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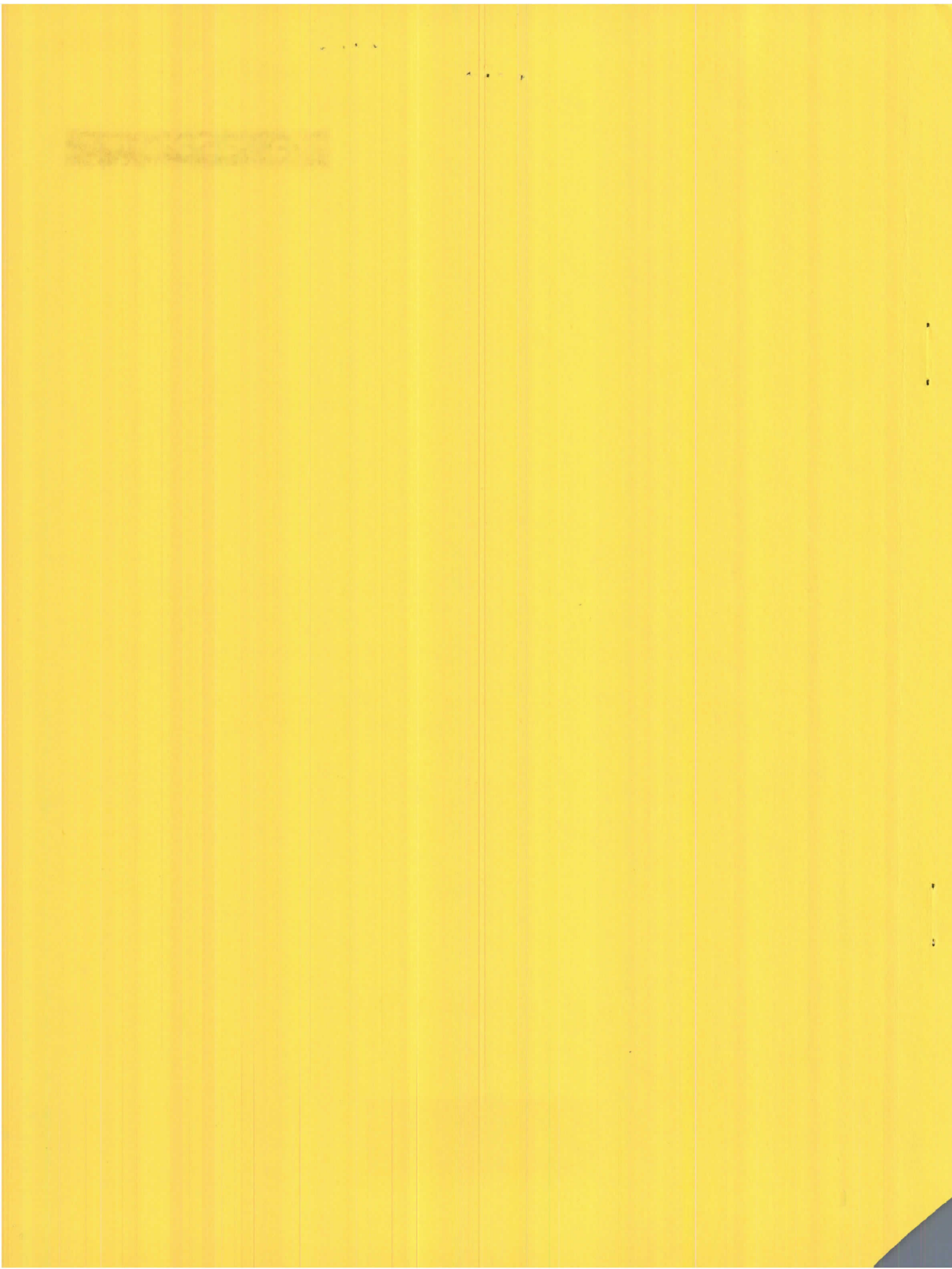
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Coal Mine Health and Safety Program

**BUREAU OF MINES TECHNICAL PROGRESS REPORT**

**SELF-SEALING BRATTICE FOR COAL  
MINE RESCUE AND RECOVERY**

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SELF-SEALING BRATTICE FOR COAL MINE RESCUE AND RECOVERY

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# SELF-SEALING BRATTICE FOR COAL MINE RESCUE AND RECOVERY

by

Fred N. Kissell<sup>1</sup> and Edward D. Thimons<sup>2</sup>

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## ABSTRACT

A self-sealing brattice intended for use during coal mine rescue and recovery operations has been designed and tested by the Bureau of Mines. The major design difference between self-sealing and conventional brattice is that the fabric is cut and sewn as a hemisphere instead of as a flat sheet. This new type of brattice offers reduced weight, leakage, and installation time. Preliminary testing indicates that the concept is worthwhile, but that further developmental research is required.

