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Pfizer QUIGLEY COMPANY, INC.
Manufacturers of Refractories — Insulations
235 E. 42nd Street New York, N.Y. 10017

# INSULAG

## WATER RESISTANT REFRACTORY LAGGING

## INSULAG

A superior refractory lagging with unsurpassed insulating and sealing properties for use on high or low temperature equipment.

Can be applied on hot or cold metal surfaces.

Fuel savings, constant temperatures and increased production result from its use.

Increases in thickness after application and retains this increased volume throughout its entire range of service temperatures.

Does not collapse after it has set, from contact with water, oil or steam.

Is non-injurious as contains no mineral wool or fine slag particles which are irritants to the body.

Develops high mechanical strength upon drying and withstands shock, moderate abrasion and vibration.

Can be applied by gun in thin coats to effect a perfect seal.

Block insulation is effectively covered and protected.

Makes a good expansion jointing.

Has excellent insulating qualities.

Weight expanded 36 lbs. to a cubic foot.

Expands approximately ½" for each inch applied if installed immediately after mixing.

Has temperature range of 2200°F. limit for interface temperature.

3 lbs. usually covers one square foot 1" thick.

Sets firmly on cold set in 24 hours.

Can be applied by gun, grout or trowel.

Packed in 100 lb. multiwall, moisture-proof bags. Proper instructions for use enclosed in each bag.

## SPECIAL APPLICATIONS

¼" coating applied by Quigley C. O. Gun on new open hearth silica roofs—increases life by eliminating initial spalling.

½" coating on brick-lined doors when new, prevents spalling.

Sealing Tuyers when banking Blast Furnaces.

Insulation and sealing Bustle Pipes.

Expansion Joints at jamb in Coke Ovens.

Insulating walls for comfort between furnaces in working areas of Reheat Furnaces.

When banking Blast Furnace seal Bosh usually by spraying.

Insulate outside of Reheat Furnace.

Cover block insulation on outside Stoves.

Spraying Annealing Oven interiors to seal cracks and spalling.

Sealing Regenerator chambers in Rolling Mills.

## SUMMARY OF PROPERTIES

| | |
|---|---|
| Temperature Range | 2200°F. Interface |
| Setting Characteristics | Hydraulic Set |
| Application | By Gun, Grout or Trowel |
| Thermal Conductivity K factor in B.t.u./ sq. ft./inch thk./ hr./°F. | @ 500°F. .56<br>@ 1000°F. .70<br>@ 1500°F. .84 |
| Spalling | Negligible |
| Weight | 36# to a cubic foot |
| Coverage | 3# covers 1 sq. ft. 1" thick |
| Packing | 50# bags |

Pfizer QUIGLEY COMPANY, INC.
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Pfizer QUIGLEY COMPANY, INC.

Manufacturers of Refractories — Insulations — Paints

235 E. 42nd Street New York, N.Y. 10017

# INSULAG

## WATER RESISTANT REFRACTORY LAGGING

**GREAT STRENGTH — QUICK SETTING — LIGHTWEIGHT — HIGH TEMPERATURE**
**EXPANDS — DOES NOT SHRINK — WATER & OIL RESISTANT — FIREPROOFING**

### INSULAG

A superior refractory lagging with unsurpassed insulating and sealing properties for use on high or low temperature equipment.

Can be applied on hot or cold metal surfaces.

Fuel savings, constant temperatures and increased production result from its use.

Increases in thickness after application and retains this increased volume throughout its entire range of service temperatures.

Does not collapse after it has set, from contact with water, oil or steam.

Is non-injurious as contains no mineral wool or fine slag particles which are irritants to the body.

Develops high mechanical strength upon drying and withstands shock, moderate abrasion and vibration.

Can be applied by gun in thin coats to effect a perfect seal.

Block insulation is effectively covered and protected.

Makes a good expansion jointing.

Has excellent insulating qualities.

Weight expanded 36 lbs. to a cubic foot.

Expands approximately ¼" for each inch applied if installed immediately after mixing.

Has temperature range of 2200°F. limit for interface temperature; 2000°F. direct flame.

3 lbs. usually covers one square foot 1" thick.

Sets firmly on cold set in 24 hours.

Can be applied by gun, grout or trowel.

Packed in 50 lb. multiwall, moisture-proof bags. Proper instructions printed on each bag.

### HOW TO MIX and APPLY INSULAG

Mix INSULAG and water (50# bag Insulag to 3½ gal. water — approx. 60% Insulag to 40% water) — to consistency of heavy plaster. Mixed INSULAG must be applied in 30 min. DO NOT MIX MORE than can be applied in 30 min. After INSULAG has been applied, do not trowel out air pockets that honeycomb INSULAG during bloating period. Use wet trowel about an hour later to smooth out. INSULAG trowels out smooth, hard and white. For reinforcing use 2x2 — 16 Ga. square mesh or metal lathe on 16" centers, well secured. Can be applied with Trowel-Gun or grout. No weather proofing is necessary. INSULAG can be painted — no sizing is necessary. Quigley AAA Paints in aluminum and colors are available.

### SUMMARY OF PROPERTIES

| | |
|---|---|
| Temperature Range | 2200°F. Interface |
| Setting Characteristics | Hydraulic Set |
| Application | By Gun, Grout or Trowel |
| Thermal Conductivity K factor in B.t.u./ sq. ft./inch thk./ hr./°F. | @ 500°F. .56<br>@ 1000°F. .70<br>@ 1500°F. .84 |
| Spalling | Negligible |
| Weight | 36# to a cubic foot |
| Coverage | 3# covers 1 sq. ft. 1" thick |
| Packing | 50# bags |

Pfizer QUIGLEY COMPANY, INC.

