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A New Asbestos Sprayer*

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A sprayer designed for spraying asbestos fibres onto different surfaces, working on the principle of low pressure air spraying, is described. The sprayer can be used for spraying both chrysotile and amphibole varieties of asbestos. Layers of amphibole asbestos obtained using the sprayer have been found to exhibit thermal insulation, sound absorbing and other desirable characteristics comparable to those of chrysotile asbestos layers obtained using imported sprayers.

SPRAYING of asbestos is commonly done on different surfaces to improve their thermal insulation and sound absorption characteristics. It also prevents sweating of walls. There are two main varieties of asbestos — chrysotile and amphibole. Fibres of the chrysotile variety are flexible and strong, their tensile strength being of the order of 100,000 lb/sq in. Fibres of amphibole asbestos are generally brittle and weak (tensile strength, ~5000-8000 lb/sq in), though crocidolite asbestos belonging to amphibole variety has also strong and flexible fibres (tensile strength, 300,000 lb/sq in).

For spraying purposes, generally fibres of the chrysotile variety are used. Apart from having high tensile strength and flexibility, these fibres can be dispersed well and the air cells formed by the dispersed fibres provide the required thermal insulation. Spraying is done either by the Limpet process (English) or the Asbestospray process (American)[1].

Most of the asbestos based industries in India, including sprayed asbestos industry, use imported chrysotile fibres. With the increasing difficulty in getting foreign exchange, attempts have been made to substitute it with Indian amphibole asbestos. The main difficulty faced in such replacement is that the amphibole fibres are generally weak and brittle and they get into powder form when sprayed with the commercially available sprayers. To overcome this difficulty, a new asbestos sprayer has been developed at the Central Building Research Institute, Roorkee. The equipment is suitable for spraying both chrysotile and amphibole varieties of asbestos. The thermal and sound insulation provided by amphibole fibres sprayed with this sprayer is comparable to that provided by sprayed chrysotile fibres.

Construction and operation of the sprayer

The sprayer developed (Figs. 1 and 2) is a low pressure sprayer. The entire spraying equipment consists of a low pressure turbo-fan fitted with a motor, an air compressor, a nozzle and connecting pipes. Asbestos mixed with the binder is put into the suction side of the low pressure turbo-fan, which throws the dry mix under pressure into the nozzle through the connecting pipes. Compressed air from the air compressor is used to atomize water which converges into the main stream of the dry mix of asbestos fibre and binder. The wet fibres are sprayed on a suitably treated surface. Subsequent coating may be applied, thus increasing the thickness of the sprayed specimen. The sprayer works on compressed air at about 35 lb/sq in and water at normal pressure.

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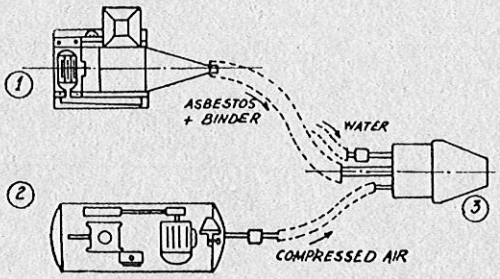

Fig. 1 — The asbestos sprayer: Schematic diagram [1, low pressure turbo-fan fitted with a motor; 2, air compressor; and 3, nozzle]

For working the equipment, the turbo-fan is switched on followed by the air compressor and the water supply. The flow of air and water are so adjusted that a fine atomized jet of water is obtained. The mix of dry asbestos and binder is then fed on to the suction hopper of the turbo-fan. The operator directs the nozzle towards the surface to be sprayed.

As the spraying operation is a low pressure process, the suction pressure is also low. Hence, the feeding at the turbo-fan end is done manually. The quality of the sprayed layer depends on the distance of the nozzle from the surface to be sprayed, the manner of spraying and uniformity of feeding.

Performance of the equipment

The performance of the equipment was judged by measuring (1) the consumption of asbestos; (2) the extent of powdering of fibres; (3) thermal conductivity, sound absorption and density of the sprayed layer; and (4) adhesion of the spray.

Extent of powdering of fibres — The extent of powdering was determined for three varieties of asbestos: (1) anthophyllite amphibole; (2) crocidolite amphibole; and (3) chrysotile. Asbestos of each variety was fed into the hopper separately and the ejected mass collected in a bag at the delivery end. It was sieved in wire mesh (No. 70 IS). The proportion passing for different varieties of fibres was as follows: Anthophyllites, 10%; chrysotile, 10%; and crocidolite, 6%.

Thermal conductivity—Sprayed and trowlled layer of amphibole (2·5 cm thick) was found to have thermal conductance 0·038 kcal/hr °C/m against a value of 0·043 kcal/hr °C/m for specimens of 2·5 cm thick chrysotile asbestos sprayed with imported sprayer supplied by the Integral Coach Factory, Perumbur.

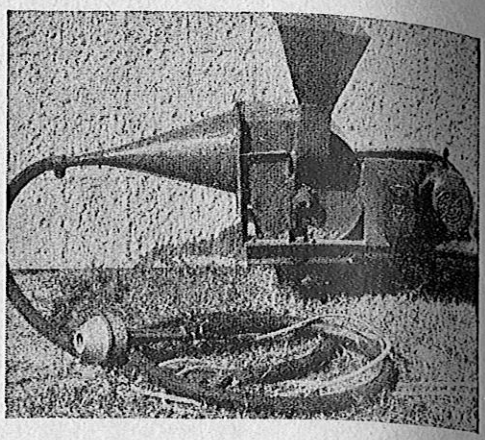

Fig. 2 — Photograph of the asbestos sprayer

Sound absorption — The sound absorbing behaviour of sprayed anthophyllite layer (2·5 cm thick) was found to be comparable to that of commercially available sounding absorbing materials. The value of the sound absorption coefficient of a 2·5 cm thick untrowlled layer of amphibole asbestos was found to be 0·33, 0·38, 0·73, 0·98 and 0·90 at frequencies of 250, 500, 1000, 2000 and 4000 c/s respectively.

Consumption of asbestos — The quantity of asbestos fibres required to cover 1 sq m area up to a thickness of 1·25 cm was found to be 2·0-2·25 kg.

Adhesion of the sprayed layers—The adhesion of sprayed specimens on a steel panel coated with a layer of adhesive was tested by jolting tests in the laboratory. The requirements of the jolting test are that the sprayed layer should not come off when jolted at the rate of 120 jolts/min through 2·5 cm for 30 min. Two specimens made from 4T chrysotile asbestos sprayed with the new sprayer withstood the jolting for more than 1 hr. Jolting was stopped after that period. Four specimens using amphibole asbestos were also similarly tested. Three of these withstood more than 1 hr of jolting and

one failed after 45 min. All the specimens thus passed the jolting test as carried out in the laboratory.

Density — The density of sprayed amphibole asbestos (anthophyllites) layer was found to be about 130 kg/m^3. The density of chrysotile asbestos layer sprayed by the Limpet process varies between 120 and 240 kg/m^3, depending upon water tightness and insulation[1].

Cost of the equipment

The estimated cost of the equipment (without air compressor) is about Rs 1500.

The cost of spraying a 25 mm layer of amphibole asbestos and trowelling it down to 12 mm is estimated to be Re 0.65 per 25 cm sq area.

Acknowledgement

The work forms a part of the normal programme of the Institute and is published with the permission of the Director, Central Building Research Institute, Roorkee.

References

1. BERGER, H., *Asbestos fundamentals*, translated from German by R. E. Oespar (Chemical Publishing Co., New York), 1963, 162.