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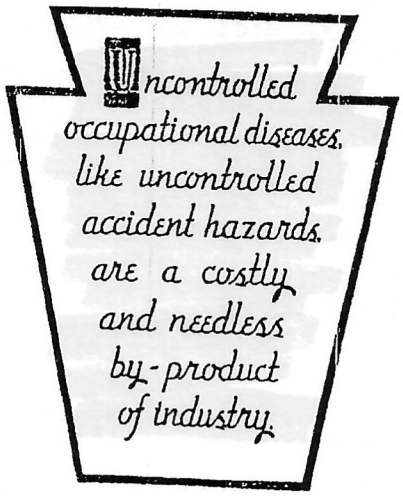
INSULATION IN STREAM LINED TRAINS

Department of Labor and Industry

Wm. H. Chesnut - Secretary

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Uncontrolled
occupational diseases,
like uncontrolled
accident hazards,
are a costly
and needless
by-product
of industry.

The following illustrated talk was presented by Dr. E.H. McIlvain at a monthly safe practice conference sponsored jointly by Penna. State College and the State Department of Labor and Industry. This conference was held at Nittany Lion Inn and was under the joint chairmanship of Dr. Frank C. Whitmore, Dean of the School of Chemistry and Physics of the College and Mr. Wm. H. Chesnut, Director of the Bureau of Workmen's Compensation.

INSULATION IN STREAM-LINED TRAINS

by

Dr. E. H. McIlvain
Medical Director and Personnel Manager
The Edward G. Budd Manufacturing Company

"One of the most interesting developments of the Railroad Industry in recent years is the advent of the lightweight streamlined train--an ideal of the modern transportation. This was conceived a few years ago by the Edward G. Budd Manufacturing Company, Philadelphia, Pennsylvania, manufacturer of automobile bodies.

When the railroads embarked on a program of modernizing their equipment, the Budd Company's method of streamlining and lessening the weight were the principal parts of that program. This resulted in more attractive surroundings while in the trains, and air conditioned atmosphere for all weathers and temperatures. This was the new program upon which the railroads and car builders embarked. It became imperative to reduce all possible non-operating weights; thus running boards, head-lights, cabs, hand rails and steps were redesigned with light, strong metal. The Edward G. Budd Manufacturing Company use stainless steel.

Realizing that railroads were hauling enormous dead loads, the Budd Company applied the principle of light weight and staunch construction with

which they had revolutionized auto body construction. The idea immediately caught and was adopted by the railroads as well as by car builders.

One of the designer's original problems was that of insulation. The new trains must be insulated with a material of extreme lightness, but of a heat transmission factor that would assure passengers the utmost in comfort from the beginning to the end of their ride, in all seasons of the year. In the search for light weight material it was opportune that the streamlined train and Fiberglas insulation occurred at the same time and the latter was selected for insulation.

It is about some of the features of insulation that I wish to direct a few remarks. Fiberglas is a product of the Owens-Corning Corporation. Its manufacture begins with the proper proportioning of sand, soda ash and lime, with some lesser ingredients, according to the selected formula. This "batch" is then melted in a standard glass tank under great heat supplied by gas burners. Up to this point, all operations are identical to those followed for the production of glass in any of its common forms, such as window glass, chemical glassware or containers.

But after the batch has been melted there are several differing methods for producing fibers. The first, which is Fiberglas wool, uses the batch from the original tank without further refinement than the melting process naturally involves. Thin streams of molten glass come through the fore-hearth of the furnace by gravity, through small aperatures in special high-temperature metals, and are immediately caught in high-pressure jets of steam. The steam draws the molten glass at the speed of a rifle bullet into long, flexible, fine fibers which settle in the form of a mat of light density wool on a conveyor. The fiber diameter may be varied at will by precise control, varying from about three ten-thousandths of an inch (.0003"), to a coarser fiber of about one one-thousandth of an inch (.001"), depending on the product to be manufactured. The length of the fibers vary with the

control. They run from about 4" in length to long fibers from 15" to 20" in length.

This material is the base for numerous products, a partial listing of which would include: Rail car and bus insulation, locomotive cab and boiler insulation, pipe-covering and blocks, insulation for domestic refrigerators and ranges, air filters, glass fabrics, yarn, roving, tape, house insulation and many others.