Manufacturers of Refractories — Insulations — Paints

235 E. 42nd Street New York, N.Y. 10017

# INSULAG

Reg. U. S. Pat. Off.

# A HIGHLY EFFICIENT INSULATING LAGGING

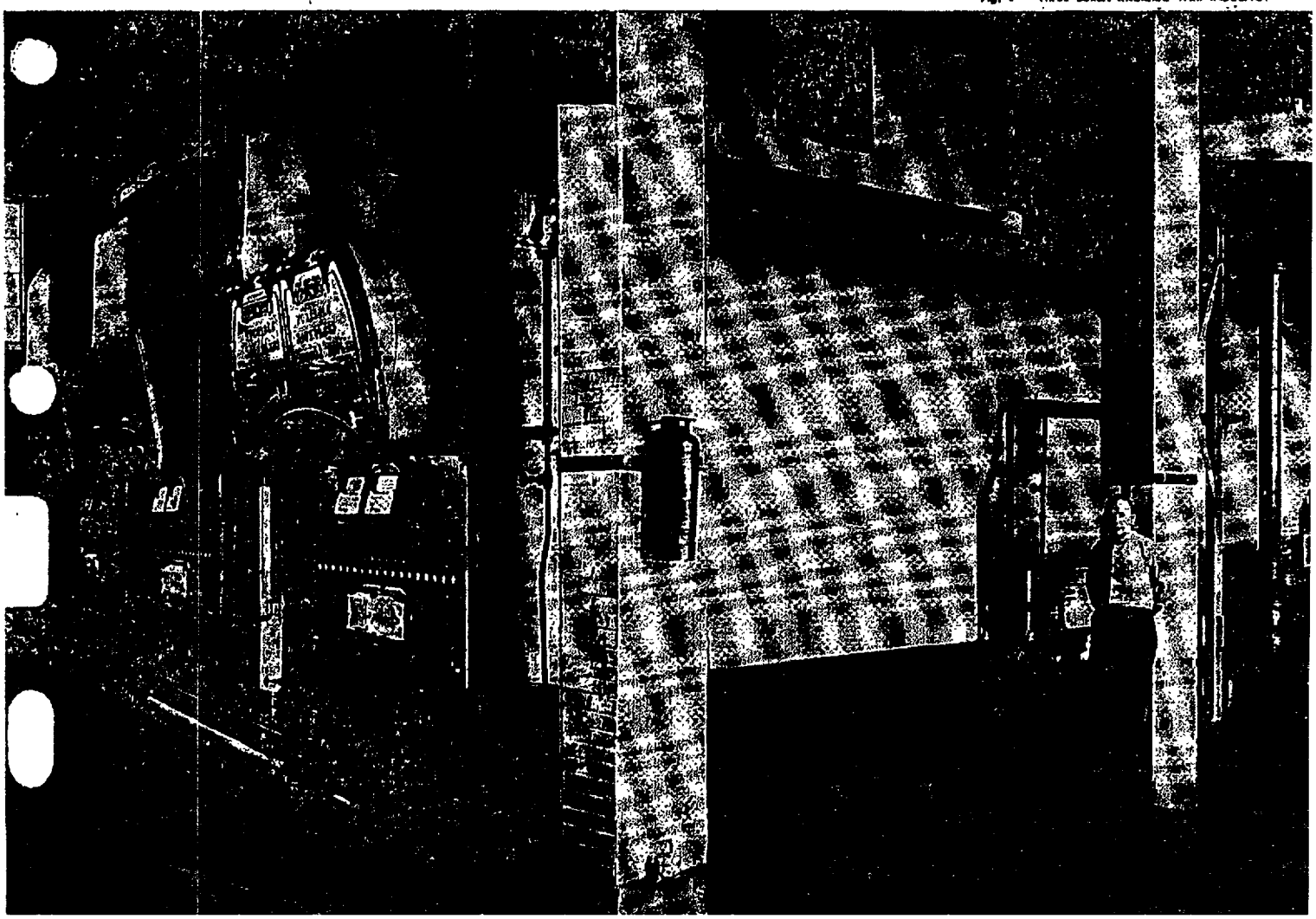
***With Air-setting Properties for a Wide Range of Temperature Applications***

**WATER RESISTANT—ECONOMICAL**

*Bulletin No. 332-F*

*A QUIGLEY PRODUCT*

Fig. 1 — Three Boilers Insulated With INSULAG.



**INSULAG** is a superior refractory lagging with unsurpassed insulating properties for use on high or low temperature equipment. It can be applied on hot or cold metal surfaces, and as a finishing coat for insulation.

INSULAG possesses at recommended temperatures exceptionally high refractory and insulating properties. INSULAG is used at operating temperatures at which other laggings fail.

Its unusual low heat storage and low thermal conductivity make INSULAG a most effective insulator for the control of temperatures. INSULAG permits reduction in thickness of heavy refractory walls and, in turn, decreases the heat capacity of the total structure. Fuel savings, constant temperatures and increased production result from its use.

INSULAG increases in thickness after application and retains this increased volume throughout its entire range of service temperatures. INSULAG, after it has set, does not dissolve or collapse from contact with water, oil or steam, which properties make it an outstanding product.

