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BUILDING RESEARCH NOTE

HOUSE DEMOLITION REVEALS EARLY USE OF INSULATED SHEATHING

by

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ABSTRACT

The demolition of a sixty year old wood frame residential building in Halifax revealed the use of "Cabot's Quilt" behind the cladding. This note records the use of this early insulated sheathing together with other design and construction details that reduced the space heating requirements to moderate levels.

INTRODUCTION

The current emphasis on new approaches to conserving energy in wood-frame buildings has led to a careful re-evaluation of some existing buildings in order to understand whether they are performing adequately and the basis for this performance. One such opportunity came up when a residential building near the Atlantic Regional Station in Halifax was demolished in preparation for a new complex.

GENERAL DESCRIPTION

The building was originally constructed in 1923 as a single family house for W.J. MacInnes (Fig. 1). It was later sold to Dalhousie University and served as a residence for women until it was demolished in 1983. The three-storey platform frame structure contained approximately 463 m^2 (5000 $ft.^2$) of heated space over a concrete foundation that was about 12 x 13 m (40 x 44 ft.) (Fig. 2).

Figure 1. View of W.J. MacInnes house from east

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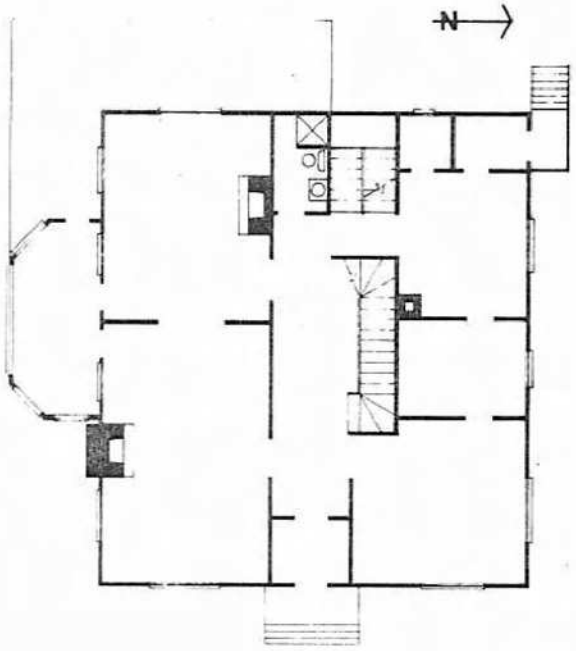
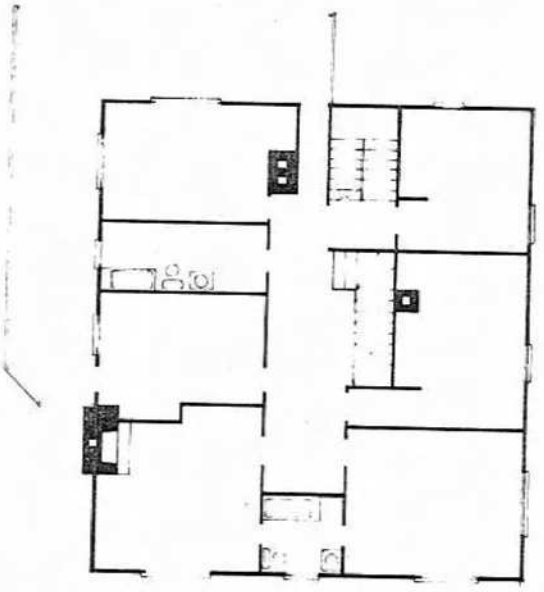
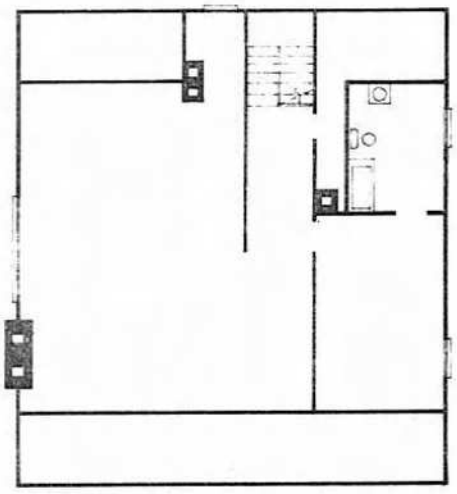


