CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
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inquiries@azgs.az.gov

J. D. MASON
PROFESSIONAL ENGINEER
4730 WEST 2ND AVE.
VANCOUVER 8, B. C.
TELEPHONE CA. 4-6021

November 3rd 1962.

Dr. E. N. Pennebaker,
P.O. Box 817,
Scottsdale, Arizona.

Dear Dr. Pennebaker,

George Freeman advised by phone today that you did not receive copies of the assays on the last composites. I am sorry but thought you did, as Jacobs was instructed to send you copies.

The following note was received in answer to my enquiry as to his assaying methods:-

"Tucson Lime,
Mr. J. D. Mason.

Calcium silicates (Amphiboles) are not soluble in acid treatment that we give your samples. Calcium reported include calcite - Ca in dolomite and probable some gypsum and if <u>any</u> calcium in scheelite ($CaWo_4$)

Ben P. Jacobs.

We do not make CO_2 determination."

The Colorado School of Mines seems to be quite enthusiastic on the burning tests; less than 4% dust loss and the lime calcines at some 300-400° less than the average temperature. Their report is expected within two weeks.

There were only the two vertical sections made as surface assays were only taken at these two points. Although the surface slopes were only surveyed in these two sections, the other areas have a similar slope.

Enclosed please find assays of the last composites.

Yours sincerely,

Jim Mason

PLEASE RETURN TO

E. N. PENNEBAKER

CONSULTING GEOLOGIST

POST OFFICE BOX 817
SCOTTSDALE, ARIZONA

DATA ON
HELVETIA LIME DEPOSITS
PIMA COUNTY, ARIZONA

SUMMARY REPORT

MOUNT FAGAN LIME DEPOSIT

ARIZONA

by

J. D. Mason, Prof. Eng.

December 10, 1959.

1158 Melville Street,
Vancouver 5, B. C.

SUMMARY REPORT

MOUNT FAGAN LIME DEPOSIT

SUMMARY & CONCLUSIONS:

The Mount Fagan lime deposit is one of exceptional purity, consisting of uniform, highgrade, white calcium carbonate.

Calcine tests and analyses show that the deposit will produce both quick and hydrated lime of excellent quality. The white color and purity indicate the probability of other premium markets.

Ore reserves appear adequate for a lifetime operation.

The location and highgrade nature of the deposit indicate that it will have an assured captive market in the Tucson area. It will also be able to compete favorably in rest of Arizona, except in the northern portion of the State.

The economics are attractive. Costs of around $11.00 per ton are indicated for bulk lime as against a present selling price in the area of $17.00 per ton for an inferior product. Unfortunately, due to existing contracts, only half the assured mining market will be available in the first 1½ years of operation. Investigation shows that the best costs are achieved with a kiln of not less than 60 tons capacity per 24 hours.

RECOMMENDATIONS:

1. The deposit should be geologically mapped and enough systematic drilling and open-cutting completed to prove ten years' ore reserve at 200 tons per day. Estimated cost $8,000.

2. A representative bulk sample of 15-20 tons should be calcined at an existing full-scale plant.

3. The building and other industrial markets should be investigated.

4. If the above confirms the preliminary investigation. Plans should be made to have the deposit in production in one year's time.

LOCATION and ACCESS:

The limestone deposit is located ten miles south of Vail Station on the Tucson-Benson highway some twenty-five miles southeast of Tucson, Arizona. The railroad, main gas transmission line and three-phase power line pass near Vail.

When the property is developed a road will be rehabilitated to Sahurita on the Nogales highway. This will save some twenty miles on product haulage to the various mines in this area.

PROPERTY and AGREEMENT:

The property consists of nine unpatented mineral claims. Title has been checked. The claims are held under an option agreement whereby minimum annual royalties of $5,000 are payable. Royalties are due at a rate of 20¢ per ton of finished product until $50,000 has been paid. The rate shall be 10¢ per ton thereafter. The agreement runs for 99 years.

DEPOSIT:

The limestone deposit is over 200 feet in width and consists essentially of pure, white, recrystalized calcium carbonate. The foot-wall contact is composed of a dioritic porphyry intrusive. A tunnel partially cross-cuts the deposit 80 feet below the surface outcrop. Many millions of tons of highgrade lime are indicated by surface exposures and the underground work. A modest mapping and drilling program is necessary to establish continuity of grade. Mining of the deposit presents no problems. Drilling costs and powder consumption would be low and extraction can be made by open-pit or glory-hole method. The terrain is such that a gravity plant could be installed.

SAMPLING and METALLURGICAL TESTING:

Channel samples taken in drift 80 feet below surface assayed as follows:

Samples commencing near face and proceeding towards portal.

MASON				FREEMAN	
Width	CaO %	Fe %	SiO_2 %	Width	CaO %
27.5'	54.3	0.3	2.5	49'	53.8
42'	52.4	0.35	3.7	22'	53.5
46'	54.0	0.35	2.4	53'	53.2

Note:- The above are channel samples. On a 1500-lb. bulk sample the Colorado School of Mines obtained iron assays of 0.02%. Additional iron determination is necessary.

A 1500-lb. bulk sample taken along length of drift assayed, after calcination, at the Pacific Foundry's lab. in San Francisco as follows:

Calcium Oxide %	Fe %	SiO_2 %	MgO %	AlO_2 %	CO_2 %
54.9	0.32	2.4	0.50	0.20	1.21

A surface sample, including some detrital material, across 150 feet, assayed 52.4% CaO.

Calcine tests by both the Pacific Foundry and the Colorado School of Mines Research Foundation returned consistently high results, averaging a 54% CaO. (Paul's Lime Co. averages 49-50% CaO). Further tests show that the calcine product slakes rapidly in water. Impurities are negligible. The hydrated lime is white in color and would be acceptable to the building trade.

Tests conducted at Kingman, Arizona, show the rock crushes readily and does not produce an excessive proportion of fines. (Discussions have been held with the smelter people at Ajo and they have indicated they are willing to purchase the crushing fines).

MARKET STUDY:

A preliminary study of the market for quick lime for metallurgical purposes has been made. The mine managers in the Tucson area have been contacted and without exception they are dissatisfied with their present source of supply and would enter into contracts. The mines in Tucson area are paying $17.00 per ton for bulk quick lime delivered to their plants. Some $2.50 to $3.00 of this is made up in haulage costs.

There are three suppliers in the State of Arizona:

1. Paul's Lime, located in the southeast corner of the State, some 150 miles from Tucson.

2. U. S. Lime Company, located at Peach Springs, some 330 miles northwest of Tucson.

3. Hoopes Lime Company, a small producer, located north of Miami on Highway #88.

It should be noted that Paul's Lime produces an inferior product, with obsolete equipment. Their production is pretty well tied up with the major mines in the Bisby and Douglas areas. Hoopes Lime sells its total production to Miami and Globe. The U.S. Lime produces a good product, but the long haul to the Tucson area makes the product costly. (See attached map for location of lime plants and nearby mines).

POTENTIAL CUSTOMERS:

The following mines are in the immediate area of the deposit and represent a captive market due to the fact that this deposit will produce a superior product with substantial savings in freight and haulage:

Banner Mines: Use 1,000 lbs. per day delivered in bulk presently by Paul's Lime. (Plan on increasing tonnage substantially).

Duvalt: Use 20-25 tons per day buying in bulk; have contract with Paul's, two years to run. Pay $17.00 per ton delivered.

Pima: Use 3 to 4 tons per day; purchase from U.S. Lime; pay $16.75 per ton at site; buy in bulk; contract up end of year.

B.M. & K: Use 1,000 lbs. per day.

Lake Shore Mines: Initially will use 1,000 tons.

Silver Bell: Use 12 to 15 tons per day. Contract expires in less than one year.

Christmas: Seven tons per day. Production starting in 1960.

Shattuck-Denn: 2.5 tons of hydrated lime per day, paying $30.00 per ton landed.

Mission: A new mine, started by American Smelting & Refining Company. Will be in production by 1962 and will use 20 to 30 tons per day of lime.

There are five or six large mines northeast of Tucson where the Mount Fagan deposit will be competitive as to haulage distance and should be able to secure part of the business due to the superior product.

BUILDING TRADES:

Preliminary testing has indicated that the lime will be satisfactory for use in plaster and the building trade. Final testing required to verify. The City of Tucson is less than twenty-five miles away and consists of a quarter-million people. Therefore, the Mount Fagan Lime should be able to undersell all competitors.

With regard to Phoenix, which is some 150 miles away, the Mount Fagan is still the closest deposit. Phoenix has some 400,000 people.

There are numerous towns of up to 30,000 people in the Tucson - Phoenix area.

OTHER USES:

Lime is the third most commonly used industrial material, being exceeded only by sulphur and sulphuric acid. It is the cheapest commercial alkali.

Due to the extreme whiteness of the lime, which is uncommon, it will find a ready market as a "whiting" and as a filler. This type of material is rare in California and is in demand.

Due to its extremely low iron content, the material should find ready acceptance in the glass manufacturing industry in California, where they are experiencing difficulty in securing low iron limestone and are paying up to $40.00 a ton for this material.

There is a good market for roofing granules in the Tucson-Phoenix area, but a six-month testing period is necessary to prove the adaptability of the Mount Fagan limestone for this use. Visually it appears satisfactory.

J. D. Mason, Prof. Eng.

JDM:hc.
December 10, 1959.

ESTIMATE - OPERATING COSTS LIME OPERATION, MT. FAGAN AREA.

Assume 100 tons lime production per day, 8.5 million b.t.u. per ton of lime, 44% ignition and dust loss; installation of plant at mine with gas line installed; sale of fines from crushing will offset loss involved; product sold in bulk.

Mining 200 tons per day @ 90¢ per ton	$ 180.00
Crushing & Screening @ 25¢ per ton, 200 tons	50.00
Haulage of finished product to railroad or customer, 110 tons @ $1.00	110.00
Calcine fuel costs, 8.5 million b.t.u. = 8.5 Mcf gas @ 38¢ x 110 tons	355.00
Calcine power, labor & maintenance @ $1.50 per day	150.00
Total Daily Direct Costs:	$ 845.00

Per ton of Lime, $\frac{845}{110}$ = $ 7.70

<u>Indirect Costs</u>:

Management, supervision and accounting	$ 60.00
Taxes, insurance, postage, stationery, etc.	30.00
Amortization of plant over 5 years	15.00
Repairs & Refactory Lining Maintenance @ 50¢ per ton	55.00
Royalty payments, 20¢ per ton	22.00
Selling costs, estimate 20¢ per ton	22.00
Total Indirect Costs per Day	$ 204.00

Total Costs for Producing 1 Ton of Bulk Lime = $ 9.60

<u>Note</u>:- Lime sold in bags to building trade would cost approximately $4.50 per ton more for bagging and there would be 50¢ per ton extra delivery costs to the Tucson area.

