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FIELD TRIALS TO ASSESS THE BLOCKAGE OF ARRESTERS BY ATMOSPHERIC POLLUTION

by

Z. W. ROGOWSKI

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FIRE RESEARCH STATION

Fire Research Station,
Borehamwood,
Herts.
Tel. 01-953-6177

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SUMMARY

Tests have been carried out to evaluate the blockage of flame arresters caused by atmospheric pollution. A Daily throughput of air of 143 m^3 (4,500 ft^3) through six arresters 2.9 cm (1.15 in) diameter over a period of 14 months resulted in an arrester blockage equivalent to 35 per cent reduction of the arrester area.

KEYWORDS: Flame arresters; blockage.

MINISTRY OF TECHNOLOGY AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

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INTRODUCTION

Flame arresters in use are often exposed to polluted and cold atmospheres and as a result cases of arresters blockage by fouling or freezing are reported. Arresters fitted to petroleum tanks are particularly vulnerable as large quantities of air are drawn rapidly through the arresters during filling and emptying operations.

The protection of electrical and other equipment by the use of flame arresters will require arresters to function outdoors, and it is desirable to have some information on possible arrester blockage that may occur in industrial use. The results reported in this paper summerize some preliminary tests aiming at evaluation of this problem.

APPARATUS AND MATERIALS

Figure 1 shows the diagram of the apparatus. Six crimped ribbon arresters were mounted underneath the box A of dimensions 23 cm x 38 cm x 20 cm (9 in x 15 in x 8 in). This box was connected to the suction side of the induction motor driven centrifugal blower B by a 2 m (6 ft) long, 5 cm (2 in) diameter pipe. The pressure inside the box was recorded all the time using an electronic transducer. The arresters had a diameter of 2.9 cm (1.15 in) and were made from 2.5 cm (1 in) wide nickel ribbon with a crimp height of 0.05 cm (0.02 in). When the blower was working there was a pressure drop across the arresters; Fig. 2 shows the relation between this pressure drop and the throughput of the blower. Figure 3 shows the relation between the pressure drop of the arrester and the per cent arrester area obstructed. This relation was arrived at by measuring the pressure drop with a given fraction of arresters area blocked.

PROCEDURE

The box was situated on the outskirts of the non industrial area, Boreham Wood, Herts.

A clock operated switch started and after 15 minutes running stopped the blower. This cycle was repeated every day at 7, 17 and 24 hrs, over the whole test period. The pressure within the box was monitored all the time.

RESULTS

Figure 4 shows the range of measured pressure drop throughout the test period. The range of monthly readings was plotted. Evidently very little blockage occurred and the fluctuation in the pressure drop were very small within this period from July to September. During October, November and December fluctuation in pressure increased continuously until the minimum pressure reached the value of 9.8 cm (3.8 in) and this value remained unchanged till May 1969. During the winter months in that period there were however large fluctuations in the maximum pressure recorded, and on 25th and 26th of December readings higher than 12.5 cm (5.0 in) of water, which was the maximum range of the instruments, were recorded.

From June 1969 onwards the minimum pressure drop increased steadily. The fluctuation in the pressure drop were however smaller than in winter months. Observation of weather conditions indicated that large fluctuations were associated with rain mist or snow. On the two occasions when the maximum pressure drop reading of more than 12.5 cm (5.0 in) of water was recorded there was rain followed by temperature below freezing. During that time formation of ice on the arrester bodies was observed and some ice was detected within the arrester apertures. It was assumed that icing was the cause of the increased pressure drop.

Examination of the arrester after the completion of the tests indicated that much of the solid deposit was on the ribbon edge exposed to the atmosphere. There was also some fibrous matter resembling fragments of seeds. The high rate of deposition during the winter months may be associated with generally a high level of smoke pollution during that time. It is not clear what caused the high rate of deposition during July and August.

