

**Babcock & Wilcox
Refractories Division****Product Information**

October 6, 1972

Page 1 of 21

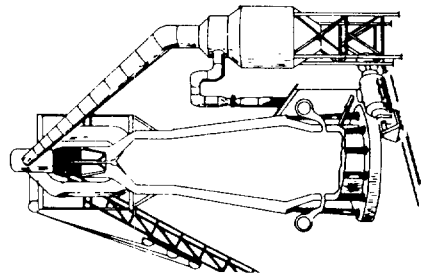
B&W KAOWOOL CERAMIC FIBER APPLICATIONSIN THESTEEL INDUSTRY

Babcock & Wilcox's versatile high temperature Kaowool ceramic fiber insulation is finding increased usage in steel mills throughout the world. From raw material preparation to finished product, almost anywhere in the steel making process you can find B&W Kaowool ceramic fiber used as a high strength resilient, fibrous insulation.

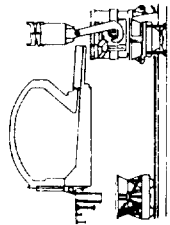
B&W Kaowool is on the leading edge of the rapidly advancing steel making technology. Personnel protection shields around BOF's and coke ovens, formerly constructed of conventional refractories now use B&W Kaowool blanket. Seals and gaskets of Kaowool have successfully replaced lower temperature fibrous materials thus aiding pollution control efforts. Significant weight savings have been attained with B&W Kaowool soaking pit cover linings, forging and reheat furnace doors, and stack linings. B&W Kaowool helps combat the impending fuel shortage with measurable savings as a furnace lining. The ease of installation generally results in labor savings when compared with a fired or rigid refractory material.

The attached sheets discuss examples of typical B&W Kaowool application which demonstrates the variety of areas that ceramic fiber can be used to produce heat savings and cost savings. These application areas are but a portion of the extensive use of B&W Kaowool in the world's steel mills.