Hydrated lime would also have an added cost for hydrating and bagging. However, quick lime adds 20% in weight when hydrated.

$1.00 per ton should be added as a contingency.

Tests on Mt. Fagan lime show ignition loss of 44%. This compares favorably with other limes, which average closer to 50%.

PRELIMINARY ESTIMATE - CAPITAL COST & OPERATING CAPITAL

(a) GENERAL

Road Construction	$ 10,000	
Site Preparation	2,000	
Water Tank & Facilities - Domestic	1,500	
Single Phase Power	2,000	
Tool & Storage Shed	500	
Small Tools	1,500	
Pickup Truck	2,000	
Sub-Total		$ 19,500

(b) MINE

Mine Preparation	2,000	
Conveying Equipment	1,500	
Crusher & Screening Plant	10,000	
Crusher & Screening Plant Installation	2,500	
Coarse & Fine Ore Bins	4,000	
Pan Feeder	1,500	
Power Plant	7,000	
Ventilation Equipment	500	
Sub-Total		$ 29,000

(c) CALCINE PLANT

Kiln, Purchase & Erection - Assume	60,000	
Batch Hydrator & Crushing	15,000	
Storage Silos, 3 Steel	9,000	
Bagging Plant & Storage	3,000	
Conveyors	1,500	
Office & Living Quarters	2,000	
Office Equipment	1,000	
Assay Equipment	1,000	
Sub-Total		$ 92,500

(d) GAS LINE 3" - 10 miles	$ 70,000	$ 70,000
(e) OPERATING CAPITAL		
Allow breaking 4,000 tons of ore (under contract)	$ 4,000	
Kiln Labor, 6-man crew @ $18 per day, 4 months	10,800	
Bags	2,000	
Fuel, Calciner - 850 Mcf per day @ 38¢ - 2 mos.	16,000	
Fuel, Power Plant - allow	2,500	
Automobile Operation	200	
Supply Purchase	2,000	
Deposits and Rentals	1,000	
Repairs	2,000	
Overhead	6,000	
Advertising	3,000	
Insurance	500	
Sub-Total		$ 50,000
Total Money Required		$ 261,000

Note:- No allowance made for sale of production during first four months. This should provide the necessary contingency.

LIMESTONE

Additional Notes to Report dated December 10, 1959.

ROOFING GRANULES:

The market for roofing granules was investigated in Phoenix and Tucson. At present there exists a demand in these two cities of not less than 50 tons per day of white limestone roofing granules.

This market is currently being supplied by sporadic, small production from south of Tucson and from the Pacific coast. The small producers in the Tucson area all have hauls of from 20 to 30 miles to reach main highways.

Present price is $17.00 per ton f.o.b. Phoenix. Freight and haulage from Mt. Fagan is approximately $4.50 per ton. It is a safe assumption that the Mt. Fagan deposit will be able to secure at least half the present market. This demand will fluctuate with housing construction. However, most of the material required would be a by-product from the lime producing plant at Mt. Fagan and it would result in securing a high-priced market for material which is normally wasted or sold to the smelter at little profit.

Further investigation has shown that the estimate in the December 10th preliminary report is not too far out of line and a plant could be installed for this money. However, additional discussions with the mines show they want a very closely controlled product, which they are not getting at present. To produce this it would require a more up-to-date plant than was originally estimated. Therefore, a further $100,000 capital expenditure should be allowed. To be absolutely safe in the initial operation, it would be advisable to supply a further $50,000 operating capital.

J. D. Mason, Prof. Eng.

JDM:hc.
May 9, 1960.

Report on
EVALUATION OF LIMESTONE SAMPLES
FOR PRODUCTION OF LIME

Prepared for
Transarizona Resources, Inc.
Project No. 591107 February 1[illegible], 1960.

Report on

EVALUATION OF LIMESTONE SAMPLES

FOR PRODUCTION OF LIME

Prepared for

Transarizona Resources, Inc.
201 East Fourth Street
Casa Grande, Arizona

By

The Colorado School of Mines Research Foundation, Inc.

Golden, Colorado

Project No. 591107

February 10, 1960

Approved:

E. H. Crabtree, Director

C. K. Amano
Senior Engineer

J. J. Lewis, Manager
Chemical Division

Mr. G. A. Freeman, Manager
Transarizona Resources, Inc.
201 East Fourth Street
Casa Grande, Arizona

Dear Mr. Freeman:

Subject: Report on "Evaluation of Limestone Samples for Quicklime Production"
CSMRR Project No. 5911#7

We have completed studies on the limestone samples to which reference is made in your authorization letters of November 7, 1959, and December 30, 1959. These samples are described as follows:

<u>Limestone Sample No. 1:</u> An approximately 50-pound sample of crushed raw limestone (minus 1 3/4, plus 3/8 inch) received from Dye and Rathrick Mining Company of Kingman, Arizona, on November 10, 1959.

<u>Limestone Sample No. 2:</u> A 42-pound sample of raw limestone stated to be "representative of a section of the deposit, 53 feet across what appears to be the highest grade and whitest in color". This sample was received via air express on December 30, 1959.

In essence, this study involved an evaluation of the two limestone samples in terms of (a) their quarry screenings on crushing,* (b) their chemical analyses, (c) their burning characteristics, (d) the chemical quality of the resulting quicklimes, and (e) the slaking characteristics of the resulting quicklimes.

Based on the data resulting from this study, our opinions are as follows:

(1) Material as represented by the samples may be considered as chemical grade, high-calcium limestone.

(2) Material as represented by the samples does not burn in a manner normally anticipated for high-calcium commercial limestone; instead, a major portion of the material "decrepitates" and disintegrates to a relatively small particle quicklime.

(3) The sample material calcines to a good chemical grade of high-calcium quicklime within the time and temperature range

* See discussion on quarry screenings on page 5.

Mr. C. A. Freeman, Manager
Page [illegible]
February [illegible], 196[illegible]

[illegible] the [illegible] quicklime produced in our [illegible] silica content of the [illegible] quicklime [illegible] than that [illegible] 1 percent SiO_2. However, other [illegible] between ½ to [illegible] magnesium, sulfur and phosphorous; [illegible] such as iron [illegible] surprisingly low.

[illegible] lime produced from the samples by simulat[illegible]. The quicklime is dark and considerably off-color [illegible] techniques. However, the slaked (hydrated) product [illegible] "whiteness" color and does not appear to seriously [illegible] slightly off-color inherent in the quicklime product. [illegible] dark color [illegible] dark material are apparent in the hydrated lime [illegible] particles [illegible] possible to reject these along with the coarse silica [illegible] by [illegible] air classification [illegible] "tailings" [illegible]

[illegible] produced is extremely reactive chem[illegible] the quicklime slakes [illegible] violently upon contact with [illegible]

[illegible] slaked in an excess of water (as [illegible] in a conventional milk-of-lime slurry), the quicklime produced from the samples yield hydrates, the particles of which are better than [illegible] percent passing a [illegible] standard sieve. [illegible] dark particles readily settle from the milk-of-lime and, therefore, could be removed by decantation.

(7) When slaked with only sufficient water to yield the conventional "dry" hydrated lime, the quicklime produced from the samples yield hydrates with about [illegible] percent passing a 200-mesh standard sieve.

(8) [illegible] the results of decrepitation during calcination [illegible] furnace [illegible] not appear excessive [illegible] calcination should [illegible] especially explored with rotary kiln manufacturers if commercial rotary kiln operation is anticipated.

(9) For all practical lime production purposes, there is no important difference, either chemically or physically, between Sample No. 1 and Sample No. 2.

The fo[illegible] is a s[illegible] of the procedures and results upon which the [illegible] conclusions have been based.

Sample Prepar[illegible]

Limestone Sample No. 1. As this sample was mark[illegible] "minus 1 3/4 inch, plus [illegible]", it was not further crushed. However, approximately five pounds of each kind was split from the total sample and a head sample was prepared for chemical analysis by proper splitting and size reduction techniques. The remaining [illegible] pounds of limestone was screened to obtain an overall screen analysis, then recomposited to form a charge for the rotary kiln operation.

Limestone Sample No. 2. The sample, "as received", passed through a 1 3/4 inch screen except for several large pieces about three inches across. These pieces were broken to pass the 1 3/4 inch screen, and a head sample was then split out for chemical analysis in a manner similar to that for Sample No. 1. A screen analysis was made and the minus [illegible] inch fraction removed prior to charging the sample to the rotary kiln.

Burning Procedure and Operating Conditions

Each limestone sample was burned on a batch basis in a No. 2, [illegible] Rotary Smelting Furnace, equipped with a fuel oil burner. A weighed charge of minus 1 3/4, plus [illegible] inch, limestone was placed in the furnace, brought to operating temperature and maintained at this temperature for forty-five minutes. During the burning of Limestone Sample No. 1, samples were ladled from the furnace, twenty, thirty and forty minutes after the entire charge had reached the calcining temperature. These samples were analyzed for their carbonate content to study the rate of calcination and to determine when complete calcination was obtained.

After the desired retention time at operating temperature, the burner was turned off and the charge was allowed to cool to a dull red heat. The entire charge was then dumped, allowed to cool to about 150° C., and then transferred to a tightly sealed can.

The conditions for the respective limestone burns were as follows:

	Limestone Burn Sample No. 1	Limestone Burn Sample No. 2
Kiln charge weight, pounds	48.0	31.9
Kiln rotational speed, RPM	2.4	2.4
Time to reach 2100° F, minutes	50	40
Operating Temperature, °F		
Average	2090	2105
Maximum	2140	2140
Minimum	2040	2090
Retention time, minutes	45	45
Charge sampled at, minutes*	25, 35, 45	On discharging

* Time at Operating Temperature

Burning Characteristics

Decrepitation or reduction in particle size on calcining was severe, however, dusting losses did not appear to be excessive. Screen analyses were run on the entire sample charged to the kiln as well as on the kiln discharge to measure the extent of the decrepitation. A dusting-loss figure for the burning of Limestone Sample No. 2, based on the weights of kiln charge and discharge and the "Loss-on-Ignition" of the kiln charge, was calculated to be 3.3 percent of the weight fed to the kiln, or 5.8 percent based on the weight of kiln discharge.

