. The past five years have seen substantial progress in that direction. The legal adoption of the flammability test devised by the American Association of Textile Chemists and Colourists has been mentioned earlier in this report. The test itself is as follows: A strip of the material to be examined is stretched on a frame at an angle of 45 degrees and a very small butane gas flame is made to impinge *downwards* on the material for *one second*. If the material ignites, and the flame travels far enough to burn through a thread a few inches away within  $3\frac{1}{2}$  seconds, the material is then rated as unduly dangerous.

In effect, the conditions of this test are such as to proscribe as dangerous only a few materials of quite exceptional flammability—brushed rayons, some loosely woven nets, and some lace fabrics. Most of the materials commonly associated with serious burning accidents (both in the United States and in Great Britain), such as flannelette, winceyette, and unbrushed rayon, will either fail to ignite or the flame will take more than the standard  $3\frac{1}{2}$  seconds to reach the thread. Such materials are therefore rated as “safe.” So it seems probable that this test can have little, if any, effect in reducing the number of ordinary clothing-burn accidents in the United States—or in this country if the American test was adopted here.

In England the assessment of flammability is being studied in the laboratories of the Fire Research Board, and two promising methods have been described by Lawson, Webster, and Gregsten (1955):

*Vertical Flame Speed Test.*—For this, a strip of material is suspended vertically from a torsion balance, and the loss of weight as it burns is registered photographically on a rotating drum.

*The Semicircular Test.*—For this, a strip of the material under examination,  $1\frac{1}{2}$  by 21 in. (3.8 by 53 cm.), is stretched over an arc-shaped metal frame and ignited at one end by burning off 0.1 ml. of absolute alcohol. The length of material burnt and the time taken are combined in an index of flammability which correlates well with the results of the more elaborate vertical flame speed test.

The latter test has recently been adopted by the British Standards Institution as the Standard Flammability Test for Thin Flexible Materials (B.S.I. 476, Part 2: 1955). It would appear that this test—and the calculation of merit obtained from it—are applicable to the grading of most textile fabrics in terms of flammability; and that its use for this purpose would have considerable advantages over the American procedure. Doubtless, too, our textile manufacturers would be glad to see this reasonable and practical test replace the standard test laid down by Regulations made under the Fabrics (Misdescription) Act (1913) as follows:

“A sample of the fabric measuring not less than one square yard shall be taken, and after it has been four times in succession thoroughly washed with soap and water, dried and ironed, shall

be suspended vertically without folds or creases and so that the lower edge shall not be a selvedge or a folded edge. The flame of a wax taper not less than 1/8 inch or more than 3/16 inch in thickness shall then be brought in contact with the fabric at its lower edge and shall be kept in contact for not less than twelve or more than fifteen seconds."

For the purposes of the above Act a fabric is held to conform to the standard of non-flammability if, when tested as described, "it is not set alight, or, if set alight, burns without a flame, or with a flame which does not spread but converges and dies out."

## SURVEY OF BURNING ACCIDENTS IN RECENT YEARS

### National Records (Fatal Cases Only)

The Registrar-General's latest return of deaths (1954), with those of the previous eight post-war years, are set out in Table I.

TABLE I.—Deaths from Burning Accidents in England and Wales (Including Conflagrations)

Year	Age Groups								All Ages
	0-4		5-14		15-64		65 and Over		
	Burns	Scalds	Burns	Scalds	Burns	Scalds	Burns	Scalds	
1946	107	127	88	6	183	16	398	21	946
1947	111	98	81	1	187	11	429	25	943
1948	84	112	48	6	127	22	250	21	670
1949	90	100	35	4	158	10	275	25	697
1950	71	75	45	2	208*	30	302	45	778*
1951	81	71	63	2	240	21	367	43	888
1952	87	56	67	2	150	22	321	46	751
1953	50	56	52	2	171	25	306	41	703
1954	70	36	52	4	162	29	374	54	781
Totals	751	731	531	29	1,586	186	3,022	321	7,157

\* These figures include 80 deaths of miners in a colliery disaster, which were registered in 1952 and included in that year's Review by the Registrar-General. The disaster occurred in 1950.