## INTRODUCTION

When an explosion occurs in an underground coal mine, the concussion blows down the block stoppings used to separate the intake and return airways. Destruction of these stoppings causes the mine ventilation air to short-circuit, preventing fresh ventilation air from reaching the region where the explosion took place and allowing explosive or harmful gases to accumulate.

To enter this region, rescue crews must reestablish the ventilation. This is generally done by carrying brattice cloth into the mine and erecting it in place of the destroyed stoppings. However, this operation may require much time and effort, especially if it is important to reduce air leakage to a minimum.

One possible device to ease this task is the new self-sealing brattice developed by the Bureau of Mines (fig. 1). This brattice appears to offer distinct advantages over conventional brattice as to both weight and tightness. Its main novel feature is that the fabric is sewn into a hemispherical or conical shape rather than a flat sheet like conventional brattice. The perimeter of the hemisphere or cone must be larger than the airway perimeter. When the stopping has this size and shape, the differential air pressure balloons out the fabric, forcing it against the mine surface and providing an automatic seal that reduces both leakage and the number of attachment points needed.

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<sup>2</sup>Supervisory physicist.

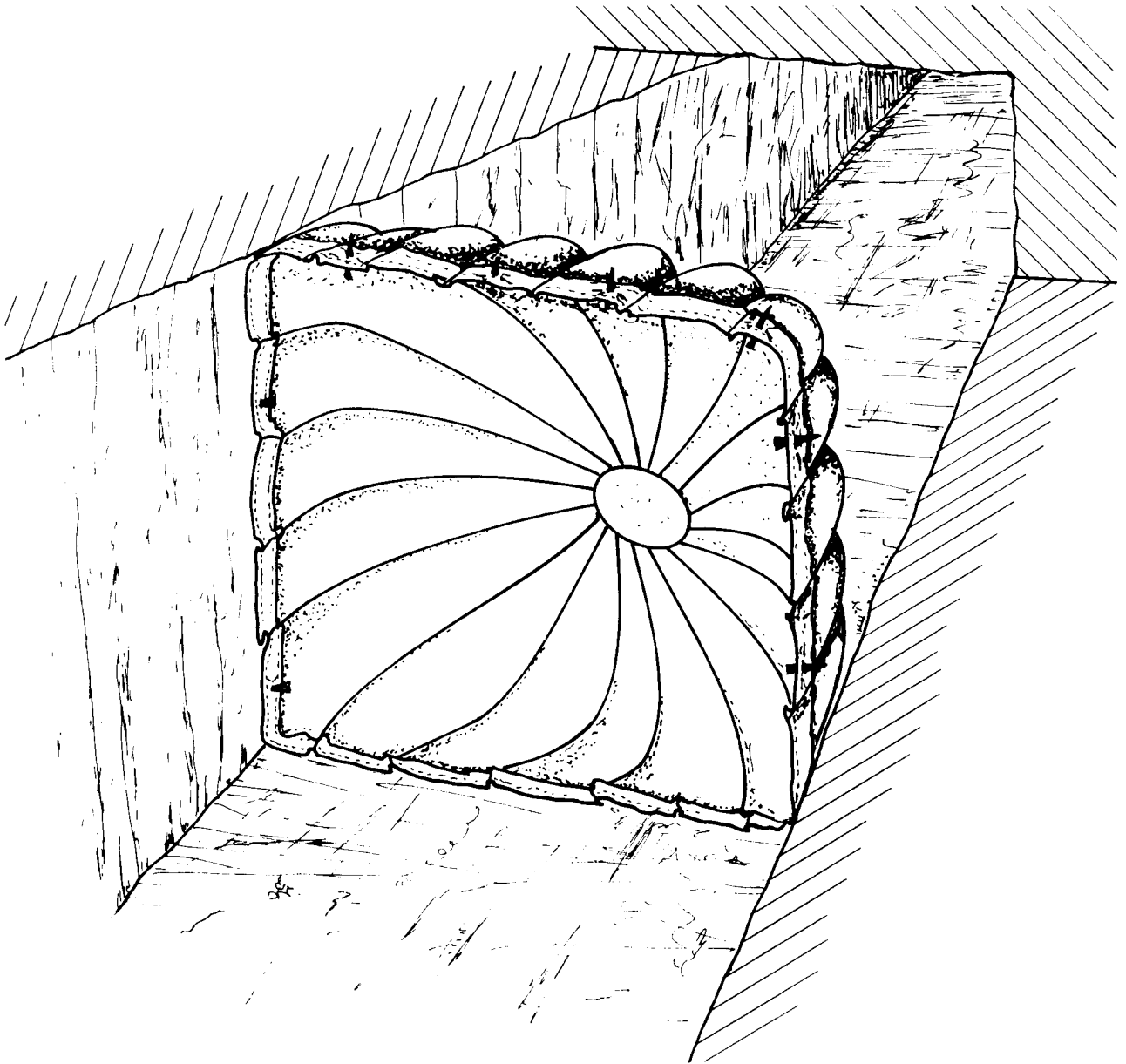


FIGURE 1. - Self-sealing brattice installed in a mine entry.

The self-sealing brattice functions in a way very similar to the Bureau of Mines parachute stopping reported previously.<sup>3</sup>