GROUND FLOOR



SECOND FLOOR



THIRD FLOOR

Figure 2. Floor plans

In the winter of 1980-81 the house used 15,955 L (3,510 gal.) of fuel oil to fire the hydronic heating system and to supply domestic hot water. Considering that the stud spaces were not insulated and the house accommodated sixteen residents using three full bathrooms and a shower, the consumption of fuel oil looked very reasonable. In fact the fuel consumption per square meter per degree day was significantly lower than a number of other residential buildings with full wall and ceiling insulation. As demolition proceeded it became apparent that good design, careful selection of materials and quality workmanship had contributed to the airtightness of the envelope resulting in low energy use.

BASEMENT

The basement walls were constructed of 300 mm (12 in.) thick concrete with between 760 and 1200 mm (30 to 48 in.) exposed above grade. No insulation had been applied to the walls. Temperatures were maintained high enough to permit the use of laundry facilities in the basement.

EXTERIOR WALLS

Of special interest in the exterior walls is the use of Cabot's single ply quilt behind the cedar shingles and the careful workmanship at the junction of the wall and foundation (Fig. 3).

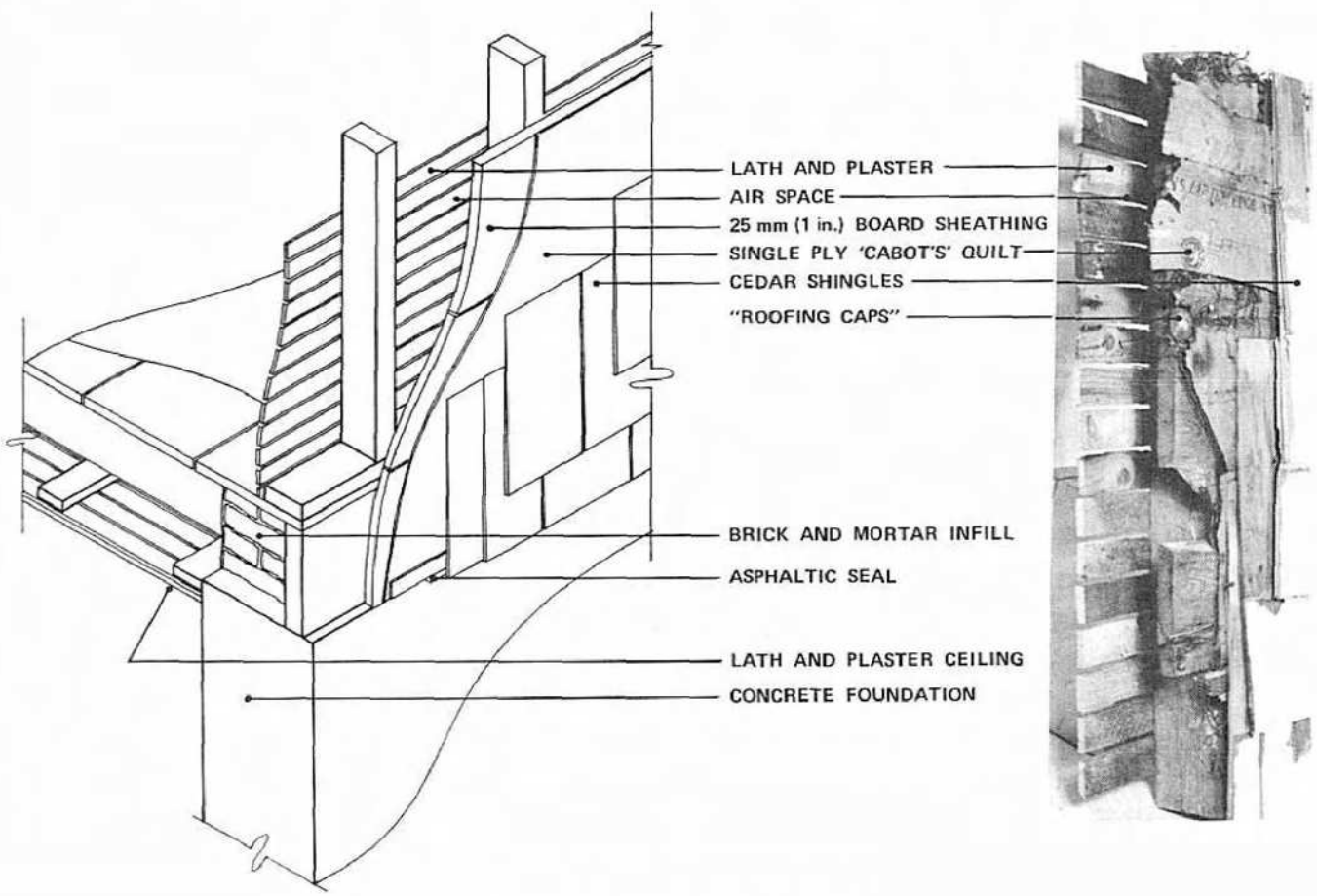


Figure 3. Exterior wall

Cabot's Quilt was composed of a thin layer of eel-grass (seaweed) between two layers of kraft paper that were stitched together to form 915 mm (1 yd.) wide rolls (Fig. 4).

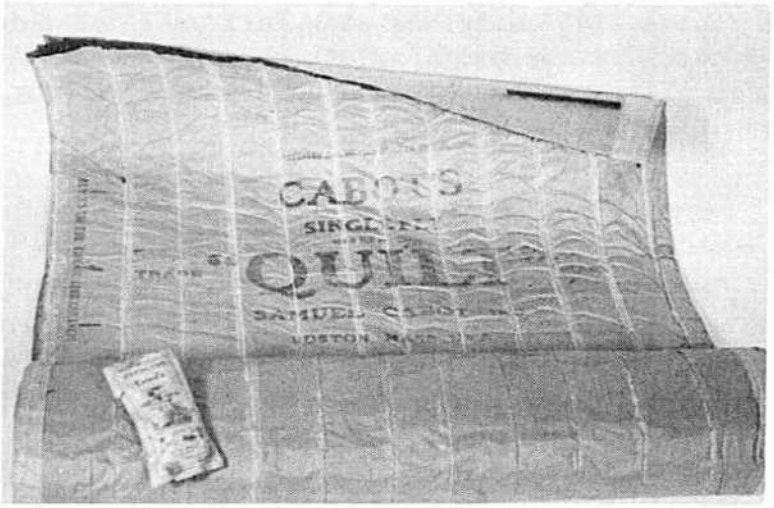


Figure 4. Roll of single ply Cabot's Quilt

Patented in 1915 and 1916, the material was applied horizontally using "roofing caps" which are large washers stamped out of reclaimed sheet metal. The sheathing boards and studs backing up the Cabot's Quilt were found to be dry and sound. Despite some water staining on both the sheathing and Cabot's Quilt the system appears to have been able to cope with the moisture cycles imposed on it (Fig. 5).