Allowing for fortuitous variations from year to year, these data show no striking change in the nine years. There was a surprising fall in the total death rate for 1948 and 1949, reflected chiefly in that of the oldest age group. We know of no explanation for this, unless it was that many institutions for old people paid more attention to the guarding of

their fires after the publication of data showing the large number of accidents associated with them (Colebrook, 1946). Table I also suggests a small decline in the scalding accidents of the 0-4 age group, and a rise in the same injuries in the past five years among elderly people.

While this failure to achieve a marked reduction in the death rate is disappointing at first sight, on reflection it is not at all surprising. For there has been little progress up till now in the guarding of the open coal-fire—the largest single factor in producing these accidents. And the Fireguards Act, which covers other heating appliances, came into operation only on October 1, 1954. Although many new fires had guards fitted by the manufacturers some months before that date, it may be taken as certain that the number of such new guarded fires actually in use before the end of 1954 was very small in comparison with the great number of unguarded old models still in use. Indeed, there is reason to fear that this disparity in numbers between the new guarded and the old unguarded fires will only gradually diminish during the next few years.

It is evident that we have a long way to go in this matter before a substantial reduction in the number of accidents can be expected. A useful step was taken when the Children and Young Persons Act of 1908, which made parents and guardians liable to a fine if a child of 7 or under was seriously injured or died from burns caused by an unguarded "firegrate," was amended in 1952 to cover children up to 12 years of age and "any heating appliance liable to cause injury to a person by contact therewith." The Fireguards Act (1952) was a further and more effective step, since it can be legally enforced. (In the case of the first-mentioned Act the police are usually reluctant to prosecute parents already suffering for their carelessness.) The adoption of a B.S.I. standard for guards for open fires, with means of attaching them to the fire-surround, will be a third step forward.

### Birmingham Figures—Non-fatal and Fatal Cases

During the period from January, 1951, to July, 1955, 1,639 patients injured at home or at their place of work have been admitted to the Birmingham Burns Unit. Thirteen others who were burned in transport accidents have been excluded from this survey. We have studied the case records of these 1,639 patients to determine whether there

TABLE II.—Distribution of Home Burns in Relation to Nature of Accident (Deaths Shown in Parentheses)

	Age Groups and Sex										Total	Case Mortality Rate (%)	Stay in Hospital (Days)	
	0-4		5-14		15-64		65 and Over		All Ages					
	M	F	M	F	M	F	M	F	M	F				
Direct or indirect contact with domestic fire:														
Coal { Unguarded ..	9	29 (3)	9 (1)	40 (7)	22 (2)	28 (3)	12 (5)	21 (10)	52 (8)	118 (23)	170 (31)			
Coal { Guarded ..	3	5 (2)	—	5 (1)	1	1	1 (1)	1 (1)	5 (1)	12 (4)	17 (5)			
Coal { Not known ..	7 (1)	13	4	7	2	9 (4)	—	3 (2)	13 (1)	32 (6)	45 (7)			
Electric { Unguarded ..	12 (1)	13 (1)	7 (1)	26 (4)	5 (1)	11 (1)	1	8 (5)	25 (3)	58 (11)	83 (14)			
Electric { Guarded ..	—	—	—	2	—	—	—	—	—	2	2			
Gas { Unguarded ..	3	9 (1)	6	4 (3)	—	3	3 (1)	3 (3)	12 (1)	19 (7)	31 (8)			
Gas { Guarded ..	—	—	1	1	—	—	—	—	1	1	2			
Type of fire not known ..	—	2	—	—	—	—	—	—	—	2	2			
Total ..	34 (2)	71 (7)	27 (2)	85 (15)	30 (3)	52 (8)	17 (7)	36 (21)	108 (14)	244 (51)	352 (65)	18.5	15,208 (average 43.2)	
Principal other causes:														
Flammable liquids ..	2	4 (1)	22	2	29	6 (2)	2	2	55	14 (3)	69 (3)			
Outside fires (bonfires, ashpits, fireworks, etc.)	4	2	19	4	3	—	1 (1)	—	27 (1)	6	33 (1)			
Electrical burns ..	1	2	3	1	1	2	—	—	5	6	11			
Hot fat ..	11	4	3	3	1	6	—	1	15	14	29			
Fall against hot metal or ashes ..	10	3	2	1	5	5	—	—	17	9	26			
Gas oven (used to warm room) ..	3 (1)	8	7	2 (2)	—	1	—	2 (1)	10 (1)	13 (3)	23 (4)			
Houses on fire ..	2	—	—	—	—	1	2 (1)	1 (1)	4 (1)	2 (1)	6 (2)			
Miscellaneous (matches, poker, hot-water bottle, candle, etc.) ..	22 (1)	28 (1)	16 (1)	21 (1)	12	23 (1)	10 (3)	20 (11)	60 (5)	92 (14)	152 (19)			
Total ..	55 (2)	51 (2)	72 (1)	34 (3)	51	44 (3)	15 (5)	27 (13)	193 (8)	156 (21)	349 (29)	8.3	10,339 (average 29.6)	
Grand total ..	89 (4)	122 (9)	99 (3)	119 (18)	81 (3)	96 (11)	32 (12)	63 (34)	301 (22)	400 (72)	701 (94)	13.4	25,547 (average 36.4)	