#### CONSTRUCTION AND TESTING

The self-sealing brattice built for these tests is a hemisphere comprising 18 gores of 1.5-oz/yd<sup>2</sup> coated nylon sailcloth. A 3-inch-wide strip of heavier nylon cloth weighing 5.5 oz/yd<sup>2</sup> is sewn to the edge of this hemisphere (fig. 2).

<sup>3</sup>Kissell, F. N., E. D. Thimons, and R. P. Vinson. The Parachute Stopping-- Preliminary Experiments. BuMines TPR 90, 1975, 6 pp.

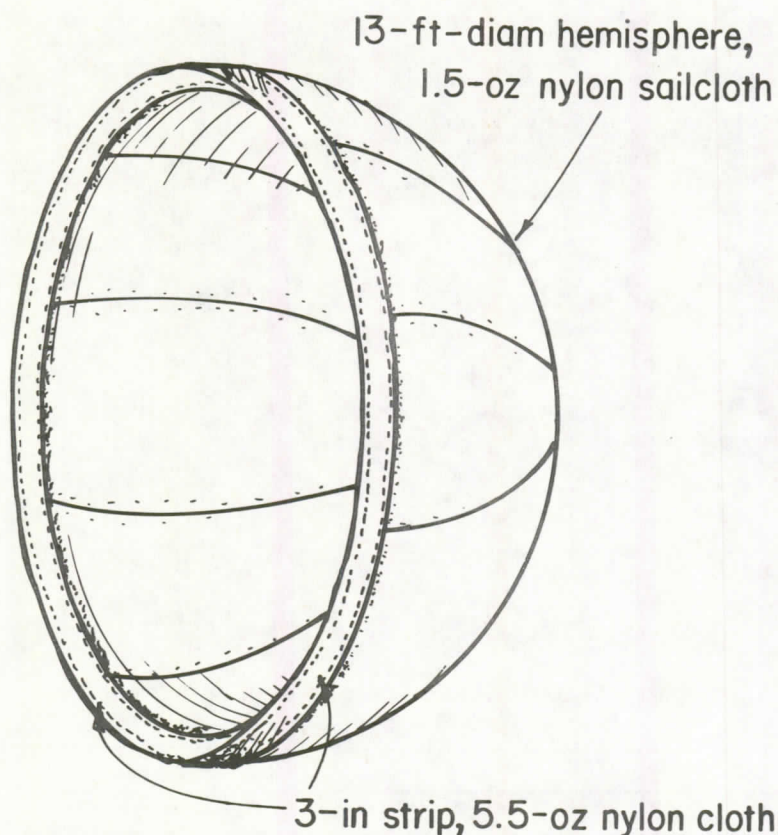


FIGURE 2. - Self-sealing brattice before installation, showing hemispherical shape.

Lightweight sailcloth was selected for the hemisphere so that it would balloon out and seal the passage even at the relatively low differential pressure found in the working sections of multiple-entry coal mines. Heavier nylon was selected for the edge strip which serves as an anchor point for spads or poles. Total weight of the brattice is 4.5 pounds, and it can be rolled into a 6- by 15-inch package (fig. 3).

Performance of the self-sealing brattice was tested in two locations, denoted A and B, in the Bureau's Experimental Mine at Bruceton, Pa.

Location A was a cross-cut equipped with a door (fig. 4). Rectangular in cross section, it was 5-3/4 feet high by 8-1/2 feet wide. With the door completely open, the air velocity was

110 ft/min, corresponding to total airflow of 5,200 cu ft/min.

The brattice was attached with five spads at intervals on the roof and rib. It inflated readily, forcing the loose fabric out against the surfaces of the crosscut (fig. 5). The differential pressure across the brattice was 0.035 inch water gage.<sup>4</sup> A smoke tube showed no discernible air movement, indicating a leakage of 1,000 cu ft/min or less.