PRACTICAL APPLICATION

These tests give limited information on the possible blockage of arresters in use. Because of the high throughput of air, and the relatively small total area of flame arresters, they may overestimate the hazards encountered in practice, where often only a fluctuation in temperature may be responsible for any movement of air through an arrester. They do, however, confirm that there is a need for some protection and periodical cleaning of the arresters. More experimental work is required to provide more information on the effect of the general level of atmospheric pollution and various climatic conditions on the rate of arrester blockage. The efficacy of protective covers should also be investigated.

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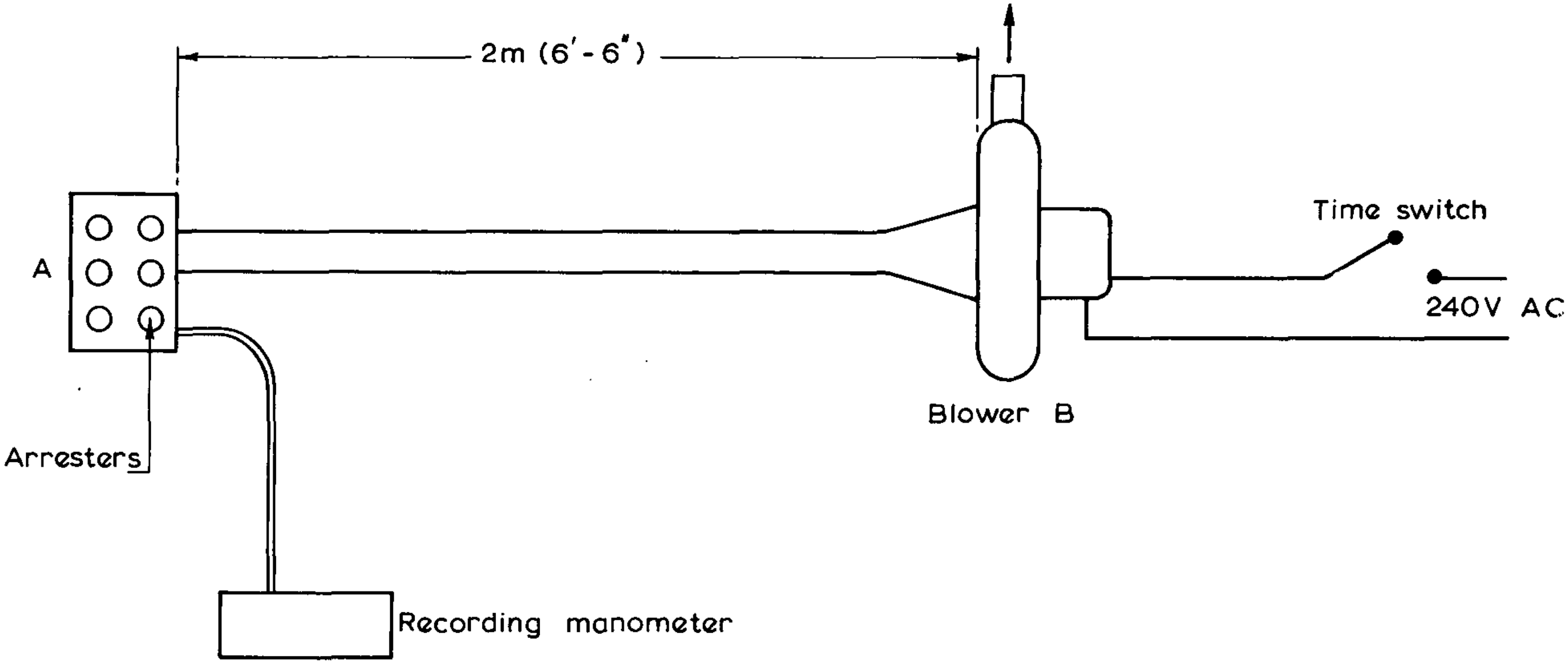