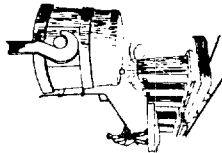
5 1 - 1



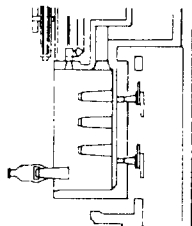
BLAST FURNACE



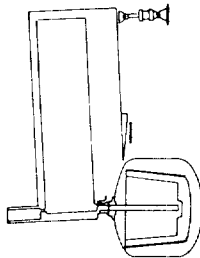
OPEN HEARTH



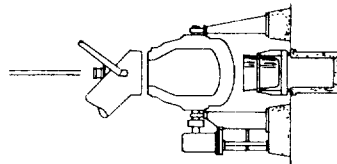
INGOT TEEMING



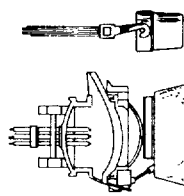
SOAKING PIT



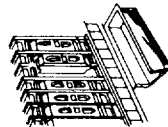
PRESSURE POURING



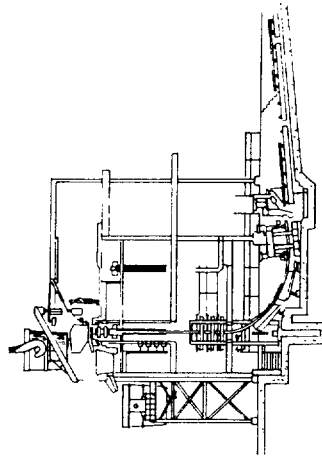
BASIC OXYGEN



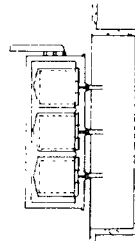
ELECTRIC



COKE OVENS



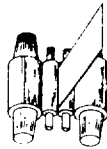
CONTINUOUS CASTING



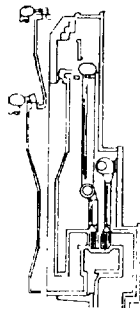
MULTI-STACK
ANNEALING FURNACE



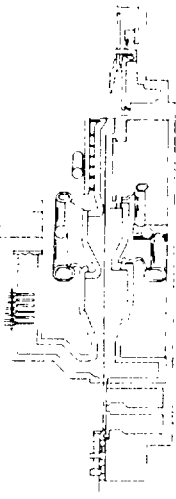
SINGLE-STACK
ANNEALING FURNACE



HOT ROLLED
SHEET & STRIP

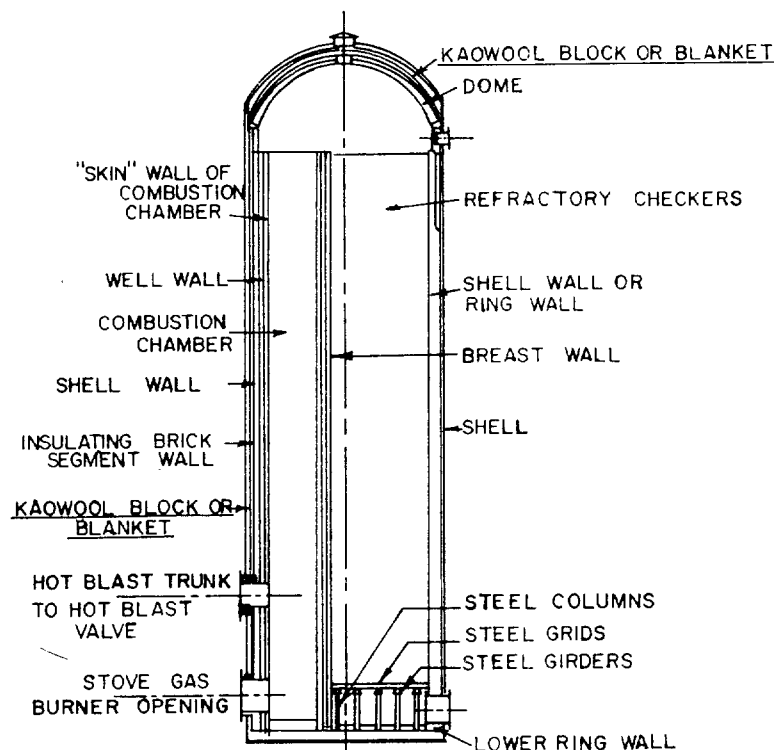


THREE ZONE
CONTINUOUS



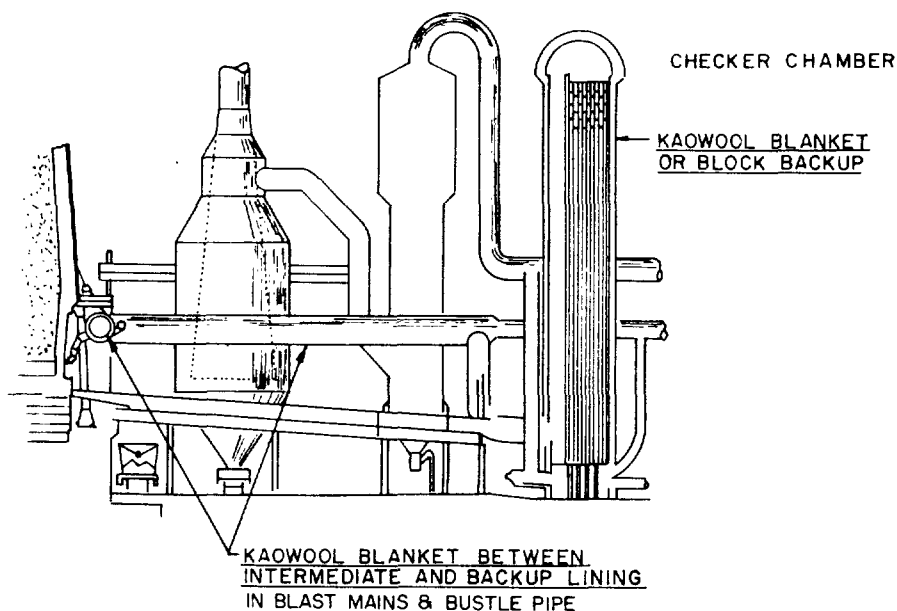
FIVE ZONE
CONTINUOUS





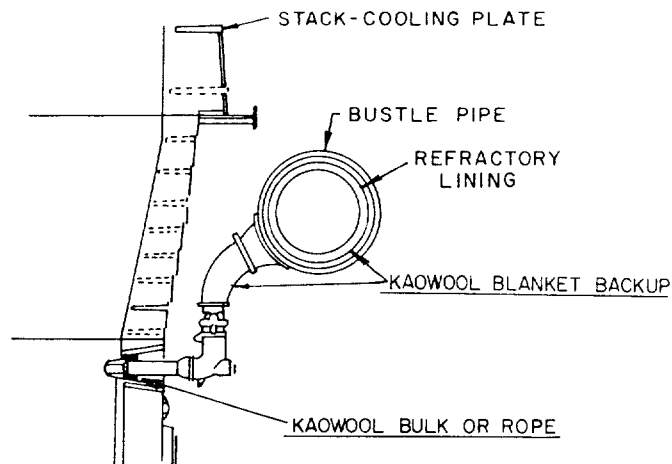
BLAST FURNACE STOVES

The backup lining in blast furnace stoves has become increasingly important as steel mill operators push for high temperatures and pressures in their stoves. A mineral wool or asbestos base insulating block cannot withstand temperatures in excess of 1900°F. B&W Kaowool ceramic fiber insulation is recommended for this application because it retains its excellent insulating properties well above 2300°F. The ease of installation is particularly important since B&W Kaowool block or blanket does not require drilling prior to impaling the material on anchor studs. In the stove dome, where the highest temperature is experienced, B&W Kaowool block or blanket can be impaled on the dome steelwork or laid on top of the dome refractory where accessibility allows. B&W Kaowool bulk fiber can be laid up with the refractory lining between the first course of brick and the shell. B&W Kaowool ceramic fiber can provide excellent insulation for blast furnace stoves which should result in increased efficiency.



BLAST MAINS AND BUSTLE PIPES

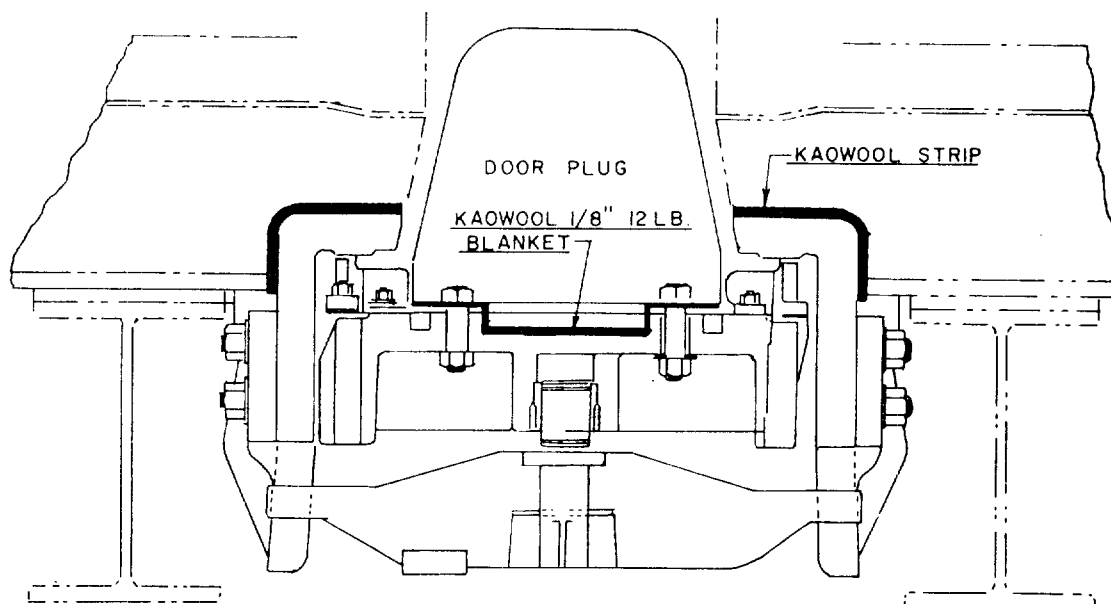
A layer of 1/2" 6 pound B&W Kaowool blanket between the intermediate and backup lining in a blast main or bustle pipe will increase the thermal efficiency of the overall lining dramatically. One European steel plant reported heat loss savings of approximately 25% and a reduction of the quality of the insulating firebrick backup lining from a 2300°F grade to a 2000°F grade. Lab tests at this same steel plant indicated that the results on a two component lining would be similar. The practice of placing a B&W Kaowool interface lining in blast mains and bustle pipes has been common in Europe and Japan for over two years.



GOOSENECK AND BLOWPIPE

In some blast furnaces, when 2000°F hot blast temperatures are approached, the goosenecks will begin to show color and radiate an excessive amount of heat. This can be overcome with the use of B&W Kaowool 1/8" 12 pound blanket placed between the refractory lining and the shell. In this manner, the heat losses can be reduced thus benefiting blast furnace efficiency.

A packing material, usually asbestos, is generally used around the blowpipe as it enters the blast furnace. Since the temperature at this point frequently exceeds the maximum use limit of asbestos, the insulation breaks down. B&W Kaowool rope or bulk fiber has the high temperature resiliency to withstand these conditions and to provide more effective insulation.

