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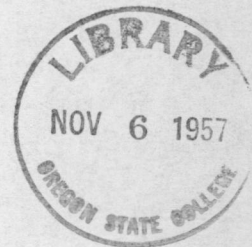
THE PROPERTIES AND USES  
OF FIR-TEX

by

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A Thesis

Presented to the Faculty  
of the  
School of Forestry  
Oregon State College



In Partial Fulfillment  
of the Requirements for the Degree  
Bachelor of Science

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OREGON STATE COLLEGE  
CORVALLIS, OREGON

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## THE PROPERTIES AND USES OF FIR-TEX

## INTRODUCTION

From the beginning of man on earth insulation has played an important part in the shelters constructed. Caves, dugouts, grass and ice huts, and many other forms of protection from the elements have developed into the various materials now available.

Insulation, whether natural or man made, is dependent on the presence of millions of microscopic air cavities or spaces. Man has always used these air spaces as protection, whether he knew it or not. With the growth of knowledge, the original products were improved upon until today Fir-Tex, the rigid, super-insulating and sound-deadening board is incorporated in the floors, walls and roofs of our most efficient homes. In addition to its insulating and accoustical properties, consideration must be given to the structural values of Fir-Tex as well as to the economies resultant from its addition to homes already built.

It is easy to understand why a specially-constructed material will do a better job of insulating and sound-deadening than ordinary materials chosen for their structural value alone, such as those which have been handed down from the days when we did not know how to cut huge fuel bills practically in half.

# *Insulate and Beautify*

AT THE COST OF INSULATION ALONE



**FIR-TEX**

SUPER INSULATING BOARD

Economy is not the only thing to be considered when using Fir-Tex. Personal health and physical well being are also promoted through its use.

#### GENERAL

There is not a person who would not benefit by using Fir-Tex. Its uses are so varied that everyone, at some time or another, has occasion to benefit by them. But before we go into detail, let us briefly review the process of manufacture and the history of Fir-Tex as written for this thesis by Mr. Glenn Cheeney, sales-manager of Fir-Tex products for Dent and Russell, Inc., who handles the sales of the product:

"In the year 1928 several enterprising business men of the Pacific Coast, residing in Los Angeles, San Francisco, Portland, Tacoma and Seattle formed the Fir-Tex Insulating Board Company for the purpose of utilizing the waste material from the forests of this great Pacific Northwest. In looking around for a place to begin, they concluded that to utilize the waste material at the sawmills would accomplish a great result and at the same time give them the raw material that they would use for the construction of an insulation board.

"The plant was built at St. Helens on the Columbia River at a cost of approximately two and one-half million dollars. The raw material then was gathered from the various mills, using the slab wood, bark and all. This was later changed, however, by removing the bark from the slab and the wood in the slab was entirely utilized."

Mr. Cheeney's description goes on to describe how the slabs are now sent to the Fir-Tex plant, where they are put through chipping machines. These machines are large vertical discs, through the face of which protrude

large knives that cut from the ends of the slabs chips approximately  $3/4$ " long. These chips pass over screens, permitting the passage of uniform sizes through the screens and onto a moving belt, by which they are taken into the main plant to await their discharge from the storage bins and into the various digesters.

These digesters, six in all, are approximately 18' in diameter, spherical in shape, and are filled at regular intervals with chips, hot water, and steam, together with the chemical softening agents. The chips remain in these digesters for a determined length of time. After the chips become softened--not cooked--they are conveyed through a large shredding machine. From this shredding machine they are deposited in a large vat, and from there, being conveyed by water, they are pumped through the other various machines, and are reduced in size from one machine to the other.

During the process of reduction and just before they are discharged from these vats, the waterproofing and the termite preventative are added. The material is then pumped onto a screen approximately 14' wide, and moving at a determined speed all the time. Through this screen is precipitated the moisture, which forms approximately 95% of the volume. This forms the board, and between rollers and vacuum boxes the moisture is drawn from the product as it is formed into a sheet, until the board has all been formed. The fibers are all entwined into a homogeneous piece of insulating material.

At this point the board contains approximately 60% of moisture and from here it enters the dry kilns. During the previously described process of manufacture, the consistency of the material is maintained the same all the time, taking into consideration the density of the board, its thickness, as well as its tensile and transfer strength. After the board has been dried, it is of uniform thickness, each sheet being approximately 12' 4" wide, and in regular lengths of 6' to 12'. The product then goes through a battery of saws cutting to widths and to lengths. It is then carefully inspected and bundled ready for the market, with the following exceptions:

Some of the material has been cut and formed into a very light-density product, as light as  $8\frac{1}{2}$  to 10 lbs. per cubic foot. This, of course, contains numerous air voids and this is used for extremely cold temperatures, such as cold-storage work, and for insulation in electric and ice refrigerators. It is used for insulation instead of imported cork from Morocco and Spain. After boards of this density have been formed, they are cut up into sizes suitable for the use of manufacturers of various electric and ice refrigerating machines, as stated above.

During the entire process of manufacture, there are many points that must be watched with a great deal of care. First of all, the board must be well waterproofed, each fiber having a coating of waterproofing. This step

includes the application of a good coat of waterproofing to each fiber. There is a chemical for this purpose. The process of manufacture must attain temperatures high enough to kill all bacteria that would naturally live in all kinds of vegetable matter. The Fir-Tex process kills these and a sterilized board is produced that will, with proper care, never grow any fungus.

In the manufacture of wallboard, which is made in  $3/8$ " and  $1/2$ " thicknesses and used for insulation as well as structural strength, the board must attain a certain tensile as well as transfer strength.

Now that I have described the process of manufacture, I want to mention that it is the object of the manufacturers of Fir-Tex to produce an insulation that will give the home owner the maximum of comfort at the lowest possible cost. In this way it is believed that it will be possible for all who are building homes to use this product and attain a still higher standard of living.

#### WHY A SPECIALLY-CONSTRUCTED INSULATING MATERIAL SHOULD BE USED

The main reasons for using a specially-constructed insulating material are: (1) greater personal comfort and (2) greater economy.

Personal comfort is one of the largest contributing factors towards happiness. It is said that happiness can not be bought, but I am suggesting one way to do it: insulate and beautify with Fir-Tex products. Many eminent

physicians contend that the common cold is caused by subjection to uneven temperatures. I do not know whether or not this is true, but I do know that the use of Fir-Tex promotes even temperatures throughout the home or office, where comfort is paramount. No more sitting in one corner of the room to avoid drafts. The Fir-Tex home is draft-free.

The greatest economy resulting from the use of Fir-Tex is that of fuel saving and smaller heating units. Other economies may be seen when consideration is given to the time saved in application with relation to materials which might have been used. When Fir-Tex lath is used as a plaster base, from eight to ten percent of the plaster is saved over wood lath, as that amount is lost through the spaces between the wood lath. If "Fir-Tex Ivorykote" is used there is a saving on painting or other interior finish which would ordinarily be required. When using "Fir-Tex Firkote," sheathing is unnecessary. One has insulation as well as sheathing, and there is an additional saving in that there is not as much waste as in lumber.

In the summer time, when no saving can be made on fuel for heating, Fir-Tex furthers the efficiency of air-conditioning plants. When this is considered, the all-around use of this product becomes more evident.

When considering that proper insulation saves 40% on fuel costs throughout the year, it is easily understood

that Fir-Tex will pay for itself in a comparatively short while. And then considering it as an investment--naturally a structure possessing the advantages of Fir-Tex will have a higher resale value.

The accoustical, or sound deadening properties of Fir-Tex are superior to those of all other fabricated boards. This can be certified by practical experience. For the past year I have lived in an apartment, lined with Fir-Tex plaster-base lath alone. On all sides and above me live students--just the ordinary type of students--who make an average amount of noise. With the bedlam at its height, I scarcely heard the sound. The infinitesimal air pockets absorb the sound. The sound waves, which bounce back and forth and jangle the nerves, are all but completely eliminated.

#### 1. LOWER FUEL BILLS

"Fir-Tex has such low thermal conductivity that refrigeration engineers specify it in place of cork. Industrial plants, railroads and city municipal departments testify to the successful use of Fir-Tex for every insulating purpose, from insulating refrigerator cars to insulating the ice slab of skating rinks."

The most important of these diversified uses, that of fuel saving, should be of paramount interest to every home owner. Proper insulation throughout a home, as expressed by the United States Bureau of Standards, affords

the following results:

Adding one-half inch of insulation saves 20 to 30%.

Adding 1-inch layer of insulation saves 30 to 40%.

Where there are very hard winters or where fuel is extremely high, insulation may pay for itself in from three to four years, and even in mild climates within a comparatively short time.

## 2. SMALLER HEATING UNITS

Where there is an inadequate heating system, insulation may be added to offset the deficiency.

When computing the size of heating units to be installed, consideration is always given to the type of materials used in construction. When Fir-Tex is used in conjunction with a hot-air, vapor, or steam system, a saving of from ten to fifteen percent will be realized on the cost of heating equipment. A hot-air system, which requires no radiators, does not afford quite as great a saving as this.

## 3. WARM IN WINTER, COOL IN SUMMER, COMFORTABLE ALWAYS

Experiments made at the university of Illinois have proved conclusively that a home, in the winter, properly insulated and with storm-proofed windows, is definitely more comfortable than one not so protected but at the same temperature. This phenomenon is explained by the fact that the interior surfaces of the unprotected structure are colder and have a chilling effect upon the body.

*The New* **FIR-TEX** *"Fir-kote"*



**SHEATHING**

**BOARD**

STRONGER THAN LUMBER... GREATER  
INSULATION AGAINST HEAT, COLD, NOISE  
... AIR TIGHT AND DUST TIGHT... WATER-  
PROOF... TERMITE PROOF... CLEAN AND  
EASY TO HANDLE... LOWERS FUEL BILLS  
LOWER APPLICATION AND MATERIAL COSTS

**FELTED FIBRES FROM LONG LIVED NORTHWEST TREES**

This principle explains why Fir-Tex insures an even temperature throughout a room, allowing correct humidification without condensation, as well as comfort and health.

Air, like other compounds, tends to equalize its differences in temperature. The rate at which it does this depends upon the thermal conductivity of the material intervening. Fir-Tex, the material planned and manufactured specifically for this purpose, has a thermal conductivity much less than that of wood. In the words of its manufacturers: "--an inch of Fir-Tex would conduct only .307° F per hour for each degree difference in the temperature on opposite sides of the board. That is heat resistance! The ability of Fir-Tex to stop heat is approximately 10% more than that of other leading insulating boards." The result is a summer temperature in many cases 15° lower than that of the uninsulated structure.

It is a matter of time until air conditioning will be as common as furnaces. Proper circulation of air by these units requires adequate insulation. The wise builder will keep these facts in mind and provide for the inevitable by the proper application of Fir-Tex.

#### 4. FIR-TEX REDUCES FIRE HAZARD

In many localities quick drops in temperature are common. If the structure is insulated with Fir-Tex the danger of fire from such a cause is at a minimum, since changes in outside temperature only gradually affect the

# FIR-TEX "Firkote"



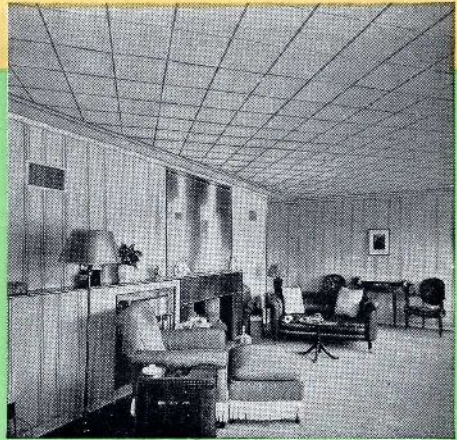
*Use* **FIR-TEX INSULATING SHEATHING BOARD INSTEAD OF LUMBER AND PAPER . . . .**

*Here's why* 

1

# A Beautiful

## INTERIOR FINISH

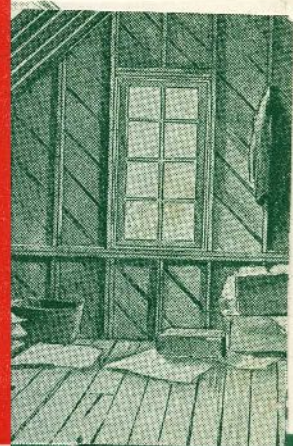


*with* **FIR-TEX  
"IVRYKOTE"**

# Dual Utility *in*

## HOME REMODELING

*with* **FIR-TEX**



## **FEATURES OF** **SUPERIORITY**

1

Saves you money. It costs no more than ordinary insulation and yet serves both as insulation and as sheathing.