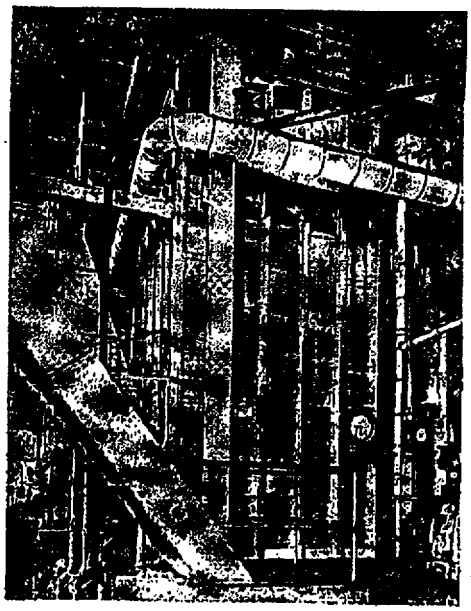


Fig. 1—Walls, Ducts, Casings, Drums of Large Boilers Insulated With INSULAG.

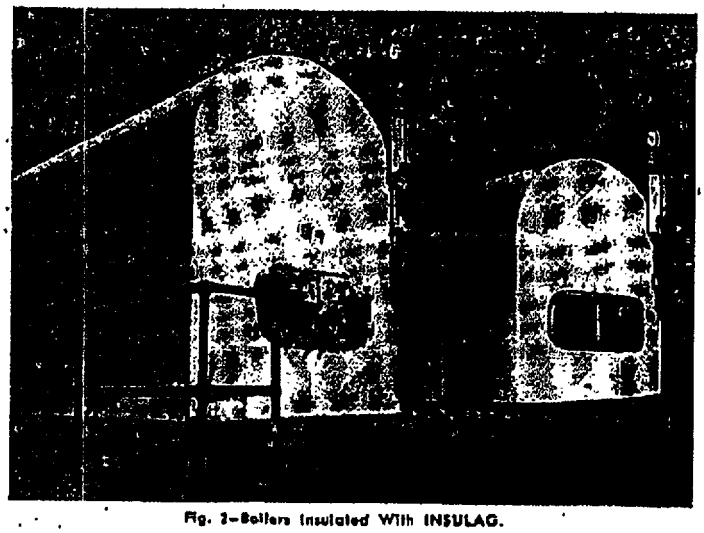


Fig. 2—Boilers Insulated With INSULAG.

**PROPERTIES OF INSULAG vs. FIRE BRICK**

Heat Conductivity B.t.u./Sq. Ft./In. Thick/°F./per hour

| MEAN TEMPERATURE | INSULAG | FIRE BRICK |
|---|---|---|
| 500°F. | .56 | — |
| 1000°F. | .70 | 8.15 |
| 1500°F. | .84 | 9.99 |
| Approximate weight per cu. ft. applied | 36 lbs. | 130 lbs. |
| Heat storage per lb. per °F. | 24 B.t.u. | .24 B.t.u. |
| Heat Storage for same insulating effect | 1/40 | 1. |

**POWER PLANTS**—INSULAG meets the engineer's demand for a suitable material for covering turbines, feed water heaters, hot liquid storage tanks, drums, smoke flues, stacks, pipes and flanges. It is also recommended as insulation in back of refractory tile of water wall boilers and outside fire brick walls in boiler furnace construction.

**ON BOILER DRUMS**—INSULAG, used on the boiler drums because it does not crack in service, can be walked on without destruction, and does not collapse due to steam leaks or water dripping on same.

**FIRE-PROOFING**—Bins, walls, roof structures, furnace rooms, columns, etc., may be protected against fire by applying INSULAG as a veneer coating. The fire retardant properties of INSULAG render it ideal for this purpose.

**GENERAL USES**—INSULAG has such a wide range of uses that it is indispensable as a plastic lagging in plants using fuel fired furnaces. It is "the lagging material of a thousand uses."

## QUICK SUMMARY

1" equals 9" of fire brick in insulating value.
1/40 heat storage capacity of fire brick for same heat flow.
High mechanical strength.
Operating temperature 2200°F. interface.
Light weight—yet rugged and strong.
Sets quickly.
Adaptable—suitable for practically every lagging need.
Water resistant—steam, oil or water leaks do not destroy.
Expands—an inch applied is more than an inch when dried.

INSULAG is shipped in 50 lb. bags, net.

Copyright, 1947 Quigley Co., Inc.

*This bulletin becomes effective as of October 1, 1948, and cancels in its entirety all previously issued bulletins or data referring to this product.*

# PROPERTIES OF INSULAG

LOW THERMAL CONDUCTIVITY—INSULAG retains practically constant insulating values throughout its service range, so that under varying conditions and temperature changes there is no appreciable loss of insulating efficiency. *One inch* of INSULAG has an insulating value equal to about *nine inches* of fire brick and has about *1/40* the heat storage capacity of fire brick walls of equal heat flow. Therefore, relatively thin applications of INSULAG may be substituted for heavy masses of refractories; heat losses are reduced and furnace production is increased.

HIGH MECHANICAL STRENGTH—INSULAG *is different.* It develops high mechanical strength upon drying and successfully withstands shock, moderate abrasion and vibration. The impact of a hammer will cause a dent in INSULAG and may even crack it, but the blow will not cause it to break away readily from the equipment to which it was applied. This is most advantageous on drums, tanks, pipe lines and other equipment subject to rough usage.

HIGH TEMPERATURE LIMITS—INSULAG will withstand a wide range of applications for high temperature direct exposure and is recommended for interface temperatures up to 2200°F.

EXPANSION — INSULAG expands after application; physical shrinkage eliminated.

LIGHT WEIGHT— On the average, three pounds of INSULAG covers 1 square foot to a thickness of 1 inch. Varying conditions, methods of application, hard troweling, kinds of surfaces, variations in mixing, water content, and temperature of surfaces at time of application may require more material.

QUICK SETTING — INSULAG cold-sets firmly in 24 hours to 48 hours and in much less time when subjected to heat. The quick drying and setting characteristics of INSULAG permit troweling to a smooth finish suitable for painting.