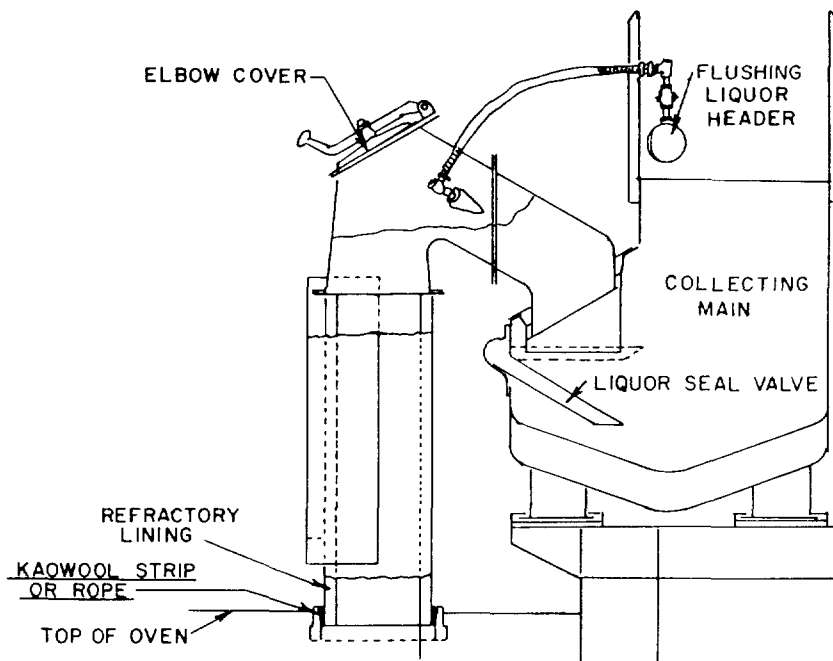


COKE OVEN DOOR PLUG BACKUP

Prior to the installation of pre-cast or fused silica door plugs, a "cushion" material consisting of asbestos paper, vermiculite paste or ceramic fiber is usually applied to the door steelwork. This material compresses and helps compensate for cold stresses introduced during the securing of the plugs. B&W Kaowool 1/8" 12 pound blanket or 1/4" 8 pound blanket performs this function as well as supplying additional insulation. The high temperature capability of B&W Kaowool insures that it will retain its properties at the operating temperatures of the coke ovens and the longer fibers make for higher handling strength during installation.

DOOR JAMBS

B&W Kaowool rope and strip are widely used in the steel industry for packing in coke oven door jambs. B&W Kaowool retains its resiliency at high temperatures and continues to perform when lesser quality materials have failed and been replaced. Some operators dip B&W Kaowool strip in airset mortar prior to installation to reduce the permeability and subsequent tar buildup. B&W Kaowool rope generally does not require this additional treatment.



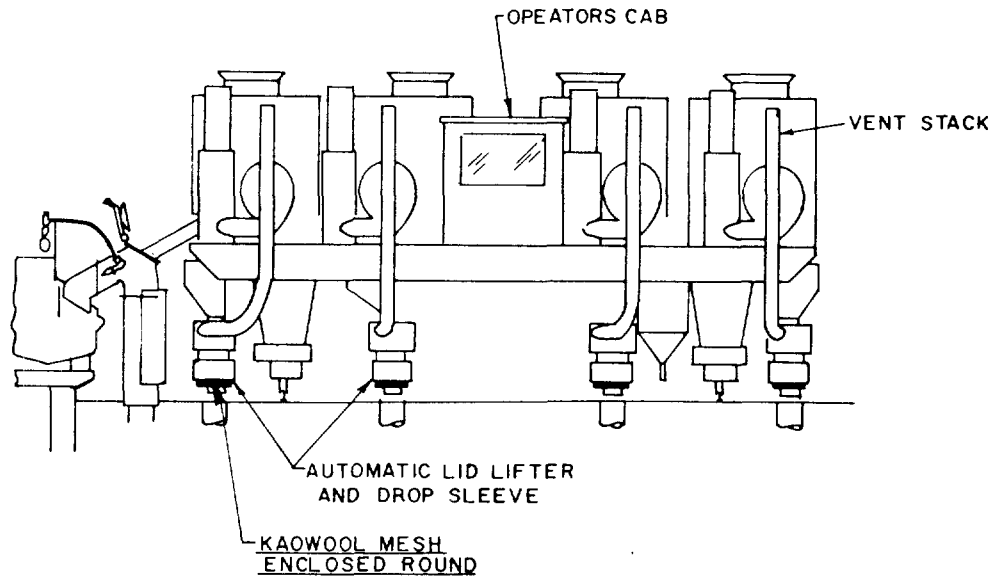
STAND PIPE PACKING

A fibrous insulation is used at the junction of the standpipe and the coke oven roof shell to compensate for movement of the standpipe. A common product used is asbestos rope which tends to break down due to the high temperature. B&W Kaowool rope, strip or bulk works well in this application and does not deteriorate due to high temperatures thus yielding superior life in this application.

PERSONNEL PROTECTION

When it becomes necessary to send workmen aloft to repair the exterior of an oven door in operation, the potential exists for a serious burn. A possible solution is currently being employed with the use of a mesh enclosed B&W Kaowool blanket. The blanket is attached to the top of the door and allowed to unroll by gravity to cover the entire door. In this manner, the workmen have the protection from at least the most severe area of radiation. The blanket is mesh enclosed to ensure reuse and the life depends upon the frequency of use. When judged no longer effective, only the blanket need be removed and the mesh reused.

For hot repairs inside the coke side door, a B&W Kaowool lined shield is currently used to provide personnel protection in this hazardous task. A curved shield fabricated of wood or light metal protected on the outside with B&W Kaowool blanket is fabricated to fit inside the door and allows the workmen more time to complete their job with greater safety.



LARRY CAR DROP CHUTES

If the drop chute does not make intimate contact with the charging hole, significant amounts of pollution are free to leak into the atmosphere. One large steel mill solved this problem with the addition of B&W Kaowool mesh enclosed rounds attached to the drop sleeves. In this manner, the Kaowool acts as a "gasket" between the drop sleeve and the charging hole thus eliminating the escaping pollution problem. The reported life of the Kaowool mesh enclosed round in continuous operation is one month.

STOPPER ROD GASKETS

Ease of installation, simplicity and reliability are the main advantages of using B&W Kaowool stopper rod gaskets. The use of preformed and sized gaskets eliminates the need for mortar in every joint and the delay necessary to force dry the completed stopper rod. B&W Kaowool gaskets enable immediate use of the stopper rod and the assembly takes no more time than the conventional practice.

LADLE LINING BACKUP

A reduction in skulling and a reduction in heat losses through the lining of a ladle would be desirable at most steel mills. This can now be accomplished through the use of B&W Kaowool 1/8" 12 pound blanket as a supplementary lining either between the working and safety linings or between the safety lining and the ladle shell. Field experience has shown that significantly less skulling occurs on a B&W Kaowool backed ladle than one that is lined conventionally. Additionally, the heat loss through the ladle side walls is cut up to 30%.

