F.R. Note No. 93/1954
Research Programme
Objective F4/4(P)

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION



# THE FIRE HAZARD OF DOMESTIC IRONING-TABLES

by

J. H. McGuire and I. C. Emson

## Summary

The temperature of the wooden surface beneath the iron-rest of various types of ironing-board has been measured for all conditions both of normal use and abuse likely to be encountered in service. A design of iron-rest has been developed which gives a negligible risk of fire in service.

February, 1954.

File No. F.1040/48/3

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## 1) Introduction

Several Fire Prevention Officers have drawn the attention of the Joint Fire Research Organization to the designs of ironing-board available on the British market, with the comment that in many of these the design of the iron-rest is such that there is a risk of ignition of the wood beneath under certain conditions.

To investigate the extent of this fire hazard, various types of ironing-board iron-rest have been constructed and subjected to conditions likely to occur in service. The following paragraphs describe the test conditions and results.

## 2) Controlled 1,000 watt iron: iron stand to B.S. 1959

The ironing-board stand, made to conform to B.S. 1959 : 1953, consisted of a (nominal) $\frac{7}{8}$ inch thick wooden base, one end of which was covered by a $10\frac{3}{4}$ inch x $6\frac{7}{8}$ inch x $\frac{1}{8}$ inch piece of asbestos millboard secured by beading on three sides. A "heat controlled" 1,000 watt iron was placed centrally on the stand, above and below the asbestos millboard of which 28 S.W.G. copper-constantan thermocouples had been placed centrally. The temperature record of the test is given in Table 1. It will be seen that the maximum temperature attained by the top surface of the wood was of the same order as the maximum iron temperature and that there was a delay of only a few minutes in the response of the top surface of the wood to changes in iron temperature.

Table 1

| Time | Temperature of iron | Temperature of wood |
|---|---|---|
| 0 | 19°C | 19°C |
| 15 min. | 225°C | - |
| 30 min. | 233°C | 214°C |
| 1 hr. 30 min. | 234°C | 218°C |
| 2 hr. 30 min. | 235°C | 233°C |
| 5 hr. 00 min. | 240°C | 235°C |
| 7 hr. 30 min. | 238°C | 232°C |

After $7\frac{1}{2}$ hours heating the asbestos millboard was removed. The wood beneath it was severely discoloured but was otherwise intact.

## 3) Uncontrolled 450 watt iron: iron stand to B.S. 1959

The ironing-board stand was constructed as in the previous experiment and the test was carried out in the same manner except that the iron was a 450 watt uncontrolled model, and 26 S.W.G. chromel-alumel thermocouples were used. The temperature record of the test is given in Table 2.

Table 2

| Time | Temperature of iron | Temperature of wood |
|---|---|---|
| 0 | 20°C | 20°C |
| 15 min. | 290°C | 222°C |
| 30 min. | 470°C | 422°C |
| 1 hour | 612°C | 588°C |
| 1½ hours | 636°C | 612°C |
| 2 hours | 647°C | 600°C |
| 4 hours | 647°C | 612°C |
| 6 hours | 624°C | 588°C |

Smoke was emitted from the wood beneath the asbestos millboard and after 35 minutes it was found to be ignitable, although flaming would not persist. After 50 minutes it was found that the smoke would both ignite and continue flaming. The smoke issuing from under the asbestos millboard was almost entirely drawn towards the iron by the convective air stream cooling the iron. Had a fault developed in the iron so as to cause a spark, it is considered that the ironing-board would probably have caught fire. Such a fault cannot be considered unlikely since the base of the iron was red hot and the non-metallic portions of the mains socket were in process of disintegration.

It was not necessary to dismantle the ironing-board stand at the conclusion of the test to determine the maximum depth of charring in the wood as the underside was charred and in one place a hole about ⅝ inch wide had appeared through which the asbestos millboard could be seen.

4) Uncontrolled 450 watt iron: additional protection above iron stand

Ironing-board stands were made in accordance with Figures 1 and 2. They consisted basically of ironing-board stands conforming to B.S. 1959 with, in the first case one, and in the second case two, additional sheets of asbestos wood mounted above and separated by asbestos spacers. In the first case the spacers sealed the three outside edges and in the second case the third side was not completely sealed.