ADAPTABILITY—INSULAG possesses properties necessary for "roughing" coat and "finishing" coat, or two coats by one application. The user of INSULAG does not find it necessary to carry in stock two or three different materials for the same job.

WATER RESISTANT—INSULAG, after setting, does not dissolve or collapse from contact with water, oil or steam. This is a decided advantage in plant maintenance. INSULAG is a superior product for insulating equipment exposed to the weather.

NON-INJURIOUS—INSULAG contains no mineral wool, or fine slag particles which are irritants to the hands or other parts of the body.

A feature of INSULAG which particularly appeals to many users is the beautiful, smooth, white surface of a trowelled finished job.

If desired an INSULAG trowelled finished job can be treated with Quigley TRIPLE-A Protective Coatings in white, black, colors or aluminum.

Various combinations of INSULAG with other INSULINE Products can be made for specific applications.

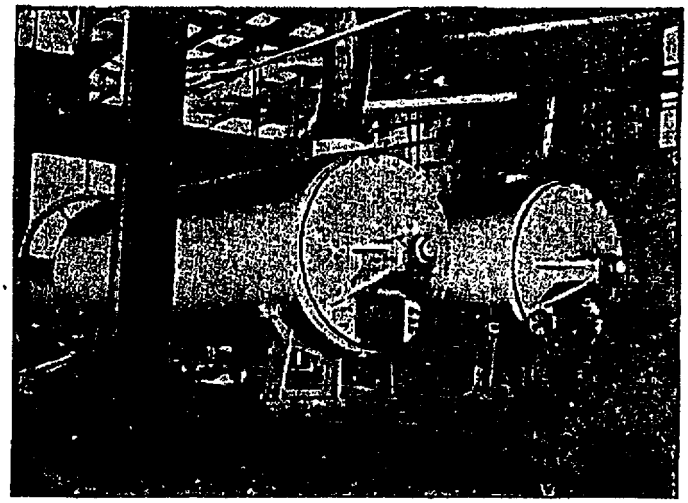


Fig. 4—Steam Driers Coated With INSULAG. No Wrapping or Painting Necessary.

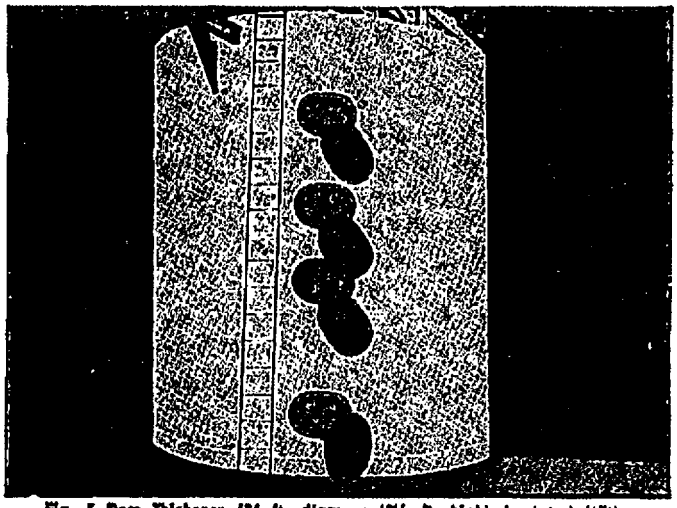


Fig. 5—Dorr Thickener (24 ft. diam. x 10½ ft. high) Insulated With INSULAG.