has been any striking change in the nature of the accidents, or in their post-admission picture. The series comprises :

Home burns ..	701	} 70% of total	Industrial burns ..	427	} 30% of total
„ scalds ..	496		„ scalds ..	15	
Total	1,197		Total	442	

The industrial group will form the subject of a separate report.

**The 701 Home Burns**

The distribution of these patients by age, sex, and the nature of their accidents is shown in Table II. It is seen that : (a) Contact, direct or indirect, with an open solid-fuel fire was responsible for the largest number, but in many other cases a gas or electric fire was involved. Together, these heating appliances were associated with 50% of the accidents—as in the series reported in 1951. And, as before, the great majority of the accidents happened when there was no guard on the fire. (b) Of the accidents associated with heating appliances, 32% happened to children aged 5 to 14 (85 girls, 27 boys), as compared with only 15% (36 girls, 19 boys) in the earlier series. The reason for that increase is not clear. It may have been due in part to the fact that in the years 1951-5 there was one exceptionally hard winter (1954-5) and two exceptionally cold wet summers, in which fires will have been in use more often than usual. But it will be noticed that there is no comparable increase in the national death rate of this age group in Table I.

**Clothing Burns**

The predominant importance of the ignition of clothing has again been the outstanding feature of these accidents, as shown in Table III. Four of every five deaths from burns have resulted from the injury inflicted by burning clothing, as in the 1945-50 series (82% in each case). The incidence of this kind of burning accident in relation to all burning accidents seems to have increased—from 36% in the earlier series to 50% in the present series. Part of this apparent increase may have been due to the fact that accumulation of severe cases has led to difficulty in admitting some less severe ones.

The increase has been decidedly greater among the females (46% to 64%) than among the males (26% to 31%). The

case mortality has also risen among the females, especially those of the 5 to 14 age group (from 10% to 18%). It is noteworthy, too, that of all the girls in this age group who were burned by contact with a heating appliance the clothing was set alight and caused the injury in no less than 82% of cases.

The importance of design of garments is again brought out in a striking fashion by the data of Table IV. In considering these data it seems legitimate to leave out of account the 149 accidents listed under "clothing," since the information about these was inadequate. When that is done it will be seen that nightdresses—that is, loose, flowing garments—were associated with 48% of the remaining 203 accidents—and female dresses with a further 36%; those associated with pyjamas were only 4%.

It will be noticed, too, that 84 children were treated for burns due to the ignition of nightdresses (with 14 deaths), as compared with 6 due to the ignition of pyjamas (with 1 death). (We do not know what proportion of the child population wear nightdresses and pyjamas respectively, but it seems unlikely that the former are 14 times the latter.)

**The 496 Home Scalds**

Although the proportion of scalds admitted is a little lower than in the 1945-50 series, that does not imply any significant reduction in the number of these accidents in and around Birmingham. Owing to the pressure on the beds, it has sometimes been necessary to give priority to more severely injured patients suffering from burns.