Slaking Tests

Approximately 50-gram samples of the quicklimes produced from the two limestone burns were crushed to 6-mesh and slaked in beakers with rapid mixing at respective water additions ranging from 100 to 300 percent of the stoichiometric requirements for 100 percent hydration of the contained calcium oxide. The optimum quantity of water required was thus established under these laboratory conditions. One-pound samples were then slaked in a mechanical mixing hydrator using water additions established previously and the amount of water to effect 100 percent hydration was again determined. Finally, five-pound samples were slaked under the best conditions to produce hydrated lime samples for color observation and screen analyses.

Data and Results

Head samples split from each sample of raw limestone were analyzed chemically as well as were the respective quicklime products resulting from their burning. Chemical-analysis data is presented in Table I, and a complete semi-quantitative spectrographic analysis of Limestone Sample No. 1 is presented in Table II. Screen-analysis data on the samples charged to the furnace as well as on the furnace products are as shown in Table III and Figure I, and that on a hydrated lime product in Table IV.

Discussion

Common rotary kiln, lime-burning practice is to reject from the kiln feed all limestone passing a ¼-inch screen. It was not possible to determine the amount of quarry screenings on crushing, for the samples involved, as both samples were small and had been crushed and screened prior to shipment to the Research Foundation. However, the usual concept of quarry screenings or "rejects" would be less apt to apply with respect to the limestone samples studied as much of the material would, during calcination to lime, disintegrate to a size less than ¼-inch. The optimum sizing of kiln feed (and the resulting production of quarry fines) therefore becomes a function of the dusting characteristics of the calcining equipment employed versus the ease of disposing of quarry fines.

The analyzed silica content of 4.20 percent for the quicklime product from Sample No. 2 is undoubtedly high as the silica analyses of Head Sample No. 1 (1.08%) and Head Sample No. 2 (1.2[illegible]) are reasonably close. This high value is attributed to the inclusion of a relatively large piece of siliceous material on sampling the kiln discharge. It was felt that the preliminary nature of this evaluation did not warrant resampling and reanalyzing the kiln discharge.

We are transmitting under separate cover, the following samples of lime products produced from our studies on Limestone Sample No. 2:

2 pounds, Kiln Discharge (quicklime)
4 pounds, Hydrated Lime
40 grams, -200 Mesh Hydrated Lime
(from screen-analysis test)

We trust the foregoing reporting, particularly our observations, are self-explanatory. However, if you should have any questions concerning the subject matter herein, please do not hesitate to get in touch with us.

It has indeed been a pleasure to undertake this assignment for your organization, and we would be delighted to expand these studies should you so desire.

Sincerely yours,

C. K. Amano

C. K. Amano
Senior Engineer

TABLE I

CHEMICAL ANALYSIS DATA

	Limestone Sample No. 1					Limestone Sample No. 2	
	Head	Kiln Samples				Head	Kiln
	Sample	25 Min. %	35 Min. %	45 Min. %	Discharge %	Sample %	Discharge %
CaO	54.85	97.1	98.9	97.5	97.8	54.80	92.3
CO_2	43.30	0.24	0.34	0.18	0.18	42.15	0.06
SiO_2	1.08	----	----	----	2.11	1.25	4.20*
R_2O_3	0.23	----	----	----	0.31	0.23	0.88
Fe_2O_3	0.038	----	----	----	0.16	0.17	0.41
MgO	0.21	----	----	----	0.12	0.20	0.52
MnO_2	----	----	----	----	0.07	----	----
LOI	43.2	----	----	----	0.43	42.8	1.32
P	0.004	----	----	----	----	----	----
S	Nil	----	----	----	----	----	----

* This percentage is high. See discussion of page 5.

TABLE II

LIMESTONE NO. 1, HEAD SAMPLE

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

(Figures are percentage estimates)

Aluminum	0.05	Potassium	0.01
Barium	0.01	Silicon	1
Calcium	Major	Strontium	0.01
Copper	0.001	Sodium	0.01
Iron	0.05	Titanium	0.01
Magnesium	1	Vanadium	0.001
Manganese	0.01		

TABLE III

PARTICLE DEGRADATION DATA AS INDICATED BY SCREEN ANALYSES

Screen Opening Size	Limestone Sample No. 1				Limestone Sample No. 2			
	Kiln Charge		Kiln Discharge		Kiln Charge		Kiln Discharge	
	Direct Percent	Cumulative Percent	Direct Percent	Cumulative Percent	Direct Percent	Cumulative Percent	Direct Percent	Cumulative Percent
-1 3/4 + 1 inch	69.7	69.7	3.6	3.6	87.2	87.2	9.5	9.5
-1 + 3/4 inch	11.9	81.6	3.1	6.7	3.8	91.0	1.5	11.0
-3/4 + ½ inch	9.2	90.8	4.7	11.4	1.9	92.9	2.7	13.7
-½ inch	9.2	100.0	(88.6)	(100.0)	7.1	100.0	(86.3)	(100.0)
(Tyler Sieves)								
-½" + 6 mesh	----	----	----	----	----	----	19.3	33.0
-½" + 8 mesh	----	----	33.5	44.9	----	----	----	----
-6 + 10 mesh	----	----	----	----	----	----	12.2	45.2
-8 + 10 mesh	----	----	7.2	52.1	----	----	----	----
-10 + 14 mesh	----	----	----	----	----	----	22.3	67.5
-10 + 20 mesh	----	----	26.8	78.9	----	----	----	----
-14 + 20 mesh	----	----	----	----	----	----	12.2	79.7
-20 + 28 mesh	----	----	11.7	90.6	----	----	----	----
-20 + 48 mesh	----	----	8.0	98.4	----	----	----	----
-48 mesh	----	----	1.4	100.0	----	----	----	----
-20 + 65 mesh	----	----	----	----	----	----	15.3	95.0
-65 mesh	----	----	----	----	----	----	5.0	100.0
Totals	100.0		100.0		100.0		100.0	

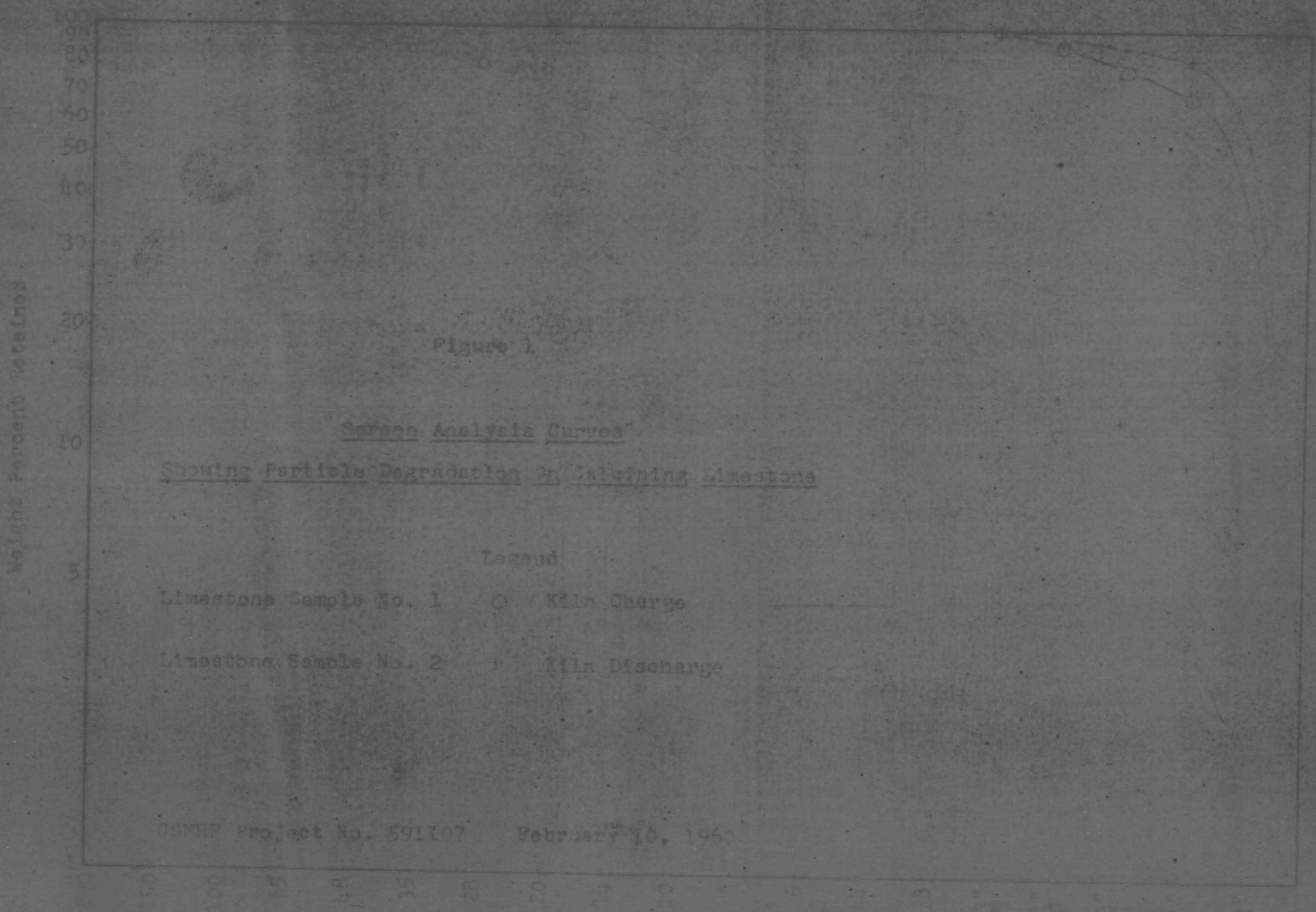

Figure 1

Screen Analysis Curves

Showing Particle Degradation in Calcining Limestone

WISSER & COX
Consulting Geologists

November 30, 1959

MEMORANDUM FOR: Mr. J. D. Mason

Sabado Limestone Deposit
Pima County, Arizona

I visited the limestone deposit south of Tucson on the Sabado claims on 11/29/59 in company with George Freeman.

The limestone occurs along the southern side of a small diorite intrusion which has an erratic shape, generally trending east and west in this area. No detailed maps are available. From cursory examination possible without mapping, it would seem that the diorite more or less follows the bedding of the limestone, but between the portal of a lower tunnel and an upper shaft, cuts to the south across the bedding. The limestone is a white coarse marble with very little in the way of argillaceous or siliceous material, only a few scattered grains of silicates, and a very intense white color. A few black dikes and one skarn zone cut the limestone along the general bedding trend, but they do not constitute any large quantity of impurities and could easily be wasted in mining.

I am most impressed with the beautiful high reflective white color of the limestone and its apparent freedom from much in the way of impurities. It would seem as though, if a substantial quantity of the rock can be developed, that uses such as glass, whiting, fillers in the paper and paint business, and in the rubber business, could be developed since there is very little in the way of useable whiting on the west coast. It certainly would make a good quality lime.