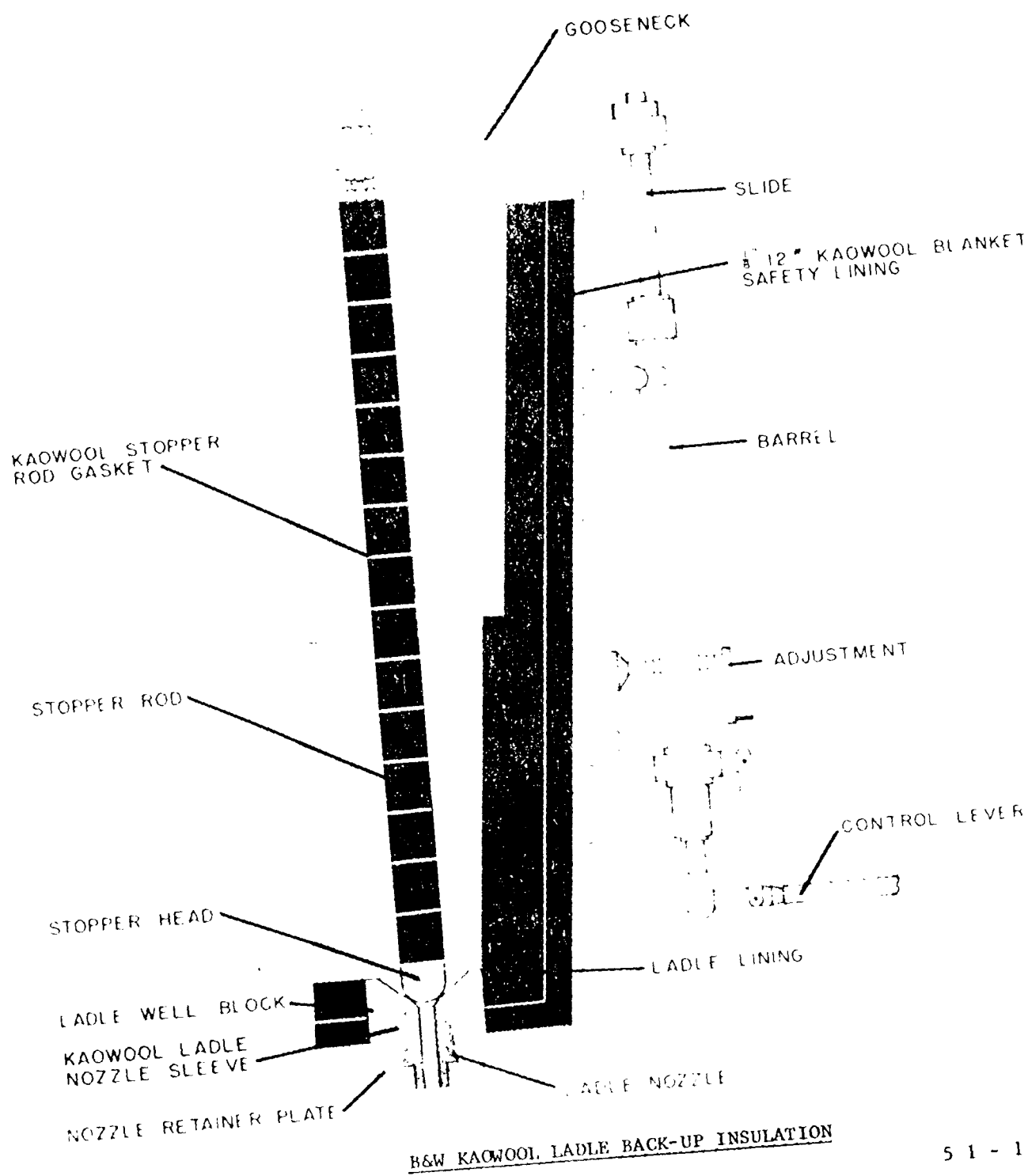
A typical recommendation would entail the use of Kaowool blanket between the working and safety lining when high alumina ladle brick is used. When bloating ladle brick is installed, B&W Kaowool would be applied between the safety lining and the shell. Experience has shown, to date, that the benefits of reduced skulling and heat losses are achieved without adverse effect on the life of the hot face lining.

An additional advantage, when used between the working and safety lining, would be the simplified removal of the hot face lining during relining. The reduced heat loss could make it possible to save a "sour" heat where metal temperature is critical - as in continuous casting. Ladle preheating could also be accelerated since less heat would be lost.

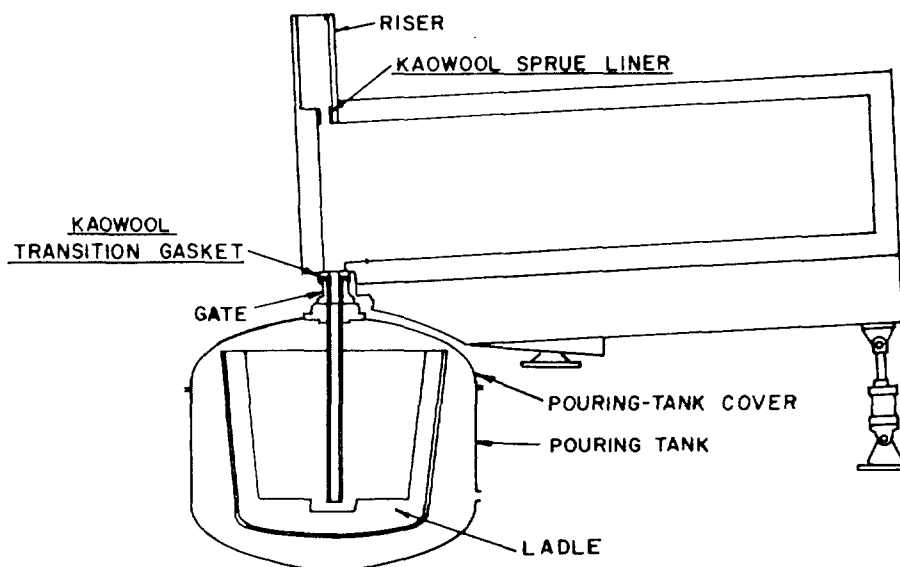
LADLE NOZZLE SLEEVE

Where mill practice includes the use of a high alumina ladle nozzle for its high wear-resistance qualities, problems are sometimes experienced with freeze-ups at the nozzle. The general cause of these freeze-ups is the high thermal conductivity of the nozzles which pulls heat from the melt. This condition can be combated with the use of a B&W Kaowool vacuum formed cylinder to surround the ladle nozzle and cut down on the heat losses.