While the brattice was still in place, the crosscut door was closed. The differential pressure across the brattice fell to 0.016 inch. The brattice began to sag, but remained inflated.

A second trial in the same location was run with the door open to ascertain whether the brattice could be held satisfactorily with two vertical poles. With this arrangement, the brattice was held at four points: two on the roof

<sup>4</sup>The pressure was measured with a Dwyer Microtector Portable Electronic Hook Gage. This is a U-tube water manometer with a needle projecting down from a micrometer to make electrical contact with the surface of the water. (Reference to specific equipment does not imply endorsement by the Bureau of Mines.)

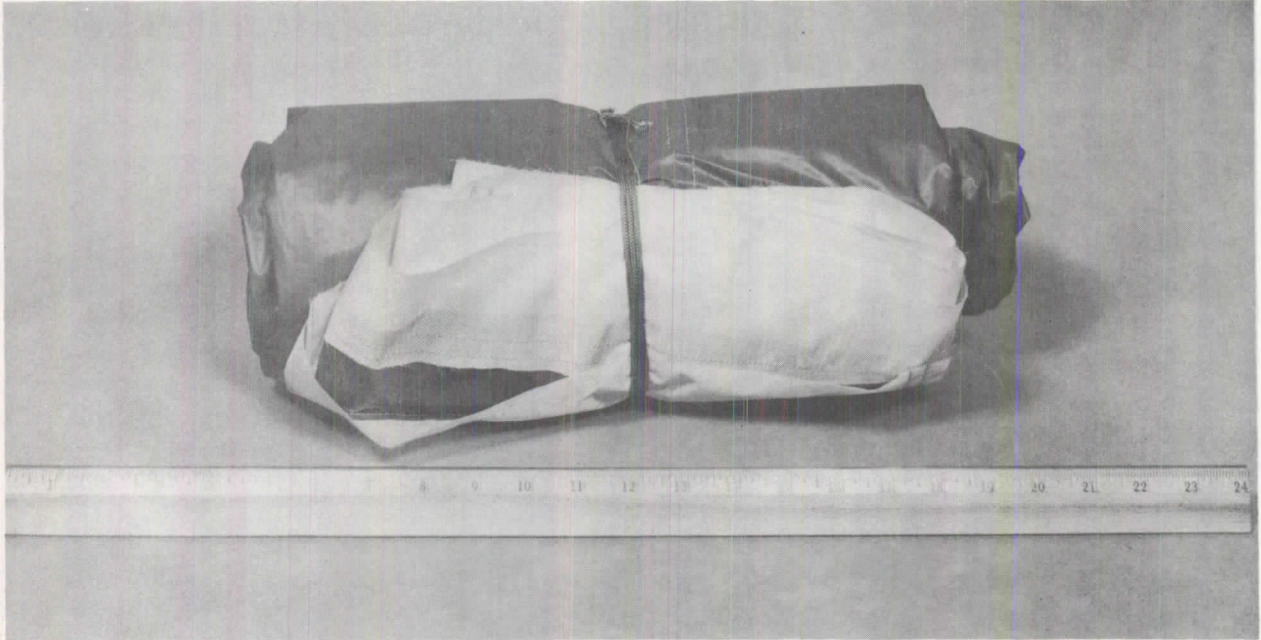


FIGURE 3. - Self-sealing brattice rolled into a 6- by 15-inch package weighing 4.5 pounds.