Again a 450 watt uncontrolled iron was used and 26 S.W.G. chromel-alumel thermocouples were mounted upon the topmost asbestos surface and on the upper surface of the wood.

The temperature records of the tests are given in Tables 3 and 4 respectively from which it will be seen that the only difference in behaviour of the two designs was that the temperature rise of the upper surface of the wood was slower with the second design.

Table 3

| Time | Temperature of iron | Temperature of wood |
|---|---|---|
| 0 | 20°C | 20°C |
| 15 min. | 271°C | 89°C |
| 30 min. | 411°C | 216°C |
| 1 hour | 553°C | 392°C |
| 2 hours | 620°C | 458°C |
| 3 hours | 638°C | 463°C |

Table 4

| Time | Temperature of iron | Temperature of wood |
|---|---|---|
| 0 | 20°C | 20°C |
| 15 min. | 290°C | 47°C |
| 30 min. | 450°C | 107°C |
| 1 hour | 588°C | 220°C |
| 1½ hours | 624°C | 290°C |
| 2 hours | 646°C | 410°C |
| 3 hours | 657°C | 457°C |

In both tests smoke was given off but at no time was it in sufficient quantity to be ignitable.

The depths of charring of the two specimens were about ½ inch and ⅝ inch respectively.

5) Uncontrolled 450 watt iron: skeleton wooden frame iron stand

The ironing-board stand was constructed to the design illustrated in Figure 3 using a piece of 3/16 inch asbestos wood under the iron and an air space of 3/16 inch. There was beading along the four sides of the stand and thus the iron could never stand directly over the wooden base of the ironing-board. Three 26 S.W.G. chromel-alumel thermocouples were located as illustrated in Figure 3. Again a 450 watt iron was placed on the ironing-board but in this test it was placed within an eighth of an inch of the beading above thermocouples 2 and 3 (Figure 3).

Table 5 is a temperature record of the test.

Table 5

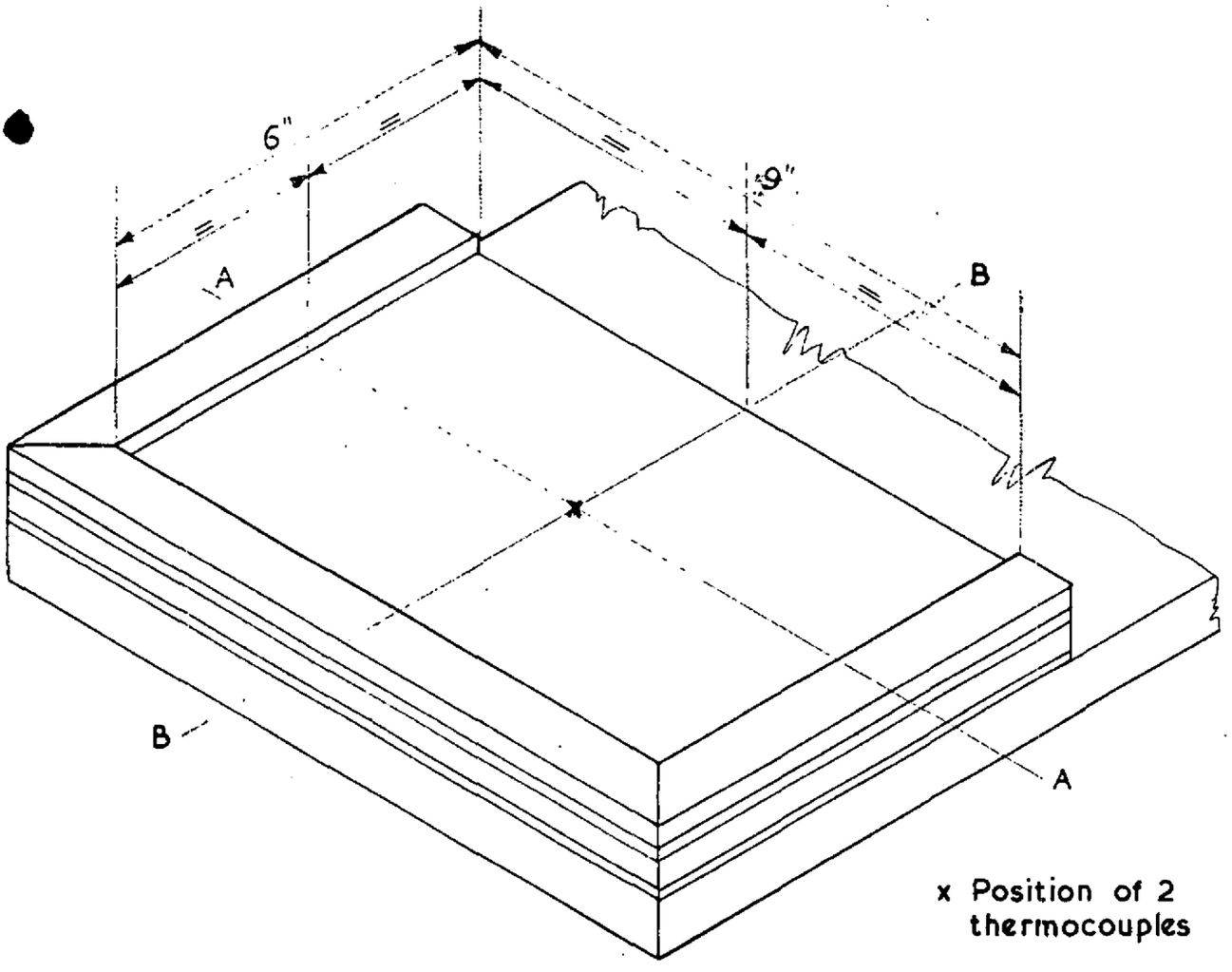
| Time | Temperature of iron | Temperature of wood | |
|---|---|---|---|
| | | Couple 2 | Couple 3 |
| 0 | 20°C | 20°C | 20°C |
| 15 min. | 266°C | 34°C | 34°C |
| 30 min. | 410°C | 63°C | 63°C |
| 1 hour | 535°C | 124°C | 120°C |
| 1½ hours | 573°C | 143°C | 139°C |
| 2 hours | 582°C | 152°C | 146°C |
| 3 hours | 603°C | 155°C | 148°C |
| 5 hours | 579°C | 155°C | 148°C |