Page 10 of 21



5 1 - 1

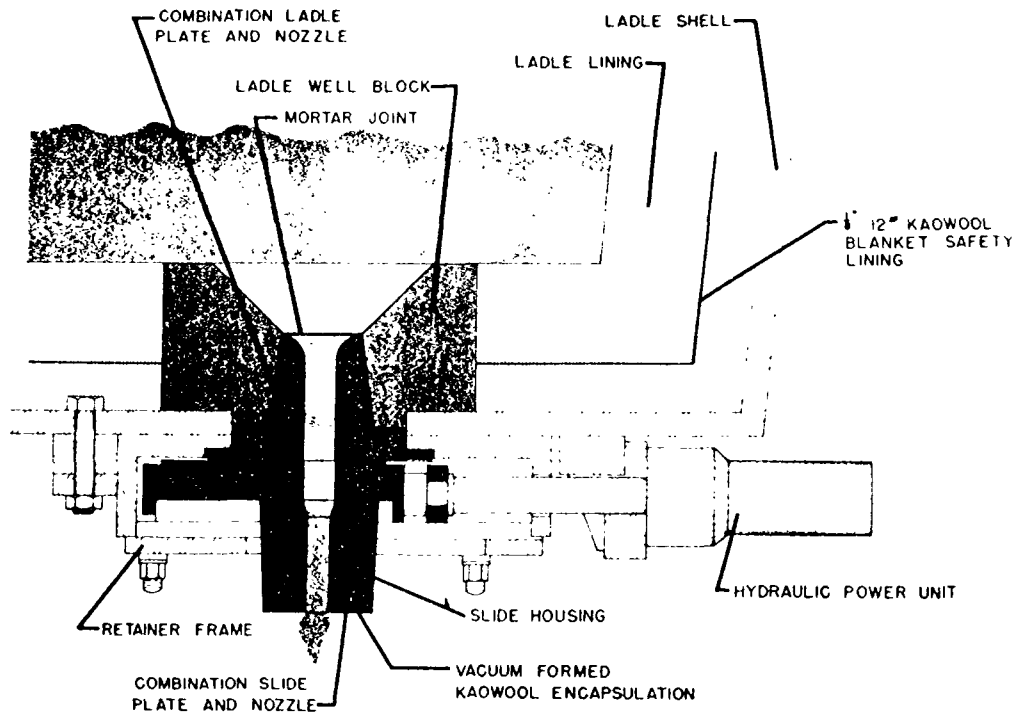


PRESSURE POURING

Where pressure pouring is practiced, an expendable B&W Kaowool vacuum formed gasket is commonly used in the transition section of the gate assembly. The high temperature resiliency of B&W Kaowool provides an excellent seal and prevents leakage of the molten steel.

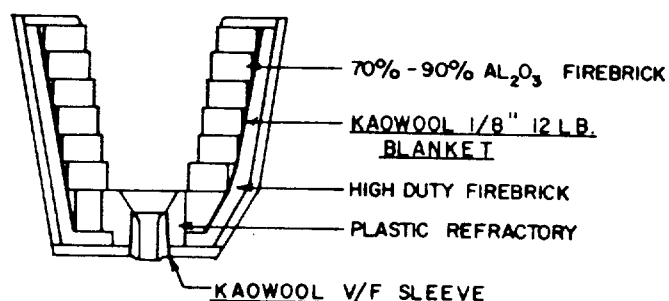
Where controlled pressure pouring of slabs is accomplished, as in the Amsted Process, a B&W Kaowool vacuum formed sprue liner is installed. This sprue directs the molten steel up from the graphite mold to the rammed sand riser. Insulation at this point is critical to ensure the proper feed of metal from the riser to the slab during cooling.

Additional Kaowool is used as miscellaneous gasketing and temporary repair in pressure pouring.



SLIDING GATE VALVE ENCAPSULATION

On sliding gate valve units where allowance is made for the setting of the slide plate and nozzle inside the slide housing with mortar, a B&W Kaowool vacuum formed encapsulation shape can be introduced. B&W Kaowool replaces the mortar and cuts down the heat losses through the plate and nozzle which are generally alumina. This method also makes installation cleaner, faster and more reliable. The insulation of this critical element of the tundish or ladle improves the smooth flow of metal so necessary in continuous casting or teeming.



TUNDISH NOZZLE

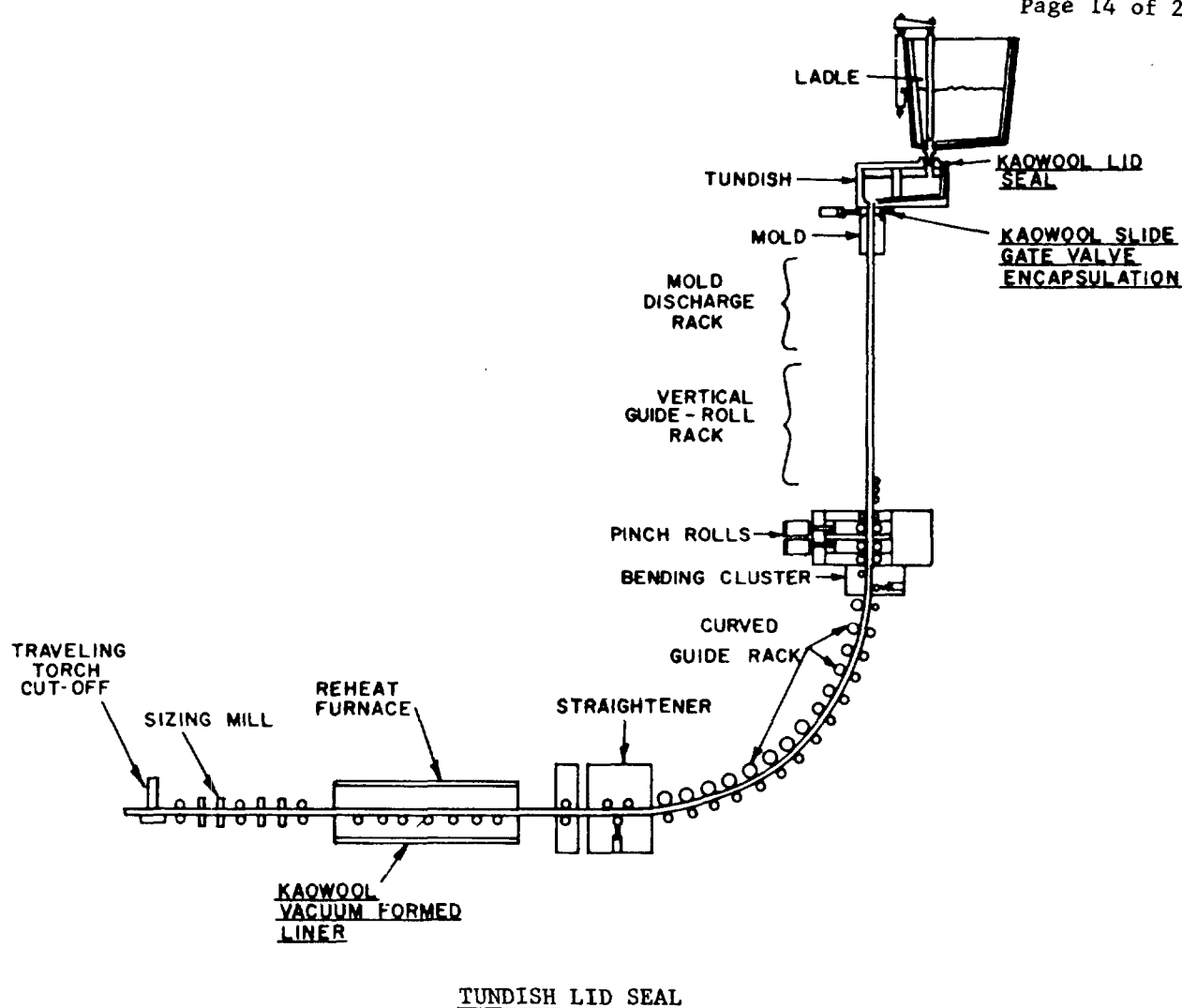
Where high alumina natural flow tundish nozzles are used, the possibility exists of a freeze-up due to the high thermal conductivity of the alumina. A B&W Kaowool vacuum formed sleeve encircling the nozzle will cut down on the heat losses through the walls of the nozzle thus aiding a steady flow of metal.