2

This super-insulation materially reduces fuel bills.

3

There is less waste than with lumber sheathing. Made in standard wall heights.

4

Adds to the durability and safety of your home. Firkote is stronger than lumber.

5

Adds to the comfort of your home. Firkote is air-tight, dust-tight, wind-proof, termite-proof. No infiltration of air or dust.

6

Protects home from dampness. Fir-Tex fibres are waterproofed in the manufacturing process. The surface of the board is further waterproofed for double protection.

2

Let us show you the many ways of insulating and beautifying with . . .

## **FIR-TEX**

### **FIR-TEX FOR THE HOME**

Fir-Tex adds greatly to the enjoyment of a home. It makes the home much more comfortable—keeping out winter cold and summer heat equally well. Fir-Tex reduces fuel bills by preventing heat wastage. And it quiets nerve-racking noises. For the air-conditioned home, efficient insulation is a necessity.

Fir-Tex is a super insulating material of many uses. In the modern home you will find Fir-Tex from foundation to ridge. It is recommended for use on outside walls as sheathing, and on inside walls either as a plaster base or as an interior finish.

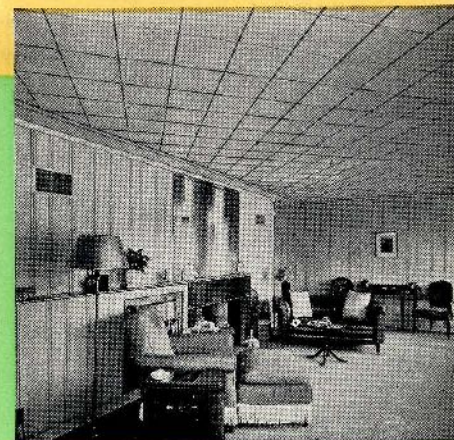
### **FIR-TEX for the OFFICE or STORE**

Comfort and profits go hand in hand with Fir-Tex installations in offices and stores. Fir-Tex increases comfort in two ways: by protecting staffs and customers from winter cold and summer heat, and by absorbing sound. And in addition, it cuts heating costs. Fir-Tex is widely used in the modernization of stores and offices—both as a plaster base and as an interior finish.

5

A Beautiful

INTERIOR FINISH



with **FIR-TEX**  
"IVRYKOTE"

**F**IR-TEX is a "year-round-Comfortizer", that affords you added protection from *heat or cold*.

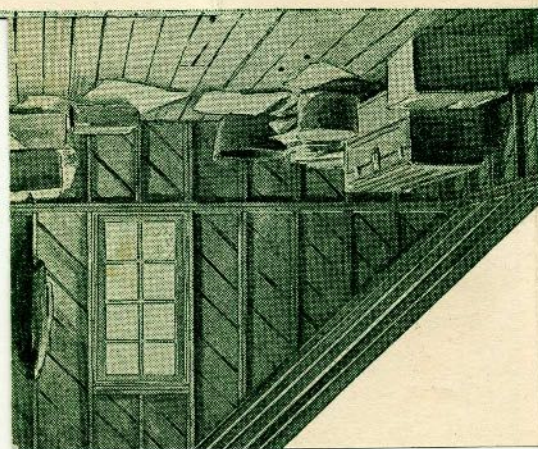
A FIR-TEX insulated house is at least 10 degrees *cooler* in *summer*, and will show *savings* up to one-third in fuel bills.

You can convert waste spaces into rooms of *beauty* and usefulness in only a short

while, as FIR-TEX is easy to apply because of its rigidity and standard sizes.

To *decorate*, the new *neutral tan color* is well in keeping with modern remodeling, and the various methods of beveling and grooving add additional charm. However, *paint* or *kalsomine* may be applied. Remodel with FIR-TEX now and you remodel with beauty and economy.

Patent No. 1841041



## FEATURES OF SUPERIORITY

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2

## FIRKOTE "FELTED FIBRES"

*keep out winter cold and  
summer heat*



Modern construction requires a sheathing material that provides insulation against heat, cold and noise . . . and one that prevents the infiltration of wind, dust and moisture.

Fir-Tex Firkote meets these requirements 100%.

And in addition to these advantages, it saves you money! For the price of insulation alone you get both insulation and sheathing.

Fir-Tex Firkote makes shiplap-and-paper obsolete.

Firkote is a glazed board, smooth as finished lumber.

It is clean to handle and is easily sawed for window and door openings.

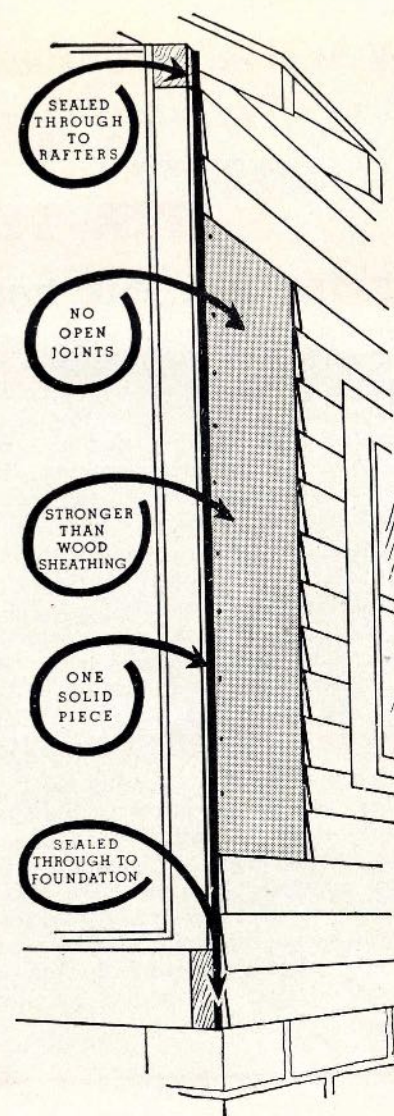
Firkote provides walls of greater bracing strength than lumber . . . and walls that are moisture-proof and termite-proof.

Fir-Tex Firkote is made in the standard thickness of  $2\frac{1}{2}$ "', is 4' wide; available in lengths of 7', 8', 9', 9 $\frac{1}{2}$ ', 10' and 12'.



### Firkote Protection Costs no More

Firkote Sheathing costs no more than lumber and building paper when you figure labor cost saving; and it's so much better. Fuel cost savings are enormous. And if you plan on air-conditioning, you simply must use Firkote Sheathing Board. *Fir-Tex is unique. It is not a plaster board. It is made from natural fibres of sound wood, sterilized and felted into boards with tremendous insulating qualities.*

3



*Dual Utility*  
*in*  
**HOME  
REMODELING**  
*with* **FIR-TEX**

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### **FIR-TEX for the OFFICE or STORE**

Comfort and profits go hand in hand with Fir-Tex installations in offices and stores. Fir-Tex increases comfort in two ways: by protecting staffs and customers from winter cold and summer heat, and by absorbing sound. And in addition, it cuts heating costs. Fir-Tex is widely used in the modernization of stores and offices—both as a plaster base and as an interior finish.

5

*A Beautiful*

**INTERIOR FINISH**



*with* **FIR-TEX**  
**"IVRYKOTE"**

*Dual Utility*  
*in*

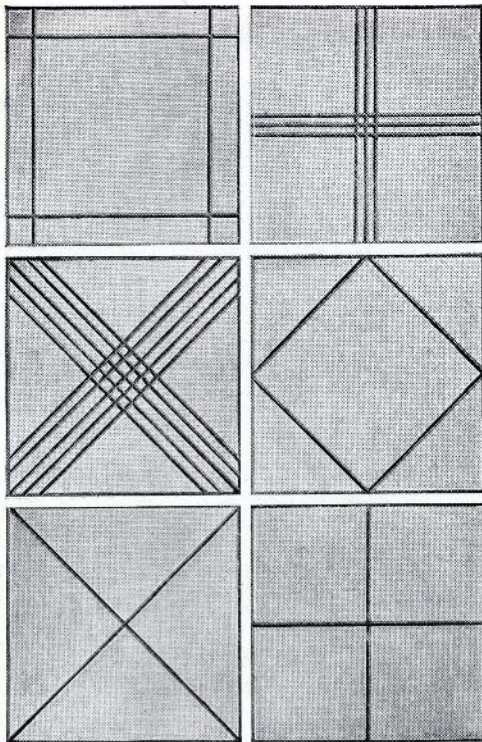
**HOME  
REMODELING**

*with* **FIR-TEX**

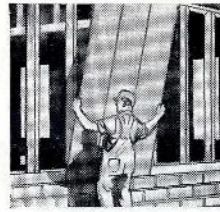


**FIR-TEX** Lends itself to  
Grooving, Paneling, Stenciling

**SUGGESTED  
TREATMENTS**

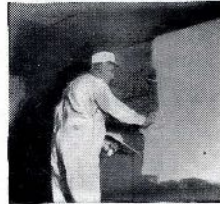


**THERE'S A SPECIAL FIR-TEX  
BUILDING BOARD FOR EACH OF  
THESE JOBS**



**Fir-Tex "Firkote"**  
for Sheathing

Save money by using Fir-Tex Firkote as sheathing. Instead of applying sheathing lumber and paper *plus* insulating board, do both jobs in one operation and at one cost by applying Fir-Tex Firkote.



**Fir-Tex Insulating  
Plaster Base Lath**

This is the modern plaster base. Nail it directly on studding, and apply plaster. You get a smooth, crack-resistant finish. And in addition you get highly efficient protection against heat, cold, noise.



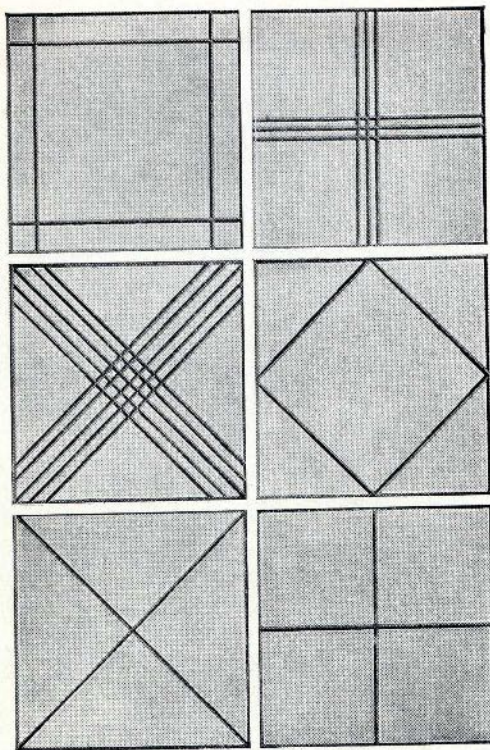
**Fir-Tex "Ivrykote"**  
for Interior Finish

This super-insulating board has a smooth, mottled-ivory surface. It is popular as an interior finish. The surface is washable. It may be used with its original surface, or may be further decorated without sizing.

*Dual Utility*  
*in*  
**HOME  
REMODELING**  
*with* **FIR-TEX**

**FIR-TEX** Lends itself to  
*Grooving, Paneling, Stenciling*

**SUGGESTED  
TREATMENTS**



2

**FIR-TEX Ivrykote** may be used in  
*its natural color, painted or kalsomined . . .*



FIR-TEX developed the "Ivrykote" board to fill a definite need—for a light-colored board of strong insulating properties, that can be used for interior finish.

Fir-Tex "Ivrykote" fills this need completely. It has an attractive mottled ivory finish. Further, the surface is smooth, and washable.

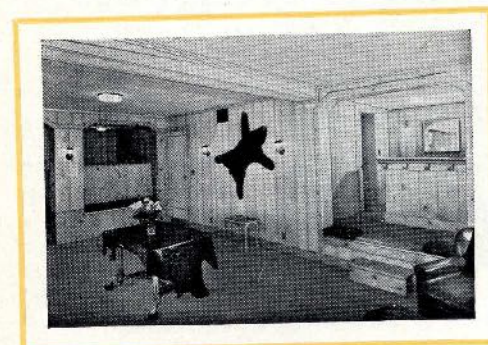
You may use Fir-Tex "Ivrykote" in its natural color, or you may paint or kalsomine it in any color you wish.

3

Interesting effects may be obtained by grooving or stenciling the board.

Like other Fir-Tex boards, "Ivrykote" is easily installed and clean to handle.