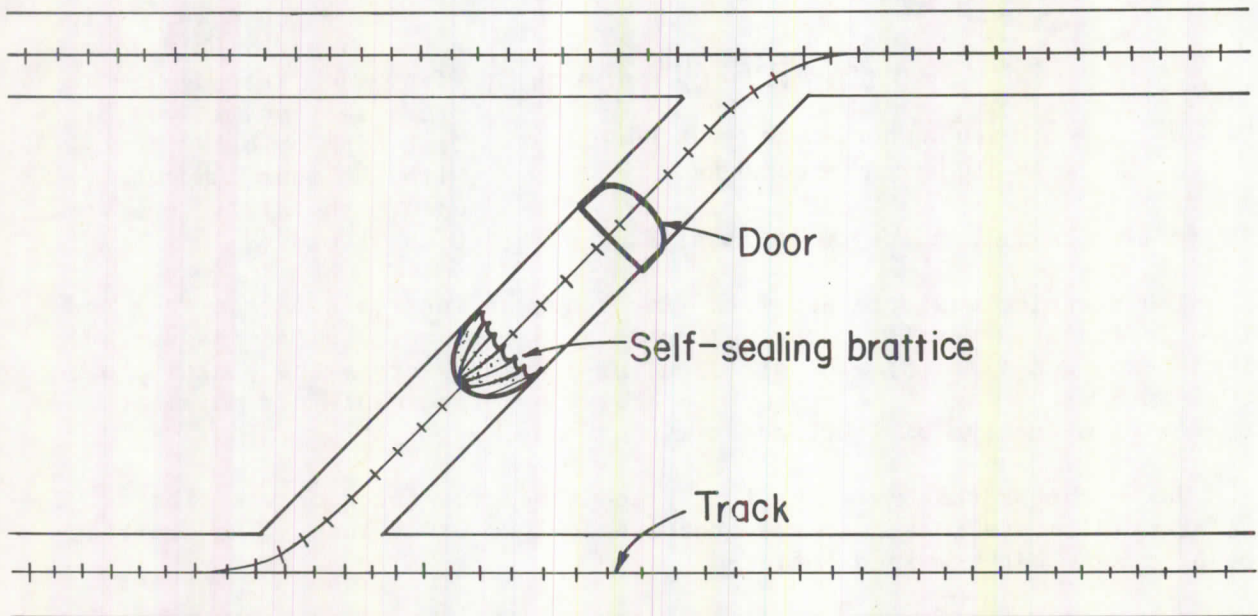


FIGURE 4. - Location A in the Experimental Mine.

each 1 foot from the rib, and two on the floor directly below. The brattice inflated easily. The differential pressure was 0.036 inch. As before, no leakage could be measured.