The distribution by age and sex and the nature of the accident is shown in Table V. It is seen that, as in the 1945-50 series, children have been the victims of scalding in more than 80% of the total incidents, and boys rather more often than girls. The 0-4 age group has been chiefly affected. The overall mortality has risen, as in the burns (from 0.07% to 2.4%).

**The Occupancy of Hospital Beds**

The in-patient treatment of the 1,639 patients during the four and a half years reviewed has entailed an occupation of beds amounting to 48,009 days—that is, just under 30

TABLE III.—Proportion and Distribution of Cases in Which Clothing Caught Fire (Deaths Shown in Parentheses)

	Age Groups and Sex										Total	Case Mortality Rate (%)	Stay in Hospital (Days)
	0-4		5-14		15-64		65 and Over		All Ages				
	M	F	M	F	M	F	M	F	M	F			
All home burns ..	89 (4)	122 (9)	99 (3)	119 (18)	81 (3)	96 (11)	32 (12)	63 (34)	301 (22)	400 (72)	701 (94)	13.4	25,547 (average 36.4)
Home burns in which clothing caught fire:													
Fire unguarded ..	10	33 (4)	15 (2)	55 (13)	6 (2)	31 (8)	2 (2)	20 (15)	33 (6)	139 (40)	172 (46)		
Fire said to be guarded*	—	8 (3)	1	16 (2)	—	—	—	—	1	24 (5)	25 (5)		
Not specified ..	1	4	1	5	—	—	—	—	2	9	11		
Other causes†	13 (1)	31 (2)	17 (1)	25 (3)	21	14 (3)	7 (4)	16 (13)	58 (6)	86 (21)	144 (27)		
Total ..	24 (1)	76 (9)	34 (3)	101 (18)	27 (2)	45 (11)	9 (6)	36 (28)	94 (12)	258 (66)	352 (78)	22.2	16,457 (average 47)

\* In 11 instances the guard was removed by the child.  
 † These included: flammable liquids 19 (2); fires outside the house, 11 (1); gas ovens used to warm room, 20 (3); gas cookers, 7 (1); houses on fire, 2 (2); spark from open fire, 6; cigarettes, 3; matches, 14 (2); explosion, 4 (1); candle, 4 (2); burning paper, 14 (2); electric ring, 1; primus stove, 3; miscellaneous and cause not known, 17 (2).

TABLE IV.—Garments Ignited in 352 Clothing Burns (Deaths Shown in Parentheses)

	Age Groups								All Ages
	0-4		5-14		15-64		65 and Over		
	M	F	M	F	M	F	M	F	
Nightdress ..	9 (1)	30 (4)	2	43 (9)	—	8 (3)	—	7 (6)	99 (23)
Pyjamas ..	2	1	2 (1)	1	2	—	—	8 (1)	8 (1)
Dress ..	—	15 (1)	1	34 (7)	—	17 (1)	—	5 (3)	72 (12)
Shirt ..	—	—	11 (1)	—	4 (1)	—	1	—	16 (2)
Dressing-gown ..	—	2	3	—	—	—	—	1	8
Clothing*	13	28 (4)	15 (1)	23 (2)	21 (1)	18 (7)	8 (6)	23 (19)	149 (40)
Total ..	24 (1)	76 (9)	34 (3)	101 (18)	27 (2)	45 (11)	9 (6)	36 (28)	352 (78)

\* In the cases included under Clothing the records did not give precise information (sometimes it was unobtainable) as to which garment was the first to be ignited.

TABLE V.—Distribution of Home Scalds in Relation to the Nature of the Accident (Deaths Shown in Parentheses)

	Age Groups and Sex										Total	Case Mortality Rate (%)	Stay in Hospital (Days)
	0-4		5-14		15-64		65 and Over		All Ages				
	M	F	M	F	M	F	M	F	M	F			
Tea pulled or knocked over by patient . . . . .	49 (1)	34	4	—	—	7	—	1	53 (1)	42	95 (1)		
Containers of other scalding liquids pulled or knocked over by patient . . . . .	61	45	22	8	11	12	2	11 (1)	96	76 (1)	172 (1)		
Baths, etc., left on floor . . . . .	40 (1)	24 (4)	3	6	—	—	—	—	43 (1)	30 (4)	73 (5)		
Other causes . . . . .	47 (2)	39	20	13	9 (1)	24	2	2 (1)	78 (3)	78 (1)	156 (4)		
Total . . . . .	197 (4)	142 (4)	49	27	20 (1)	43	4	14 (2)	270 (5)	226 (6)	496 (11)	2.4	11,237 (average 22.6)

days per patient. To this total the clothing burns contributed 16,457 days. The average stay of the non-fatal cases in this category was 56 days.

