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

A VIBRATION TEST FOR HEAT SENSITIVE FIRE DETECTORS

by

R.W. Pickard

SUMMARY

The effects of vibration on heat-sensitive fire detectors are discussed. A vibration test is described and the results obtained with a number of proprietary detectors are given.

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1. Introduction

Fire detectors in service are required to withstand the effects of the vibrations of the structure on which they are mounted, and it is necessary, therefore, that a suitable test procedure should be developed to check whether they are likely to prove satisfactory.

Since most detector installations are serviced at regular intervals, it seems unlikely that faults due to the loosening or fatigue of components would develop to the extent which would prevent operation of a system. It is possible, however, for a detector to have a component which has a natural frequency of vibration within the range of vibrational frequencies to which it is subjected. If this is so, the amplitude of vibration of the component may become large compared with that of the vibrating source and may result in false alarms due to the movement of electrical contacts.

A satisfactory vibration test should therefore indicate the possibility of resonance effects occurring in the practical frequency range, and show whether the design of the detector is such that these effects are likely to result in damage or false alarms. Investigations[1] have shown that most building vibrations lie in a frequency range of 10 to 50 c/s while the amplitude is rarely likely to exceed 5/1000 in. These values were therefore adopted for the test.

2. Experimental

A vibrating table was constructed which could produce vibrations within the required limits. A 9 in. square plate (Fig.1) was pivoted along one edge, the opposite edge being moved vertically with an amplitude of 10/1000 in. by means of a cam driven by a variable-speed electric motor. The speed of rotation of the cam was measured by a tachometer.

The following testing procedure was adopted with four proprietary detectors. The detector was mounted at the centre of the table where the amplitude of vibration was 5/1000 in. and wired so that operation of the detector was indicated automatically. The speed of the motor was adjusted to give a vibrational frequency of 10 c/s and was maintained for a period of 5 minutes. This procedure was repeated at intervals of 5 c/s up to 50 c/s during which any frequency at which resonance occurred was noted. The detector was then vibrated for a further hour at the resonant frequency, or, if no resonance occurred, at the maximum frequency of 50 c/s. It was then examined for mechanical damage and tested for normal thermal operation by the standard method[2].

3. Discussion of results

Of the four detectors tested, one showed a marked resonance effect at 35 c/s resulting in a false alarm. No mechanical damage was observed in any detector and all operated normally at the completion of the test.

Conclusions

It appears likely, from the results, that a test procedure of this type is successful in showing weak points in design and construction likely to lead to false alarms due to resonance. The test was not considered from the point of view of an endurance test for resonant failures.

References

1. Building Research Station Digest No.78, Vibrations in Buildings, June, 1955. H.M.S.O.

2. Hird, D., Pickard, R.W., Ross, W. Thermal tests on some heat sensitive fire detectors. F.R. Note No.275/1956.

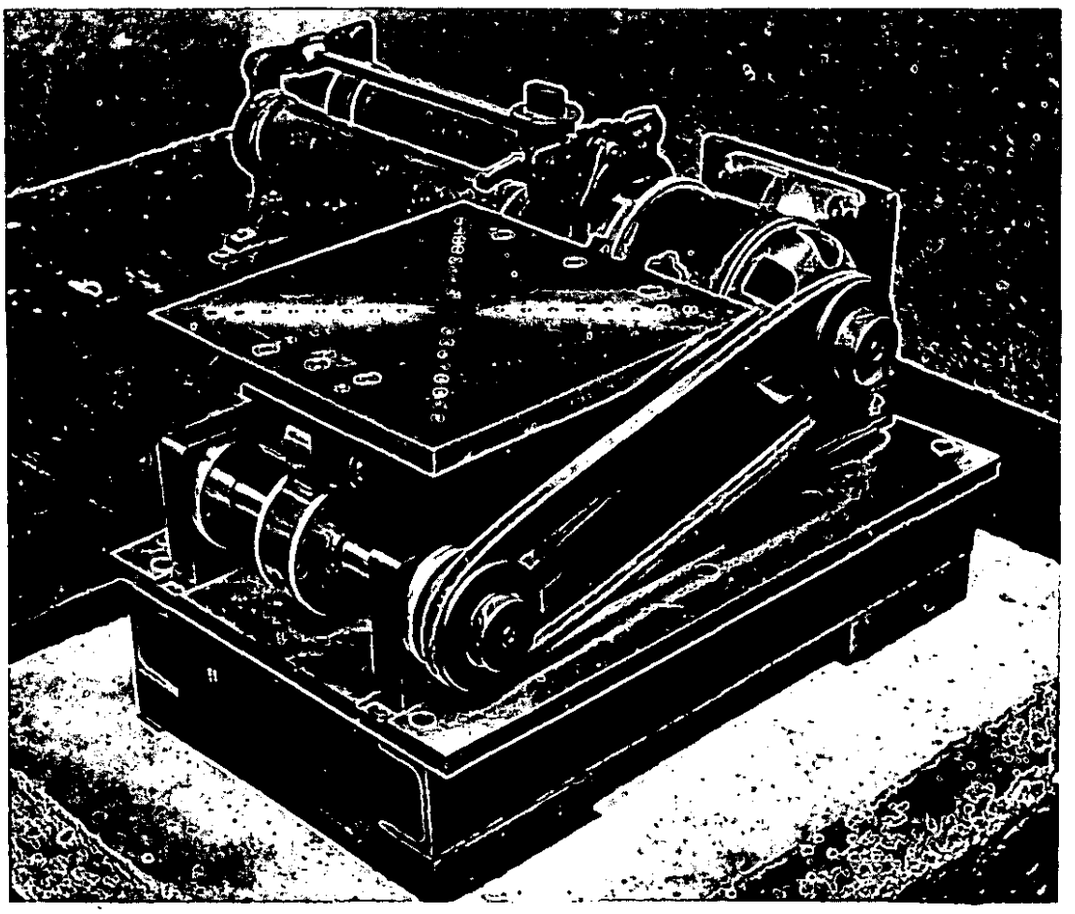

FIG. I. VIBRATING TABLE