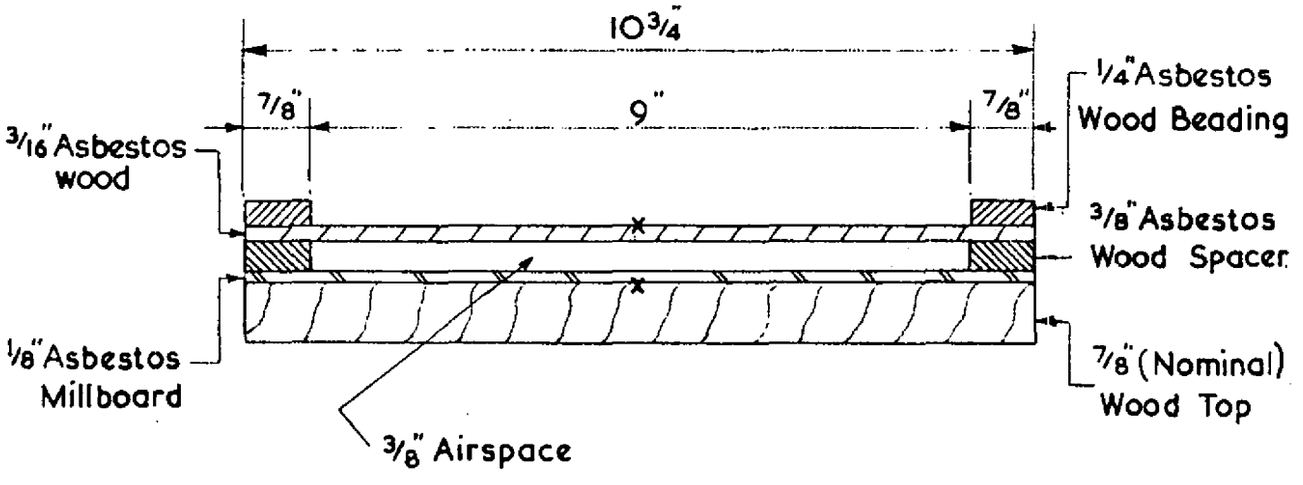
No smoke issued from the wood and, after five hours of test, it was not discoloured. When the iron was placed centrally on the board, wood temperatures did not exceed 135°C, but if the beading and the spacer above couples 2 and 3 were removed and the iron placed over the couples wood temperatures of 227°C were attained. In this latter instance some discoloration occurred.