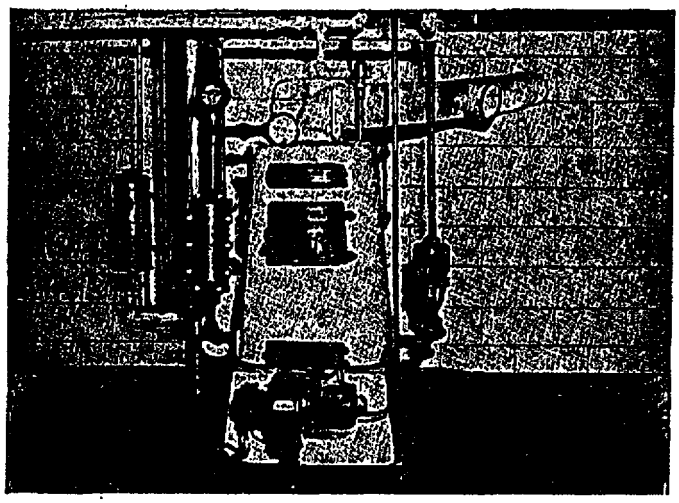
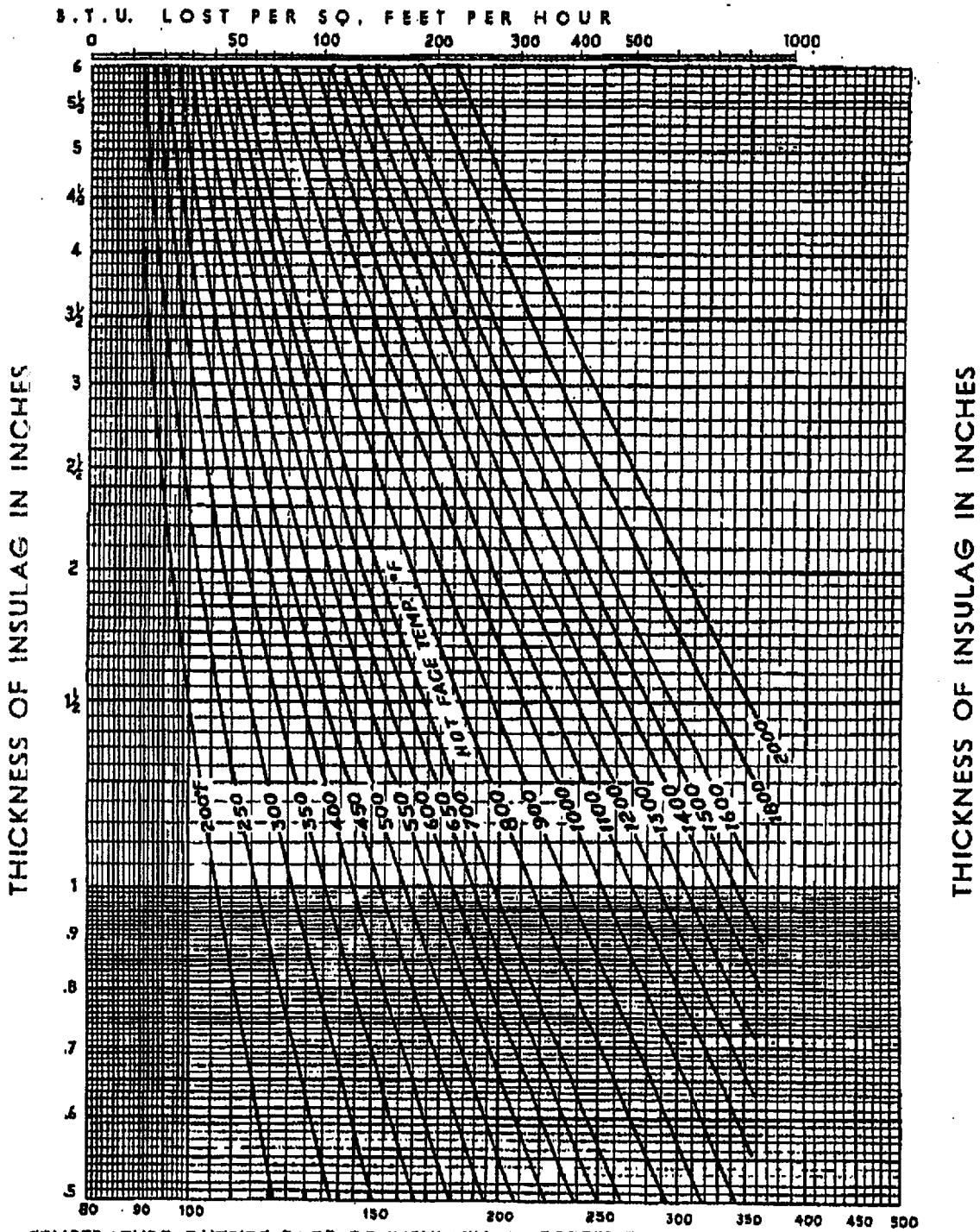


Fig. 6—Water Tank and Boiler Domestic Fuel Oil Burner Insulated With INSULAG.

## INSULAG—THICKNESS IN INCHES REQUIRED FOR VARIOUS HOT FACE TEMPERATURES




*BASED ON STILL AIR AT 80°F.*

THIS CURVE IS BASED ON THE INSULATING MATERIAL CAST AND DRIED AND WITH A SURFACE EMISSIVITY FACTOR OF 0.89.

### How to Determine Heat Savings Effected by INSULAG.

Chart above indicates the heat loss through graduated combination thicknesses of INSULAG, as well as the temperature of the outside surface of the INSULAG at given temperature for the hot surface.

1. To determine the thickness of INSULAG required to give an outside surface temperature.
   *Example:* Temperature of the hot surface is 500°F. What total thickness will give a temperature of about 130°F.? Follow 130°F. line upward until it meets 500°F. curve line. At this point follow horizontal line and read 2 in. Therefore a 2 in. thickness of INSULAG is required.
2. To determine the heat loss through given thickness of INSULAG or from outside face temperature.
   *Example:* Similar conditions as that given under "1". From 130°F. at bottom of chart follow upward until you read 90 B. t. u.'s on the upper scale.


Pfizer QUIGLEY COMPANY, INC.

Manufacturers of Refractories — Insulations

235 E. 42nd Street New York, N.Y. 10017



Printed in U.S.A.

Bulletin 332 F-5M-1-[illegible]

# INSULAG

REG. U. S. PAT. OFF.

# FIREPROOFING CEMENT



***INSULAG*** s a fire retardant, lightweight formulation, having a fire and water resistant smooth white surface.

***INSULAG*** weighs only 40 pounds per cubic foot; 1/3rd the weight of concrete, common brick or other such fire proofing materials. Therefore, excessive loads are not added to existing structures, or those under design.

***INSULAG*** was subjected to exhaustive fire-proofing tests by a nationally recognized research laboratory and large oil refinery. Their reports proved INSULAG is capable of withstanding THERMAL SHOCK without spalling or destruction when 100 lb. per square inch water pressure was played on it by hose, with nozzle, at all distances, and at all temperatures up to 2000°F.

***INSULAG*** is the ideal fireproof protection for Structural Columns, Beams, Channels and Angles, LP Gas Tanks, Oil Tanks, Tower Skirts, Pipe Line Supports and All Exposed Steel in Oil Refineries, Steel and Chemical Plants.

***INSULAG*** is regulary used as a Refractory Insulation by all types of industries, inside and outside of furnaces and boiler settings, for temperatures up to 2200°F. It is also used for many types of insulations inside and outside of buildings, regardless of climate and without weather proofing.