"Ivrykote" is particularly adaptable for use in modernization of homes. Add new living space to your home by finishing an attic bedroom in "Ivrykote," or by converting an unused basement space into a recreation room. In the attic, insulation against heat and cold is needed. In the basement, soundproofing is desirable. Fir-Tex "Ivrykote" meets both requirements.



4

*Dual Utility*  
*in*

**HOME  
REMODELING**

*with* **FIR-TEX**



inside temperature, and consequently no sudden huge furnace fires are necessary. Such furnace fires, necessary in unprotected structures, are very often a cause of serious fires which annually take a devastating toll.

Fir-TEX is very fire resistant, and when ignited, is extremely slow-burning. Tests are now being run on a new board which has "Unifil" interspersed throughout the fibers. Unifil is a mineral product which is 100% fire-resistant and a non-conductor of electricity. This new material should prove to be an ideal product.

#### SIZES, THICKNESSES, FINISHES OF FIR-TEX INSULATING BOARD

The Fir-TEX Insulating Board Company has, at the present time, eight major types of their product on the market. Each is specially adapted to one or more purposes. A list of these follows:

##### 1. FIR-TEX BUILDING BOARD

Natural Tan Color

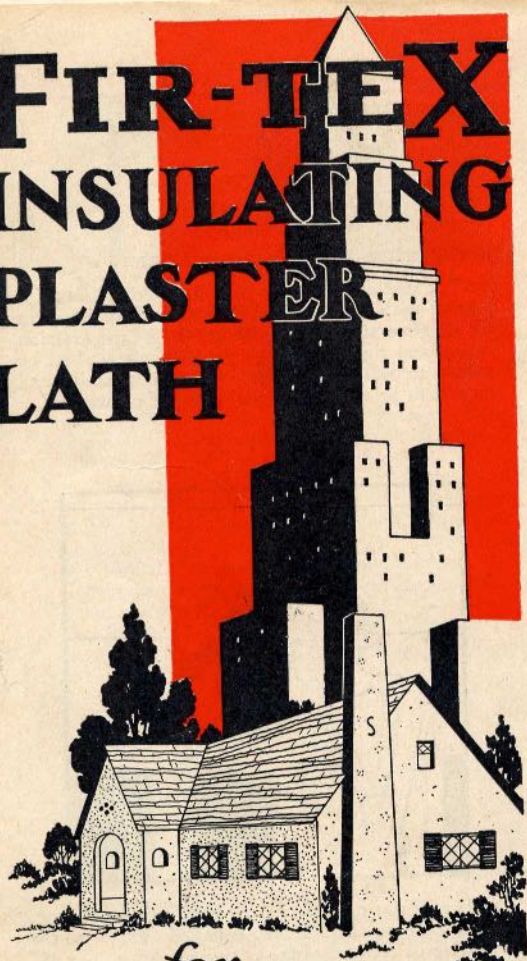
Standard Thicknesses:  $\frac{1}{2}$ " and 1".

Sizes: 4' x 4', 4' x 5', 4' x 6', 4' x 7',  
4' x 8', 4' x  $8\frac{1}{2}$ ', 4' x 9', 4' x  $9\frac{1}{2}$ ',  
4' x 10', 4' x 12'.

##### 2. FIR-TEX "IVRYKOTE"

Same sizes and thickness as regular building building board, only with mottled ivory, glazed washable surface.

# FIR-TEX INSULATING PLASTER LATH



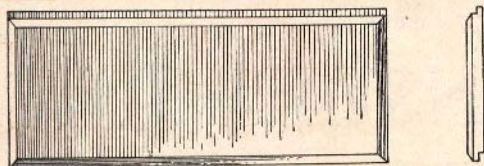
*for*  
All Buildings

# FIR-TEX *Roof Insulation Board*



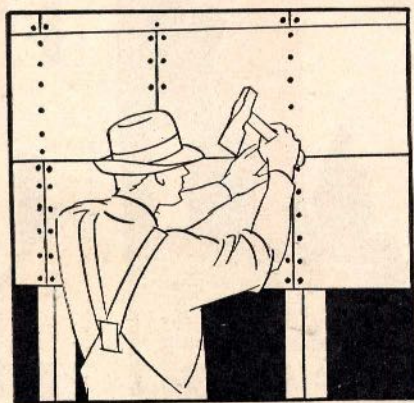
**Lower Application Cost  
Greater Effectiveness**

### All Edges and Ends Beveled



Fir-Tex Insulating Plaster Lath has both edges shiplapped, with all edges and ends beveled as shown in the diagram above. The lath is full  $\frac{1}{2}$ " thick and is strong and rigid. Studs, joists, and rafters shall be framed according to ordinary frame construction and they shall be spaced accurately on 16" centers.

### Easy to Apply



Fir-Tex Insulating Plaster Lath is 18" wide, 48" long, and full  $\frac{1}{2}$ " thick. The lath is nailed directly to the studding or ceiling joists, as shown above. The 48" length is proper for studding and joists placed upon 16" centers, which measurement we consider necessary for satisfactory results.

### Apply Fir-Tex Plaster Lath

To be applied with the *beveled* edges exposed to receive and reinforce the plaster.

To be laid horizontally across studding in a continuous line. The ends to be centered on the studding or joists. Leave  $\frac{3}{16}$ " space between ends of lath on studs or joists, and  $\frac{1}{16}$ " space between shiplapped edges. The end joints of lath to be staggered on studs and joists in all following courses.

- To cut Fir-Tex lath, score with sharp edge of hatchet; break along scored line or cut with standard hand saw.
- To cover curves and arches, nail at the center first, then bend and nail at each stud.
- For 18" Fir-Tex lath use 6 nails per stud, using Blued nails  $1\frac{1}{8}$ " long with  $\frac{1}{8}$ " heads. *Always nail lath at center first!*
- All corners from ceiling to floor to be reinforced with standard galvanized metal. All angles, both ceiling and walls, to be reinforced with wire mesh or metal lath 6" wide, bent and stapled over the Fir-Tex lath to the framing every 12 inches. Reinforce joints between framing and masonry walls same as interior angles.
- All Fir-Tex Lath is full  $\frac{1}{2}$ " thick, wrapped in kraft paper packages, each containing 15 lath or 10 square yards per package.

### Directions for Plastering

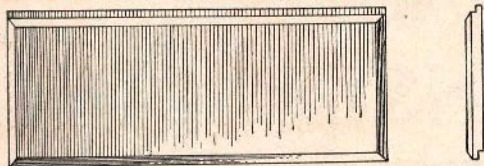
- Use Gypsum plaster with not to exceed two parts of clean sand, measurement by weight.
- Do not wet Fir-Tex Lath! Apply plaster, pressing well into all joints. Spread the first coat of plaster very thin and even, pressing into beveled edges and joints. Scratch and brown coats together must have a thickness of at least  $\frac{3}{8}$ ". The finish coat should not be more than  $\frac{1}{8}$ " thickness, and the total plaster thickness not less than  $\frac{1}{2}$ ". A standard three coat plaster job is recommended.
- Rod strokes should be in the direction of the joists or studs and should always span two joists or studs.
- Do not let plaster freeze. Thoroughly ventilate and heat rooms if necessary.

# **FIR-TEX.**

## Roof Insulation Board

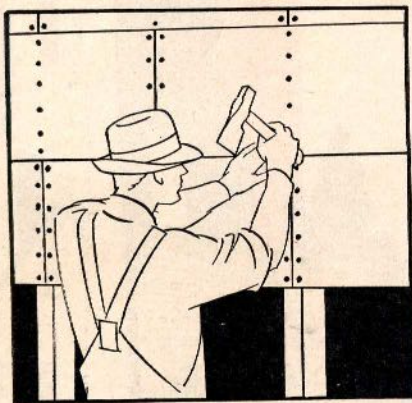
**Lower Application Cost**  
**Greater Effectiveness**

## All Edges and Ends Beveled



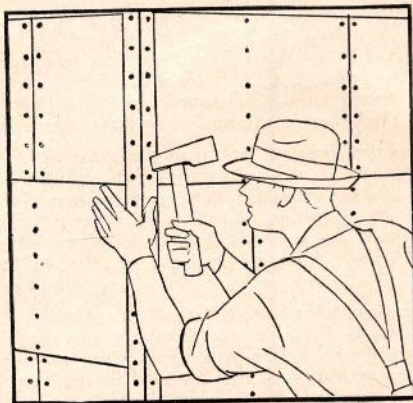
Fir-Tex Insulating Plaster Lath has both edges shiplapped, with all edges and ends beveled as shown in the diagram above. The lath is full  $\frac{1}{2}$ " thick and is strong and rigid. Studs, joists, and rafters shall be framed according to ordinary frame construction and they shall be spaced accurately on 16" centers.

## Easy to Apply



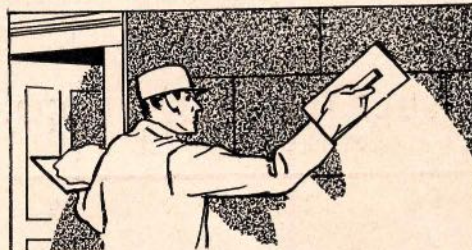
Fir-Tex Insulating Plaster Lath is 18" wide, 48" long, and full  $\frac{1}{2}$ " thick. The lath is nailed directly to the studding or ceiling joists, as shown above. The 48" length is proper for studding and joists placed upon 16" centers, which measurement we consider necessary for satisfactory results.

## Applying Metal Corners



Upon completion of the entire area of your room with Fir-Tex Insulating Plaster Lath, all exterior angles shall be reinforced with metal corner Bead, and all interior angles shall be reinforced with standard wire mesh, bent into the angle, and secured by stapling or nailing.

## Plaster Directly Upon Fir-Tex



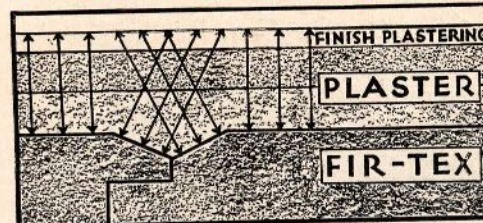
Plaster is applied directly upon Fir-Tex Insulating Lath, as shown above. Do not wet Fir-Tex Lath before plastering. Prepared Gypsum plaster may be

used. For neat Gypsum plaster; mix one part Gypsum plaster with two parts, by weight, clean, sharp sand. Sanded Gypsum plaster or Gypsum fiber plaster may be used when mixed according to manufacturer's specifications.

Lime plaster must not be used for either scratch or brown coats. Spread the first coat of plaster very thin and even, pressing into beveled edges and joints. When dry, apply brown coat. Both scratch and brown coats shall have a thickness of not less than  $\frac{3}{8}$ ", and the over all plaster thickness shall not be less than  $\frac{1}{2}$ ". Brown coat must be thoroughly dry before finish coat is applied. When mixed according to manufacturer's specifications, any type of finish coat may be applied providing its thickness does not exceed  $\frac{1}{8}$ ".

When uneven ceiling joists cause an uneven surface after the lath is applied, a three coat job should be applied over the entire ceiling area. After the scratch coat is thoroughly dry, the brown coat should be applied and the surface made smooth and even by properly rodding the brown coat. Plaster jobs when applied to Fir-Tex Insulating Lath in the foregoing manner will eliminate heat leakage and plaster cracks.

## Note the Finished Results



Fir-Tex Insulating Plaster Lath as shown above contains the finished plaster. Note the reinforcement obtained from the bevel and the rigidity obtained from the shiplap.

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## You Get Better Insulation at Less Cost with **FIR-TEX** Roof Insulation Board

THERE is a growing recognition of the need for insulation in commercial and industrial buildings. The first point to be insulated in almost any building is the roof. To fill the need for a superior roof insulating material, Fir-Tex has developed this board.

Fir-Tex Roof Insulation Board has many points of superiority. First of all, it is made by the exclusive Fir-Tex process, by which natural fibres of sound wood are sterilized and then felted together into boards possessing tremendous insulating qualities.



A quarter-million square feet of Fir-Tex is used for roof insulation in this warehouse of Joseph E. Seagram & Sons, Inc., Louisville, Ky.

## THERE'S A SPECIAL FIR-TEX BUILDING BOARD FOR EACH OF THESE JOBS



### **Fir-Tex "Firkote"** for Sheathing

Save money by using Fir-Tex Firkote as sheathing. Instead of applying sheathing lumber and paper *plus* insulating board, do both jobs in one operation and at one cost by applying Fir-Tex Firkote.



### **Fir-Tex Insulating Plaster Base Lath**

This is the modern plaster base. Nail it directly on studding, and apply plaster. You get a smooth, crack-resistant finish. And in addition you get highly efficient protection against heat, cold, noise.