FIG. 1. DIAGRAM OF THE APPARATUS

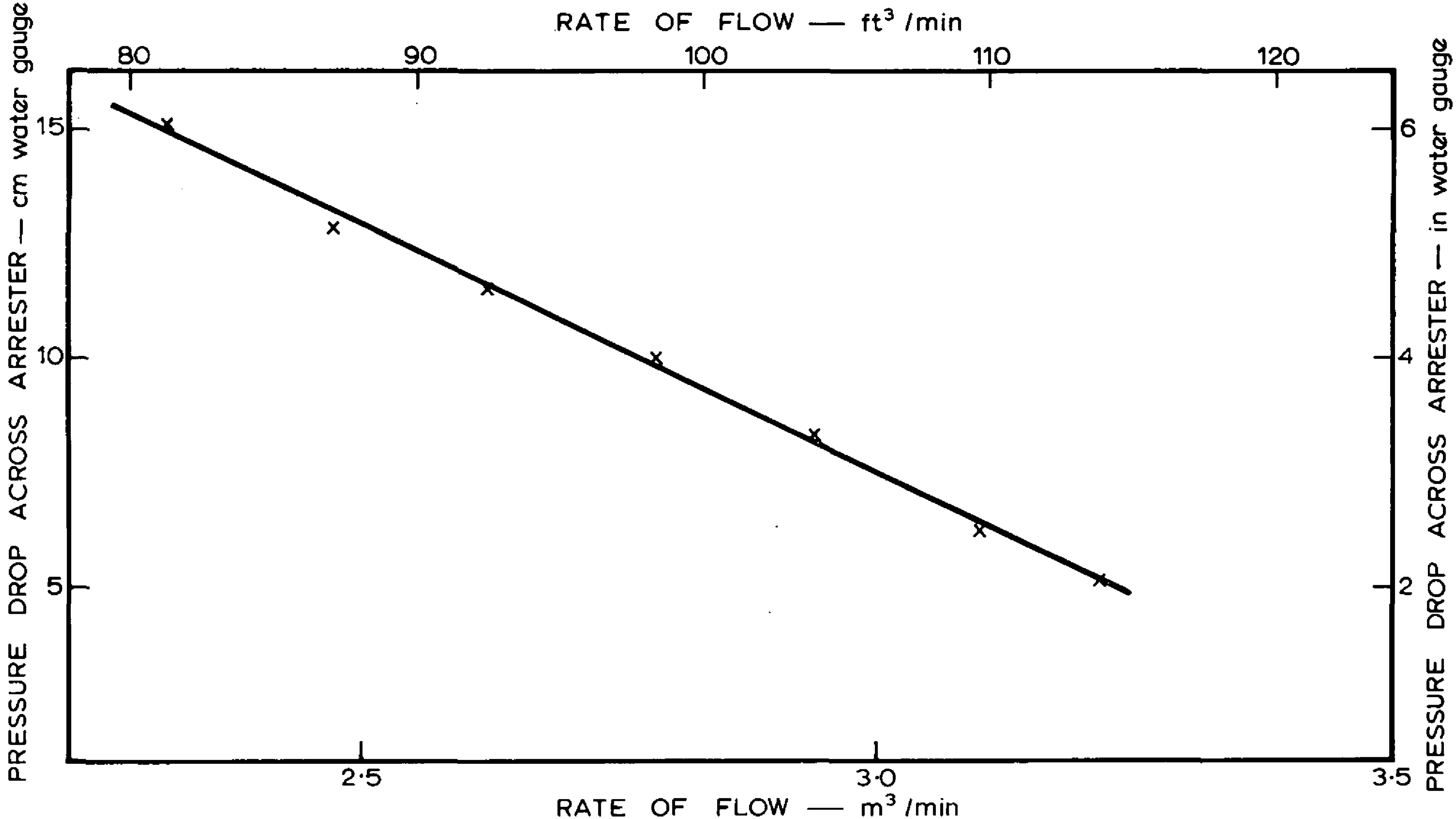

FIG. 2. RELATION BETWEEN PRESSURE DROP AND RATE OF FLOW
(Blower constant rev/min)