CONTINUOUS CASTING TUNDISH

In the continuous casting tundish, where fluidity of the steel is critical, B&W Kaowool 1/8", 12 pound blanket has been used between the high alumina working lining and the safety lining. The major advantage is the reduction of heat losses through the wall thus reducing the possibility of a freeze-up due to "cold" metal. The working lining can be more easily removed during relining with less damage to the backup lining due to the "parting media" effect of the Kaowool blanket.

October 6, 1972

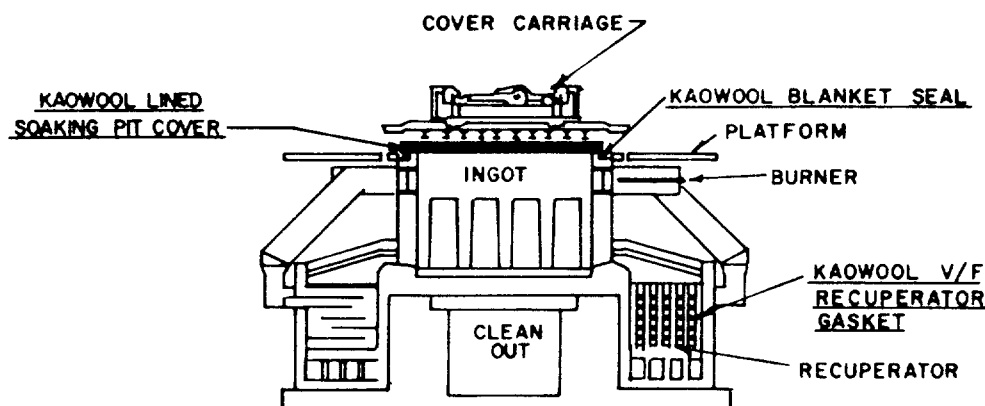
Page 14 of 21



It is common practice to use B&W Kaowool ceramic fiber blanket or strip as a seal on continuous casting tundishes which have lids. The high temperature qualities as well as strength under compression make this application ideal for B&W Kaowool ceramic fiber. The lid seal is reusable and with proper care last for several weeks.

REHEAT FURNACE LINER

An induction reheat furnace is frequently installed when a continuous casting layout has a sizing mill. Refractory linings used in these furnaces are both cumbersome and time consuming to install. A B&W Kaowool vacuum formed furnace liner is easily inserted and provides the thermal and electrical insulation necessary. The life is comparable to a castable or ramming mix lining and the installed cost is usually less.



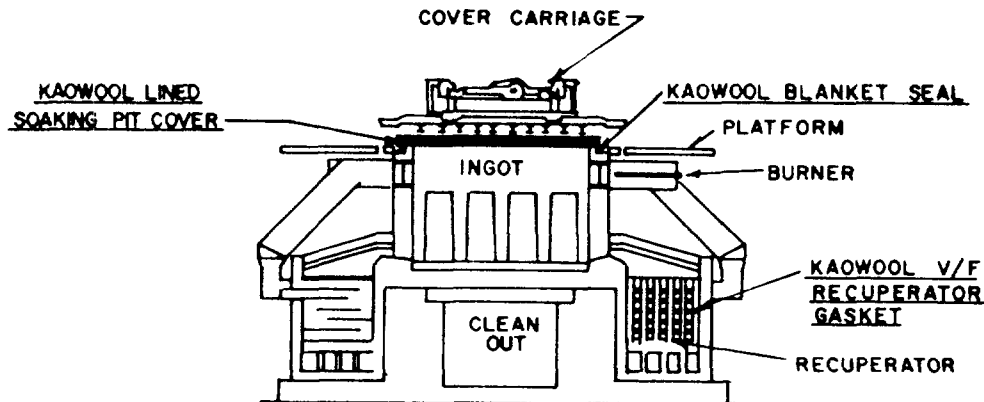
SOAKING PIT COVER

Although a fairly recent innovation, the replacement of brick or plastic by B&W Kaowool blanket as a soaking pit cover lining is rapidly gaining popularity. A patented method of fastener location and compensation for expected shrinkage allows the use of B&W Kaowool blanket at temperatures that were previously considered prohibitive. The first linings reduced the cover weight by as much as 90% while giving insulating and heat loss qualities superior to the previous linings. A reduction in fuel consumption can be anticipated. The B&W Kaowool lined covers, being much lighter, require less power to lift. Additionally, the cover can now flex and move without adversely affecting the lining as is the concern with a conventional cover. The installed cost of the B&W Kaowool cover is comparable to a conventional cover.

Most practical with a top or side-fired pit, B&W Kaowool covers can actually increase the pit efficiency through greater insulation, lighter weight and fuel savings.

RECUPERATOR TUBE GASKETS

Where refractory recuperator tube segments are used, B&W Kaowool vacuum formed recuperator tube gaskets have been installed between each segment. This method allows for quick and clean installation or repair of the recuperator section. B&W Kaowool can be compressed to compensate for any irregularity between the mating segments of the tubes and they remain in place at the operating temperature. The gaskets also compensate for expansion and contraction of the recuperator segments and restrict contamination by exhaust gases.

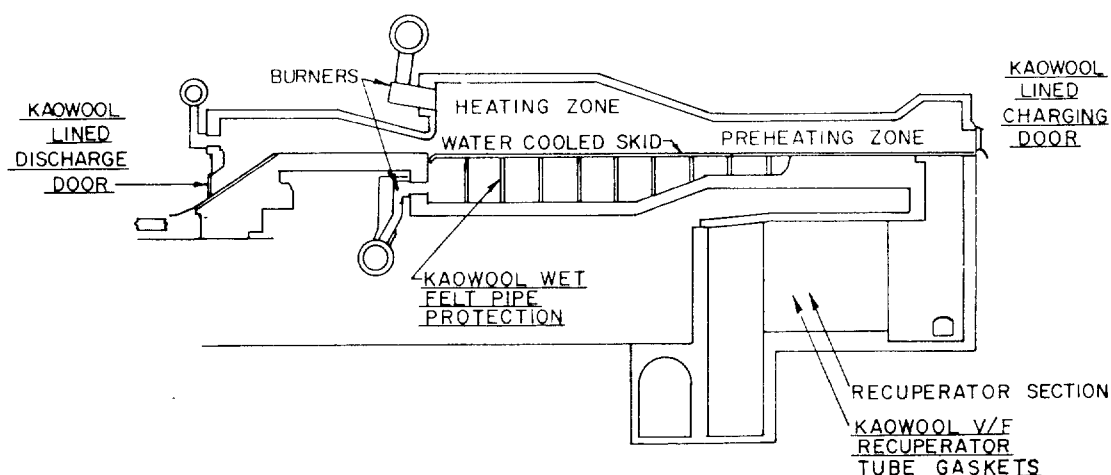


SOAKING PIT COVER

SOAKING PIT SEALS

B&W Kaowool blanket for use as a soaking pit seal has been a common application for several years. The most common method of installation in the United States has been to lay two to four inches of lightweight B&W Kaowool blanket in the seal trough or on top of the coping where no trough is provided. Approximately one to two inches of coarse sand is then laid on top of the Kaowool. The sand (pea gravel) completes the seal with the dipper plate and prevents the steel from sticking to the Kaowool. The ceramic fiber blanket allows for resiliency in the seal and keeps the sand out of the division wall.