The experiment was repeated using a piece of $\frac{3}{8}$ inch asbestos wood under the iron and increasing the air space to $\frac{5}{8}$ inch. With the iron located within an eighth of an inch of the beading above couples 2 and 3 the temperature of the wood did not exceed 110°C.

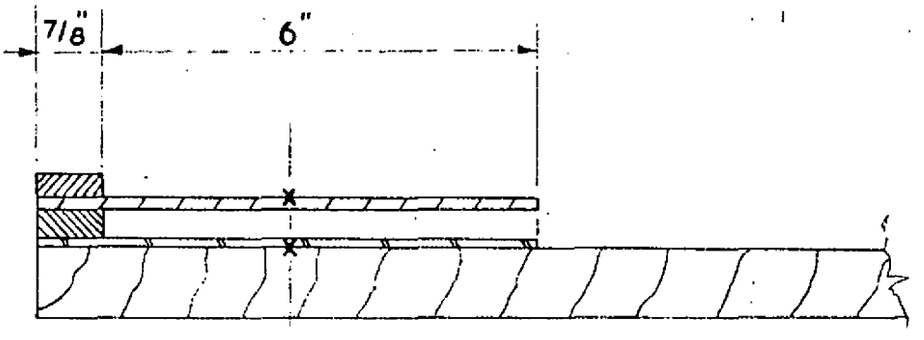
Conclusions

Of the types of ironing-board iron stand tested, only the designs illustrated in Figure 3 can be regarded as satisfactory from the fire hazard aspect.