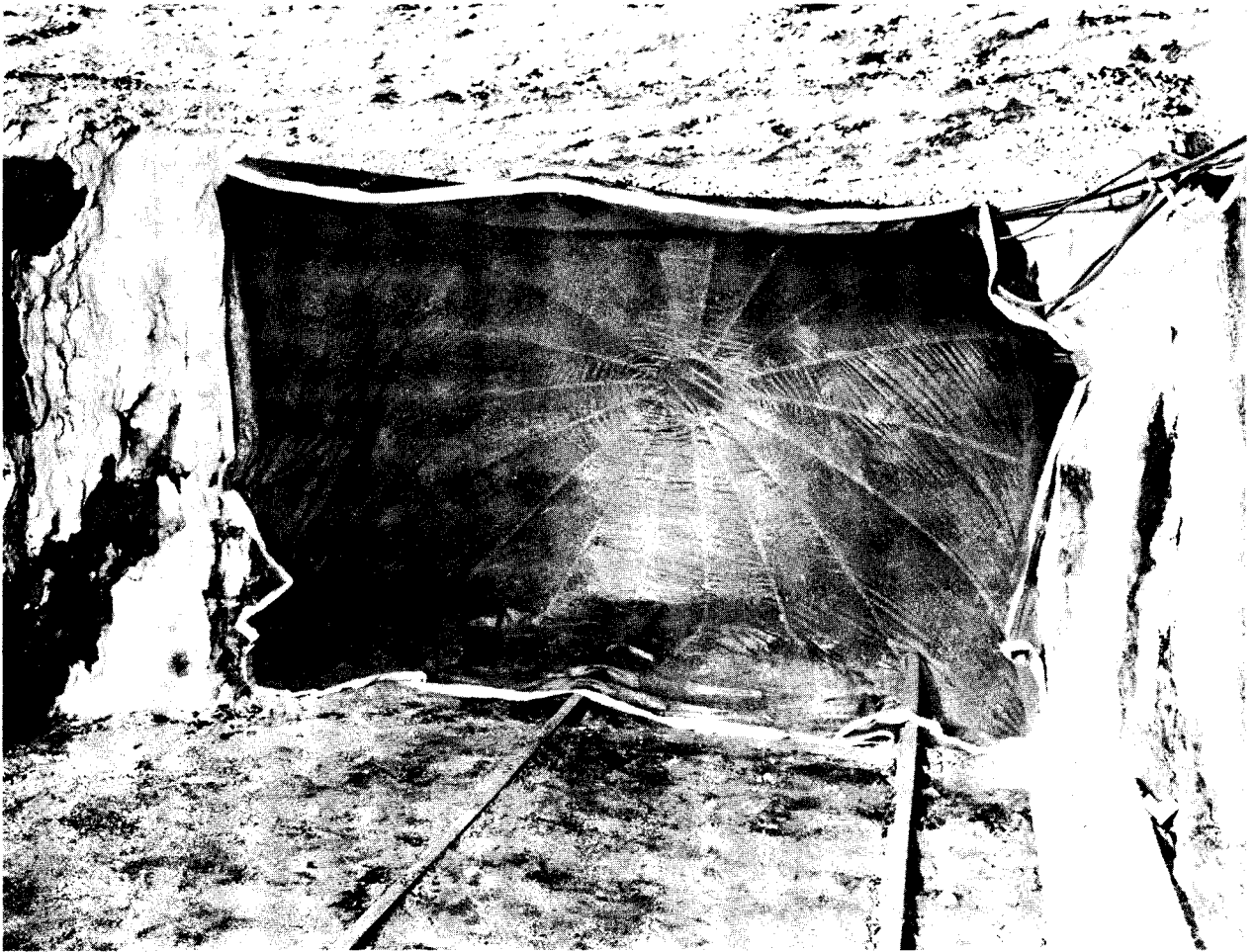


FIGURE 5. - Self-sealing brattice inflated in the Experimental Mine.

Location B was rectangular in cross section, about 6-1/2 feet high by 12-3/4 feet wide. The air velocity was 240 ft/min, corresponding to an air-flow of 19,500 cu ft/min. The brattice was first held at four locations to simulate attachment by vertical poles located 1 foot from the rib, as before. It inflated readily, with only minor leakage at the center of both ribs, indicating that even in a wider passage two poles would be sufficient.

Next, the brattice was secured at eight points with spads and ramset pins (fig. 6). With the brattice up, it was apparent that the attachment strip had been stretched too tightly between pins 2 and 3 and between pins 6 and 7, creating leaks there. The differential pressure across the stopping was 0.55 inch water gage. The initial leakage was 2,600 cu ft/min and was reduced to 1,400 cu ft/min by some adjusting of the fabric. Further improvements would have required pulling the brattice down and starting over, taking care to provide excess fabric in the upper corners.