No product used for insulating streamlined cars or trains should have properties which affect metals, be inflammable, or be affected or destroyed by normal moisture. It should be thoroughly adaptable to the car builder's requirements, light in weight, and remain permanently in place. Naturally, though I leave it last to mention, it must be safe for employees to install.

Professor Hechler of the Engineering Experiment Station of Pennsylvania State College has just presented a technical discussion on various insulation products which his Department is constantly testing. I am informed that for the past two years, Purdue University has carried on an extensive and exhaustive study of the durability of insulating materials, including Fiberglas. During this time, such durability has been studied under repeated atmospheric and temperature changes, vibration, vapor diffusion, penetration, absorption and saturation.

Fiberglas is flameproof. It is incombustible and non-inflammable. The use of this insulation eliminates any possibility of a shop hazard where welding or cutting torches are being used in the vicinity of the insulation or even when brought in contact with it. It will not support combustion in any form. Its use eliminates the hazard to man and of loss to equipment due to a fire being progressively carried through the walls of a car in the insulation, which has happened when inflammable insulations were used.

As an added measure of safety, the facing usually used on Fiberglas in passenger rail cars is a flame-proof muslin which, like the insulation, will not burn or support combustion. Thus welding, gas or torch flames may be freely used on either the light weight stainless steel of the Budd type or the heavier plates of other construction, without the workman needing to concern himself with what is in back of the plates.

The widening use of overhead electric catenaries, and the possibility of fire from any source in tunnels, have caused a demand by some railroads for fireproof insulation.

This glass material is non-corrosive. It contains no sulphates, chlorates, or sulphides. It is free from such corrosive agents. This means the workmen handle a chemically inert material. Metals from which cars are constructed are not affected, assuring permanent safety and freedom from corrosion or static, such as is generated by metal insulation materials.

From the standpoint of sanitation, there is much to be said. The material is non-organic; therefore it will not sustain animal, bacterial or fungus growths. It is vermin proof, termite proof, and rodent proof.

Being glass it is non-conductor of electricity. Crossed or broken wires, or wires with covering worn, will not be grounded through this material.

Occupational diseases are a serious consideration with all of us. Their hazard to health, and their cost, are factors which cannot be ignored. No responsible data have been collected on the subject, according to my best information, but one thing is obvious: proper insulation will keep it to a minimum. Silicosis, according to the Pennsylvania Medical Journal for June, 1937, Page 790, depends upon the size and concentration of the particles inhaled. The most damaging are those of five microns or less in size. Those measuring ten microns or more, it continues, probably do no damage.

My information is that in railroad insulation blankets, the diameter of Fiberglas fibers are on the safe side of such measurements. The long length of these fibers inhibits dusting or sifting and thus keeps atmospheric concentration to a minimum.

The thermal conductivity of Fiberglas varies with the mean temperature and with the density with which the insulation is installed.

At 50 degrees F. mean temperature, and a density of 3# per cubic foot, Fiberglas has a "K" factor of .25 B. T. U. per hour, per square foot, per inch thickness, per degree difference. At 6# density, the value is approximately .22 B. T. U.

At 90 degrees F. mean temperature, the conductivities for the densities of 2 and 3 pounds are .265, and .235.

Passing up into the higher temperature ranges, at 300 degrees F. mean temperature, the 3# density Fiberglas has a conductivity of .41; the 6# of .325 and the material with an 8# per cubic foot density has a coefficient of .295.

At the higher service temperatures, higher density Giberglas is always employed. For instance, at a mean temperature of 500 degrees F., Fiborglas wool at 6# density has a conductivity of .59 and at 8# density it has a conductivity of about .49.

To you who are familiar with the properties of various insulating materials, these figures will appear quite striking, as they demonstrate that Fiberglas combines low weight with high thermal values, and the ability to withstand extreme temperatures.

One insulation material may have excellent thermal efficiency, but a lot of dust. Another, no dust, but lower efficiency. A third might efficiency and cleanliness, yet be vulnerable to fire or absorb and hold moisture. Fiberglas provides the qualities generally sought as an insulation product in stream-lined trains and in addition has proven safe for handling purposes by our workmen."