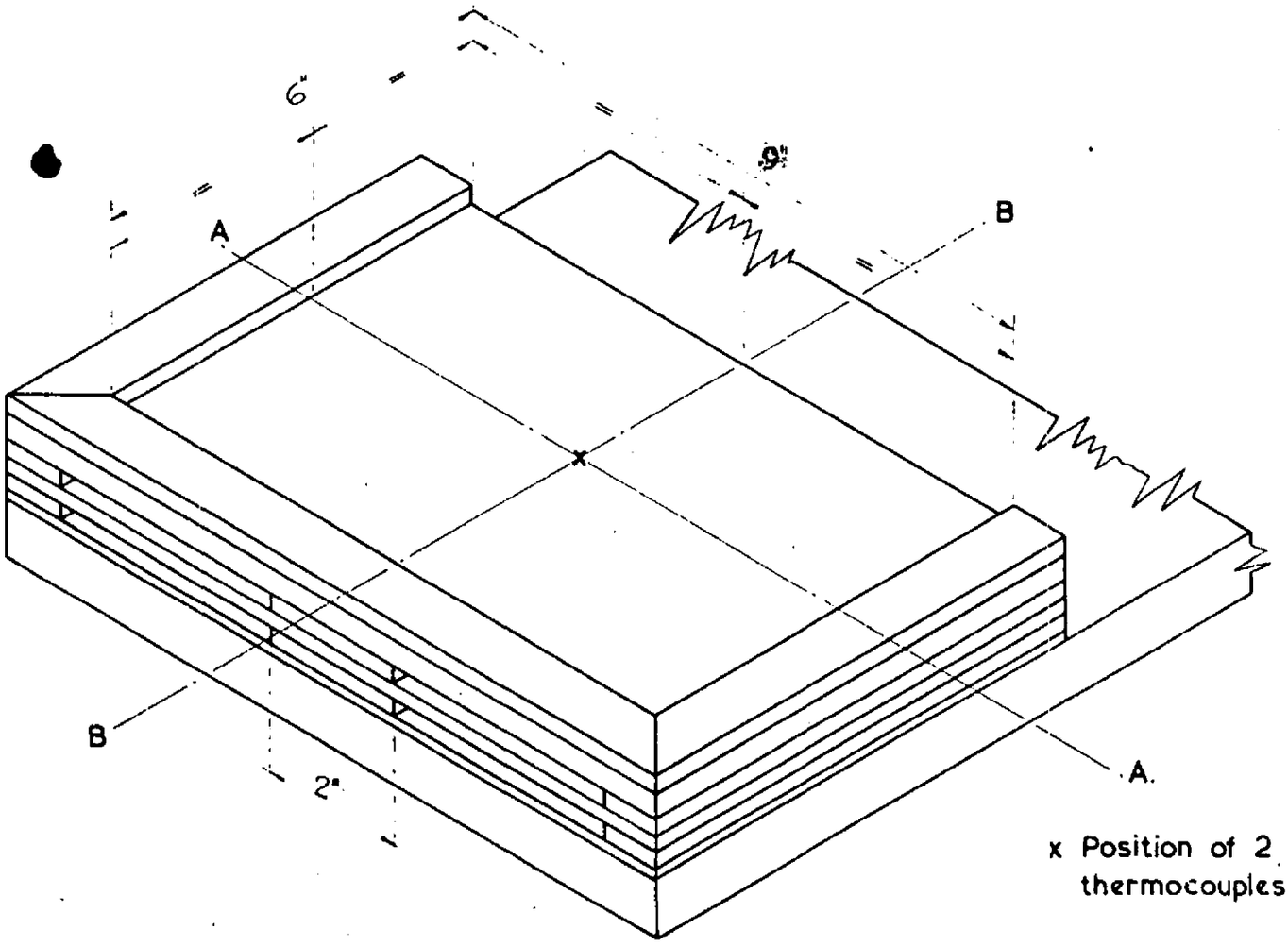



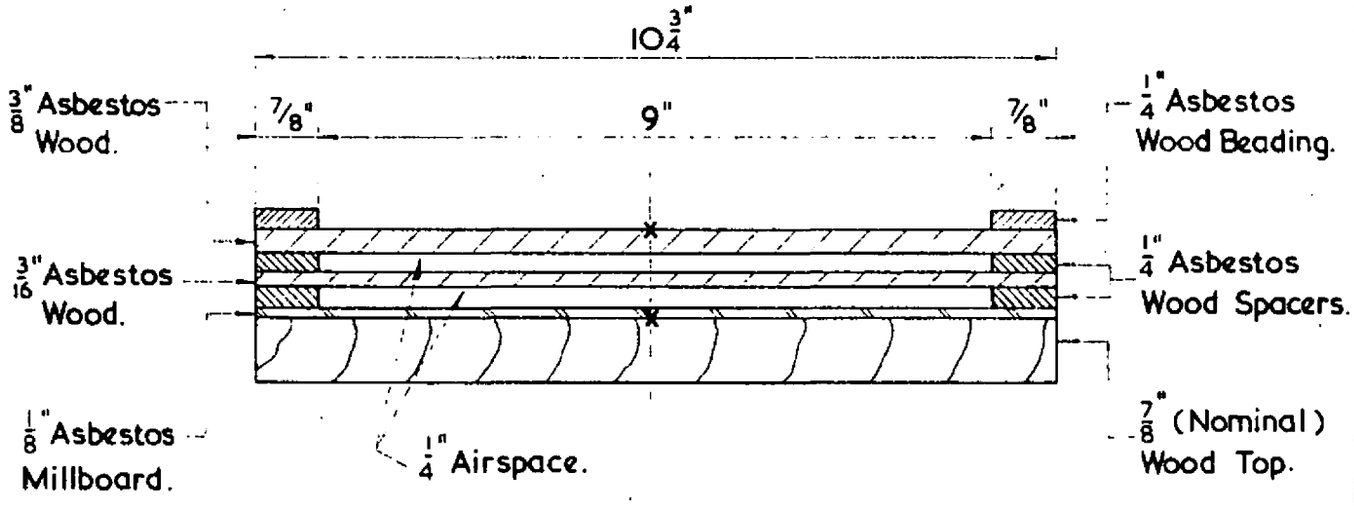

CROSS SECTION AT A.A.