One of the questions which can only be answered by exploration is the shape of the diorite contact below the limestone. As exposed by natural erosion, it appears to be very steep. However, the fact that the limestone is converted to a coarsely crystalline marble for a substantial distance horizontally from the diorite outcrops, could be interpreted to mean that diorite underlies the limestone at a very shallow depth. It would appear that, assuming 200 tons a day operation and 20 years life, that somewhere around 1,500,000 tons of high grade limestone should be developed. This could best be done by first, detailed mapping, probably with a plane table, and second, perhaps $8,000 to $10,000 worth of drill exploration and open cuts, actually drilling and blasting in a number of places and making cross sections of the deposit by horizontal and/or vertical drilling. I doubt that the tonnage can be proved up for less than $8,000 and I don't think it would cost more than $10,000. Location of the drill holes and their depths, etc. would have to await detailed mapping. This mapping would probably take ten days to two weeks with a two-man crew of plane table operator and geologist.

Respectfully submitted

/s/ M. W. Cox

FOLLOW-UP REPORT ON THE MT. FAGAN MARBLE DEPOSITS

Pima County, Arizona

January, 1963

E. N. PENNEBAKER
CONSULTING GEOLOGIST
SCOTTSDALE, ARIZONA

January 11, 1963

Mr. T. A. Goodnight
Valley National Bank
1400 No. First Street
Phoenix, Arizona

Dear Tom:

Enclosed are four copies of my report on the Sabado limestone property. I would appreciate your distributing these copies to those who should receive them.

My statement in duplicate is enclosed.

With best personal regards,

Yours sincerely

E. N. Pennebaker

ENP:mc
encls.

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FOLLOW-UP REPORT

ON THE

MT. FAGAN MARBLE DEPOSITS
(SABADO LIMESTONE DEPOSITS)

PIMA COUNTY, ARIZONA

-- Submitted to Tucson Lime and Chemical Company

January 12, 1963

By E. N. Pennebaker

E. N. Pennebaker

FOLLOW-UP REPORT

ON THE

MT. FAGAN MARBLE DEPOSITS

PIMA COUNTY, ARIZONA

INTRODUCTION

The writer has done the following things with respect to the further investigation of these deposits, also known as the Sabado limestone deposits, and described in his report dated January 17, 1961.

1. In company with Mr. J. D. Mason the core obtained from seven exploratory diamond drill holes was examined.
2. A trip was made to the property with Mr. T. A. Goodnight in order to verify the drill holes, their locations and attitudes.
3. In the office rough estimates were made of the tonnage and grade of material that might be extracted from two different quarry designs.
4. Data from the experimental calcining operations conducted by the Colorado School of Mines Research Foundation were studied.

These various items are discussed in the following report.

DIAMOND DRILL HOLES

Seven diamond drill holes have been put into the so-called "Northern Deposit". These are along five profiles spaced at about 200 feet. Three holes are along profile A-A; one each are along the others. Thus a strike length of about 1,000 feet was tested. The holes are of BX diameter and excellent recovery was obtained.

The holes, with one exception, are pointed southerly at a minus angle of about 40 degrees. The exception is a flat hole drilled southerly into the face of the old tunnel. These holes are shown on a plan map prepared by Mr. Mason, and four of them appear on the two cross-sections also prepared by him. The writer has constructed three other working sections for the reserve estimate.

The geologic logs of the holes were made by Mr. Mason and were judged to be properly done. The sampling was generally adequate, although in places the sample intervals are rather long.

The chemical analyses were made by Jacobs Assay Office of Tucson, Arizona, a laboratory with an excellent reputation. All samples were tested for CaO content referable to calcite (also to dolomite, gypsum and scheelite if such were present, which is very doubtful). Tests for impurities were made on composites for intervals selected by Mr. Mason. These do not cover all of the better limestone in all of the holes, and further tests for intervals falling within the tentative quarry profiles would be helpful.

The analyses made available to the writer were mostly on compilations prepared by Mr. Mason. The original reports by Jacobs were not transmitted.

INSPECTION OF THE GROUND

The writer was not present during the drilling of the holes, but the drill hole locations were inspected on November 18, 1962, and the drill hole collars were verified.

The slopes of the profiles above the drill holes were also checked by Brunton at this time, along with the bearings of the holes and their inclinations.

RESERVE ESTIMATES

Tonnage

It is obvious that more limestone of good quality has been outlined by drilling than can be conveniently and economically quarried, because of the configuration of the ground with respect to the shape of the limestone body. Consequently, in order to estimate a reserve tonnage, the writer has set up two tentative quarry outlines and has estimated the quantity of rock within them.

Quarry A. This tentative excavation has a steep south bank about with the inclination of the bedding, ranging from 70 to 80 degrees to the north. The north bank slopes southerly at 60 degrees. This quarry is about 1,000 feet long with a width at the top varying from about 100 to 250 feet. Its floor is at an elevation of 4,400 feet above sea level. The vertical heights of the steep south bank varies from 200 to 250 feet.

The tonnage for Quarry A, using a factor of 11.5 cu. ft. of rock in place equals 1 short tons, is as follows:

Total tonnage...............	1,643,500
Less 10%....................	164,350
	1,479,150

The 10% subtracted is an arbitrary figure for waste material (dikes and chert) to be cast out, for near-surface dirty material to be discarded, and to compensate for the drill holes not being parallel with the block margins.

Quarry B. Inasmuch as the south margin of Quarry A, above, is very steep and it may be found impossible to mine to it, another quarry outline was tentatively set up with a south bank slope at 60 degrees. This lifted the floor to an elevation of 4,450 feet above sea level and gave the following results:

Total tonnage..................	970,000
Less 10%	97,000
	873,000

The above tonnage estimates were made from five vertical cross-sections showing the shapes of the limestone body and the outlines of the quarries. Two of the profiles were obtained from Mr. Mason's cross-sections. The other three were determined by the writer using a Brunton clinometer. Consequently the profiles are approximate and they yield only a rough estimate.

Limestone areas within the quarries, as shown on the vertical cross-sections, were determined by planimeter. These were multiplied by block lengths within which each hole (or the three holes on Section A-A) was considered to have an influence on tonnage and grade. The volume so determined was divided by a factor of 11.5 to convert to short tons in place.

Cross-sections and maps do not accompany this report. However Mr. Mason has prepared a plan map and two cross-sections, and the writer's working sections are available upon request.

Grade

The grade, or chemical content of lime (CaO), was averaged over various interval groupings for the individual holes. This is a "weighted average", and those intervals falling within the quarry outlines were used to derive the grade of each block. Where analyses from surface sampling were available, or where several holes fell on a section (such as Section A-A), a general average was determined. Using the tonnage in each block, a weighted general average was then obtained, with the following results:

Quarry A .... 52.06% CaO

Quarry B .... 52.08% CaO

Impurities

The general average amounts of the impurities present in the limestone are more difficult to estimate because the intervals analyzed do not fall neatly within the quarry limits. Probably the best estimate is that obtained by a weighted average of all the core analyzed, regardless of whether it is within or outside of the tentative quarry outlines. This is as follows:

Silica - SiO_2	2.92%
Ferric oxide - Fe_2O_3	0.19%
Magnesia - MgO	0.05%
Alumina - Al_2O_3	0.25 to 0.60% (?)

The writer believes that the above-noted amount of silica (2.92%) may be somewhat too high and that a figure of 2.50 to 2.75% is probably more correct. However, some additional sampling for this impurity would yield helpful information.

The foregoing estimates should be considered as "probable" tonnages and grades rather than as "proved". This is because of the various reasons already noted and also because most of the diamond drill holes cut well below the quarry floors and their information must be projected up a considerable distance. This is partly offset by two profiles sampled by Mr. Mason at the surface, but from such sampling it is difficult to obtain representative samples of the impurities present.

On the other hand, the evenness of grade obtained from all sources is definitely reassuring.

CALCINATION TESTS

Test work was conducted by the Colorado School of Mines Research Foundation, Inc. Results of the work are contained in a report dated November 28, 1962, a copy of which was made available to the writer on January 11, 1963.

A brief summary of some of its conclusions are as follows:

Good Points

1. "The limestone feed to the kiln calcined normally as compared with the high calcium quicklime of commerce".
2. "Material as represented by the limestone sample should be able to be converted to quicklime in a conventional rotary lined kiln under conditions which should render the quicklime product economically competitive in its market area".
3. Previous tests, reported in 1960, "indicated the sample material to be a good grade of high calcium limestone which upon calcination would result in a quicklime product meeting the chemical specifications for a high calcium quicklime".
4. The limestone decrepitated in a manner that makes it unnecessary to remove quarry screenings prior to calcination.
5. "The dust loss resulting from decrepitation was surprisingly low".

Problems

1. "The quicklime product is definitely off-color as compared to the normal white high calcium quicklimes of commerce. However, this should not impair its usefulness for applications where color is not at a premium". It is suggested in the report that "dry air classification might considerably upgrade the appearance of the quicklime.

2. The material tested by the Colorado School of Mines Research Foundation was somewhat higher in quality than the writer's determination of the general average tenor of the deposit.

CONCLUSIONS

The foregoing point should be particularly noted. The following is a comparison of analyses:

	Material Tested in Colorado	Average Grade Estimate by E.N.P.
CaO	55.16%	52.07%
CO_2	43.20	(40.93, calculated)
SiO_2	1.13	2.75
R_2O_3	0.24	0.19 (Fe_2O_3)
MgO	0.05	0.05
H_2O	0.10	0.25 - 0.60 Al_2O_3)

Nevertheless, the quality of the average feed can probably be improved by careful quarry practice plus hand sorting.

Air classification tests should be undertaken on material of average grade to determine if improvements in both color and chemical quality can be made. (This is contrary to the Foundation's conclusion on page 15 of the report dated November 28, 1962, because the tests were made on material that turned out to be purer than the average.)

An added safeguard would be the drilling of several additional exploratory holes that would pierce the limestone within the suggested quarry outlines.

In general the writer's view is favorable to the project. The tonnage of raw material is adequate, a quality of feed better than some of the other operating Arizona plants can be provided if proper care be exercised, and the test work yielded promising results.

E. N. Pennebaker

Scottsdale, Arizona
January 12, 1963

Report on

ROTARY KILN CALCINATION OF LIMESTONE SAMPLE

Tucson Lime and Chemical Company

Project No. 191107 November 28, 1962

Report on

ROTARY KILN CALCINATION OF LIMESTONE SAMPLE

Prepared for

Tucson Lime and Chemical Company
4730 West 2nd Avenue
Vancouver 8, B. C.

