F.R. Note No.349/1958.

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

AN IMPACT TEST FOR HEAT-SENSITIVE FIRE DETECTORS

by

I.C. Emson

SUMMARY

It is considered that heat-sensitive fire detectors should be able to withstand impacts similar in magnitude to those which can be withstood by sprinklers. The effect of a typical impact on various proprietary fire detectors has been examined.

F.
April, 1958.

Fire Research Station,
Boreham Wood,
Herts.

AN IMPACT TEST FOR HEAT-SENSITIVE FIRE DETECTORS

by

I.C. Emson

1. Introduction

Heat-sensitive fire detectors in service may be subjected to occasional blows from carelessly handled ladders, pipes, etc. Since fire detectors are mounted in similar positions to sprinklers, which have been used successfully for many years, it is considered that a fire detector should be able to withstand an impact of like magnitude to that which can be withstood by a sprinkler.

For a number of years, samples of sprinklers taken from installations have been submitted to the Joint Fire Research Organization for routine examination and test. Several of these have at one time or another been subjected to blows which, although not resulting in dislodgment of strut or valve parts, have caused bending of the yoke arms. Impact tests on new sprinklers have been carried out and the energy required for a cylindrical striker to produce a similar degree of bending in the new sprinklers has been found.

Impact tests on various proprietary fire detectors using this energy have also been carried out.

2. Experimental

The apparatus used for testing sprinklers is shown in Fig.1. Sprinklers were screwed horizontally into a $\frac{1}{2}$ in. elbow connected via a second elbow to a short length of $\frac{1}{2}$ in. pipe, which was gripped firmly in a vice. To the other end of the pipe was joined a vertical support for a striker guide. The striker itself was a piece of mild steel rod 10 in. long by $\frac{7}{8}$ in. diameter having plane ends and weighing 1.7 lb.

Tests were carried out by first adjusting the striker guide so that it was vertically aboe the deflector of a sprinkler, then raising the striker to a pre-determined height and releasing it. The effect on the sprinkler of an impact on the deflector was recorded.

The apparatus for testing fire detectors is shown in Fig.2. Detectors were secured side uppermost, by their normal fixing arrangements to a cast iron base plate which was held firmly in a vice. The same striker guide as used in the sprinkler test was vertically above the detector connected to the base plate by a vertical support. The same striker was also used.

The tests were carried out by first adjusting the striker guide so that it was vertically above a selected part of the detector. The striker was then raised to a given height and was released. The effect of the impact on the detector was recorded.

3. Results of tests

Five types of sprinkler, representative of those found in service, were tested. The results of impacts by a striker having potential energies of 1.4 and 2.8 ft-lb are given in Table 1.

TABLE 1

Impact tests on sprinklers

Sprinkler	Potential Energy of $\frac{7}{8}$ in. dia. striker (ft-lb)	Amount yoke bent	500 lb/sq. in. static pressure test
A	1.4 2.8	Slightly $\frac{1}{4}$ in.	- Leaked at 175 lb/sq. in.
B	1.4 2.8	$\frac{1}{8}$ in. $\frac{1}{4}$ in.	- Leaked at 275 lb/sq. in.
C	1.4 2.8	Slightly 3/16 in.	- No leakage
D	1.4 2.8	Slightly $\frac{1}{8}$ in.	- No leakage
E	2.8	$\frac{1}{2}$ in.	Leaked at 175 lb/sq. in.

A comparison between these results and the results obtained from sprinklers removed from installations shows that a sprinkler is likely to withstand, without leaking at normal operating pressures, an impact equivalent to that due to a cylindrical striker $\frac{7}{8}$ in. in diameter having potential energy of about 3 ft-lb.

Tests were carried out on six proprietary fire detectors using the same striker, with a potential energy of 3 ft-lb. The results are given in Table 2.

TABLE 2

Impact tests on detector heads

Detector	Point of Impact	Remarks
A	Normal to aluminium hemispherical cover.	Cover forced two resistance wires into contact resulting in a false alarm.
B	Side of heat-sensitive strip.	Opening pin forced against side of hole preventing detector operating.
C	Side of expanded Aluminium cover.	$\frac{1}{2}$ in. dent in cover. No effect on operation.
D	Tubular casing.	Casing slightly dented. No effect on operation.
E	Top of aluminium cover.	Cover made contact with heat-sensitive strip. Likely to have affected operation.
F	Side of steel cover.	No damage.