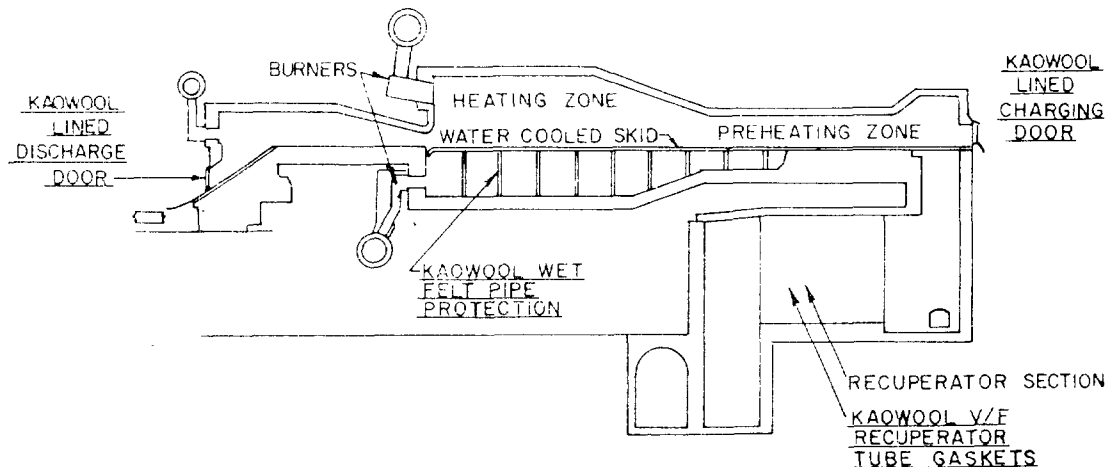
A modification to the above could be the use of B&W Kaowool alone in a trough or on top of the coping as is widely practiced in Europe. In these applications, studs are driven into the coping to prevent blanket pickup by the cover when lifted.



SLAB/BILLET REHEAT FURNACES

Vibration has traditionally been a problem in insulation of water cooled riser and crossover pipes of slab/billet reheating furnaces. Refractory insulation, either cast on site or pre-formed tend to fail by cracking after a period of time. B&W Kaowool wet felt, however, has better insulating qualities than these refractories and is resilient enough to withstand the mechanical abuse. The wet felt is easily installed and when dried forms a hard body to withstand scale attack and buildup. The Kaowool installed cost up to 75% less than traditional refractories and is available in 12" or 24" width. A subsequent coating of B&W Kaowool cement (optional) further enhances the surface hardness of the wet felt.

In the particularly severe areas where fired refractories are used to resist wet scale, a backup lining of B&W Kaowool blanket enhances the effectiveness of the refractory insulation and offers some protection to the refractory against vibration and movement of the pipes.

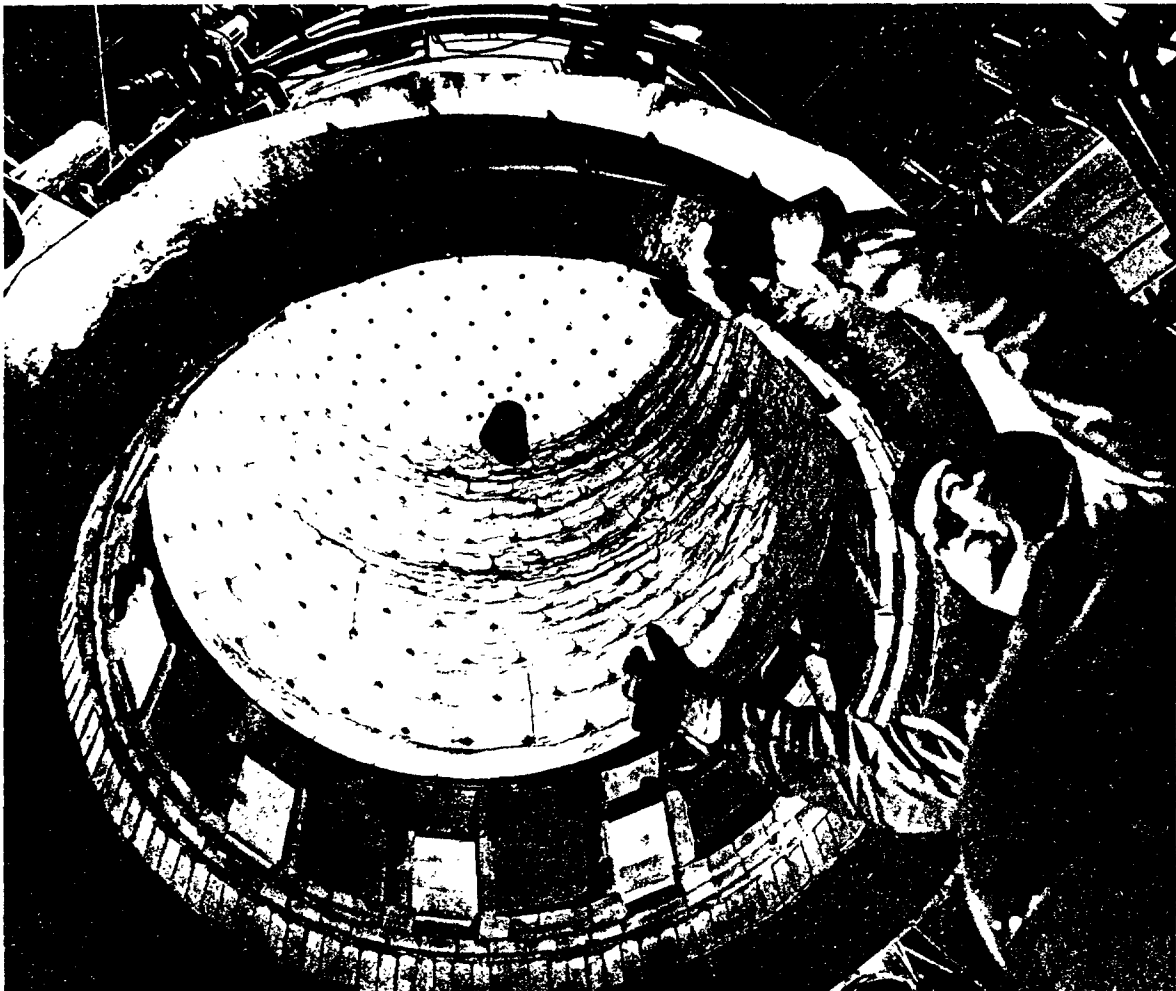


REHEAT FURNACE DOORS

Recently the use of B&W Kaowool in the stack design has been used to line reheat furnace doors. The primary benefits achieved are resistance to mechanical shock (such as the ram striking the door) of a fibrous lining, excellent thermal shock properties and superior insulation. Where the door operation does not entail close parallel movement with the door frame steelwork (which could damage the Kaowool), the installation can be achieved in less time than casting or bricking and is immediately ready for installation.