### Personal Cost of Severe Burns

Extensive burns often involve some of the limb flexures, and perhaps also the hands, face, and neck. Contractures are likely in all these sites, even with the best treatment, and a number of subsequent admissions to hospital are then necessary to correct the skin shortage with further plastic surgery procedures.

A 7-year-old girl, for example, who received a 55% burn of her trunk and all limbs 15 months ago has already had 12 grafting operations, the last four being for contractures of the groins and axillae. She will require about 10 further operations between now and puberty to correct the contractures which are still present on the front and sides of her neck, at both elbows and axillae, and over the breasts. During the past 15 months since her injury she has not been home, as her parents, who live in poor circumstances, feel they cannot look after her adequately.

The physical results of non-fatal burns are usually obvious, but the tragic character of the mental suffering is frequently overlooked. Acute fear at the time of the accident may be prolonged for weeks in adults by the fear of disfigurement, disability, or even death, and in children by the fear of separation, insecurity, and pain. Added to this may be feelings of guilt, loneliness, and inferiority. Almost inevitably a severe burn leaves a permanent scar on the patient's life and personality. This may be further accentuated by prolonged absence from school and resulting mental backwardness, or in adults by loss of earning ability or enforced changes of occupation.

## THE PRESENT SITUATION, AND WHAT SHOULD BE DONE ABOUT IT

The above survey shows that, broadly speaking, the situation is nearly the same as it was 10 years ago. In England and Wales we still have over 700 deaths a year from burning accidents (an average of two every day) and a much larger number of non-fatal but serious burns, many of which entail great suffering and many of which will have important adverse effects on the whole life of the victims. It is still true, as the *Lancet* wrote in 1946, that "in the homes of the people we neglect the most elementary precautions against accident, and wantonly permit hazards that would arouse a public scandal in the most primitive factory or workshop." To meet this unsatisfactory situation we think that the following practical measures are required.

### 1. Guarding of Open Solid-fuel Fires

(a) Steps should be taken, as soon as possible after the publication of the forthcoming British Standard Specifications for guards for open solid-fuel fires, to ensure the disappearance from the retail market of the many flimsy unattachable guards now on sale (it is assumed that they will not comply with the new standard). Clear distinction should be made between those guards which are designed only to

protect the hearthrug (spark guards) and those capable of giving a reasonable amount of protection to young children and elderly people (fire guards).

(b) Local authorities should be pressed to hire guards (complying with the standard specifications) to the parents of young children and to old-age pensioners who cannot otherwise afford them. Permission to do this seems to be implicit in the wording of Section 136 of the Local Government Act of 1948, which allows "a local authority in England and Wales, with the consent of the Minister, given either generally or specially, to contribute towards the expenses of any body carrying on activities within the area of that authority, being activities for the purpose of . . . giving advice, information or other assistance to persons resident therein, or otherwise for the benefit of that area or those persons."

(c) Eyelets, to which a guard can be securely attached, should be provided in fire-surrounds in all new local authority houses. Local authorities should also be encouraged to supply these in older council houses when requested. The advantages of, and the methods of fixing, these eyelets, with guidance as to their height from the hearth—probably about 14 in. (36 cm.)—might well be demonstrated on the television and cinema screens. It might be demonstrated at the same time that a length of expanding curtain wire, when stretched round the front of a guard and attached to either eyelet, renders an inefficient guard much more effective (see Fig. 1).

### 2. Guarding of Gas and Electric Fires Bought before October 1, 1954

The attention of the public should be called to the availability of separate guards for gas and electric fires bought by them before 1954. The guards might be demonstrated on television, and should be on display in *all* showrooms of our nationalized gas and electrical industries.