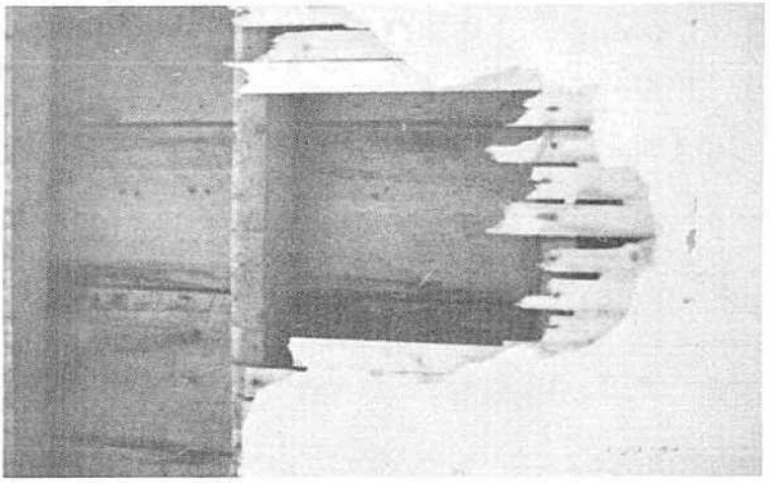


Figure 5. Water staining on the back of sheathing boards

The wall-foundation junction was also carefully sealed. From the inside, bricks were layed between the top of the foundation and the subfloor and parged (Fig. 6). This remained in remarkably good condition over the 60-year life of the building and could possibly be attributed to the dry condition of the floor joists at the time of installation. Outside, the header joist was covered with a layer of Cabot's Quilt and sealed to the foundation with a material similar to plastic cement (Fig. 7).

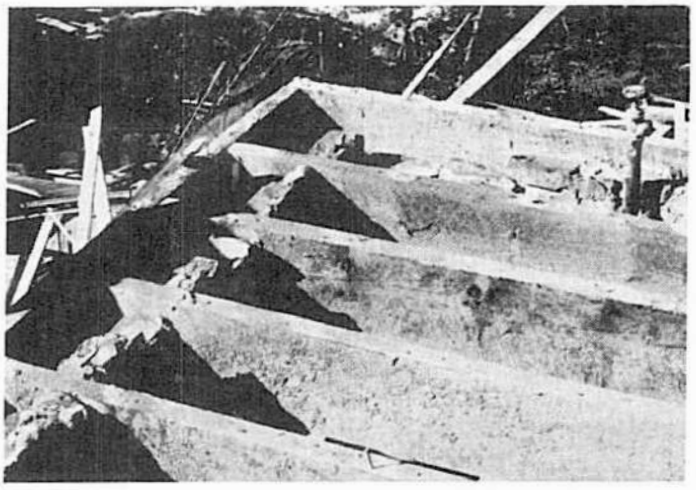


Figure 6. Brick infill between floor joists

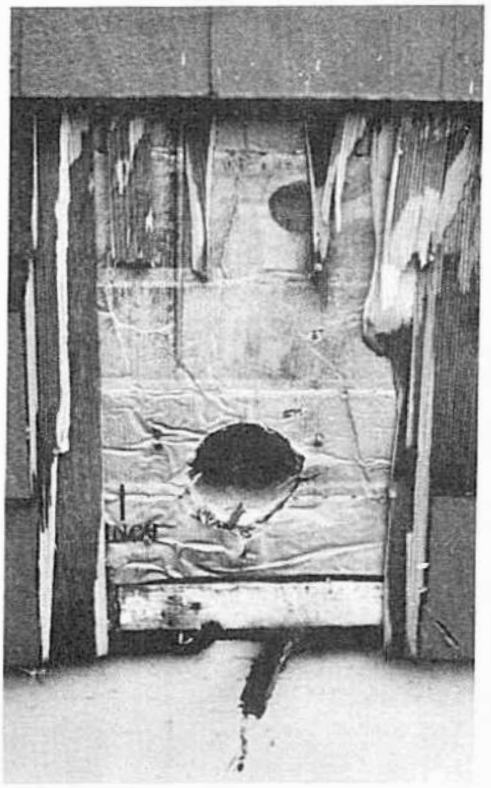


Figure 7. Wall foundation connection

These features, combined with a full plaster ceiling in the basement, would limit air infiltration into the basement and from the basement to the first floor. At the second floor line the Cabot's Quilt extended across the bottom of a decorative canopy and returned under the asphalt shingles to the wall above (Fig. 8). Where this detail was not used the Cabot's Quilt extended across the joist line backed up by a 25 x 250 mm (1 x 10 in.) header.