### **Fir-Tex "Ivrykote"** for Interior Finish

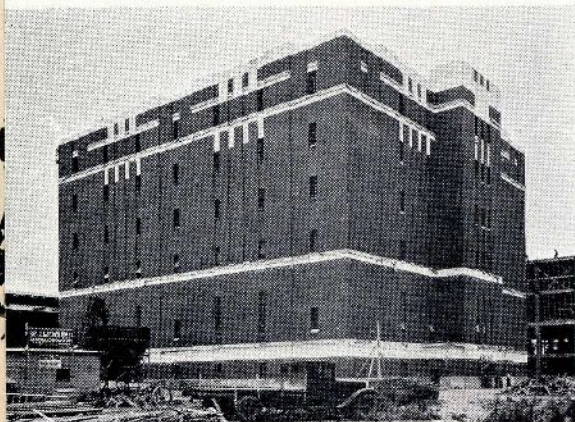
This super-insulating board has a smooth, mottled-ivory surface. It is popular as an interior finish. The surface is washable. It may be used with its original surface, or may be further decorated without sizing.

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## You Get Better Insulation at Less Cost with **FIR-TEX** Roof Insulation Board

THERE is a growing recognition of the need for insulation in commercial and industrial buildings. The first point to be insulated in almost any building is the roof. To fill the need for a superior roof insulating material, Fir-Tex has developed this board.

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A quarter-million square feet of Fir-Tex is used for roof insulation in this warehouse of Joseph E. Seagram & Sons, Inc., Louisville, Ky.



Fir-Tex Roof Insulation is installed in this plant of the General Brewing Corporation, San Francisco.

Fir-Tex Insulation Board is made up to 1½-inch in thickness without lamination. This factor reduces application costs by eliminating extra moppings. Less asphalt is required than with a thin board which requires more than one layer. And the less asphalt the greater the insulation.

Fir-Tex fibres are waterproofed in the manufacturing process, giving you added protection.

### OUTSTANDING USERS of Fir-Tex Roof Insulation Board include:

Seagram's Distillery . . .	Louisville, Ky.
Seagram's Distillery . . .	Lawrenceburg, Ind.
General Brewing Company . . .	San Francisco, Calif.
Newark Airport . . . . .	Newark, N.J.
Old Harbor Federal Housing Project . . . . .	Boston, Mass.
Will Rogers Memorial Federal Housing Project . . . . .	Oklahoma City, Okla.
Jane Addams Housing Project . . . . .	Chicago, Ill.
Times Bldg. . . . .	Seattle, Wash.

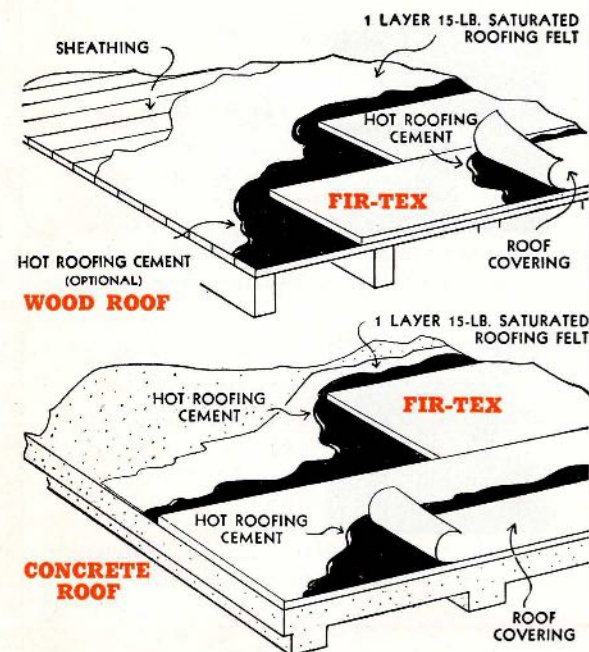
Armory Building . . . . St. Paul, Minn.  
Municipal Docks . . . . Vancouver, Wash.

and on

### UNITED STATES POSTOFFICES at:

Berkeley, Calif.	Hollywood, Calif.
Marysville, Calif.	Klamath Falls, Ore.
Oakland, Calif.	Oregon City, Ore.
Petaluma, Calif.	Portland, Ore.
San Francisco, Calif.	St. Johns, Ore.
San Jose, Calif.	Kingsville, Tex.
San Ysidro, Calif.	Dalhart, Tex.
Long Beach, Calif.	Metalline Falls, Wash.
Winona, Minn.	

In applying Fir-Tex Roof Insulation Board, follow standard practices. The diagrams below indicate most popular methods.



## 3. FIR-TEX PLASTER BASE LATH

Standard thickness:  $\frac{1}{2}$ " ,  $\frac{3}{4}$ " , & 1" .

Sizes: 18" x 48" .

## 4. FIR-TEX "FIRKOTE" SHEATHING BOARD

Glazed, Waterproof Surface.

Standard thickness:  $25/32$ " .

Sizes: 4' x 7' , 4' x 8' , 4' x  $8\frac{1}{2}$ ' , 4' x 9' ,  
4' x  $9\frac{1}{2}$ ' , 4' x 10' , 4' x 12' .

## 5. FIR-TEX FINISH PLANK

Long edges beveled and beaded.

Standard thicknesses:  $\frac{1}{2}$ " & 1" .

Sizes: 6" , 8" , 10" , 12" , 16" wide x 6' , 7' ,  
8' , 9' , 10' , 12' long; also multiple  
finish plank 4' wide, same lengths.

Colors: Natural tan and "Ivrykote"

## 6. FIR-TEX TILE BOARD

Standard thicknesses:  $\frac{1}{2}$ " ,  $\frac{3}{4}$ " , 1" .

Sizes: 6" x 6" , 6" x 12" , 8" x 8" , 8" x 16" ,  
12" x 12" , 12" x 24" , 16" x 16" , 24" x  
24" , 16" x 32" , 18" x 32" , 16" x 48" ,  
18" x 48" , 24" x 48" ; also multiple  
tile board 48" x 48" .

Colors: Natural tan and "Ivrykote."

## 7. FIR-TEX ROOF INSULATION BOARD

Standard thicknesses:  $\frac{1}{2}$ " , 1" ,  $1\frac{1}{2}$ " , 2" .

Size: 22" x 47" , 24" x 48" .

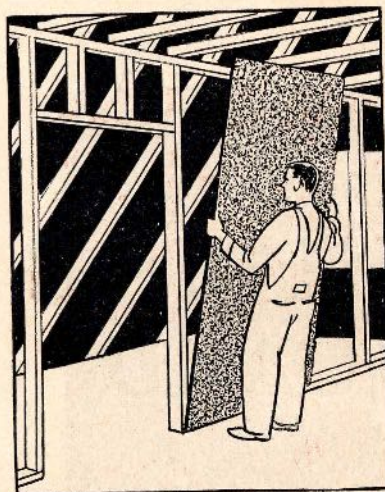


**FIR-TEX  
BUILDING  
BOARD**

*for*  
Structural  
Strength

**7200  
LBS.**

## In Convenient Sizes for All Uses



Fir-Tex Building Board is made full  $\frac{1}{2}$ " thick, 4' wide, and from six to 12 feet long, wrapped in substantial packages, each containing six sheets. All packages are plainly marked as to number and size of contents.

Fir-Tex is manufactured from fir wood exclusively, which, when reduced to fibers, are formed into a sheet, and by their lacing and interlacing process these sheets are given great rigidity and strength, and are easily handled without breakage.



Fir-Tex Building Board can be used in your home as above described, and if so desired, the interior or exterior of the walls can be battened with either Fir-Tex or wood battens. The Fir-Tex board can then be paint decorated by first using a standard glue sizing, to which apply required coats of any desired color paint.

## Fir-Tex Building Board in the Home



Fir-Tex Building Board in standard sizes is universally used for increasing the comforts of the home. When placed over ceiling joists or nailed to the under side of rafters, heat loss in your

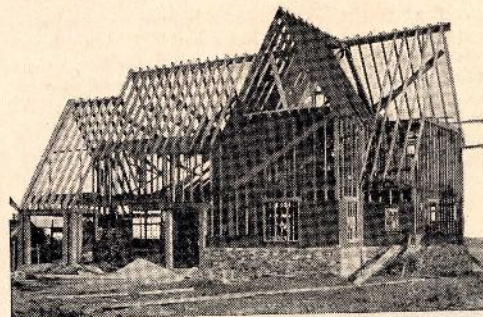
present home is checked and consequent saving in fuel bills is realized.

By the use of Fir-Tex Building Board you can easily finish an attic to make an attractive spare bedroom or a playroom for the children. Fir-Tex Building Board is 4' wide which is the proper width for nailing direct to wall studs, floor and ceiling joists, and roofing rafters where they are spaced on 16" centers.



Fir-Tex Building Board is a very efficient material, and in standard sizes can be used to finish the interior of your present garage. A garage finished in this manner aside from extremely low temperatures, will prevent your automobile from freezing during the winter months. It may also be used as sheathing, or left exposed when given a coat of size and paint.

## Ideal for Sheathing Purposes

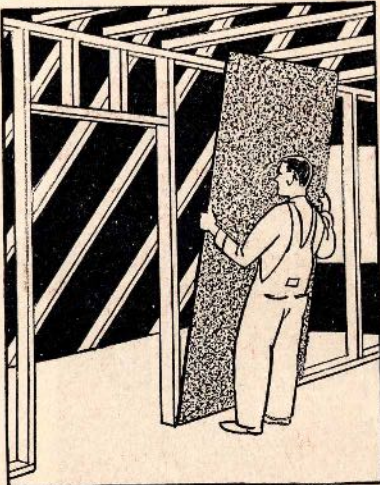


Fir-Tex Building Board was used in the construction of this home as sheathing, and Fir-Tex Insulating Lath was used as a plaster base on the interior. Fir-Tex Super Insulation, 1" thick, was laid over the joists of the top floor ceiling. Fuel bills for this home are 40% less than for homes of like size in the same locality.

Fir-Tex Building Board, by a special chemical treatment given the fir fibers, is highly water resisting. Place a piece of Fir-Tex in water for twenty-four hours and note the surprising results.

Fir-Tex Building Board is a very slow burning material. It chars rather than burns. Fir-Tex  $\frac{1}{2}$ " Building Board has a tensile strength of over 250 lbs. per square inch. During its manufacturing processes these fir fibers are so skillfully laced and interlaced that great strength and rigidity in this board is the result. During twenty-four hour operation, tensile strength tests are made every half hour.

## In Convenient Sizes for All Uses



Fir-Tex Building Board is made full  $\frac{1}{2}$ " thick, 4' wide, and from six to 12 feet long, wrapped in substantial packages, each containing six sheets. All packages are plainly marked as to number and size of contents.

Fir-Tex is manufactured from fir wood exclusively, which, when reduced to fibers, are formed into a sheet, and by their lacing and interlacing process these sheets are given great rigidity and strength, and are easily handled without breakage.

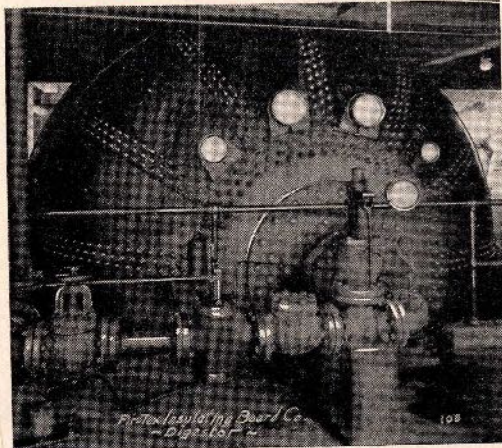


Fir-Tex Building Board can be used in your home as above described, and if so desired, the interior or exterior of the walls can be battened with either Fir-Tex or wood battens. The Fir-Tex board can then be paint decorated by first using a standard glue sizing, to which apply required coats of any desired color paint.

## Superior Quality of Fir-Tex Board

According to the United States Bureau of Standards, as stated in their circular letter No. 227, Fibre Board contains more insulating and sound deadening values than even greater thicknesses of solid wood, plaster, brick or concrete. A one-half inch thickness of Fir-Tex Building Board would be the superior of  $1\frac{3}{8}$  inches of solid wood, 2 inches of plaster, or 4 inches of brick or concrete.