4. Conclusions

Heat-sensitive fire detectors are normally installed in similar situations to sprinklers and are therefore likely to suffer accidental damage from similar causes. Experience over a number of years has shown that, although damage severe enough to result in failure is rare, sprinklers are occasionally struck by ladders, pipes, etc., but are usually sufficiently strong to withstand such blows without dislodgment of valve parts, although bending of the yoke arms may occur. If fire detectors are to have the same degree of reliability as sprinklers from this point of view, they should be sufficiently robust to be able to withstand impacts of the same magnitude.

After comparison between the results of impact tests on new sprinklers and the amount of bending suffered by sprinklers removed from service and which had been subjected to accidental impact, it is considered that a sprinkler is able to withstand a blow equivalent to that from a $\frac{7}{8}$ in. diameter mild steel striker having a potential energy of 3 ft-lb.

Tests carried out on six proprietary fire detectors show that three of them were inadequately protected against impact damage of this magnitude.

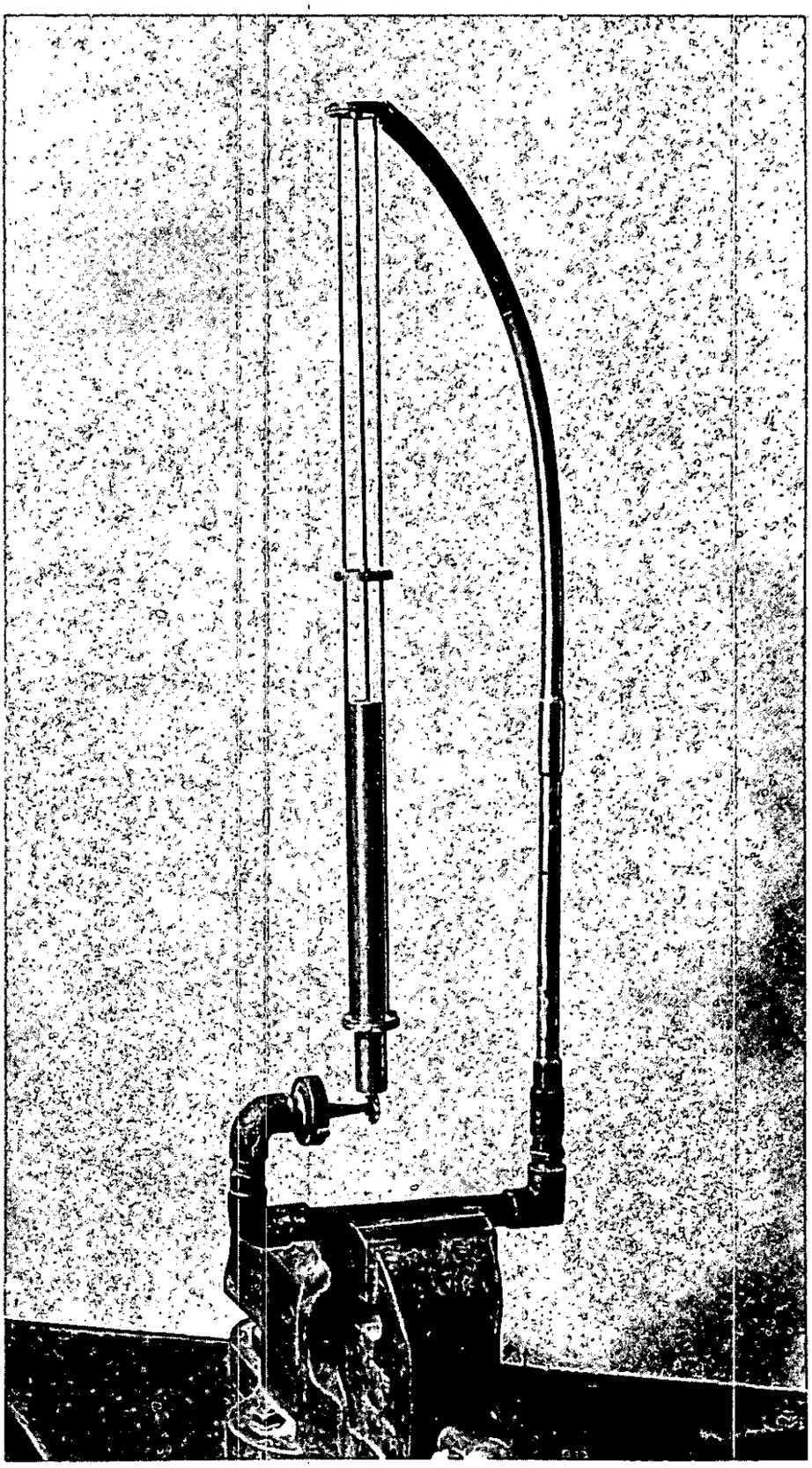

FIG. I. APPARATUS FOR IMPACT TESTS ON SPRINKLERS

DS 40049/11/324 30 2/59 CL

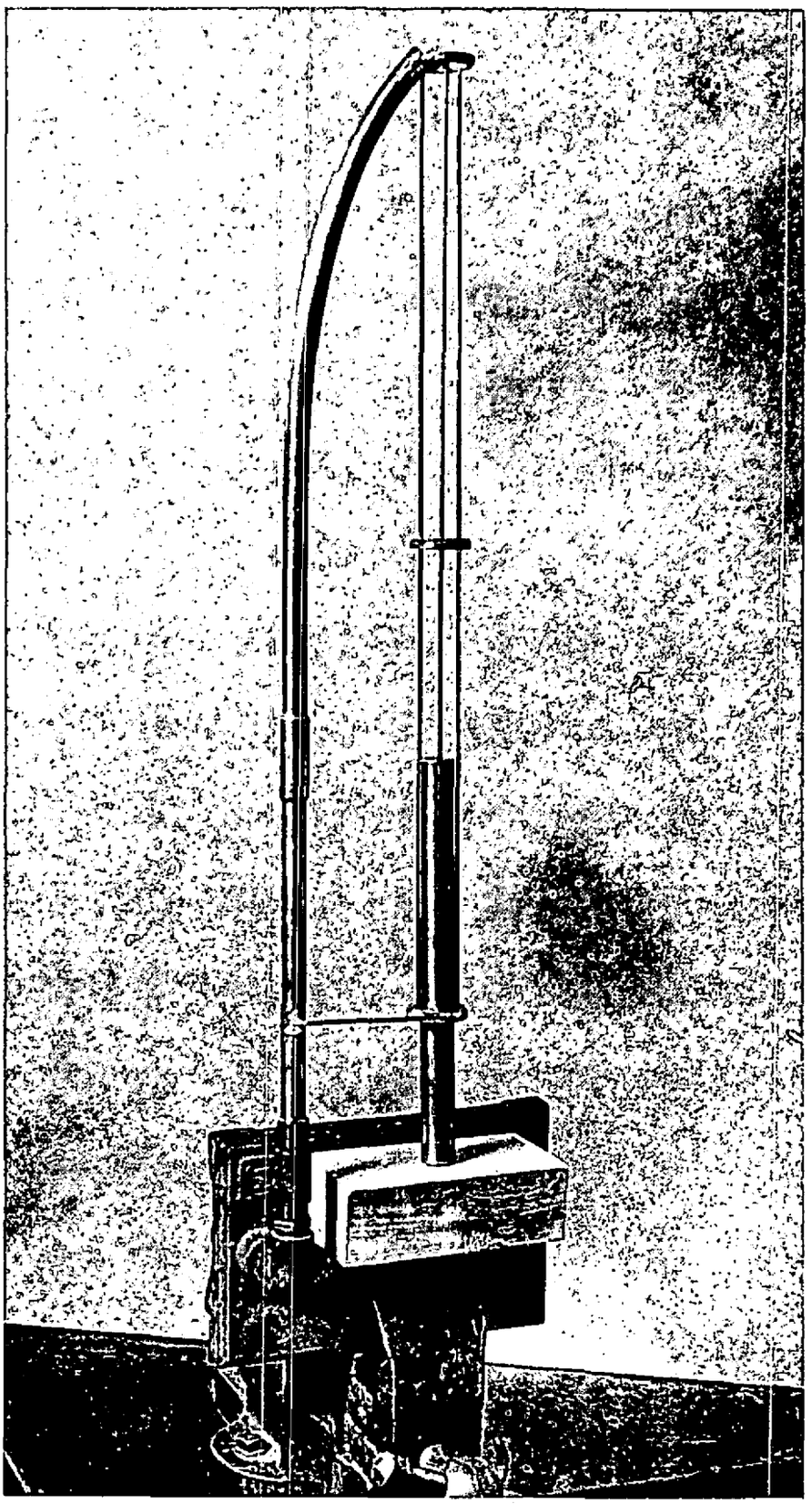

FIG. 2. APPARATUS FOR IMPACT TESTS ON FIRE DETECTORS

D540049/1/324 30 2/59 CL