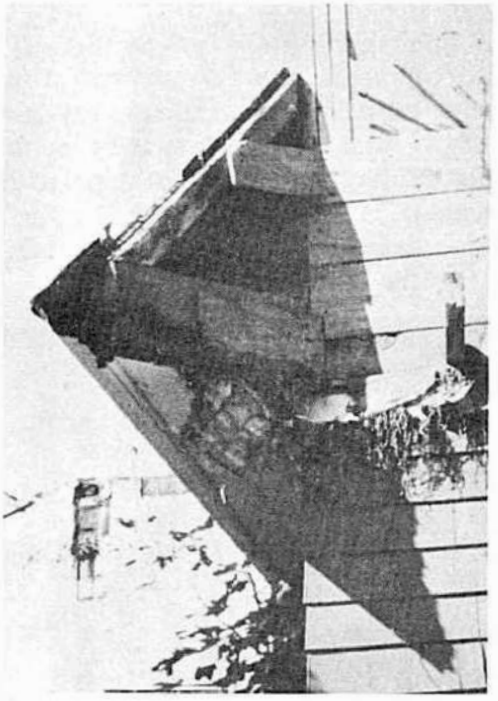
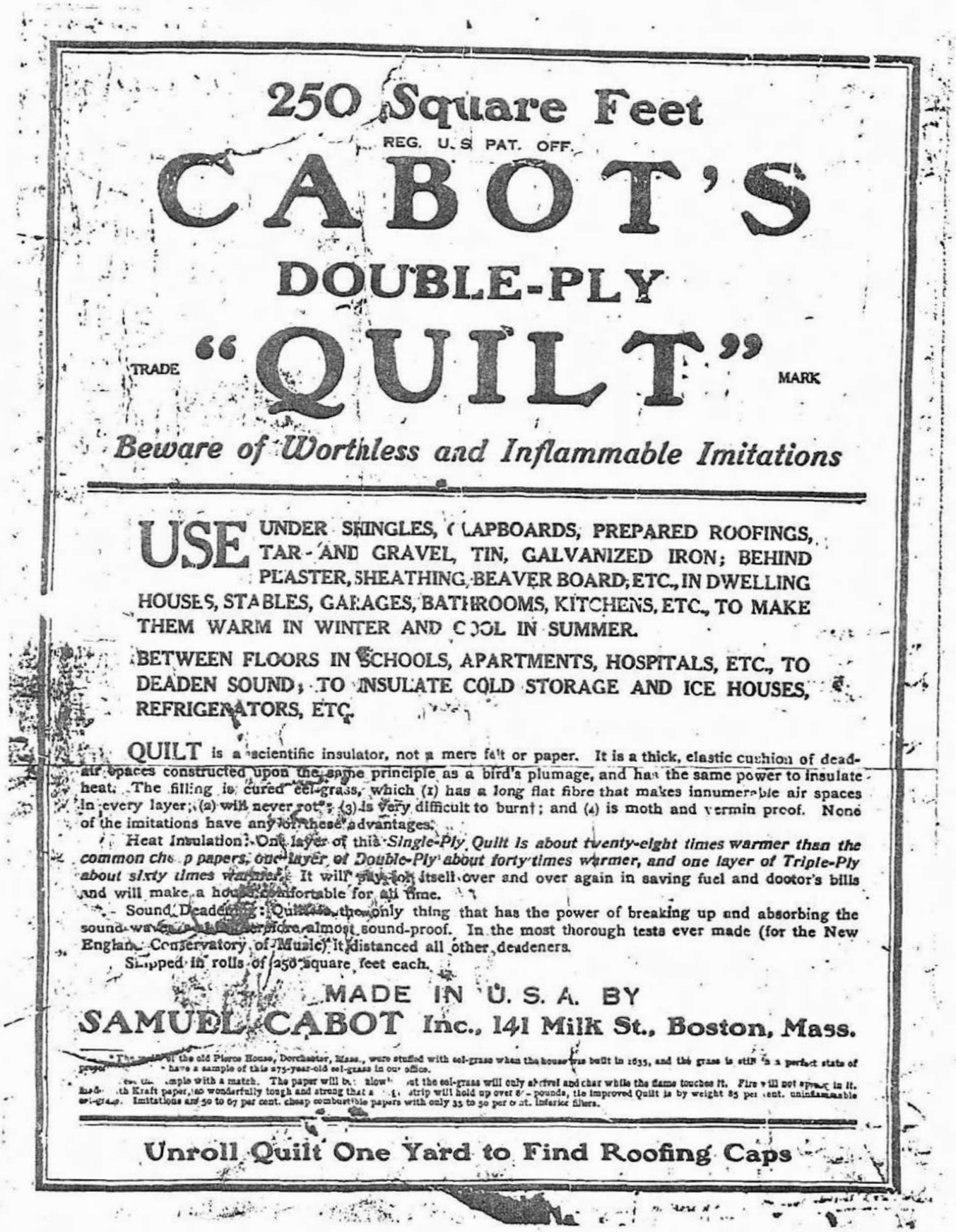