By

Chemical Division

Colorado School of Mines Research Foundation, Inc.
Golden, Colorado

Approved:

Project No. 191107
November 28, 1962

E. H. Crabtree
Director

J. L. Drobnick
Assistant Manager

C. J. Lewis
Director of Research

Phil Jameson
Project Engineer

AUTHORIZATION

This work has been authorized by contractual arrangement of October 8, 1962, between the Tucson Lime and Chemical Company, Inc. and the Colorado School of Mines Research Foundation, Inc.

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OBJECTIVES

The purpose of this undertaking has been (1) to determine the yield of quicklime product resulting from processing a large sample of Tucson Lime and Chemical Company high calcium limestone through a pilot size rotary kiln under commercial production conditions and (2) to thus obtain a substantial quantity of the quicklime product for further evaluation. These objectives are more fully outlined in a letter of October 8, 1962, from C. J. Lewis of the Research Foundation to Mr. J. D. Mason of Tucson Lime and Chemical Company (appendix).

FOREWORD

Commercial high calcium quicklime is usually manufactured from limestone containing at least 95% calcium carbonate. In this respect the high calcium product differs from dolomitic quicklime which is manufactured from dolomitic limestone containing calcium carbonate and magnesium carbonate in about equal molar ratio.

Practically all commercial quicklime is produced by calcining the limestone in direct-fired brick-lined rotary kilns. However, under some circumstances, vertical (stationary shaft) kilns are used and in special cases hearth roasters and fluid bed kilns are in operation. It can be stated however, that unless special circumstances warrant otherwise, the rotary kiln is preferred.

When limestone is converted to quicklime, the volatile matter including carbon dioxide, moisture and organic matter is driven off and, of these, the carbon dioxide usually represents from 41-43% of the weight loss. Thus for 100 tons of limestone fed to the calcining operation, only about 60 tons of quicklime could be potentially realized and this figure would be further decreased as the result of loss of fine limestone and quicklime in the kiln exhaust gases. On the other hand, the loss of this volatile matter during calcination increases the amount of non-volatile impurities in the resulting quicklime. For example, a limestone feed containing 1% silica (SiO_2) would result in a quicklime containing about 1.81% silica, assuming 42% weight loss during calcination. For this reason non-volatile impurities in the raw limestone become quite significant in the quicklime product.

In the case of the limestone of interest to the Tucson Lime and Chemical Company, a previous evaluation of samples of this material by the Research Foundation had indicated the sample material to be a good grade of high calcium limestone which upon calcination, would result in a quicklime product meeting the chemical specifications for a high calcium quicklime. The only adverse characteristic of the quicklime produced from the samples was that of color - - the products being somewhat darker (less white) than the usual high calcium quicklimes. However this was and is, not believed highly significant to the potential uses in the market areas involved. These considerations are more fully described in a report of February 10, 1960, entitled "Evaluation of Limestone Samples for Production of Lime".

However, the studies resulting in the aforementioned report brought out the highly significant fact that limestone as represented by the samples tended to decrepitate during the calcining operation. In other words, the limestone broke up into substantially -1/8" particles when changed from limestone to quicklime. Such decrepitation subsequently results in the formation of a substantial amount of dust and fine material which is entrained in the gases leaving the kiln, thus causing an important materials loss. In such cases, hearth roasters or fluid bed kilns may be required for technical reasons and to minimize the loss of fine material. However, in the studies as reflected in the report to which reference has been made, it was determined that the limestone sample decrepitated during calcination without producing the expected large amount of fines and dust. This fact was interpreted as indicative of the amenability of limestone, as represented by the samples, to convetional rotary kiln calcination.

Also, it was apparent that if the limestone decrepitated to approximately -1/8" during calcination, there would be no need to remove fine limestone (quarry screenings) from the limestone feed prior to calcination. As is well known, limestone feed to the rotary kiln must be sized for most efficient kiln operation and quicklime quality control in the case of limestones which burn normally and do not decrepitate. This results from 10-20% of the limestone mined or quarried being rejected as "screenings". However, as indicated, the nature of the Tucson Lime and Chemical material offered the possibility of eliminating the problem of "screenings".

As the result of the foregoing considerations, Tucson Lime and Chemical Company authorized the work represented herein, primarily to determine the behavior of a large sample of limestone when converted to quicklime under actual commercial rotary kiln operations, and secondarily to thus produce a large quantity of quicklime for possible further laboratory testing and market evaluation.

This calcination, involving nearly 5 tons of limestone, was undertaken in a direct gas-fired rotary kiln approximately 18' in length and 16" internal diameter.

SAMPLES

1. Limestone - Approximately 10 tons of limestone crushed to pass a 6" square opening were delivered to the Research Foundation by Tucson Lime and Chemical Company. Nine tons of this material was crushed to pass a 3/4" square opening. No effort was made to screen out the fine material resulting from the crushing operation since it was known that the limestone would decrepitate to approximately 1/8" during the calcination. This -3/4" crushed limestone is referred to as "feed" throughout this report.

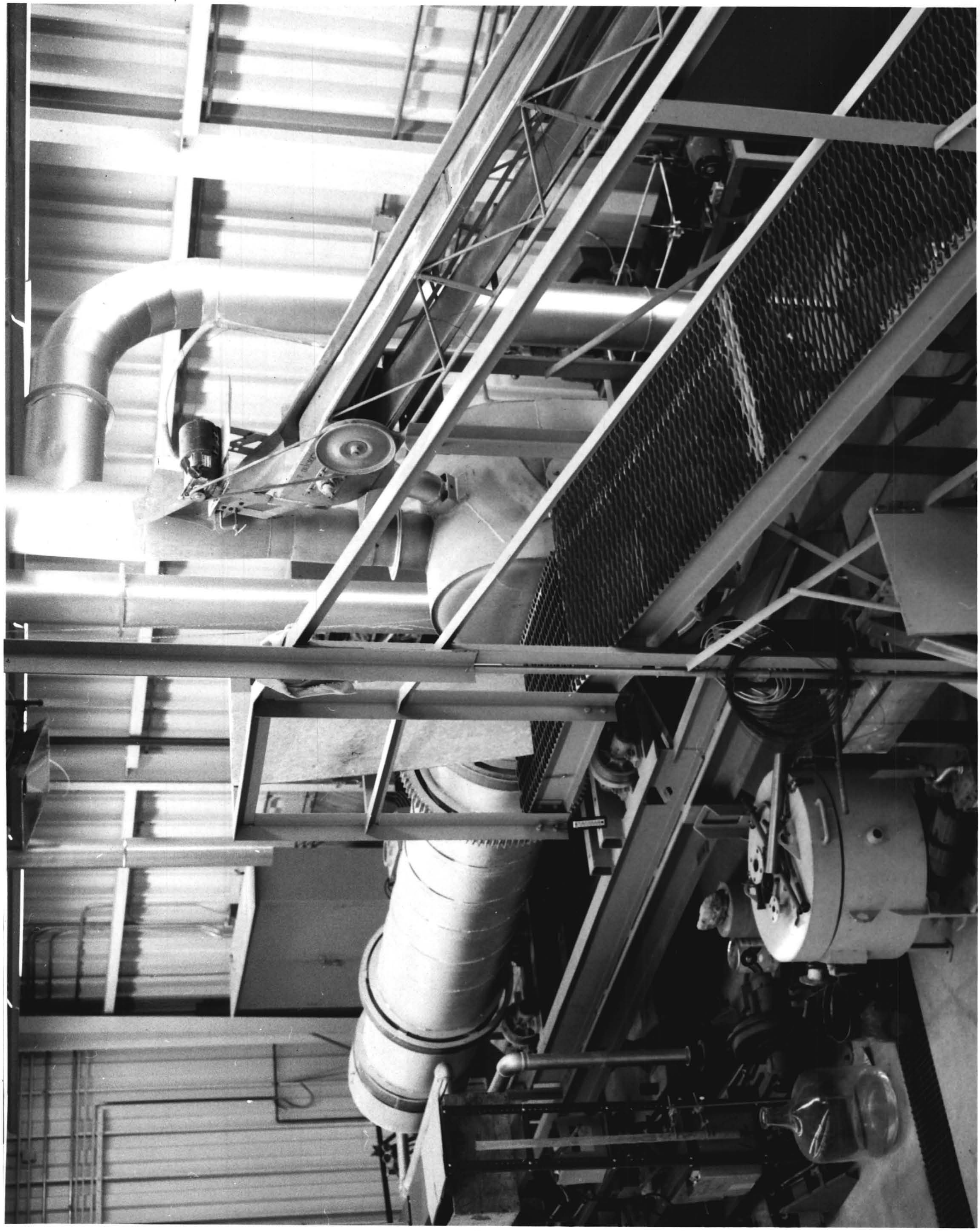
2. Quicklime - During the calcining operations 5065 lbs. of quicklime product were recovered. During calcining, samples of quicklime product were taken every hour. These samples were later composited into 2 master samples referred to herein as "product first half" and "product second half".