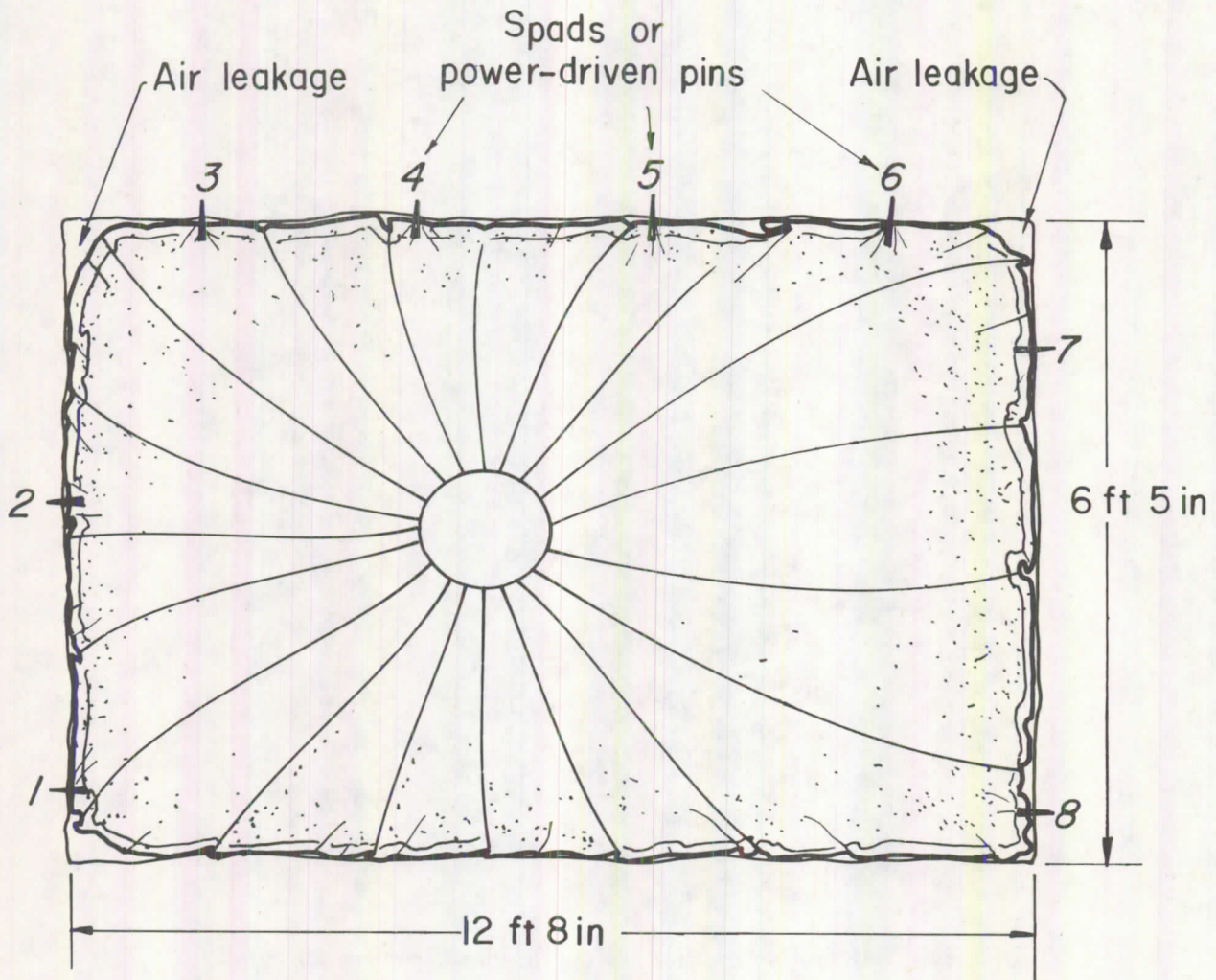


FIGURE 6. - Attachment points at location B.

#### DIFFERENTIAL PRESSURE MEASUREMENTS

Earlier experiments on the parachute stopping,<sup>5</sup> which functions much like the self-sealing brattice, showed that a minimum air velocity of about 100 ft/min was required to inflate it and then some minimum static pressure was required to hold it in place. In the case of the self-sealing brattice, lightweight sailcloth was used in order that the required static pressure be as low as possible. The test at location A indicated that at least 0.016 inch water gage was required and so we thought it necessary to have some indication whether this much pressure would always be available.

The Experimental Mine was used again to simulate a situation where low differential pressures would be expected, as shown in figure 7. Here, the air velocity in the main entry was 400 ft/min, corresponding to an airflow of

<sup>5</sup>Work cited in footnote 3.