## No Foreign Matter in Fir-Tex



*One of the mammoth "digesters" in which the Douglas Fir chips are softened so their minute, long fibers can be separated.*

The above illustration shows one of our immense digesters in the Fir-Tex plant in the process of manufacturing Fir-Tex from fir wood. In this process all wood used is thoroughly sterilized by high steam temperatures, and by this process, the tests which have been made by the best authorities in the country show that Fir-Tex Building Board contains no fungus growth, consequently will never mold nor deteriorate. Further, Fir-Tex Building Board contains no vegetable matter whatsoever, so is not food for vermin.

## 8. FIR-TEX REFRIGERATOR INSULATION BLOCKS

Standard thicknesses: 1", 1½", 2", 3", 4".

Low density blocks wrapped in vapor tight paper. Moisture-proof, water-proof, vapor-proof. Rectangular shapes.

The Ivrykote finish referred to is put on in the process of manufacture as the last operation before cutting to size. It is a smooth, washable finish. It can be painted or kalsomined. This board was developed to meet the growing need for a light colored, smooth-surfaced board suitable for interior finish. A very attractive effect is gained by grooving the board, various methods of which are shown in the discussion to follow.

Fir-Tex building board is mainly used for sheathing and above ceilings and below rafters. It has a tensile strength of over 250 lbs. per square inch. Being contained in packages of six sheets each, it is easily handled. Like the other Fir-Tex products, Building Board is very moisture proof and fire resistant. It chars rather than burning.

Fir-Tex Fir-Kote sheathing board, with lower application and material costs, makes wood sheathing and building paper obsolete. It has a glazed waterproof surface. Fir-Kote has greater bracing strength than lumber, and it gives greater insulation against heat, cold and noise.

The Fir-Tex way is the modern way of preparing walls for plaster. The use of Fir-Tex Insulating Lath directly

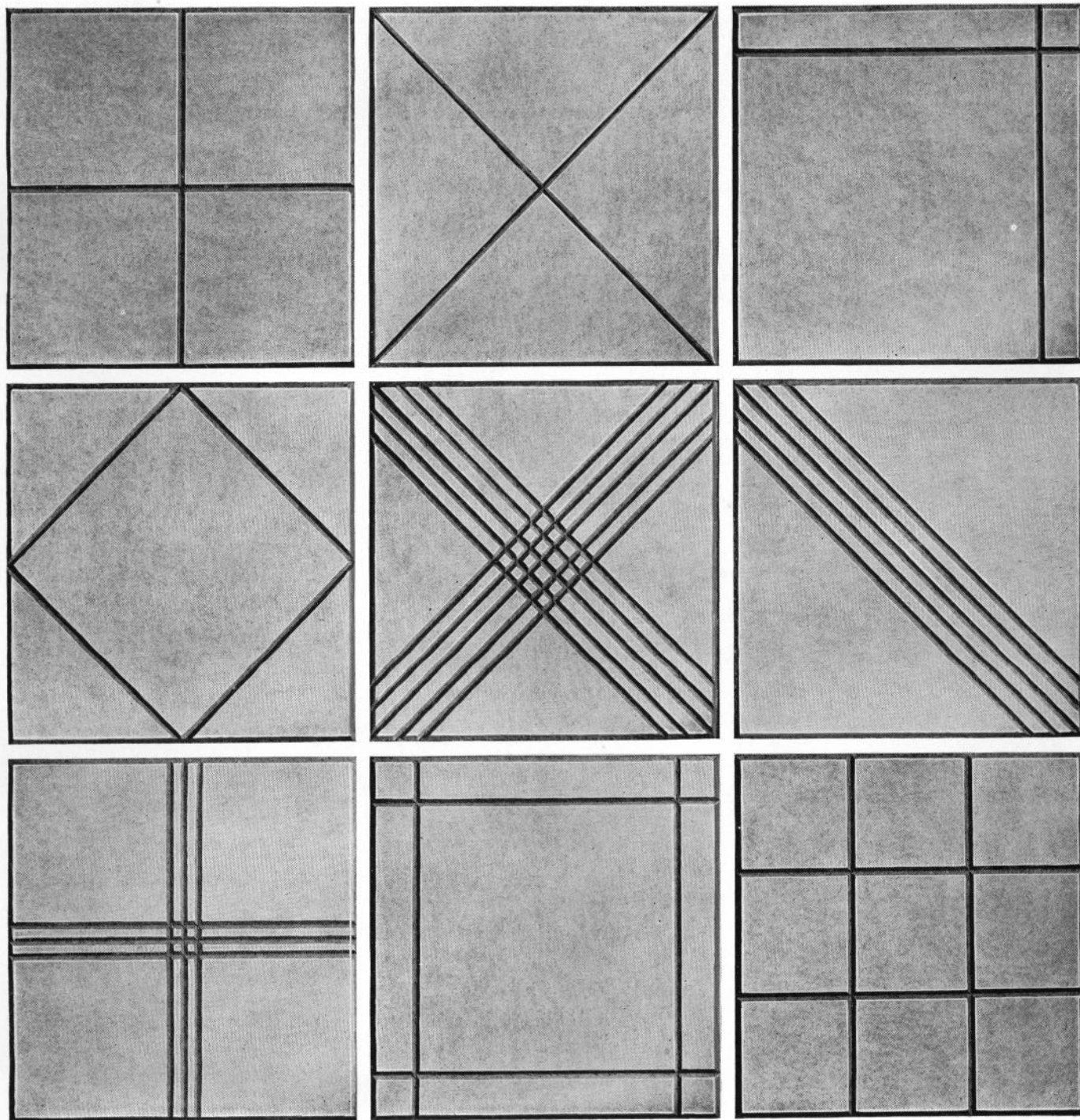
# FIR-TEX may be Stained, Kalsomined, or used in its Natural Color

**Y**OU may finish a room with Fir-Tex in many attractive forms. You have a choice of (1) the neutral tan surface of the standard board and (2) the mottled ivory, washable surface of the Ivrykote board.

Ivrykote is presized, and its smooth surface lends itself readily to treatment with stains, paints or kalsomines.

Your architect or builder can suggest many beautiful effects with Fir-Tex Insulation Board.

In addition to its use as an interior finish, Fir-Tex is unexcelled as a plaster base. Fir-Tex Insulating Lath replaces old-fashioned wood lath, reduces plaster cracking to a minimum.



on the studding, followed by plaster on the Fir-Tex, will result in a smooth, crack-resisting job. Plaster sticks to Fir-Tex like glue.

Fir-Tex Finish Plank, beveled and beaded, is extremely popular for interior finish. It is extensively used for interior finish. It is available both in the natural tan color and in the Ivrykote mottled ivory surface.

Fir-Tex Tile Board is widely used for interior finish, being available in a wide variety of sizes. You may have Tile Board in the natural tan and Evrykote surfaces.

This board is of the same high quality as Fir-Tex Building Board, the only difference being in the thickness of the product. Fir-Tex Economy Board is made in 3/8" thickness. Fir-Tex Refrigeration, also Insulation Blocks, are used in some of the foremost industries in the country. The Northern Pacific Railroad installed this low-density product in their cross-country refrigerator cars. It is replacing cork as refrigeration installation.

#### GENERAL CONSIDERATIONS

Most building materials possess heat-resisting properties to some degree. Fir-Tex, the commercial insulating material, however, has these properties to such an extent that even relatively thin layers will retard effectively the passage of heat. Greater effectiveness results when Fir-Tex is used in addition to the standard construction,

rather than to replace another product such as wood lath or sheathing. This is obvious when it is considered that the building products replaced usually have insulating values which necessarily are lost when those materials are omitted from the construction.

Fir-Tex shows greater effectiveness when applied in the middle of an air space, such as that between the studs in a frame wall, than when placed in contact with another material such as sheathing, lath, or plaster. The reason is that an additional air pocket is formed, which is in itself somewhat of an insulator. A half-inch layer of Fir-Tex applied in the center of an air space is the equivalent of a little more than three-quarters of an inch added at some other place in the space; a one-inch layer is the equivalent of a little more than  $1\frac{1}{4}$  inches.

Long life in insulation is just as important as in other building materials. The hidden parts of the construction unquestionably should be of a permanent character. Fir-Tex does not disintegrate under normal conditions of temperature and moisture and does not attract insects or vermin.

#### INSULATING EFFICIENCY

Statements concerning comparative insulating efficiencies are usually based upon the heat-resisting ability of 1-inch layers of materials in still air and in an "air-dry" condition. Under these conditions, some materials

have greater inherent heat-resisting properties than others and are therefore more efficient.

### INSULATION OF WALLS, FLOORS, AND ROOFS

Heat passes in and out of a building by two distinct methods: (1) It is transmitted directly through the materials that make up the walls, floors, and roofs--just as the heat is conducted through an iron rod, and (2) it escapes by means of a constant exchange of inside and outside air, through openings and cracks around windows and doors, and other places where the various parts of a house are joined.

The heat loss from the average uninsulated house during the winter months is estimated as follows: 40 to 60% goes directly through walls, floors, and roofs; 15 to 30% leaks through cracks and crevices; and 20 to 35% is conducted through windows and doors.

In poorly built houses a much greater loss occurs through cracks and crevices. In such cases it is not uncommon to find large openings at the eaves where the wall sheathing has not been carried up between the rafters. This permits cold air to sweep across the attic floor, carrying away heat which has escaped from the rooms below. In the basement, excessive leakage may occur at the sill where the frame-work and foundation meet. To prevent the sacrifice of the effectiveness of insulation, all such cracks and openings, as well as those around windows and doors,

must be blocked off. In some instances Fir-Tex itself can be used for this purpose.

The home builder should realize that despite the numerous advantages of insulation, its application is limited, after all, to walls, floors, and roofs--those parts of a house which are responsible for only a portion of all the total heat passage. Obviously, a house that is drafty because of loose-fitting construction can not be heated properly, regardless of how well it is insulated.

When restricted expenditure is necessary, much can be accomplished through insulating only the roof of the ceiling of the upper story rooms. This is true whether Fir-Tex is employed for retaining heat in winter or shutting out heat in summer. If the attic is to be heated, apply it on or between the roof rafters. If, however, this space is to be utilized only for unheated storage, Fir-Tex will be most effective when applied on or between the attic floor joists. This reduces the amount of air space to be heated in winter and requires the minimum amount of insulating material.

When Fir-Tex is installed it is advisable to provide windows or lowered openings in the gable ends by which the space above the insulating material may be ventilated. In summer free circulation of air will rid this space of heat which penetrates the roof, and in winter ventilation will prevent the formation of frost, which sometimes occurs on the under side of the roof boards in cold climates.

Roofs are vulnerable spots for heat entrance, being exposed to the sun for the greater part of the day. From the standpoint of summer comfort, therefore, insulation of roofs or top-floor ceilings is most important. When possible, however, the walls also should be insulated to insure complete protection.

Without artificial cooling, maximum comfort in warm locations, even in the insulated house, is obtained only through proper control of ventilation and the shutting out of direct sunshine. Usually this means keeping the house closed during the hottest part of the day and opening it during the cooler evening and night. Before the temperature outside reaches the point of discomfort, windows and doors should be closed, window blinds drawn, and awnings lowered, or shutters closed on the sides which are exposed to the sun. When the outside temperature drops, ventilation will remove the air inside which has necessarily been warmed to some extent. Although insulated walls and roof shut out the intense heat to a large degree, obviously it is of little benefit to exclude heat by one means and permit it to enter by another.

#### THICKNESS OF FIR-TEX TO USE

"What thickness of Fir-Tex shall I use?" is a question frequently asked by the home builder. When fuel economy is the principal consideration, select a thickness that

is economical--one which, in the form of fuel savings, pays a fair return on the insulation investment. If comfort is the prime deciding factor, however, use a thickness sufficient to give maximum protection both in winter and in summer.

In determining the proper insulation thickness from the investment standpoint, each house represents a specific problem for the owner. The factors to be considered are fuel saving and the cost of insulating.

In fuel saving, the geographic location and exposure of the house, the kind of fuel burned, the quality of the house construction, and the effectiveness of the insulating material, all have a direct bearing on the net result. It is evident that where the heating season is long and severe, such as that in northern localities, and where the house is exposed on all sides to the free play of the elements, greater opportunities exist for saving fuel than in the mild southern climates. Whether the fuel used is wood, coal, oil, gas, or electricity also makes a difference, since the savings derived through the use of Fir-Tex insulation increase with the cost of the fuel. In houses built of materials having poor insulating qualities, the net saving with insulation is greater than in those constructed of materials naturally resistant to heat passage.

To determine whether or not the expenditure for Fir-Tex is justified, when considered purely as a financial

investment, weigh the fuel savings against the cost of insulating. Net insulation cost, like fuel saving, is dependent upon a number of factors. Briefly, these are: insulation thickness, the labor for installing the material, the savings resulting from a reduction in the size of the heating equipment, and the savings resulting from the replacement of structural materials with Fir-Tex.