It is true that when these guards are not stocked one will always be ordered for a customer who can give the measurements of his fire. But in practice this means that the would-be purchaser must usually return home to measure his fire—and may put off doing so; must telephone, or go again, to the showroom to give the measurements—and may keep on forgetting to do so; must call after an interval to collect the guard, and may perhaps have to go several times before the guard arrives. It is therefore not surprising if many get no further than the original inquiry.

All this hindrance is unnecessary. The guards have been designed with the pre-1954 fires in mind. They have been made in three or four different sizes, which the makers say will fit nearly all the old models. They can easily be attached to these fires if expanding curtain wire is used. We would suggest that at least all the gas and electricity board showrooms should make a window display of several of the popular pre-1954 fires with the new guards attached to them, and should draw attention to them by suitable advertisement. Thus only a few guards of each size need be stocked at first by any showroom, until the public demand for them can be estimated.



### 3. Minimizing the Risk of Clothing Burns

(a) The fabrics commonly used to-day, and new ones as they appear on the market, should be graded in terms of flammability, and the grading indicated by some mark when they are offered for sale. The buying public will then know what fire hazard is involved in their choice, and wise mothers will come to regard safety from fire as a very desirable quality, just as they now desire that the materials they buy shall be crease-resisting, be pre-shrunk, and shall not lose their dyes on laundering.

(b) It is hoped that the textile industry will apply itself urgently to the task of finding suitable non-flammable processes and finishes to replace the flammable ones now sometimes used; and that special care will be taken to see that when the original fibre is by nature non-flammable it shall not be rendered flammable during the manufacture of the fabric. It is hoped, too, that when all future new textiles are tested in the experimental stage for durability, fastness to light, dye, etc., a test for undue flammability will also be included; and that if some new material is found to be clearly hazardous efforts will be made to reduce the danger. If these efforts fail then we would suggest that the material should not be mass-produced.

(c) Since it is clear that the long, full skirt of the nightdress is in itself a contributory hazard, while the design of pyjamas contributes to safety, perhaps a composite garment could be devised for children, one having the comparative safety of the ankle-fitting trouser-leg without the tedious detail of the ordinary pyjama pattern.

(d) There is now evidence (personal communication to the authors from the independent laboratories carrying out the tests) that both the Erifon and the T.H.P.C.-proofed flannelette and winceyette (see above) can be worn by children without appreciable risk of any undesirable effects on the skin, or toxic effects if the proofed garment should be sucked. These fabrics should therefore be given a thorough trial as soon as possible. If such a trial shows them to be satisfactory on prolonged wearing and repeated launderings, positive steps should be taken to create a large demand for them, in the hope that this will reduce the cost of their production and their retail price. Such a demand could perhaps be created most effectively by simple demonstrations of their non-combustibility in some of the larger retail stores, by wide advertisement, and by the co-operative efforts of women's organizations, radio and television, and the press.

The economic difficulties of marketing these more expensive materials and garments will require special consideration. Many mothers who feel that such a disaster as a serious burning accident must be avoided at all costs will recognize that the extra outlay of a few shillings on a child's nightdress (which should last two years or more) is a valuable form of insurance, and one which will greatly increase their own peace of mind. But probably many more, somewhat more happy-go-lucky and less imaginative, and also others who must count their shillings, will continue to buy the cheaper flammable materials. In that case we would submit that the Government might reasonably consider the merits of a small subsidy to assist the sale of the safer fabrics, offsetting this against the high cost to the National Health Service for the hospital treatment of so many seriously burned patients. It is anticipated that such a subsidy might be needed only to "prime the pump."