RECUPERATOR TUBE GASKETS

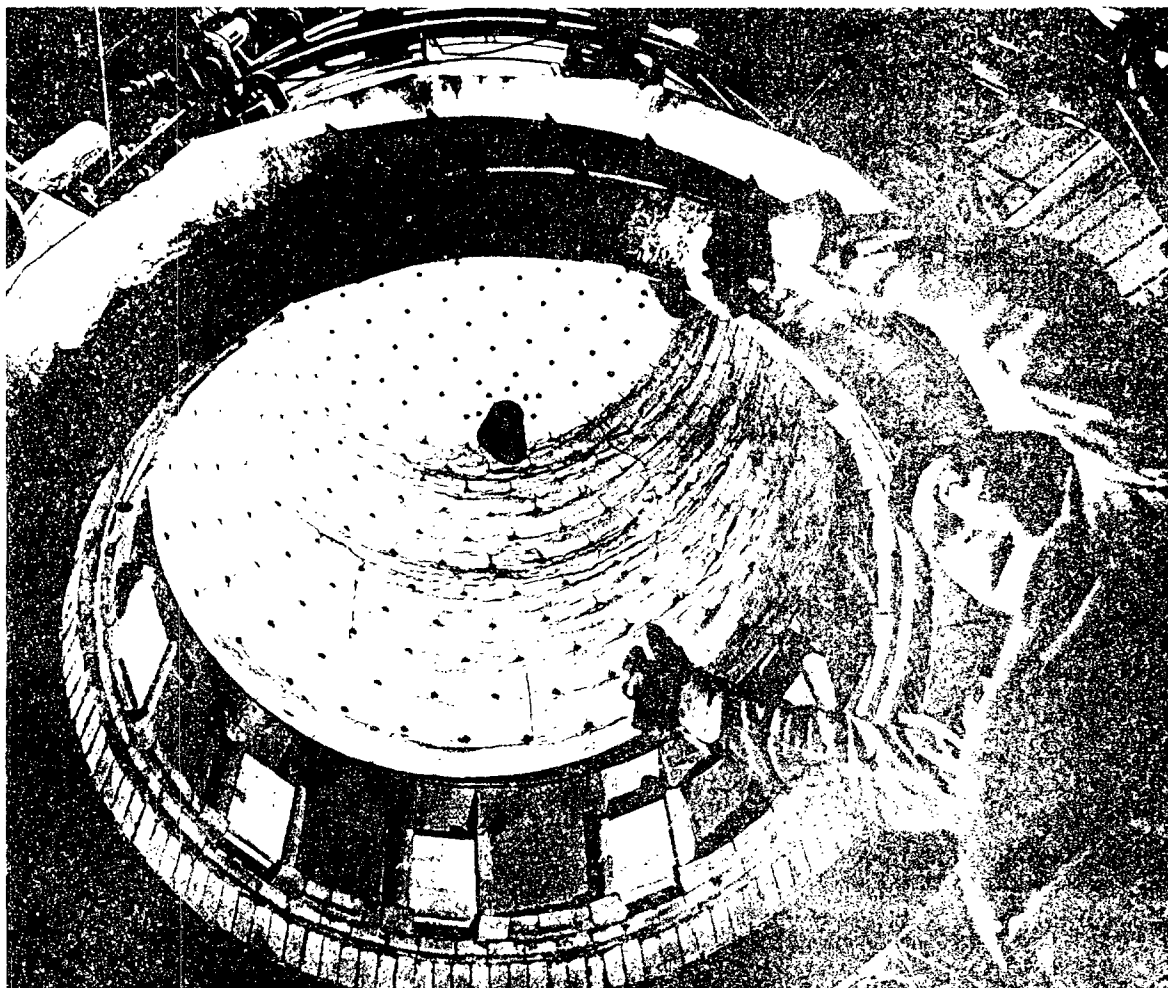
This application is nearly identical to the soaking pit recuperator tube gaskets application mentioned earlier.



ANNEALING FURNACE LINING

The first B&W Kaowool annealing furnace linings were installed in the late 1960's and have been gaining popularity since that time. The lightweight and decreased lining thickness aid in the placement of the furnaces over the inner covers. The decreased heat storage in the furnace lining makes greater efficiency and up to 25% fuel savings an accomplished fact. The installed cost of a B&W Kaowool lining is generally less than the conventional insulating firebrick lined furnace primarily due to the decreased labor time required. In the event of damage to the lining, repair is quickly and easily accomplished. The thermal shock characteristics of B&W Kaowool makes it possible to quick cool without adversely affecting the lining.

Linings for continuous annealing furnaces present an even greater opportunity for installation and fuel savings with a B&W Kaowool lining.



ANNEALING INNER COVER SEALS

B&W Kaowool mesh enclosed seals have replaced sand seals in many of the Nations larger steel mills. The problems of leakage, causing blue steel, and sand pick-up by the coils being annealed have all but been eliminated in most operations. B&W Kaowool, encased in 430 SS wire mesh, gives outstanding life with over 50 heats being a common achievement. Simplicity of operation is an advantage since sand no longer has to be heaped around the inner coils to insure good annealing. When necessary, the seal is easily and quickly replaced with no loss in production.

MISCELLANEOUS KAOWOOL APPLICATIONS

Expansion Joint Packing

Burner Block Packing and Gaskets

Ingot Stool Covers

Ingot Mold Seals

Ingot Hot Top Seals

Overhead Crane Cab Insulation

Vacuum Degassing Snorkel Tube Packing

Continuous Casting Shroud Wrapping

Structural Steel Insulation

Electrical Cable Tray Fire Stops

Sticker Cage Insulation

Hot Ingot Transporter Car Lining

Furnace Door Seals

Forge Furnace Roof and Door Lining

Reheat Furnace Charging Door Lining

Heat Treating, Normalizing, Annealing, Etc., Furnace Linings

Ladle Preheater Lid Lining

Expansion Joints & Supplementary Insulation In Open Hearths

Personnel Protection Shields

Pollution Control Ductwork Lining & Gaskets

Stack Lining

Induction Furnace Safety Lining (Against Coils)

Die Cut Gaskets