The use of Fir-Tex insulation in increasing thicknesses follows the law of diminishing returns. That is, doubling the thickness does not double the comfort and fuel savings. From an investment standpoint this usually means that  $\frac{1}{2}$ -inch boards, for example, show a larger percentage of return than thicker ones which cost more. This does not mean, however, that the thicker Fir-Tex is uneconomical. In fact, in many instances, the additional fuel saving resulting from the use of the thicker material is sufficient to justify the additional expenditure.

The following example will serve to illustrate this particular point:

A \$100 investment in  $\frac{1}{2}$ -inch Fir-Tex may result in a yearly fuel saving of \$25. After deducting 6 per cent for interest charges on the additional investment, and 2 per cent for depreciation charges, there remains a 17 per cent dividend. A \$150 investment in 1-inch thick insulation may show a corresponding saving of \$35, and the returns in this case, after deducting interest and depreciation

charges, amounts to 15 1/3 %. Although the return on the thicker insulation is less, it probably would still be large enough to warrant its use. Even greater thicknesses might be used economically, the limiting factor being the minimum return on the investment represented in fuel savings that would be acceptable to the owner.

Another factor which should be considered in determining the thickness of Fir-Tex insulation is comfort. This presents a problem which does not lend itself to such accurate solution. In many instances, however, the comfort consideration is probably of greater importance than that of investment, and protection against the discomforts of hot or cold weather may be uppermost in the mind of the home owner.

Considering then both investment and comfort, one-half inch of Fir-Tex added to the walls and 1 inch added to the roof or top floor ceiling, has been found practicable in many cases. Greater thicknesses than these, however, are often used to good advantage. If in doubt, architects, engineers, builders, and the Fir-Tex manufacturers acquainted with the local weather conditions and with the various factors that influence the insulation problem, may be relied upon for advice.

#### METHOD OF APPLYING THE FIR-TEX MATERIALS

No less important than knowing where to insulate and what thickness to use is knowing how to apply the Fir-Tex.

The effectiveness of insulation depends to a large degree upon the way the material is installed--the manner and the quality of workmanship. A knowledge of the proper application of Fir-Tex will be of value to the person building or buying a home since it will enable him to judge good construction for himself.

It is not the purpose of this thesis to approve or disapprove any method of application, but rather to give the accepted specifications for the different applications.

In this discussion, certain fundamental facts about insulation are given that should be understood to appreciate fully what can be expected from different applications of the same materials.

Fir-Tex Plaster Base Lath is used as a base for plaster, replacing both wood and metal lath. It combines insulating value with the ability to hold plaster, thereby serving a twofold purpose.

When forming an integral part of the structure, such as sheathing or lath, it is important that Fir-Tex be adequately and properly nailed to the framework or furring members. Satisfactory results in this respect may usually be assured by following carefully the instructions that accompany the material, or those set forth in this thesis.

When used either for its structural or insulating value, careful attention should be given to fastening securely all edges in order to exclude wind leakage. Fir-Tex should fit snugly against all framing members and window

and door frames. Where it is installed to divide the air space between the framing members, it is important that all edges be tightly fastened to prevent the circulation of air from one side to the other.

In using building paper over sheathing, the edges of the paper should be lapped 2 or 3 inches. Improper application and inferior construction methods may easily reduce the effectiveness of the Fir-Tex insulation.

#### INSULATING FRAME CONSTRUCTION

From a structural standpoint, wood-frame construction offers excellent possibilities for the application of Fir-Tex. All types of material in practically any desired thickness are readily installed, either between or over the wall studs, floor joists, and roof rafters.

There are two general methods of using Fir-Tex insulation with frame construction: (1) Applied over the outside or inside edges of framing members, such as wall studs, floor joists, and roof rafters, and used with or without a covering of wood sheathing, wood or metal lath; and (2) applied between the framing members with an air space on each side.

##### Over Outside Edges of Framing Members

As sheathing.--When Fir-Tex is used as wall sheathing under wood siding, shingles, brick veneer, or stucco, large panels are preferred. They may be cut to the size required

and nailed directly to and parallel with the framing members. The panels should be sufficiently long to span the distance between sills and plates, but where this is impossible and end joints fall midway the length of a stud or rafter, the joints should be reinforced with a 2 by 4 support (or header) to which the panel ends may be nailed.

The edges and ends of the panels should be spaced approximately one-eighth of an inch apart, so that there will be no danger of buckling if swelling occurs. The Fir-Tex should be brought in close contact with window and door frames.

Fasten the panels to the framing, using 6 or 8 penny box nails. Beginning at the center of the panel, nail first to the intermediate studs, then around all edges, setting the nails approximately three-eighths of an inch from the edge. Space the nails from 4 to 6 inches apart. Drive them flush with the surface of the panel.

The wall framework over which Fir-Tex is applied as sheathing may be strengthened with corner bracing, the same as when horizontal wood sheathing is used.

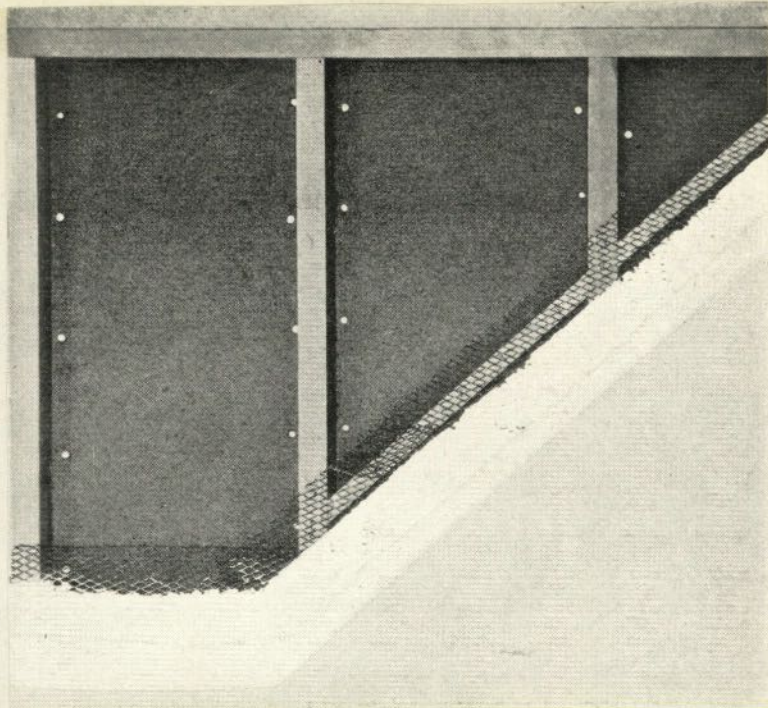
Under wood sheathing.--In this method of application wood sheathing is applied directly over the Fir-Tex and fastened to the framing members with nails one-half to 1 inch longer than ordinarily called for in uninsulated construction. In such cases, the nails in the Fir-Tex may be spaced as much as 10 or 12 inches.

Over the Inside Edges of Framing Members

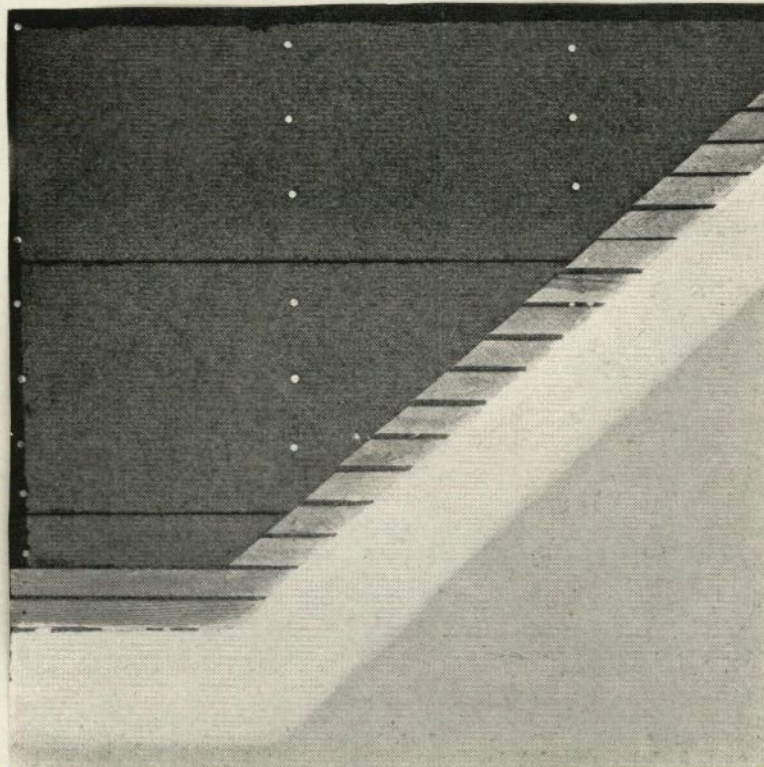
Fir-Tex insulating board is applied over the inside edges of wall, ceiling, or roof framing members for the following purposes: (1) As a base for plaster, (2) as interior finish, (3) as a base for paint or wall paper, and (4) as added insulation under lath and plaster.

As plaster base--The plaster and its application are no less important than the base. Gypsum plaster should be used over the insulating materials. A 2-coat job consisting of scratch and finish may be sufficient, but care should be taken to obtain a plaster thickness of at least one-half inch. To aid the plasterer, some builders nail strips of metal lath 3 or 4 inches wide diagonally across the surface to be plastered. When completely covered, they insure the desired thickness. Proper ventilation and heating are important in connection with plastering on the insulating boards.

Framing members to which Fir-Tex is applied should be not more than 16 inches from center to center. Place the small-size sheets with the length at right angles to the studs, joists, or rafters. End joints should center over the framing members. Bring the interlocking edges of adjacent sheets to moderate contact, but do not force into place. Stagger the end joints so as to make a patchwork of the sheets. Each sheet should be nailed first to the intermediate supports, then at the ends. The nails should be spaced 4 to 6 inches, and at the ends they should be



*This photo shows the construction from the inside, with deep air space between the inch thick Fir-Tex super-insulation and the plaster base.*



*Inside view of lath and plastered wall applied directly over Fir-Tex inch thick super-insulation.*

set approximately three-eighths of an inch from the edge. Thin shank nails (four or six penny box) are recommended by the manufacturers of Fir-Tex. The nail heads should not be countersunk into the material. In some instances "cornerites" consisting of strips of metal lath 4 to 6 inches wide are applied to internal angles.

As interior finish.--The various Fir-Tex products designed for interior use have been previously described. For best results, these materials should be applied over framework, the spacing of which does not exceed 16 inches between centers. Large panels, when applied with the length parallel to the studs, joists, or rafters, should be of sufficient length to span the height, length, or width of the room. Where this is impossible, however, and joints fall midway the length of the framing member, the joints should be reinforced with a header or support to which the ends may be nailed. In instances where the boards are applied horizontally around the room, each panel should be sufficiently long to cover the wall areas so that vertical joints occur only at corners. Provision should be made in this latter application for a support behind all horizontal edges.

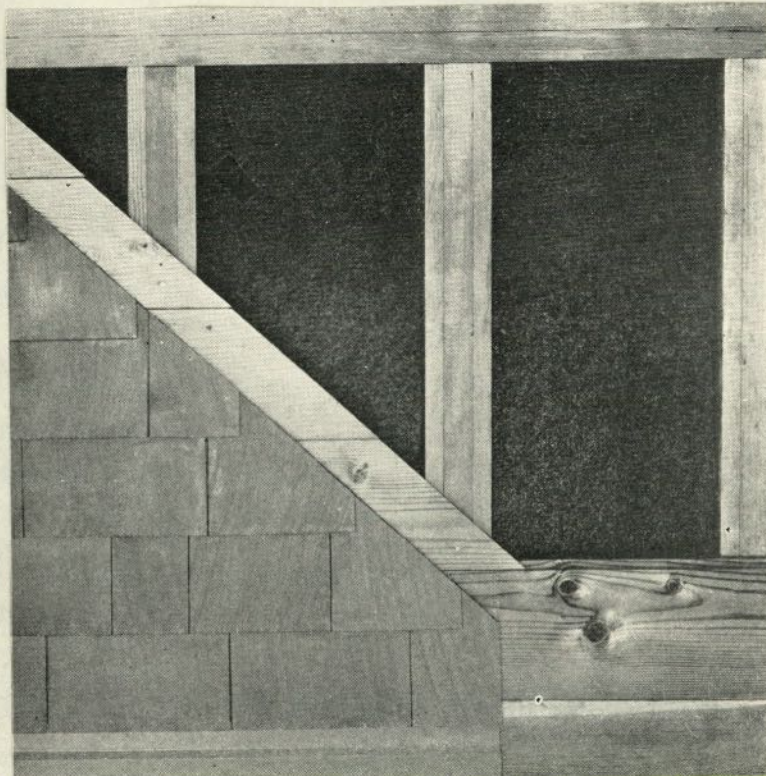
The usual method of fastening the large panels to the framing is as follows: Beginning in the center the boards are nailed to the intermediate studs, joists, or rafters with finishing nails approximately  $1\frac{1}{2}$  inches long, spaced 4 to 6 inches, and set about three-eighths of an inch from

the edge. The panels should be spaced approximately one-eighth to one-fourth of an inch apart at all edges and ends.