***INSULAG*** is the only material required for a fireproofing and water resistant insulating job.

## *BE ASSURED OF YOUR FIREPROOFING BY USING INSULAG*

### PROPERTIES OF INSULAG A FIREPROOFING CEMENT

***LOW THERMAL CONDUCTIVITY***—1" has insulating value of 9" Firebrick

***HIGH MECHANICAL STRENGTH***—Withstands vibration—Moderate Abrasion

***HIGH TEMPERATURE LIMITS***—2200°F.

***LIGHT WEIGHT***—Trowelled: 40 lbs. per cu. ft.
Gunned: Approx. 45 lbs. per cu. ft.

***QUICK SETTING***—(2-24 hours) Depending upon temperature and atmospheric conditions

***NON-INJURIOUS***—Contains no mineral wool.

***WATER RESISTANT***—After setting does not dissolve or collapse in contact with water, steam or oil. Does not require water-proofing.

***ADAPTABILITY***—Roughed or scratched, Coat and Finish Coat with one product INSULAG. Trowels to a hard smooth, white finished surface.

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Pfizer QUIGLEY COMPANY, INC.

Manufacturers of Refractories — Insulations

225 E. 42nd Street New York, N.Y. 10017

# INSULAG FOR FIRE PROOFING

## Where to Use

**ACID PLANTS—**
Structural Steel for Absorption—Glover—Lussac Towers and Tanks

**CHEMICAL PLANTS—**
Structural Steel for Heaters—Chemical Units—Still and Tanks

**COAL COLLIERIES AND MINES—**

**COPPER—LEAD—ZINC MINES—**
Structural Steel—Bins—Underground Timber Supports

**GLASS PLANTS—**
Structural Steel—Melt Room

**LUMBER MILLS—**
Structural Steel—Fuel Bin—Burner—Dry Kilns

**OIL REFINERIES—NATURAL GASOLINE PLANTS—**

**CARBON PLANTS—ASPHALT PLANTS—**
Structural Steel—Vessel Skirts—Pipe Stanchions—Supporting Steel of Towers—Heaters—Crackers—Tanks—Gas Absorbers—Evaporators—Decarbonizing Units

**PAINT MANUFACTURERS—**
Structural Steel—Storage Tanks—Warehouse—Varnish Plants

**PAPER MILLS—**
Structural Steel—Recovery Furnace Room—Stock Rooms

**STEEL MILLS—**
Structural Steel Supports—
Blast Furnace—Conveyors—Scrubbers—Stoves
By-Products Plant—Distillation Unit
Coke Oven Plant—Pusher—Quenching Equipment.
Stock Piles—Conveyors—Coke—Coal

**SMELTERS—**
Structural Steel Supports
Anode Furnace Room
Convertor—Platform Struts
Refinery—Pouring Platform
Reverbatory

**WAREHOUSES—Inflammables—**
Structural Steel

## How to Use

### INSULAG A FIREPROOFING CEMENT

***REINFORCEMENT or SUPPORT for STRUCTURAL STEEL***

Use flat expanded diamond mesh, with metal spacers or
Use high rib lath or other suitable reinforcements, all to have corner beads.
On Larger Surfaces, weld on studs, to which attach square mesh welded fabric with opening of not less than 2"x2".

***INSTALLATION***

Can be Cast—Trowelled or Gunned by using above conventional methods of reinforcements.

***MIXING***

For Cast or Trowelled installations, add sufficient water to make a smooth easy-working mixture. Use clean, fresh water at 60-65°F. An average mixture takes about ten and one-half (10½) gallons of water to a one hundred (100) pound bag. Mix only quantity that can be applied within twenty (20) minutes.

For Gun Applications use minimum air pressure and maximum quantity of clean fresh water at 60°F., but no higher than 90°F., that permits placement without slump.

***APPLICATION***

A one and three quarters (1¾) inch thickness is required for a three (3) hour fire resisting rating. Apply by either Cast—Trowel or Gun method.

A one and one eighth (1⅛) to one and one quarter (1¼) inch thickness of mixed INSULAG which will bloat to one and five eighth (1⅝) to one and three quarters (1¾) inch. Allow to set. If a smooth finish is required, SCRATCH or ROUGHEN this surface before applying the one eighth (⅛) inch finishing coat.

If the original application has dried, same should be moistened prior to applying the finished coat. For the finish coat, INSULAG should be mixed with water, allowed to bloat and remixed. This finished coat should be trowelled smooth.

Additional Fire Resistance Rating can be secured by increasing thickness of INSULAG.

AN OPPORTUNITIES IN ENGINEERING FEATURE

# ENGINEE

health. Although significant contribu-
clinical and diagnostic medicine, many
nation of existing technology and from

of New York

The adaptation of engineering techniques and the medical problems is an especially appealing concept.

means immediately come to mind. The space pro-
monitoring instrumentation and signal processing, as

The [illegible] of communication that have devel-
systems have followed naturally from activities of
meld are held annually with such topics as intern-

operation and interest

groups of health and [illegible]
were reviewed to determine the use of electronic di-
machines, electrocardiographs, or routine laboratory
biopsies, etc.). The results appear in Table 1 (p.
[illegible] the electronic gear and only 14.5 percent re-
pitalization. If one also excludes electroencephalo-
partment, and hardly a new device. These percent-
[illegible]

the hospital. Portable machines of dentistry,
[illegible]

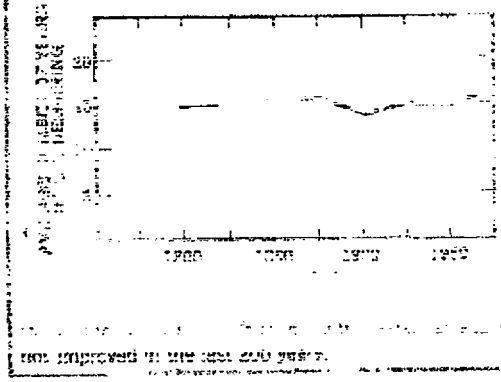
an analysis of the life expectancy of [illegible]
[illegible]
technology to prolong life in adulthood have been
the life expectancy of U. S. white males,

during admission prior to day of survey ..... 128 12.3

*Excluding ECG, x-ray, and service laboratories, but including EEG, isotope scanning, electromyography, audiometry, artificial kidney, pacemakers, etc.