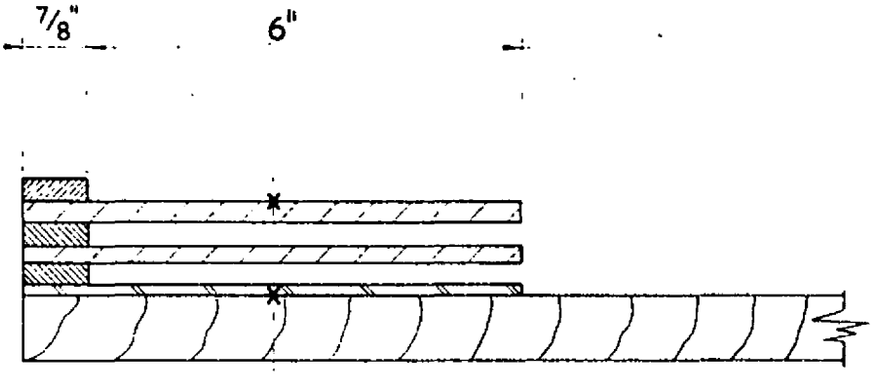

CROSS SECTION AT B.B.

FIG. 1.



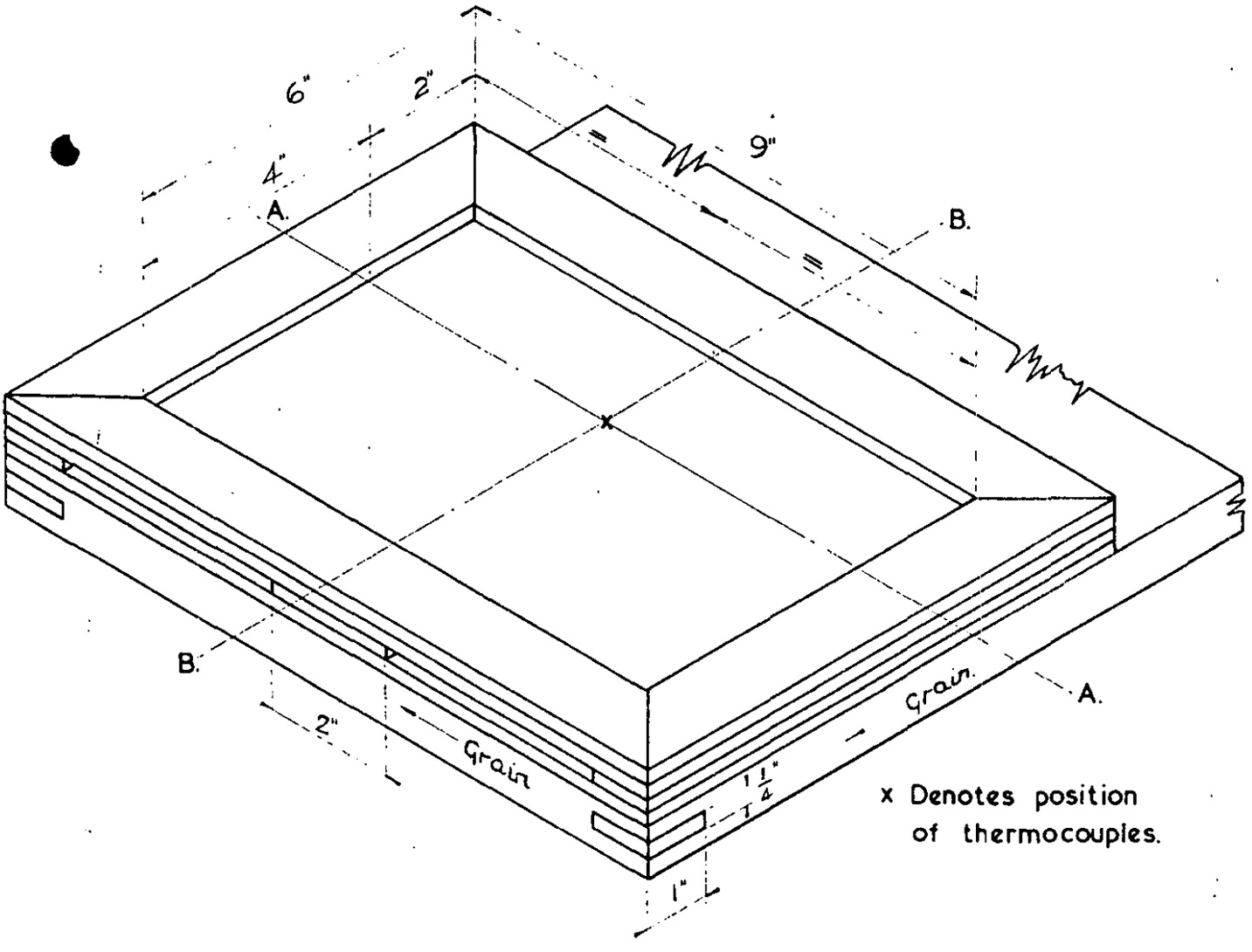



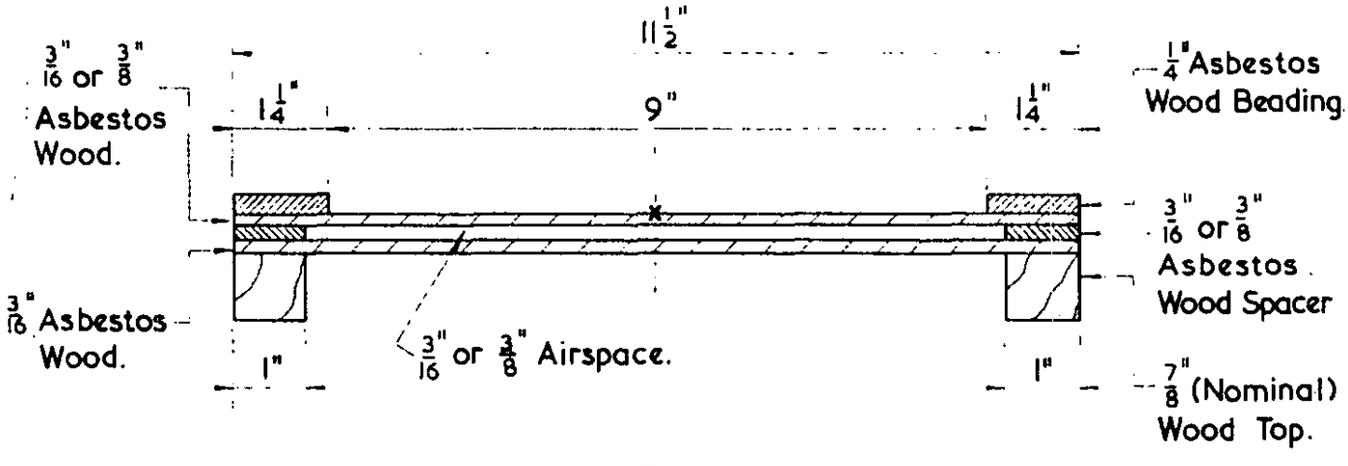