"Beveled tile" panels are applied with 1-inch finishing nails, spaced 4 to 6 inches on all edges and over intermediate supports, with heads countersunk into the material. The edges of adjacent pieces should be brought into moderate contact, but not forced into place. With this application, the joints need no further treatment, since the small panels with edges cut back present a pleasing and attractive appearance.

When using large boards, however, the joints should be covered either with wood molding strips or with narrow strips of Fir-Tex cut specially for this purpose. These may be obtained from the manufacturers. When this method is used for finishing the interiors of important rooms, careful thought should be given to working out the arrangement of the panels so they will present a symmetrical and artistic appearance. It may be necessary to install additional framing members in order to facilitate this arrangement. In attics, storerooms, basements, and garages where appearance is not so important, however, such modification of the framing would not be necessary. Here the panels may be applied to conform to the supports already in place.

As a base for paint and wall paper.--Since the natural color and surface texture of Fir-Tex is pleasing, the panels



*The above construction shows Fir-Tex inch thick super-insulation applied between the studs. A method recommended by government experts as being of greater efficiency.*

are often left unfinished when used for room interiors. They may, however, be covered with either oil or water paint, with plastic or textural paint, and in some instances with wall paper.

The joints between the boards, except in those cases where molding strips are used to cover the edges, must be specially treated to prevent cracking of the surface finish which might be caused by any slight expansion or contraction of the boards. Because it is difficult to prevent the cracking of paper over Fir-Tex joints, the manufacturers hesitate to recommend their products for use as a base for wall paper.

As added insulation under wood or metal lath.--Either the large or small boards may be employed for this purpose. The small boards are applied the same as for plaster base; the large panels should be placed according to the specifications for applying Fir-Tex over the outside edge of framing.

When wood lath or nonfurring metal lath is the plaster base used, 1 by 2 inch furring strips are nailed over the Fir-Tex at the framing members and parallel to the latter. Self-furring metal lath is applied without the use of wood furring strips.

As insulation in the floor.--In floors, Fir-Tex generally is applied directly to the floor joists with the subfloor laid directly over it. For this, large panels are preferable, although any size may be used.

Fir-Tex may also be installed between the subfloor and the finish floor. In this case nailing is unnecessary, since the sheets are held in place by the finish floor.

#### Between Framing Members

In this application studs, joists, and rafters are equipped near their outer edge with a 1 x 2 inch nailing strip. The Fir-Tex is then cut to the size of the openings between the framing members, fitted to the strips, and nailed in place.

### INSULATING MASONRY CONSTRUCTION

Since the floor, ceiling, and roof construction of a masonry house, whether of brick, concrete, hollow tile, or stone, are usually the same as in an all-frame house, the application of insulation to walls only need be considered here.

Fir-Tex insulation in masonry construction usually is applied either between or over wood furring strips placed 12 or 16 inches on center. An air space that prevents direct contact between insulating and wall increases the total heat-resisting value of the wall and minimizes the possibility of the Fir-Tex absorbing moisture. The waterproofed "Firkote" is recommended here.

When it is known at the time of construction that furring strips are required, wood strips to which the furring members may be nailed are inserted at regular intervals into the masonry joints. Otherwise, the furring strips

are fastened to the wall, either with expansion bolts or by nails driven into the mortar.

#### COST OF FIR-TEX INSULATION

Whether it is the new house, attic of the present one, the garage, or summer cottage, the cost of insulating is a matter of interest. The important consideration, however, is not so much the price per square foot of Fir-Tex but rather the cost per unit of insulating efficiency when installed. In other words, "As applied to my house, how much insulating value am I getting for my money!"

##### As sheathing

Fir-Tex insulating boards in the  $\frac{1}{2}$ -inch thickness commonly used for sheathing usually cost more than lumber used for the same purpose. The labor cost for applying the large insulation panels, however, is frequently less than that for applying wood sheathing; thus the net cost of each is about the same. When the construction with Fir-Tex necessitates the use of additional materials such as furring strips under wood shingles on walls and under roof covering, the cost will obviously be increased.

##### As plaster base

When Fir-Tex is used to replace lath, the cost of insulating is usually less than when insulation is added to regular construction, inasmuch as the cost of the lathing material replaced may be applied toward the new plaster base.

The accompanying table gives an approximate estimate of the total cost of insulating and plastering when using Fir-Tex Plaster Base Lath. Owing to a wide variation in the costs of materials and labor, no attempt is made here to compare the cost of this application with other forms of plaster base. It is assumed that a plastering contractor familiar with local prices and conditions may be consulted in regard to the cost of plastering on other types of lath.

The possible saving resulting from reduced size of heating system has not been considered in the following table.

In estimating the quantities of material needed for the 5-room bungalow and the 6-room 2-story house, the following areas, which represent the average of a number of houses actually built, have been used.

#### Five-room Bungalow

Net wall area	900 sq. ft.
Net ceiling area	<u>900 sq. ft.</u>
Total	1,800 sq. ft.

#### Six-room Two-story House

Net wall area	1,750 sq. ft.
Net ceiling area	<u>750 sq. ft.</u>
Total	2,500 sq. ft.

Approximate combined cost of materials and labor  
for Fir-Tex Plaster Base Lath and plaster:

Material and labor cost  
when Fir-Tex is applied  
as plaster base

Per 100 sq. yds. of net area	For a five-room bungalow (Outside walls and ceiling)	For a 6-room 2-story house (Outside walls and top floor ceiling)
---------------------------------------	---	---

Insulation:

$\frac{1}{2}$ -inch thick: \$45	\$124.85	\$249.70	\$347.08
1-inch thick: \$80	\$157.93	\$315.86	\$439.05

EXAMPLES OF THE COST OF FIR-TEX INSULATION

As a further aid in determining the cost of insulating, the prospective home owner is advised to study the actual cost figures given below. These have been selected at random from actual cases.

It will be noted that all of these examples represent the cost of added insulation. When Fir-Tex replaces some other building product, it is impossible to give examples of comparative costs because of the wide variation in cost of the materials replaced.

It should be realized that the examples given here are typical for the application they represent, and are not necessarily minimum costs. Costs vary with conditions and many other factors.

## Example 1.

Size of house: 6 rooms with garage attached.

Insulation specifications:

Thickness--

1 inch on walls and second-story ceiling of house.

$\frac{1}{2}$  inch on walls and roof of garage.

Quantity--

1,925 sq. ft. for walls of house

875 sq. ft. for second-story ceiling of house.

375 sq. ft. for walls and roof of garage.

Application--Between wall studs and over top edges of ceiling joists.

Cost:

Material--

Insulation, 2800 sq. ft of 1-inch thick Fir-Tex at \$87 per 1000 sq. ft. \$243.60

Insulation, 375 sq. ft. of  $\frac{1}{2}$ -inch thick Fir-Tex at \$50 per 1000 sq. ft. 18.75

Lath, 1,000 at \$8/ 1,000 8.00

Nails, 15 lbs. of fourpenny box nails at 6 cents / lb. .90

Labor, carpenter's time, 37.8 hours at \$1/hour. 37.80

Total cost \$309.05

## Example 2.

Size of house: 7 rooms.

Insulation specifications:

Thickness--

$\frac{1}{2}$  inch on walls and in attic floor.

Quantity--2750 sq. ft.

Application--Between wall studs and attic floor joists.

Cost:

Material--

Fir-Tex, 2750 sq. ft at \$55 / 1,000 \$151.25

Lath, 1,000 at \$8 8.00

Nails, 12 lbs. 4d box nails at 6¢/lb. .72

Labor, carpenter's time, 35 hrs. at \$1 / hr. 35.00

Total cost \$194.97

EXHIBITS



**DR. HENRY ARNSTEIN**191 E. ROOSEVELT BLVD.  
PHILADELPHIA, PA.CONSULTING TECHNOLOGIST  
INDUSTRIAL EFFICIENCY ENGINEER

July 29, 1930

COMPARATIVE TEST BETWEEN OREGON FIR-TEX  
AND CORK.

By placing an equal volume of Cork and Fir-Tex in a metal container and submerging it in water Fir-Tex will absorb 15% more air than Cork, thus proving it to be more porous and containing more air space, which will account for its superiority to cork for insulating purposes. Actual tests have borne out this contention.

Under the identical conditions of surface and thickness, the heat penetrated at 50° C. in an equal measure through Fir-Tex and Cork. Above 50° and below 50° C. Fir-Tex was found to be superior to Cork, for heat or cold insulation.

## Heat Penetrating Tests at Various Temperatures.

- 100° C. Fir-Tex insulation 7% more efficient than Cork
- 50° C. Fir-Tex insulation identical to Cork insulation
- 0° C. (32° F.) Fir-Tex insulation 17% more efficient than Cork
- 50° C. Fir-Tex insulation 25% more efficient than Cork

The heat penetration tests were performed by permitting heat waves travelling from the same source simultaneously through an inverted "T" like tube insulated on one end with Cork and at the other end with Fir-Tex. The temperatures were read at each end simultaneously.

From this test it is evident that Fir-Tex has the same insulating ability as Cork at 50° C. (120° F.).

Above 50° C. and below 50° C. there is a decided improvement noted by the use of Fir-Tex when compared with Cork.


  
DR. HENRY ARNSTEIN
SCHOOL OF FORESTRY  
OREGON STATE COLLEGE  
CORVALLIS, OREGON

ROBERT W. HUNT COMPANY, ENGINEERS

CHICAGO      PITTSBURG      NEW YORK  
LONDON      ST. LOUIS      SAN FRANCISCO

FILE NO. 25126-1    ORDER B-52817

REPORT 33908-9

Chicago, Illinois,  
August 13, 1930

Fir-Tex Insulating Board Co.  
St. Helens,  
Oregon.

Gentlemen:

The following is the result of capillarity test authorized by your letter of July 28, 1930 on a sample cut from one of the 3 ft. square pieces of "Fir-Tex" received from you by express August 4, 1930.


A piece 4" square was cut by knife from the big sheet and was placed in a desiccator over concentrated sulphuric acid for twenty-four hours. The sample was then weighed and placed in a covered tank containing big volume of water and suspended over the water so that one edge of the sample was submerged 1/2" in the water. The air was saturated and at a temperature of 70° F. After twenty-four hours the sample was removed and reweighed and the absorption by weight and by volume was calculated.

The apparent specific gravity used to calculate the absorption by volume was obtained from weight and measurement of a 3 ft. square sample of the material.

Weight per cu. ft. of material	15.4 lbs.
Apparent specific gravity	.246
Edge immersed	Parallel to machine direction
Thickness of sample	1.03"
Dry weight	68.53 grams
Wet weight	75.30 "
Water absorbed	6.77 "
Absorption by weight	9.88%
Absorption by volume	2.43%

Respectfully submitted,

ROBERT W. HUNT COMPANY

  
H. S. Bowen

ROBERT W. HUNT COMPANY, ENGINEERS

CHICAGO      PITTSBURG      NEW YORK  
LONDON      ST. LOUIS      SAN FRANCISCO

No. 25126-1 ORDER B-52817  
REPORT LG 69

Chicago, Illinois,  
August 14, 1930

Fir-Tex Insulating Board Co.  
St. Helens,  
Oregon.

Gentlemen:

The following is results of investigations as to odor emission of "Fir-Tex" authorized by your letter of July 28, 1930.

Three small boxes constructed from samples of "Fir-Tex" received from you August 4, 1930.

In one of these boxes a piece of fresh unsalted butter was placed, the box was then placed in a tight container and placed in a refrigerator at a temperature of about 40° F. for 24 hours. At the end of that treatment no odor could be detected nor was there any foreign taste detected in the butter.