Figure 8. Cabot's Quilt at second floor canopy

Double ply Cabot's Quilt was also applied perpendicular to the second and third floor joists. This material was carefully lapped 25 mm (1 in.) under the strapping and formed a continuous barrier at the floor line except where it was interrupted for services and at two main load bearing partitions (Figs. 9 and 10).

Figure 9. Double ply Cabot's Quilt between floors



250 Square Feet

REG. U. S PAT. OFF.

CABOT'S

DOUBLE-PLY

TRADE "QUILT" MARK

Beware of Worthless and Inflammable Imitations

USE UNDER SHINGLES, CLAPBOARDS, PREPARED ROOFINGS, TAR-AND GRAVEL, TIN, GALVANIZED IRON; BEHIND PLASTER, SHEATHING, BEAVER BOARD, ETC., IN DWELLING HOUSES, STABLES, GARAGES, BATHROOMS, KITCHENS, ETC., TO MAKE THEM WARM IN WINTER AND COOL IN SUMMER.

BETWEEN FLOORS IN SCHOOLS, APARTMENTS, HOSPITALS, ETC., TO DEADEN SOUND; TO INSULATE COLD STORAGE AND ICE HOUSES, REFRIGERATORS, ETC.

QUILT is a scientific insulator, not a mere felt or paper. It is a thick, elastic cushion of dead-air spaces constructed upon the same principle as a bird's plumage, and has the same power to insulate heat. The filling is cured eel-grass, which (1) has a long flat fibre that makes innumerable air spaces in every layer; (2) will never rot; (3) is very difficult to burn†; and (4) is moth and vermin proof. None of the imitations have any of these advantages.

Heat Insulation: One layer of this *Single-Ply Quilt is about twenty-eight times warmer than the common cheap papers, one layer of Double-Ply about forty times warmer, and one layer of Triple-Ply about sixty times warmer.* It will pay for itself over and over again in saving fuel and doctor's bills and will make a house comfortable for all time.

Sound Deadening: Quilt is the only thing that has the power of breaking up and absorbing the sound waves and therefore almost sound-proof. In the most thorough tests ever made (for the New England Conservatory of Music) it distanced all other deadeners.

Shipped in rolls of 250 square feet each.

MADE IN U. S. A. BY

SAMUEL CABOT Inc., 141 Milk St., Boston, Mass.

† The walls of the old Pierce House, Dorchester, Mass., were stuffed with eel-grass when the house was built in 1635, and the grass is still in a perfect state of preservation. We have a sample of this 275-year-old eel-grass in our office.

Test the sample with a match. The paper will burn, allowing the eel-grass will only shrivel and char while the flame touches it. Fire will not spread in it. Backed with Kraft paper, so wonderfully tough and strong that a 1-inch strip will hold up over 60 pounds, the improved Quilt is by weight 85 per cent. uninflammable eel-grass. Imitations are 50 to 67 per cent. cheap combustible papers with only 33 to 50 per cent. inferior fillers.