CROSS SECTION AT A.A.



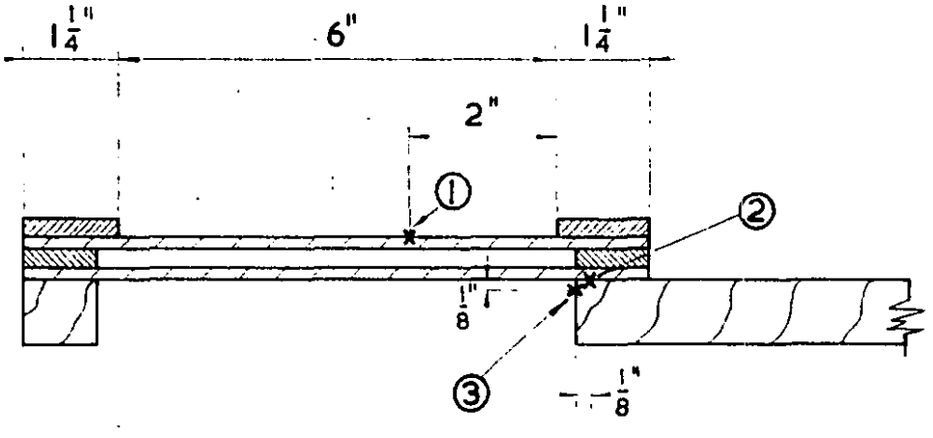

CROSS SECTION AT B.B.

FIG. 2.




CROSS SECTION AT A.A.




CROSS SECTION AT B.B.

FIG. 3.