| | |
|---|---|
| ECG | 3 |
| Electronic transducer | 5 |
| Emmerson chest suction | 2 |
| Hypothermic mattress* | 3 |
| Monitoring system | 15 |
| Pacemaker* | 11 |
| Pulsometer | 4 |
| Radioisotope scanner | 22 |
| Respirator (Bennet) | 9 |
| Sampling blood liquids | 14 |
| Ultrasonic nebulizer | 12 |
| Total | 126 |

*Developed in the last decade.



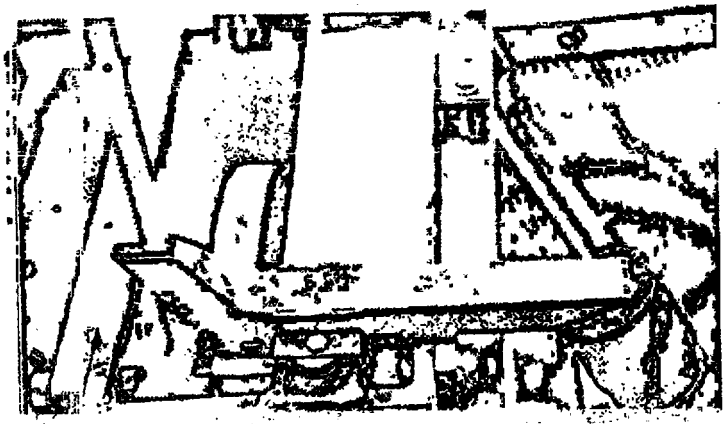
not improved in the last 200 years.

...ealing community, problems whose solutions can ... important to public health. We have been able to send a man to the moon in an environment clean enough to perform major surgery, yet a large number of America's workers labor in dust conditions that would be considered intolerable even by ... standards. In other circumstances, a patient can await replacement of a mitral valve in a $150-a-day room while a few blocks away a child is doomed to a life of impairment as a result of permanent brain damage suffered from eating leaded paint chips falling from the ceiling and the crib.

For a significant impact to be made in many of ... it is not necessary that new sophisticated technology or elaborate gadgetry be developed. What is needed is the application of existing technology to this relatively neglected class of medical problems. Of equal importance is the need for an engineering systems approach to such large-scale health issues. In many areas of community health, models can be developed, system components and their interactions defined quantitatively, and changes and their consequences simulated as part of a comprehensive approach to the solution of urban health problems. A consideration in depth of a specific example of these broad problems—that of the health effects associated with the use of toxic and industrial materials—will illustrate the role of the engineer in their solution.

## Asbestos-related Disease

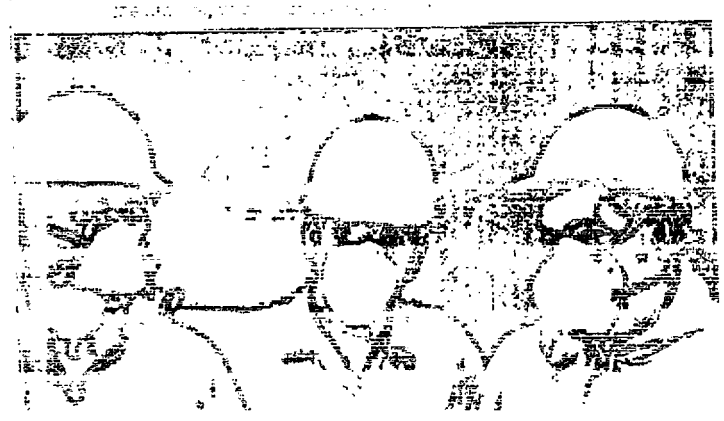
Occupational exposure to asbestos dates from 2500 B.C., when the Greeks used it in the weaving of funeral shrouds. Clinical recognition of asbestosis came in 1924, when Cooke described the pathological findings in the lungs of a 33-year-old woman who had been employed in a textile factory for 13 years. In 1960 autopsy performed on a 33-year-old woman who had been employed in a textile factory for 13 years. ... the sole survivor of a group of 16 individuals em-



ployed in a factory since 1886 [3]. A 1930 British study [4] further documented the pervasive presence of asbestosis (the term applied to the pulmonary fibrosis and scarring resulting from the inhalation of significant quantities of asbestos) in factory workers. This led to the imposition of what were thought to be stringent control measures in British factories producing asbestos products. Later research uncovered the existence of an additional problem. Lung cancer was suggested as being causally associated with an asbestos exposure in 1933 [5], and the association was fully confirmed in 1948 [6] and 1955 [7] studies.

In spite of this long history of disease, studies of Selikoff, Hammond, and Churg [8] demonstrated





nearly one in 10 from mesothelioma, a disease so rare in the general population that perhaps only one in 10,000 deaths are from this cause; one in 10 from cancer of the gastrointestinal tract, three times as expected, one in 10 from other cancers, and almost [illegible] over 20 years ago. Nearly 40 percent of [illegible] deaths can be attributed to their occupational exposure to asbestos. Moreover, recent studies of an asbestos-products manufacturing facility point to the existence of an even greater health problem in factories [9].