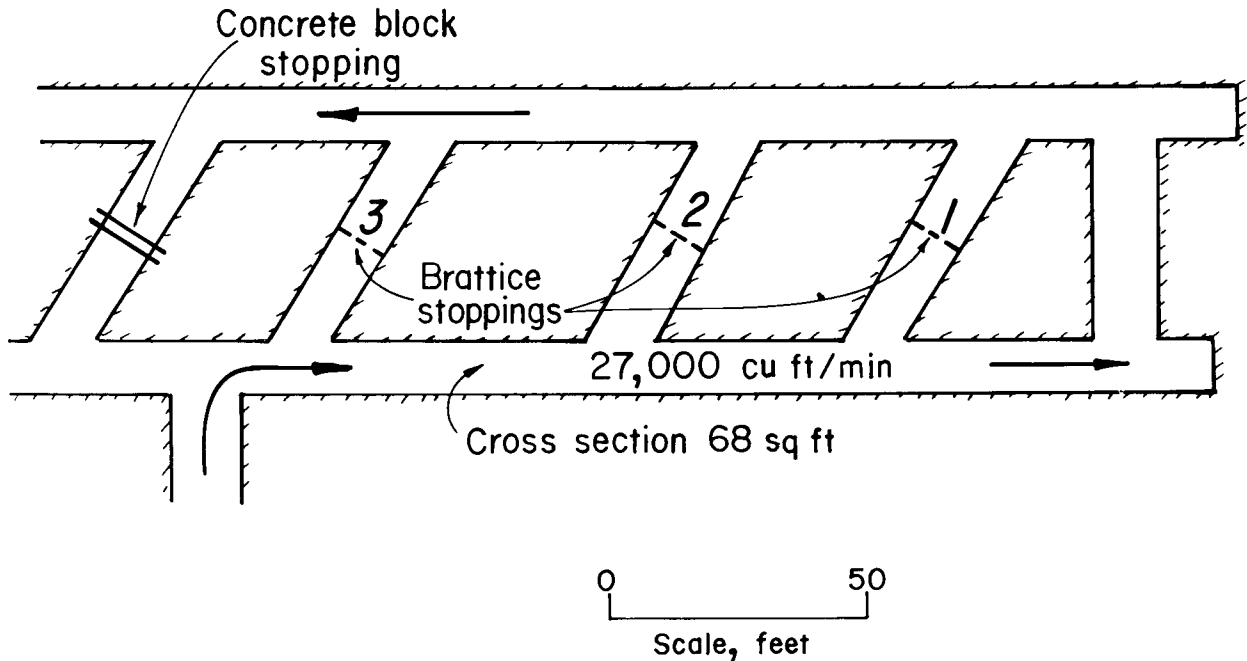


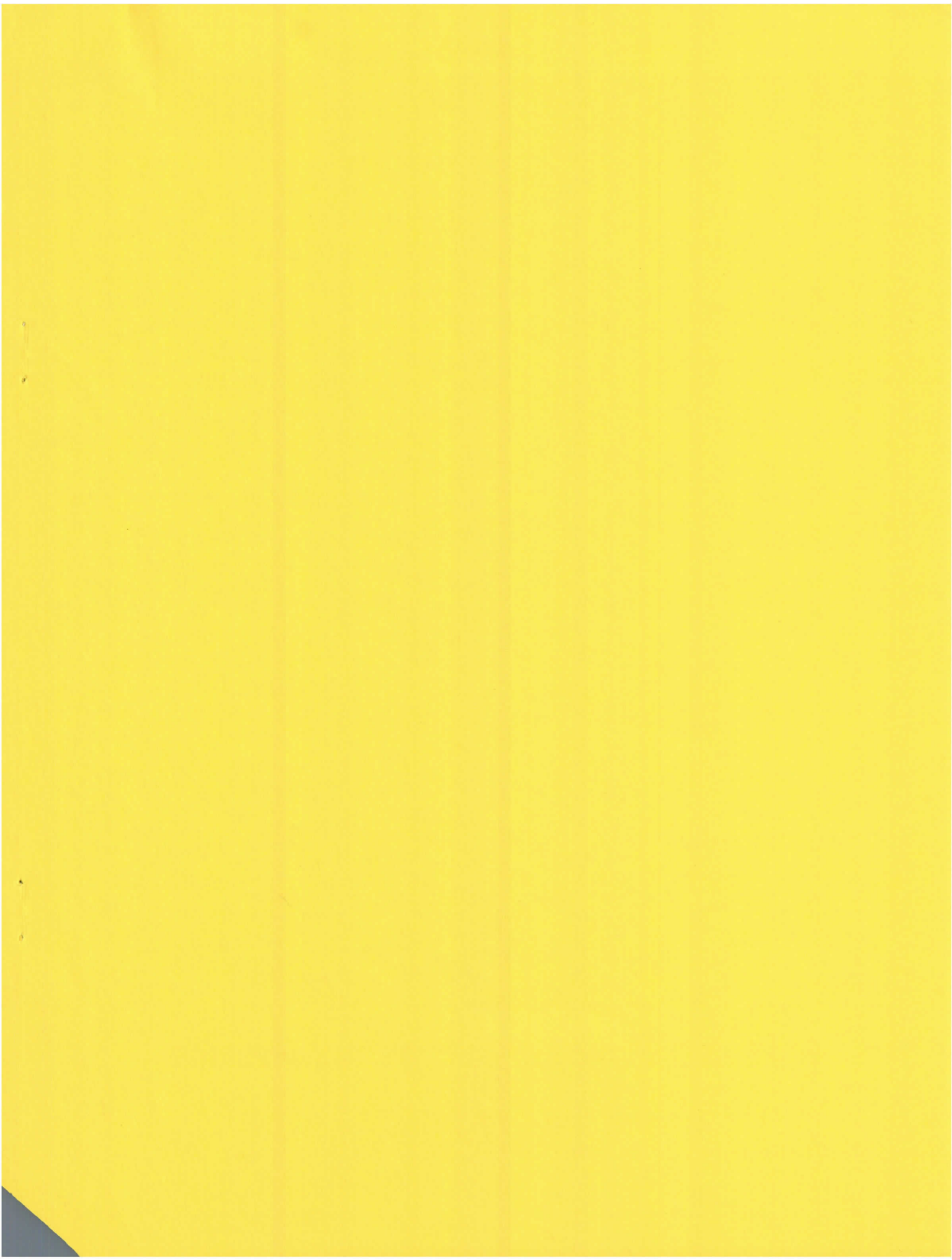
FIGURE 7. - Test location for differential pressure measurements.

27,000 cu ft/min. Conventional flat brattice stoppings were located at crosscuts shown as 1, 2, and 3 in figure 7. Under these conditions, the differential pressure was 0.020 inch water gage at crosscut 1, 0.024 inch at crosscut 2, and 0.034 inch at crosscut 3. Thus, it seems that an adequate differential pressure might be expected under most conditions.

#### SUMMARY

A self-sealing brattice was conceived and developed for use in sealing mine passages. Preliminary experiments indicate that such a brattice is a workable concept and may be useful for coal mine emergency applications. The lightweight fabric would rule out day-to-day use. Further research is necessary to determine operating limitations of the self-sealing brattice more precisely.





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