### PREVENTING SCALDS

Because scalds have a much lower death rate than burns their gravity is often underestimated. A severe scald (such as that shown in Fig. 2) is by no means uncommon, and may mean the occupation of a hospital bed for three months or more, while the victim may remain scarred for life. This emphasizes the importance of warnings and suggestions by maternity nurses, health visitors, doctors, and friends, and the value of films such as the Ministry of Health's *Playing with Fire*. Fresh films should be made every few years. These films, as well as demonstrations on the television and cinema screens, should be shown to all older children as well as to young wives associations and similar organizations. (For

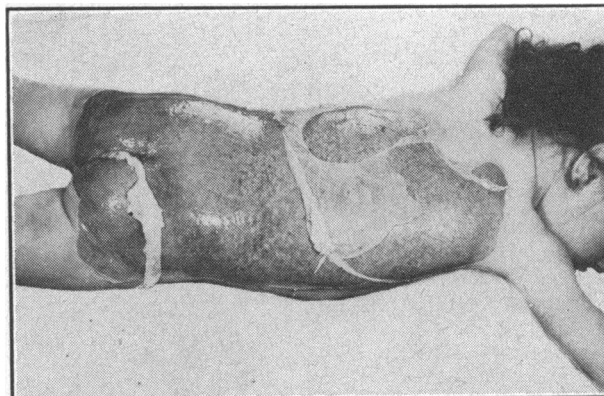


FIG. 2.—A scald of 25% of the body surface. This 2-year-old child tripped and fell into a bucket of hot water.

local propaganda, amateur cinecamera groups might co-operate with their home safety committees.)

There is also urgent need for more thought to be given to safety in the design of household equipment. The most serious scalding hazard in the British home is perhaps the teapot. If this had a lid with two lugs (see Fig. 3) to prevent it from falling out if the teapot were upset many very young children would be saved from most painful injury. The risk of upsetting would also be reduced if teapots were made with a wide base instead of the usual incurved one

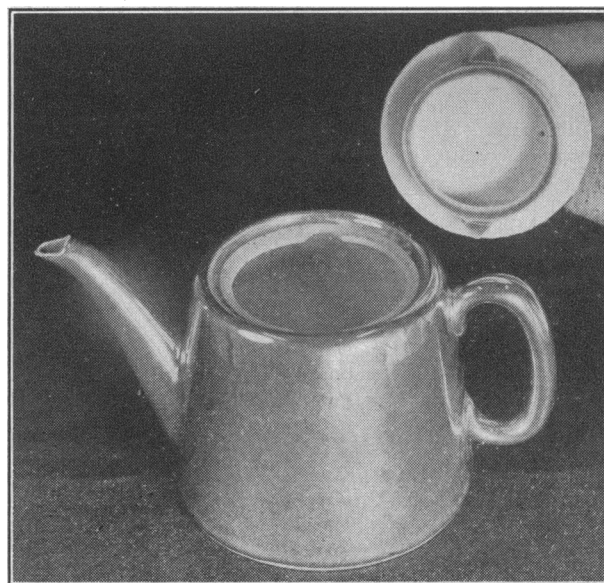


FIG. 3.—Teapot having broad base and double lugs for lid.

(see Fig. 3). Manufacturers should be asked to co-operate in the marketing of such safe types, and mothers should take the initiative in asking for them.

Two gadgets which would help to prevent the upsetting of teapots and other containers of scalding liquids are worthy of consideration. One—which originated in New Zealand,\* where electric hot-water jugs are often put on the tea-table with flex dangling—is shown in Fig. 4. It is essentially a clamp for the table edge, and serves as a double safeguard; it carries two adjustable arms which enclose the teapot, jug, or coffee-pot, so as to prevent it being pulled backwards from the table, and it also prevents the toddler from pulling the tablecloth off. The other gadget consists of a simple plastic base from which two elastic hoops are stretched to hold down the lid of the teapot (see Fig. 5).

### Good and Bad Kitchen Design

Bad kitchen design can create opportunities for scalding accidents. This is obvious in the slum houses in which too many of our citizens still live. But the design of new houses

\*N.Z. Patent No. 91604.