Unroll Quilt One Yard to Find Roofing Caps

Figure 10. Wrapping label from double ply Cabot's Quilt

DOORS AND WINDOWS

Zinc flashing at door and window jambs was carefully detailed to maintain a wind barrier in line with the Cabot's Quilt in the wall (Fig. 11). Steel framed storm windows were added at a later date.

Figure 11. Zinc flashing maintains air barrier at windows

INTERIOR DETAILS

Interior partitions on the third floor had continuous top plates limiting the amount of air exfiltration into the attic (Fig. 12). Electrical outlets were located mainly on interior walls. Since the interior finish was lath and plaster, air leakage around any exterior electrical boxes and plumbing supply or drain pipes was minimized (Fig. 13). The three fireplaces had been closed off with masonry and parged over.

Figure 12. Continuous top plates

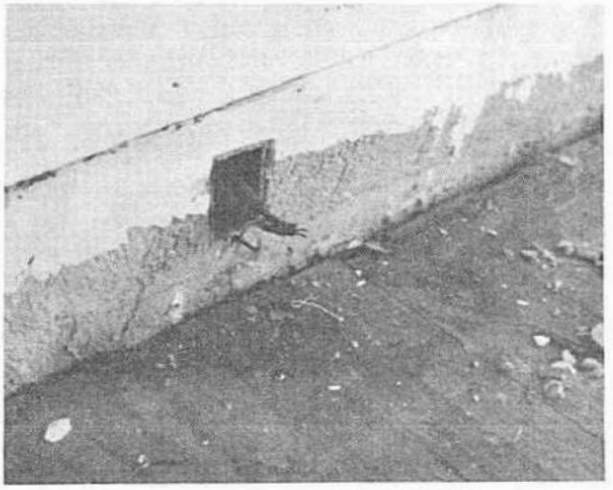


Figure 13. Electrical outlets

ATTIC

The third floor ceiling was covered with a layer of double ply Cabot's Quilt running perpendicular to the ceiling joists. This material extended into the kneewall spaces maintaining the air barrier down to the exterior wall (Fig. 14). In the attic, a second layer of quilt was lapped over the ceiling joists.

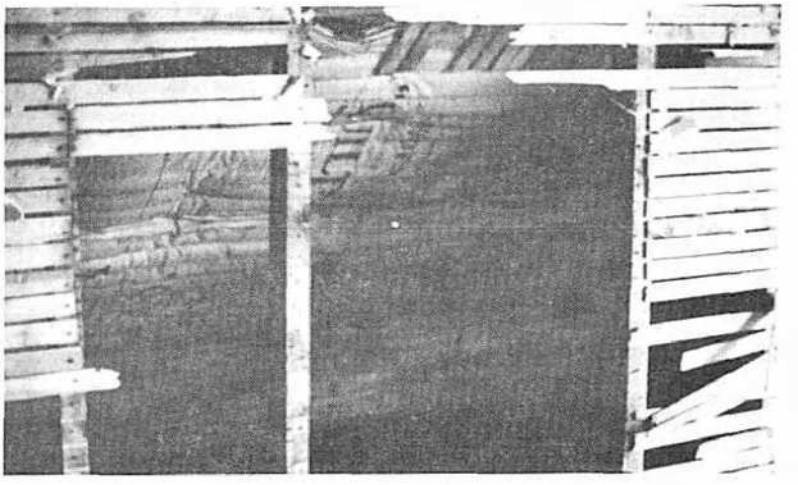


Figure 14. Double ply Cabot's Quilt on rafters

CONCLUSION

Careful site inspection during building demolition can lead to an understanding of why some buildings have modest space heating costs. For the building reported in this Note, it is apparent that the selection of quality materials and careful workmanship at the time of construction both contributed to its overall performance.

ACKNOWLEDGEMENT

The author expresses his appreciation to Mr. Reuben Marriott and the work crew of Manhattan Demolition for their assistance on site and to Walter Crosby for the preparation of photographic material.