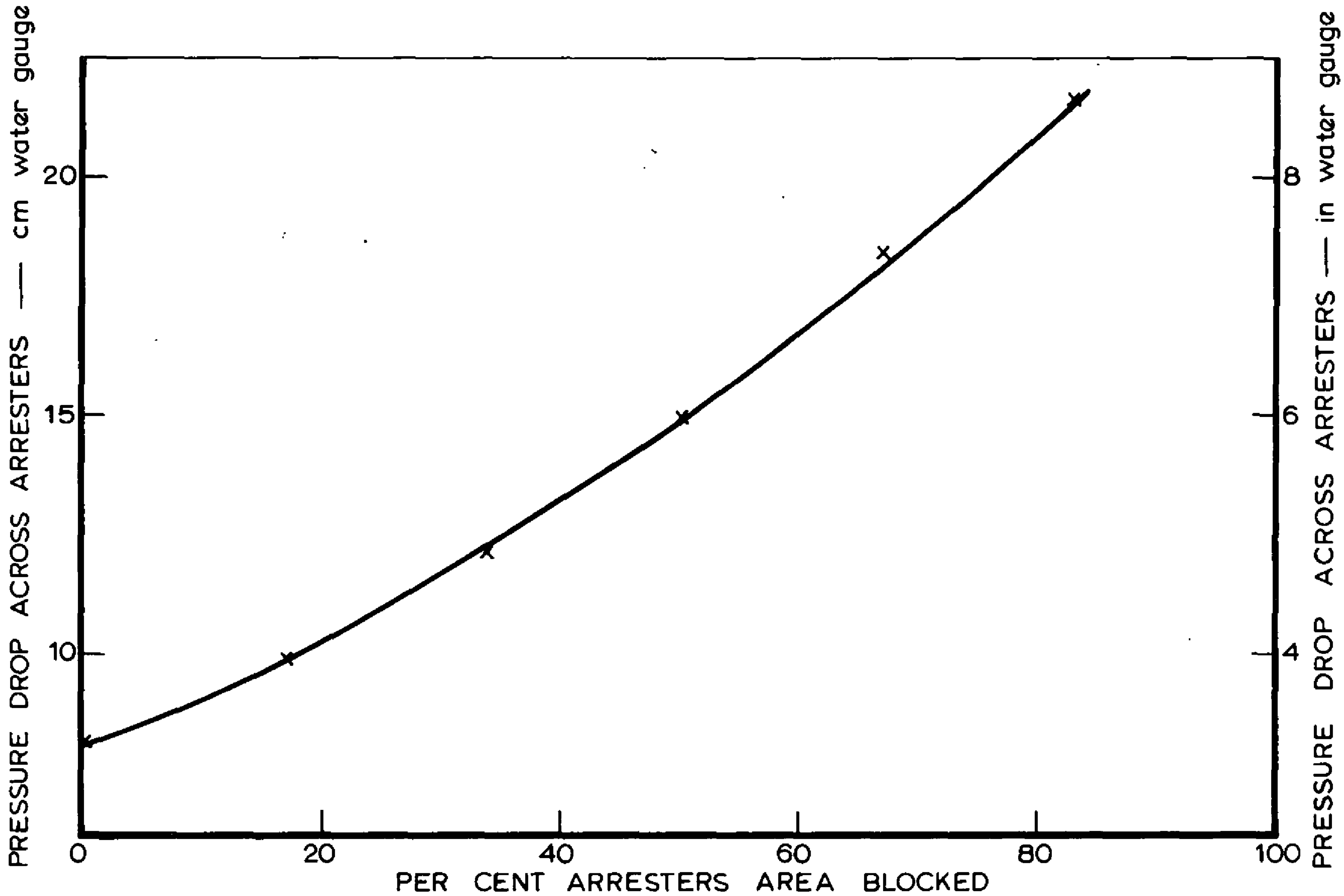

FIG. 3. RELATION BETWEEN PRESSURE DROP AND AREA BLOCKED