In another of the boxes a quantity of boiled cabbage was placed and inserted in a tight container. After 24 hours the cabbage was replaced with fresh unsalted butter. After 24 hours in a refrigerator at 40° F. there was no odor or foreign taste to the butter which could be detected.

Respectfully submitted,

ROBERT W. HUNT COMPANY

  
H. S. BOWEN

HSB-M

VERN O. KNUDSEN, PH. D.  
PHYSICIST AND CONSULTANT ON ACOUSTICS  
228 WOODRUFF AVENUE  
LOS ANGELES

REPORT ON SOUND ABSORPTIVE TESTS ON  
1/2", 1" AND 1-1/2" FIR-TEX ACOUSTICAL TILE

This will report the results of tests conducted by the writer for the purpose of determining the coefficients of sound absorption of Fir-Tex Acoustical Tile, 1/2", 1", and 1-1/2" thick. Each tile was 1' x 1', with beveled edges. The tile was placed directly upon the concrete floor of the reverberation room in the form of a rectangle 8' x 9', so that the test area consisted of 72 square feet. The Fir-Tex was decorated with Dynam Acoustic Paint P. F. 723, manufactured by the W. P. Fuller Company.

The measurements were made by a registering type of reverberation meter which measured the rate of decay in the room, first empty and then with the panels in the room. Tests were conducted at 128, 256, 512, 1024, 2048, and 4096 cycles.

The results of the tests are given in the following table:

Frequency of Test Tone	Coefficients of Sound Absorption		
	<u>1/2" thick</u>	<u>1" thick</u>	<u>1-1/2" thick</u>
128 cycles	.17	.15	.18
256 "	.30	.52	.65
512 "	.47	.57	.65
1024 "	.41	.55	.60
2048 "	.47	.55	.58
4096 "	.49	.48	.52

Respectfully submitted,

April 22, 1936.

VOK C

**ROBERT W. HUNT COMPANY, ENGINEERS**

CHICAGO    PITTSBURGH    NEW YORK  
LONDON    ST. LOUIS    SAN FRANCISCO

FILE NO. 25126-1    ORDER B-52817  
REPORT #71-L.G.

Chicago, Illinois  
February 5, 1931

Fir-Tex Insulating Board Company  
St. Helens  
Oregon

Gentlemen:

The following are results of mold and fungus growth analysis authorized by your letter of July 28, 1930, on samples of fiber board received by us August 4, 1930.

This investigation was placed in the hands of a recognized authority in bacteriology who reports as follows:

"Portions of fiber were taken aseptically from inner layers of the board and suspended in sterile water and were plated out in plain agar and in malt agar. Incubation of the plate cultures at body temperature and at room temperature produced only occasional colonies of common spore-forming bacilli. No growth of molds or other micro-organisms appeared.

"Portions of the fiber taken with aseptic precautions from the interior layers of the board were placed in bottles of sterile water and sterile physiological salt solution. These were incubated at body temperature (37° C.) and at room temperature (20 to 25° C.). In six months no growth of any sort has appeared.

"Flasks of nutrient broths were inoculated in the same way with fiber from inner, unexposed layers of the board and incubated at the same temperatures. These cultures have shown growth only of common spore forming bacilli, *Bacillus subtilis*, the hay bacillus and similar species.

"A flask of malt extract broth, a medium favorable to mold growth, which was inoculated with scraps of the fiber taken without special care from the outside of the board has been incubated at room temperature. Slow growth of a white mold appeared in this culture.

"An open bowl filled with bits of the fiber kept moist with water from the tap and sitting uncovered in the room shows a light growth of mildew on the upper surfaces of fiber.

"Our observations of this fiber board lead us to conclude that a few spores of fungi are present on its surface. The substance of the board also is capable of providing nutriment for molds when the conditions of air and moisture are favorable for their development. But with either moisture or air (or both) excluded to a usual degree, this fiber board is more than ordinarily immune to attack by fungus growth."

Respectfully submitted,

ROBERT W. HUNT COMPANY,

HSB:FMP

  
H. S. Bowen

ROBERT W. HUNT COMPANY, ENGINEERS

CHICAGO      PITTSBURG      NEW YORK  
LONDON      ST. LOUIS      SAN FRANCISCO

FILE NO. 25126-1 ORDER B-52817

REPORT 33908-9

Chicago, Illinois,  
August 13, 1930

Fir-Tex Insulating Board Co.  
St. Helens,  
Oregon.

Gentlemen:

The following is the result of vapor absorption test authorized by your letter of July 28, 1930 on a sample cut from one of the 3 ft. square pieces of "Fir-Tex" received from you by express August 4, 1930.

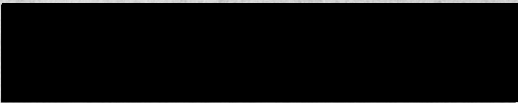
A piece 4" square was cut by knife from the big sheet and was placed in a desiccator over concentrated sulphuric acid for twenty-four hours. The sample was then weighed and placed in a covered tank containing big volume of water and suspended over the water where the air was saturated and at a temperature of 70° F. After twenty-four hours the sample was removed and reweighed and the absorption by weight and by volume was calculated.

The apparent specific gravity used to calculate the absorption by volume was obtained from weight and measurement of a 3 ft. square sample of the material.

Weight per cu. ft. of material	15.4 lbs.	
Apparent specific gravity	.246	
Thickness	1.03"	1.03"
Dry weight	68.73 grams	66.84 grams
Moist weight	71.82 grams	70.17 grams
Water absorbed	3.09 grams	3.33 grams
Absorption by weight	4.50%	4.98%
Absorption by volume	1.11%	1.23%

Respectfully submitted,

ROBERT W. HUNT COMPANY

  
H. S. BOWEN

HSB/MM

J. C. PEEBLES  
MECHANICAL ENGINEER  
INSPECTIONS, TESTS AND CONSULTATIONS  
OFFICE AND LABORATORIES  
ARMOUR INSTITUTE OF TECHNOLOGY  
CHICAGO

January 3, 1931

Fir-Tex Insulating Board Company  
St. Helens  
Oregon

Attention: Mr. A. E. Millington

Gentlemen:

In the data below I present the results obtained from heat conductance tests which I have made on your Fir-Tex Super Insulation, samples of which you submitted to me recently.

In making these tests I have used the flat plate method, and have expressed the heat conductance in Btu's per hour and per day, per square feet of material, per degree Fahrenheit of temperature difference between the surfaces of the material, for a 1" thickness. The results are as follows:

Heat Conductance of Fir-Tex Super In-  
sulation.

Flat Plate Method

Sample	Thickness Inches	Density Lbs.Cu.Ft.	Mean Temp. Deg. Fah.	Heat Conductance: Btu's	
				Per Hour	Per Day
G-3	0.97	11.9	72	0.278	6.67

Respectfully submitted,



JCP:L

# DANT & RUSSELL

INC.

Wholesale

Lumber and Shingles

Porter Building  
Portland, Oregon

Dec. 1, 1931

## INSTRUCTIONS FOR DECORATING FIR-TEX

The treatment of Fir-Tex comes under the heading of three different types of finishes, that is, an acoustical treatment which requires an open unobstructed surface which will allow the absorption of the sound waves. The second type of finish would be classed as a water finish, and then the other type would be an oil finish. I will endeavor to cover each type by itself.

In treating Fir-Tex to bring out all of its virtues from an acoustical standpoint, it is necessary to use materials that do not close the pores of the Fir-Tex, and that are as porous as is possible in the surface treatment. The best method for treatment of this type is to use diatomaceous earth to which you would add a small amount, let us say 10% by weight, of fibrous asbestos. However, you could use an asbestos that is known as magnesia asbestos. Use a very small amount of casein glue as a binder, which must be used very sparingly. To this mixture add the necessary colors to get the shade desired, using it only in the dry material. The last addition to this material is a small amount of powdered borax. Do all the mixing dry, then add sufficient water to make the material workable, and apply over the Fir-Tex without the addition of any size to the board. In case you want to spray the surface, eliminate the asbestos.

For an ordinary treatment over the 1" tile ceiling it will require approximately one pound to the square yard, and can ordinarily be done for a cost of five cents per square foot, and pay a good profit to the contractor.

A treatment of this type will absolutely hide the color of Fir-Tex and should increase its acoustical value anywhere from ten to thirty per cent, depending upon the roughness of the textured surface.

The best method of application is to use a dutch brush, which is the ordinary type of brush used in the application of kalsomine, and by using the swirls or stipples, will give an attractive appearing surface.

In the treatment of Fir-Tex with a water treatment, by which I mean a material that is mixed with water, where sound absorption is not a factor, I have found that there are two types of surface size that are acceptable. The first would be to use a good flake glue mixed in the proportion of about one and a half pounds of glue to a gallon of water, using the usual procedure of making a glue size.

The West Coast Kalsomine Company make a size which they call Viscote, which comes in cans. One gallon of this material makes three and a half gallons of a good strong size which you would apply in the usual method, preferably using a dutch kalsomine brush for application.

After the application of the size, and the surface is thoroughly dry, then you can proceed to use the regular kalsomine treatment or water texture such as Belgian Textural Compound, the U.S. Gypsum Company's Textone or Laux Textural Compound, and follow their directions for working out the decorative effects.

My suggestion would be that you get in touch with these firms, who will be glad to supply you with booklets and samples giving all the different methods of application.

In doing paint work, which would take in flat wall paints and ordinary oil painted surfaces, as well as enameled surfaces, you would use the size treatment as referred to, in the same manner in this treatment.

I have found that where a smooth surface is required, if you will use a steel trowel, smoothing down the surface as you apply the glue size, you will be able to get a wall nearly as smooth as a plastered surface. Then trowel your flat coats over the glue size, and you will have a surface that is ready for enamel work or for working out the various tiffany blends, glaze coats or other decorative effects where a flat surface is required.

There are a great many oil textured surfaces being used today, and I find that by using flat wall paint and mixing this material to a consistency for texture work, with dry bolted whiting, that a very inexpensive washable wall surface can be produced in one coat over a glue size. This material will dry sufficiently hard that it is not necessary to size before using a glaze coat over the same.

The Sherwin-Williams Company have several booklets and samples of glaze finishes, as well as texture finishes, showing them in colors which can be easily reproduced over Fir-Tex. In fact, the effect is more pleasing, due to the fact that it brings out the textured surface of Fir-Tex.

The National Lead Company have some very attractive samples of their lead texture which can be reproduced over Fir-Tex after the board has been sized.

There is another type of finish which can be applied directly to Fir-Tex without the size, which is produced by the use of water soluble analines. These materials are distributed by Geisey & Company. The application of this treatment is accomplished by the use of an air spray equipment producing different cloud effects, or can be sprayed through stencil patterns, giving an all-over treatment in very decorative designs.

In using wall paper as a treatment, I have found that it is advisable to use a glue size first, then apply blank stock or use the ordinary manila paper, which is sometimes referred to as butcher paper. Use a small amount of glue size in the wall paper paste in the application of this blank stock. Do not lap the joints. Then apply your wall paper in the usual method.

In doing canvas work or the application of Sanitas or oil-cloth materials, use the glue size and blank stock as referred to, then the usual application for canvas or oilcloth materials.

The treatment of seams or joints seems to be the most serious problem from a decorator's standpoint, and the ordinary patching plaster or material such as Plaster of Paris or any of the plaster type of materials are not very satisfactory for work of this type. However, I believe that a satisfactory solution for this problem would be to use a Para Rubber material which is very similar to the cement used in the patching of automobile tires. Mix in a solution of benzine to which you add the fibre of the Fir-Tex, or let us say the sawdust from Fir-Tex, with a small amount of bolted whiting, mixed something after this fashion: Dissolve your Para Rubber in the benzine, then in a different container mix together your Fir-Tex sawdust and whiting and a small amount of casein binder, then put this into a paste form with water. Then add to this mixture the Para Rubber and benzine mixture which should produce a cement that is pliable and will not break in case of expansion or contraction of an ordinary amount.

Do not put the Fir-Tex boards tight together. Leave 1/8" space then work this cement into the seams with a trowel, also use the same material for filling nail holes or other breaks in the surface.

After this material is thoroughly dry use a heavy garnet paper on a block, using a circular motion in the bringing of the surface down to a level condition.

I have found that the Sherwin-Williams Company have a lacquer used for waterproofing wall paper, which is absolutely water white. It is an excellent material for waterproofing over kalsomine or water textured surfaces, without influencing the colors. This also can be used over the water soluble analines treatment.

Should you require samples prepared, my suggestion would be that you use the three foot by four foot size.

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