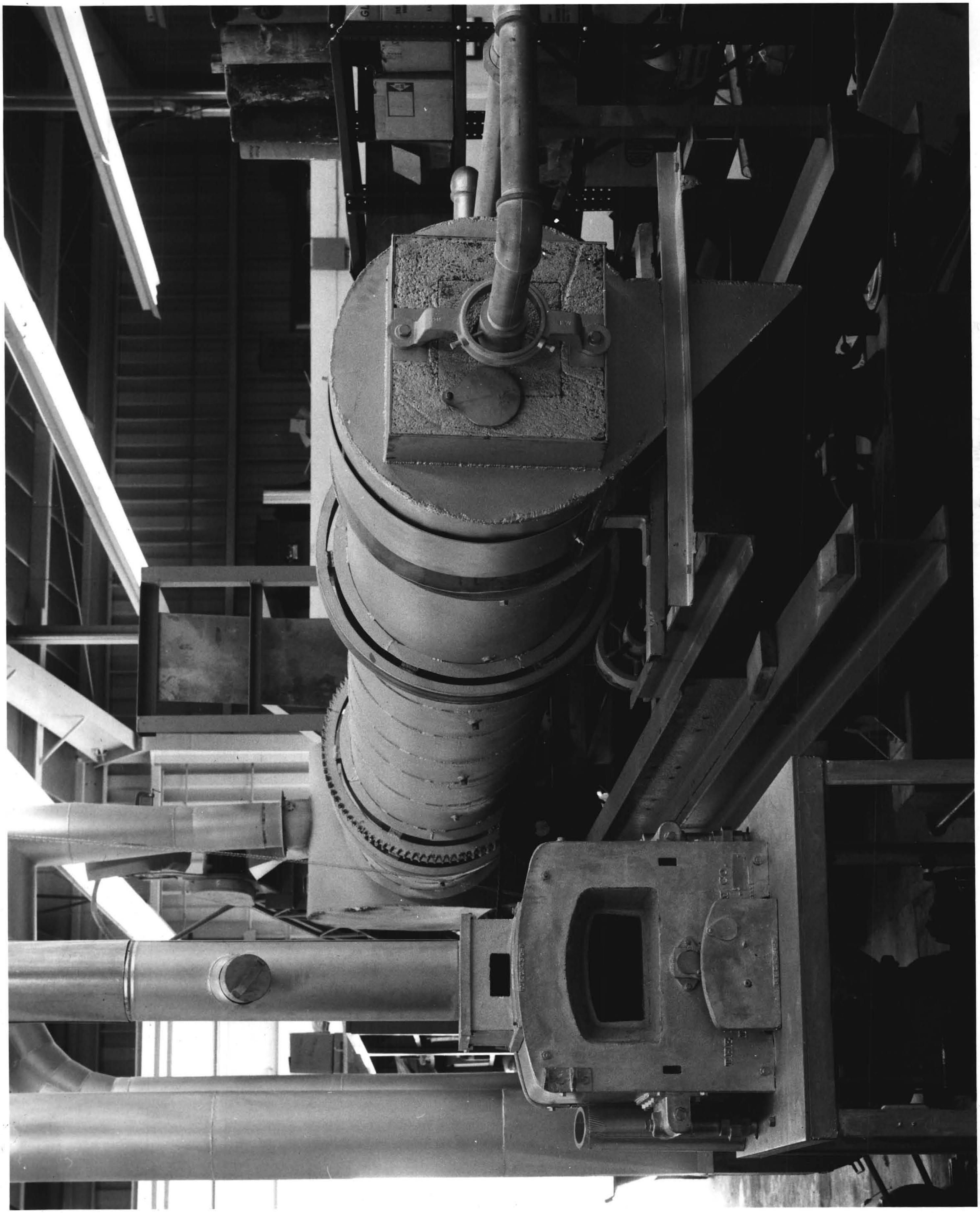
3. Dust - A dust sample was taken on an hourly basis near the dust chamber at the feed end of the rotary kiln. This sampling point was considered significant in that it represented the first major decrease in velocity of the gases leaving the rotary kiln and is in the normal dust collecting area of a rotary kiln operation. The samples were composited and analyzed.

4. Stack discharge sample - At the end of the calcining operation a quantity of extremely fine dust on the roof of the building housing the kiln was obtained, mixed and sampled. This is considered to reflect the stack discharge of the very fine material which would normally not report in the conventional dust collecting chamber.

Rotary Kiln Specifications and Operating Conditions

Length	18'
Diameter	16"
Slope	0.0448 ft./ft. or 0.537 in./ft.
r.p.m.	3/4
Retention time	90 min.
Load %	10.1
Bed depth	2.6"
Retaining ring	2" (inside diameter 16")
Feed chute	2 1/2"
Feed rate	150 lbs./hr.





SUMMARY

The limestone feed to the kiln calcined normally as compared with the high calcium quicklimes of commerce. The optimum calcining temperature range was between 2000° F. and 2200° F. At temperatures below 1800° F. core (unburned limestone) appeared in the product and the feed rate would have had to be substantially reduced to produce a quality product in the 1800°F. range. On the other hand, the quicklime product began to glaze at around 2300° F. thus suggesting over-burning and possible damage to the kiln lining. The optimum temperature range therefore lies between 2000°F. and 2200° F. and the preferred temperature, within this range, would have to be established in terms of the commercial kiln involved.

The expected decrepitation of the limestone occurred and appeared to be maximum in the hottest zone of the kiln where quicklime was being formed at the maximum rate. The dust loss resulting from decrepitation was surprisingly low. From the approximately 9600 lbs. of limestone feed to the kiln, 5065 lbs. of quicklime product were obtained. From the inventory of feed and product the actual dust loss calculates to only 3.9%. It may be concluded therefore, that from all limestone as represented by the sample, an overall quicklime yield of at least 95% could be obtained via rotary kiln calcining.

Based on all data and observations arising from this undertaking, material as represented by the limestone sample should be able to be converted to quicklime in a conventional rotary lined kiln under conditions which should render the quicklime product economically competitive in its market area.

DETAIL OF WORK PERFORMED

1. Preliminary batch calcination operations in rotary smelting furnace. The purpose of these experiments was to gain reassurance that the limestone sample would decrepitate without severe dust loss and to establish a suitable size to which all the large samples should be crushed.

Four grab samples of the 6 inch limestone were taken and were crushed and screened as follows:

1.	-1 1/2	+ 1/4
2.	-1 1/4	+ 1/4
3.	-1	+ 1/4
4.	-3/4	+ 1/4

Ten lbs. of No. 1 were calcined at 2040° F. for 20 min. 4.96 lbs. of quicklime was recovered. Running time was 3 hours 45 minutes.

Fifty lbs. of No. 2 was put into a preheated (1500° F.) furnace. Running time 2 hrs. 20 min. The final temperature was 2010° F. for 30 min. 29.5 lbs. of product recovered.

A screen analysis was made on the two batch calcined products:

Tyler screen	Wt. % retained No. 1	Wt. % retained No. 2
+ 3 mesh	13.2	5.6
- 3 + 6	13.5	11.7
- 6 + 10	22.4	25.4
- 10 + 20	29.4	31.3
- 20 + 28	11.1	13.3
-28	10.7	12.8
Total	100.3	100.1

As a result of these studies, particularly based on observations of the decrepitation, it was concluded that the sample could all be crushed to pass a 3/4" square screen for the rotary kiln feed. Nine tons of the limestone was therefore crushed and screened to -3/4" with no removal of dust or fines. The remainder of the original limestone sample was reserved for possible further use.

2. Kiln operations.

A. Start up.

The kiln was fired up and heated for 6 hours. The exhaust fan was turned off because temperature could not be attained. The feed was started in at a rate of 100 lbs./hr. The first discharge was 50 minutes from start to feed. 50-75 lbs. was returned to the kiln because it was not completely calcined. The feed rate was increased to 150 lbs./hr. 3 ½ hours after initial feed. The initial shakedown lasted for 8 hours before the kiln was judged to be in a steady-state. Additional information is presented in the Operations Log.

B. Operation

9590 lbs. of -3/4" limestone was fed to the kiln and 5065 lbs. of quicklime was recovered. A dust loss of 374 lbs. (3.9%) was calculated from a material balance. Additional information is presented in Operations Log. The product was sealed in barrels to prevent adsorption of moisture and carbon dioxide.

C. Operating conditions

The temperature ranged from 1830° F. to 2200° F. but averaged between 2000° F. and 2100° F. The feed rate initially was 100 lbs./hr. but was increased to 150 lbs./hr. The retention time was approximately 90 minutes.

D. Sampling

1. The feed was sampled as it was crushed and placed in the barrels. The samples were composited and a screen and chemical analysis made.

2. The product was sampled every hour and the sample was placed in a labeled bottle. The samples were then composited into two samples, 1st half of run and 2nd half of run, for analysis.

3. A dust sample was taken on an hourly basis at the feed chute. A screen analysis and a chemical analysis was run on this sample.

A stack discharge sample was taken at the end of operation. This was taken from the roof of the building near the flue stack discharge. An analysis was run on this sample.

E. Design data

The following design information pertains to the pilot kiln used in this study:

Length	18'
Diameter	16"
Slope	0.0448 ft./ft. or 0.537 in./ft.
r.p.m.	3/4
Retention time	90 min.
Load %	10.1
Bed depth	2.6'
Retaining ring	2"(inside diameter 16")
Feed chute	2 1/2"
Feed rate	150 lbs./hr. limestone sample

F. Operational difficulties

The only trouble that was encountered during the operation was mechanical. The fan on the stack was too large, thus pulling too much air and cooling the limestone charge. The speed of the fan was reduced.

The feed conveyor motor was over the feed chute and the heat caused motor failure. During the 2 hour period required for repair of the motor, hand feed was employed. The difficulties encountered were easily solved.

ANALYSIS

I. Chemical

Constituents	% Feed	Product 1st half	Product 2nd half	Dust	Stack discharge
CaO	55.20	97.9	95.9	55.4	70.9
R_2O_3	0.24	0.37	0.42	0.55	0.64
SiO_2	1.13	1.47	3.46	2.30	2.27
MgO	0.05	---	---	---	---
CO_2	43.20	0.31	0.45	41.0	25.2
LOI	43.30	0.34	0.47	41.1	26.3
Moisture	0.48	nil	nil	0.03	nil
Total (minus LOI)	100.2	99.05	100.23	99.28	99.01

Screen:

Tyler Standard Screen:	Feed - wt. % retained
+ 3	54.7
- 3 + 6	10.9
- 6 + 10	8.5
- 10 + 20	9.3
-20 + 28	4.2
- 20 + 65	6.6
-65	5.9
Total	100.1

Tyler Standard Screen	Dust Sample wt. % Retained	Stack Discharge wt. % Retained
+ 48	0.1	2.1
- 48 + 65	1.3	7.9
- 65 + 100	13.7	24.9
-100 + 150	23.2	26.1
- 150 + 200	24.8	20.1
- 200	36.9	19.0
Total	100.0	100.1

Dust Loss Calculations

Feed	9590 lb.	
CO_2 loss	4161 lb.	(43.2% x 9590 lb.)
Product	5065 lb.	
Dust loss	374 lb. or 3.9%	

OBSERVATIONS

The operation proceeded so smoothly that about the only generalized observation which can be made is that material as represented by the sample is amenable to quicklime production via the rotary kiln route. It should be pointed out that the size of the feed for commercial production will probably lie between a top size of 1 1/2" and a bottom size of 1/2". However, there appears to be no reason to crush any finer than the limiting top size since decrepitation to about 1/8" will occur in any case. The limiting top size is that which will become completely decrepitated during calcination so that no large pieces of partially burned limestone report with the quicklime product. While these could be readily screened out, their occurrence would reflect a materials loss. Based on prior experience, we believe the limiting top size would be around 1 1/2" .

The quicklime product is definitely off-color as compared to the normal white high-calcium quicklimes of commerce. However, this should not impair its usefulness for application where color is not at a premium. The quicklime product is violently reactive in water and slakes normally to a putty which is whiter than the quicklime itself. The slaked product diluted to a hydrated lime slurry containing about 10 weight per cent solids appears almost as white as the best grades of high-calcium hydrated quicklime. It appears that much of the discoloring matter reports as a residue which can be settled out of the milk of lime slurry. This further suggests that dry air classification might considerably upgrade the appearance of the quicklime product. However, as may be noted from the chemical analysis, the product is nearly 98% calcium oxide and it is unlikely therefore, that either air or water classification could chemically upgrade the product to any important degree.