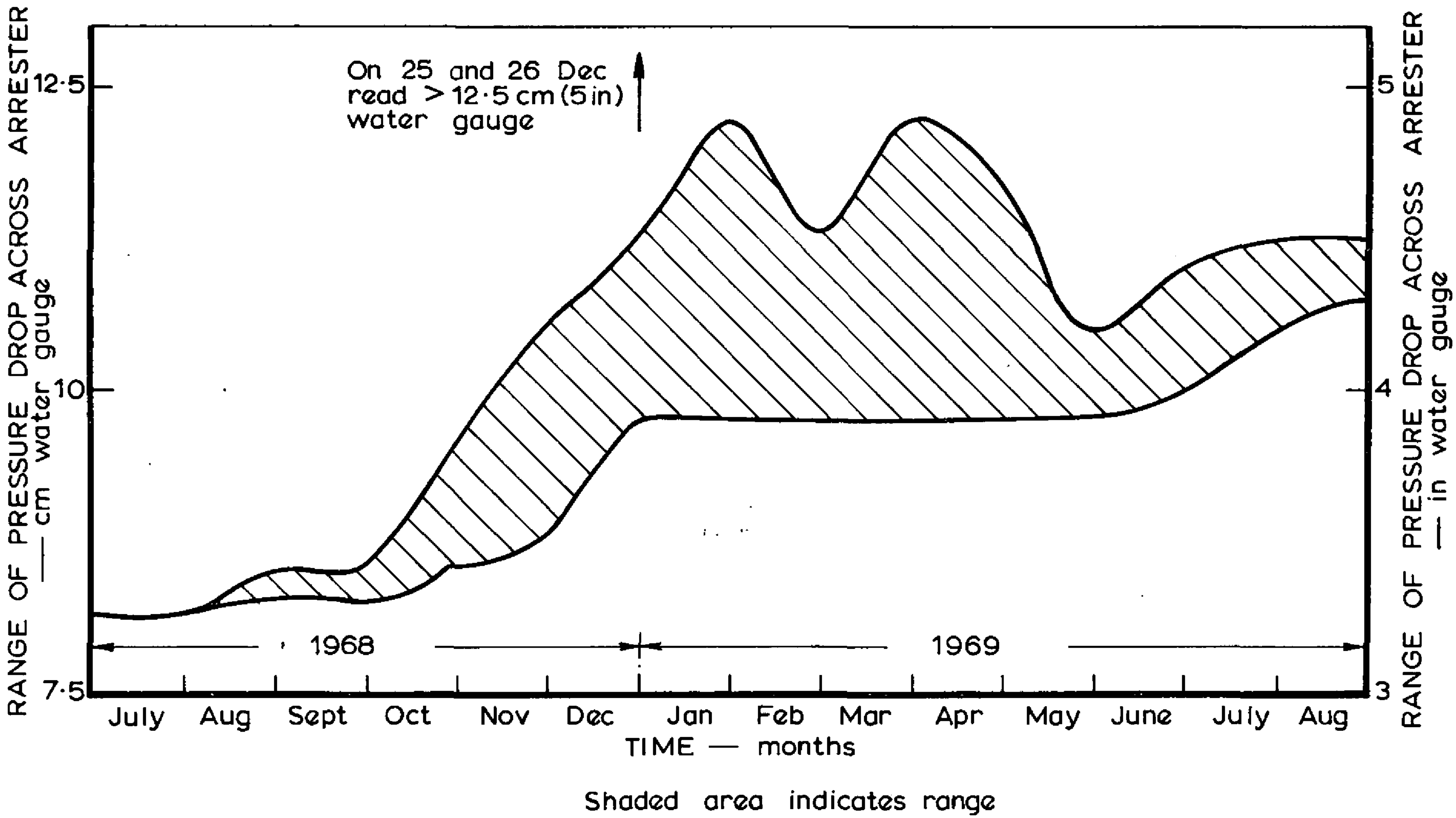

FIG. 4. RELATION BETWEEN TIME OF EXPOSURE AND PRESSURE DROP