In addition to the extent of the disease experience

**TABLE 2**

**Deaths among 625 N.Y.–N.J. Insulation Workers Observed Prospectively 1943–1971, after Reaching 20 Years from Onset of Work**

| | Expected | Observed | Percent |
|---|---|---|---|
| Total workers, both | — | — | — |
| [illegible] | [illegible] | [illegible] | [illegible] |
| Lung cancer | 11.2 | [illegible] | [illegible] |
| Pleural mesothelioma | — | [illegible] | [illegible] |
| Peritoneal mesothelioma | — | [illegible] | [illegible] |
| Cancer stomach | [illegible] | [illegible] | [illegible] |
| Cancer colon, rectum | [illegible] | [illegible] | [illegible] |
| Cancer all other sites | [illegible] | [illegible] | [illegible] |
| Asbestosis | — | 32 | [illegible] |
| All other causes | 236.5 | 204 | 87.5 |

two other important concepts were revealed in these

pationally related deaths from asbestos exposure came only after 20, 30, 40, or more years since onset of exposure. This, of course, has presented considerable difficulties in attempting to apply proper control measures based on information of disease experience produced by inadequately evaluated environmental exposures of past decades. In short, there is

one of 32 deaths of 87 nonsmokers was of lung cancer. Thus, while an asbestos exposure alone may give rise to some increased risk of lung cancer, the combination of asbestos exposure and cigarette

working in the vicinity of the application of asbestos products, to the families of asbestos-factory workers, and to people who simply live in the neighborhood of mines or factories. Mesothelioma has been shown to occur in excess in shipyard employees such as weld-

asbestos-related disease was concomitantly reduced. However, the number of individuals potentially exposed is numbered in the tens of millions. Of special concern in this context is the widespread dis-

cities.

### Engineering Approaches to Environmental Control

Having identified the scope of the health problems associated with the use of asbestos and asbestos products, a cooperative effort was initiated at Mount

ate all aspects of the health problem and to develop

utilizing optical and electron microscopy and electron microprobe analysis documented the air levels and tissue burdens of asbestos from occupational and environmental exposure. Research on control strategies was mounted to reduce asbestos exposures to all segments of the population.

In the initial efforts to develop control measures to

Severe inconsistencies in the area of respiratory protection were quickly revealed. Although insulation contractors would supply workers with half-face-mask, replaceable-filter respirators approved by

read of mines, industrial-hygiene engineers from Mount Sinai School of Medicine, and Johns-Manville Corp. has finally culminated in the availability of three economical, approved, comfortable respirators having minimum breathing resistance.

with engineers at Florida Institute of Technology, room cleaning systems are now being developed and tested. In this study, such procedures as air curtains and directed air-cleaning systems are under

### Problems of Implementation

As in all problems having significant impact on various groups in society, implementation of identified solutions to problems can be slow, difficult, and frustrating. Many of the solutions forthcoming from the M.S.S.M. Insulation Industry Research Program were not immediately implemented, although they

board" implementation by industry, no single contractor wished to be placed at even a slight economic disadvantage. Thus action by the federal government was necessary, and an improved, but still inadequate, asbestos standard was promulgated by the Department of Labor on June 7, 1972, which incorporated some of the foregoing procedures [13].

It is important that engineering input be available for such implementation processes, especially to individuals proposing courses of action or budgetary commitments by the government. Without such input, political or economic considerations will dominate the governmental decision-making process. Thus many research results and much technical development may be wasted without the commitment of engineers to the full process of development *and* implementation of the work.

### Occupational Health

Asbestos was described in detail to illustrate the full scope of a health problem and the different aspects where the approach and the knowledge of engineers proved of benefit. An engineering systems

identified or developed to control the excessive asbestos exposures found, and finally, engineering input into the regulatory process was of benefit in the initial steps taken by government to control the uses of asbestos.

ly by virtue of their jobs. The effect on health achieved by adequately controlling the occupational use of this substance alone could result in a saving of over 5000 lives annually. Additionally, proper control of the work environment can significantly reduce the exposure and risk to the general public. However, asbestos is only one substance found in the occupational workplace. Silica, coal, and other dusts

cals are on the toxic substances list of the National

sis in refineries, chemical plants, and other factories

stances has not been established, especially the long

of materials. A multitude of urgent challenges await

### Summary

technology have had an impact on some areas of medicine, many additional areas exist where a transfer of engineering skills and technology can have a significant impact on the solution of major health problems. These lie in areas where the need for new developments is far less than the need for an innovative engineering approach and the application of existing technology. Many areas of health could benefit, but it will be necessary for the medical community to be educated as to what the potential contributions of engineers might be. While it is the medical community that requires the education, the initiative for this process must come from the engineering community. However, in bridging the communications gap that exists between parts of these two communities, engineers must reach out beyond the departments of medicine or physiology to the departments of community medicine or occupational health. Epidemiologists and sociologists as well as surgeons and biophysicists must be contacted. Speak also to psychologists concerned with the mental health of workers confined to the drudgery of a single task on a massive assembly line and those concerned with making the workplace, the home, or the automobile safer.

However, as important as communication between engineers and the medical community is, it is only a first step. Dialogues at long range are singularly unproductive. Also of limited productivity is the procedure of engineers coming to medicine with a gadget, a technique, or a material and asking for a use

nity. He must stay current with new information and new technology, but for full effectiveness in the field of public health he must become totally immersed in its activities. It might be appropriate to close by suggesting that engineers apply "human factors" to their counsel for an involvement in public health. Willie Sutton, when asked why he robbed banks, replied "because that's where the money is." If engineers wish to make an impact on public health, they must go where the problems are.

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to develop channels of cooperation between these important profes-
sions. It appears that it will be less costly to our engineers to stop the
the application of existing engineering technology, and methods to
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