FIG. 4.—Retaining clip for a jug or percolator (or, if suitably modified, a teapot)

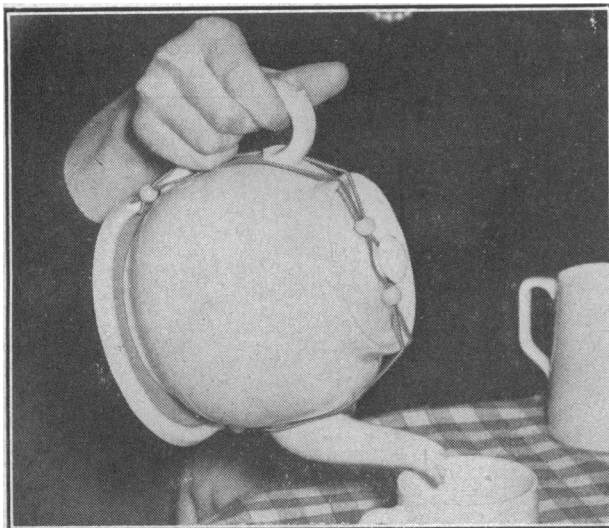


FIG. 5.—Teapot stand with retaining loops for the lid.

also often leaves room for improvement. As a principle, the cooker and sink should be aligned along the same, or at most adjacent, walls. If the sink and cooker are situated on opposite walls then the mother must lift containers of scalding liquid right across the room several times a day, year after year, and it is not practicable to keep children out of the kitchen every time a meal is in preparation. It is hoped that the next edition of the *Housing Manual* will draw attention to the desirability of this precaution.

In the *Housing Manual* of 1949 (para. 214) it is recommended that cookers "should be placed with sufficient free space around them for easy cleaning." But this also enables a child to stand in the space and pull down the handle of saucepans boiling on the stove. We suggest that working surfaces should always be brought right up to each side of the cooker (unless one side goes close to a wall angle). If one of the surfaces—for example, the draining-board—is made removable then the housewife can much more easily clean thoroughly behind the cooker, while the opportunity for this particular scalding accident is limited.

#### SUMMARY

Progress in the guarding of new gas and electric fires and oil-heaters is reported; but also failure to achieve the guarding of the many in use before the Fireguard

Act came into operation on October 1, 1954. It is probable that these unguarded old fires still in use far exceed in number those which have been guarded in the past two years.

The open coal-fire continues to be the most important single factor in burning accidents in the home. Very few local authorities have acted upon the 1949 recommendation of the Minister of Housing that provision should be made in council houses for the fixing of fire-guards so that children cannot easily remove them.

The national record of deaths from burns still stands at about 700 a year in England and Wales. It has declined very little in the past five years, and is not expected to do so until most of the gas and electric fires in use carry efficient guards and the satisfactory guarding of open coal-fires is much more usual. The records of non-fatal as well as fatal burning accidents in Birmingham also show little change, although they suggest that the proportion of clothing burns has considerably increased.

The very serious risk of dangerously flammable clothing fabrics is again emphasized. Children's night-dresses and the garments of elderly women are seen to carry additional risk by reason of their design. The comparative safety of pyjamas is noted. The diminution of the flammability hazard seems, however, to be a little nearer. A recently introduced test for flammability is applicable to the grading of most clothing materials. Satisfactory flame-proofing processes are now available for some of the more dangerous fabrics widely worn by children and elderly women.

It is suggested that the following further steps are now required: (a) Better guarding of the open coal-fire, and provision of eyelets in the surrounds of all new fires to facilitate the fixing of guards. (b) A publicity campaign to encourage the owners of all gas and electric fires bought before 1954 to attach guards to them. (c) With the adoption of a standard test the flammability grading of all fabrics should be required, and this grade should be indicated by an appropriate mark when the fabrics are offered for sale. (d) A test for undue flammability should be undertaken as standard practice in the experimental stages of all future new materials. If any such materials are found to be exceptionally hazardous they should not be mass-produced in this condition. The use of flammable finishes on threads which are by nature flame-resistant should be avoided. (e) Where chemicals known to be dangerous are employed in flame-proofing procedures the possible hazard to the wearer of the garment should be borne in mind, and recognized tests for toxicity should be carried out before the material is put on the market. (f) As soon as satisfactory flame-proofed clothing materials become generally available every effort should be made to encourage their use in place of unproofed fabrics of the same kind. Should it become evident that the higher cost of the safe materials is putting them out of the reach of many parents and old-age pensioners then the case for a Government subsidy (designed to reduce the retail cost) should be pressed.

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