RECOMMENDATIONS

1. Because the lime putty resulting from slaking the quicklime product appears to be unusually plastic to the touch, plasticity characteristics should be investigated on a laboratory basis in order to ascertain whether the quicklime product might be superior in building construction applications.

2. Since it is probable that the quicklime product will require a further crushing or possibly an air classification in the interest of uniformity, crushing, grinding, and air classification of the product should be investigated in order to determine which route, if any, might improve the color of the product.

3. Since a market for high calcium hydrated lime in bags might be developed, the dry hydration of the quicklime product followed by the usual air classification of a hydrate should be examined.

The Colorado School of Mines Research Foundation is presently in position to undertake studies in any or all of the foregoing areas, including a market survey.

OPERATION LOG

SUMMARY

Feed	9590 lbs.	Total feed	9691 lbs.
Product	5064 lbs.	- Spillage	101 lbs.
CO_2 loss	4153 lbs.	Net feed	9590 lbs.
Dust loss	374 lbs.*		
% Dust loss	3.9		

Products

Normal product	4764 3/4 lbs.
Special products	
A. End of Run	90 1/4 lbs.
B. Ideal Roast	55 1/4 lbs.
C. 2300 Product	95 1/4 lbs.
D. 2100-2200 Prod.	59 1/2 lbs.
Total	5064 lbs.

*Calculation

OPERATION LOG

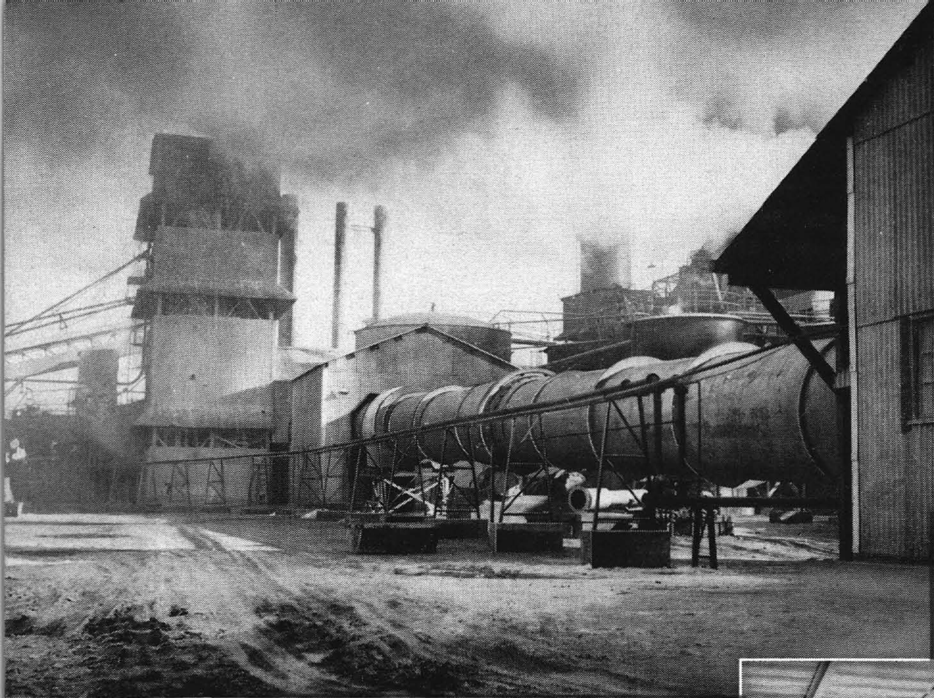
Date	Time	lbs. Feed Cumulative	lbs. Product	Temp. Range ° F.	Notes
Oct. 12, 1962	1810	100			Fan turned on.
	1800-1900	250			Adjusted feed to 100 lbs./hr.
	1900-2000	350			
	2000-2100	450			
	2100-2200	575			
	2200-2300	725			Adjusted feed to 150 lbs/hr.
	2300-2400	875			
Oct. 13, 1962	2400-0100				
	0100-0200	1091	309 3/4	1980-2030	End of shake down.
Oct. 13, 1962	0200-0300	150		1950-2200	
	0300-0400	300		1800-2100	
	0400-0500	450		1900-1940	
	0500-0600	600		1900-2180	
	0600-0700	750	372 3/4	1890-2010	Product barrel No. 2
Oct. 13, 1962	0700-0800	150		1930-2000	
	0800-0900	300		1850-1880	
	0900-1000	450		1800-1830	
	1000-1100	600		1860-2020	
	1100-1200	750		1980-2070	
	1200-1300	900		2080-2110	
	1300-1400	1050		2040-2100	

OPERATION LOG

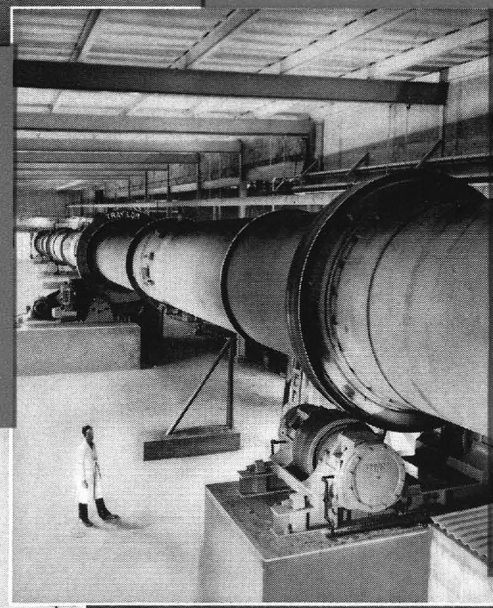
Date	Time	lbs. Feed Cumulative	lbs. Product	Temp. Range ° F.	Notes
Oct. 13, 1962	1400-1500	1200	359 1/4	2060	Product barrel No. 3
	1500-1600	1350	350 1/2	2060-2090	Product barrel No. 4
Oct. 13, 1962	1600-1700	150		2040-2090	
	1700-1800	300		1990-2030	
	1800-1900	450		1980-2080	
	1900-2000	600		1990-2100	
	2000-2100	750	325 1/4	2010-2090	Product barrel No. 5
	2100-2200	900		2030-2090	
	2200-2300	1050		1980-2110	2325 Feed to kiln plugged 2340 Feed to kiln open
	2300-2400	1200	295 3/4	1990-2100	Product barrel No. 6
Oct. 14, 1962	2400-0100	150		1910-1990	Gas meter reading@0020 hr 920,410 cu. ft.
	0100-0200	300		1990-2110	
	0200-0300	450		2010-2110	
	0300-0400	600		1990-2020	
	0400-0500	750		1990-2080	125 lbs. of reburn added. 0400 hrs.
	0500-0600	900	337 3/4	2010-1860	Product barrel No. 7
	0600-0700	1050		1910-2040	
	0700-0800	1200	280 1/4	1980-2040	Product barrel No. 8
Oct. 14, 1962	0800-0900	50		2040-2000	0800 hrs. Conveyor motor stopped - hand feed.
	0900-1000	200		2000	1040 hrs. Conveyor back on.
	1000-1100	350		2000-1900	
	1100-1200	500		1860-1900	
	1200-1300	650		1830-1880	
Oct. 14, 1962	1300-1400	800		1900-2020	Exhaust fan on.
	1400-1500	950		2000-2030	Exhaust fan off, cooled charge.
	1500-1600	1100		2020-1850	
	1600-1700	1250	465	1990-2080	Barrel No. 9
	1700-1800	1400		1970-2030	
	1800-1900	1550		2030-2150	
	1900-2000	1700	424	1990-2020	Barrel No. 10
Oct. 14, 1962	2000-2100	150		2000-2050	
	2100-2200	300		2100-2230	
	2200-2300	450		2050-2080	Gas meter reading @2345 hrs. 946,100 cu. ft.
	2300-2400	600	275 1/2	2050-2080	Barrel No. 11
Oct. 15, 1962	2400-0100	150		1900-2000	
	0100-0200	300		2000-2080	
	0200-0300	450		2010-2050	
	0300-0400	600		1910-2010	
	0400-0500	750	342 3/4	1960-2030	Barrel No. 12
	0500-0600	900		2010-2090	
	0600-0700	1050		2060-2140	Gas meter reading@ 0620 953,850 cu. ft.
	0700-0800	1200	326	2000-2080	Barrel No. 13
Oct. 15, 1962	0800-0900	150		2050-2110	
	0900-1000	300		2080-2120	
	1000-1100	450		1990-2050	Gas meter reading@ 1040 959,270 cu. ft.
	1100-1200	600	299 1/4		Barrel No. 14. Fuel off. End of operation

TRAYLOR LIME SLUDGE RECOVERY KILNS

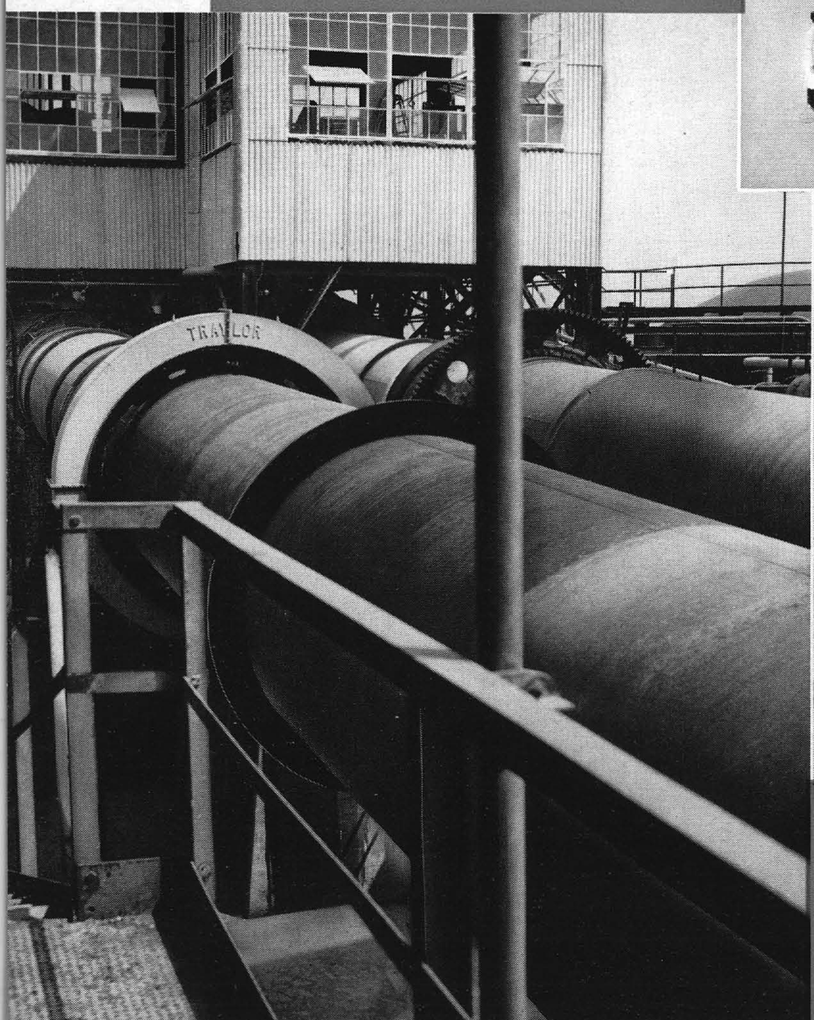
IN THE PAPER AND CHEMICAL PROCESSING INDUSTRIES



7'-0" dia. x 250'-0" Traylor Rotary Lime Sludge Recovery Kiln in paper mill in Oregon, U.S.A.

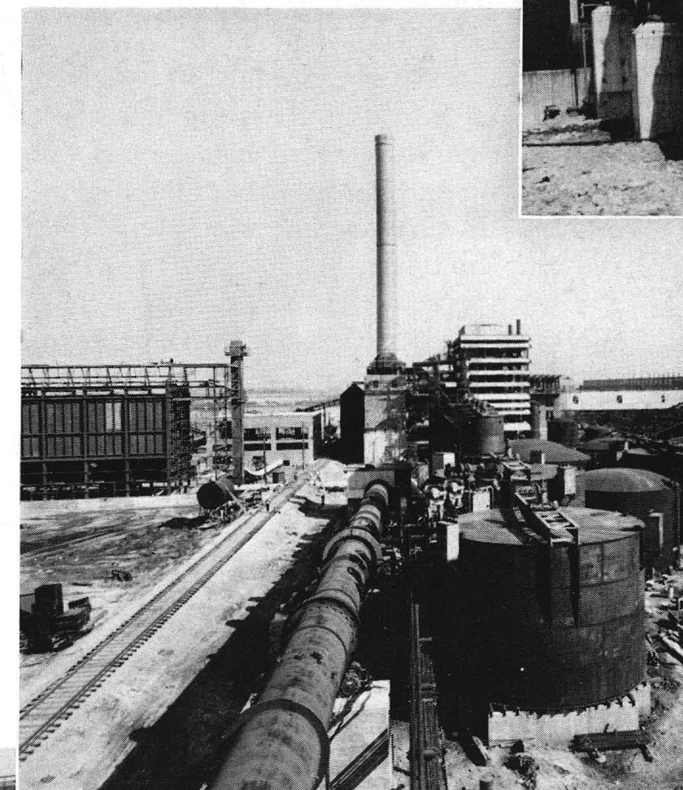


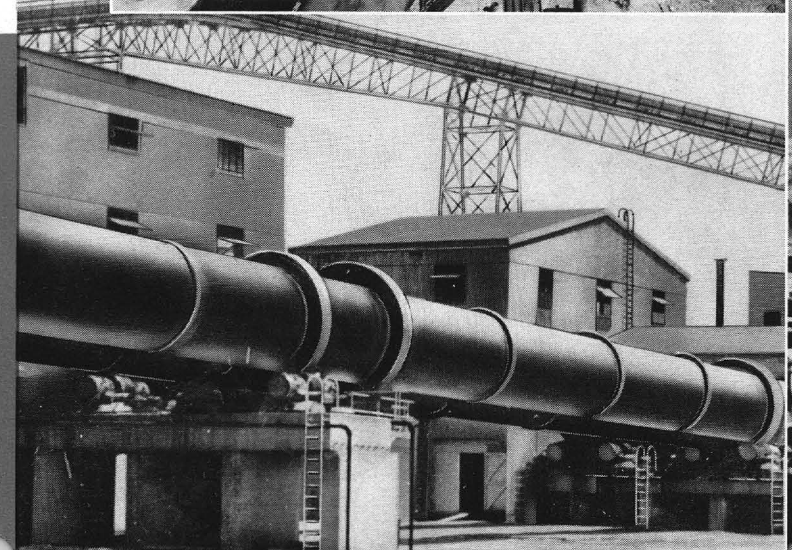
8'-6" dia. x 350'-0" Traylor Rotary Lime Sludge Recovery Kiln in paper mill in Louisiana, U.S.A.



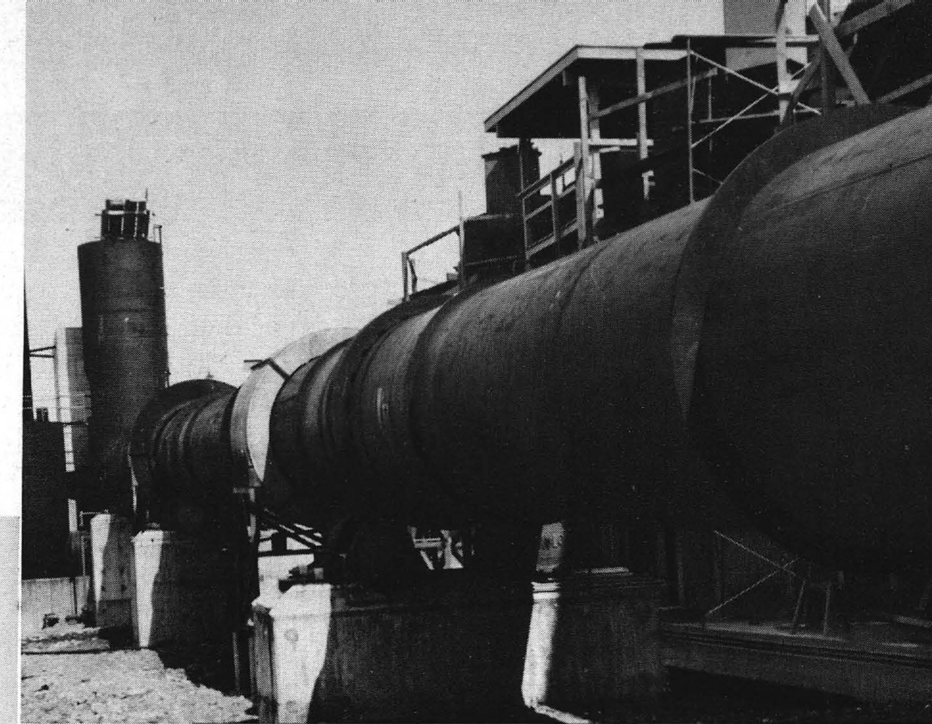
8'-0" dia. x 160'-0" Traylor Lime Sludge Recovery Kiln in paper mill, Alabama, U.S.A.

8'-6" dia. x 215'-0" Traylor Lime Sludge Recovery Kiln in paper mill, North Carolina, U.S.A.





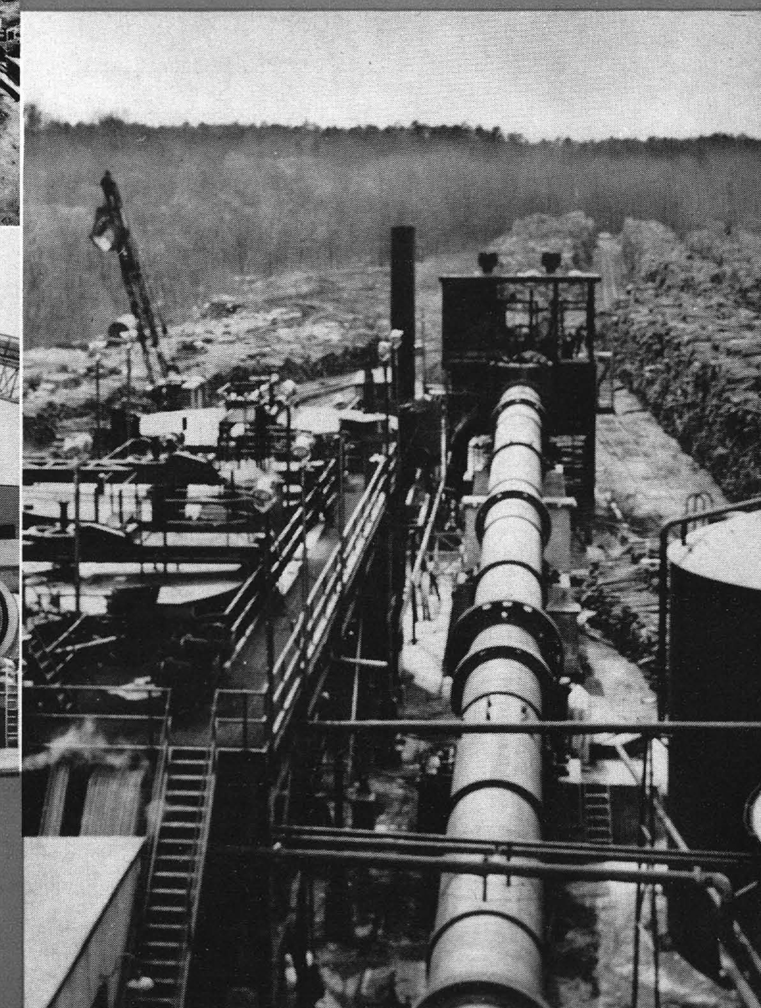
7'-0" dia. x 300'-0" Traylor Rotary Kiln for lime sludge recovery in paper mill in Alabama, U.S.A.



7'-0" dia. x 250'-0" Traylor Rotary Lime Sludge Recovery Kiln in paper mill, British Columbia, Canada.

8'-0" dia. x 300'-0" Traylor Lime Sludge Recovery Kiln in paper mill, Georgia, U.S.A.

8'-6" dia. x 170'-0" Traylor Lime Sludge Recovery Kiln at paper mill in South Carolina, U.S.A.



ROTARY COOLERS

Traylor Rotary Coolers provide satisfactory cooling of many kinds of hot materials—in short, any product in which it is required to reduce the temperature of the material (for handling on belts or for storage or sacking) with full recovery of the balance of the heat contained in the material. These coolers are designed to accomplish quick cooling of the material and, therefore, large capacities are secured by their use.

Traylor Rotary Coolers are built in four types, to meet practically all requirements, viz:—(I) Conventional; (II) Diaphragm; (III) Multiple Tube (Air and Water-cooled); (IV) Multiple Tube (Water-cooled).

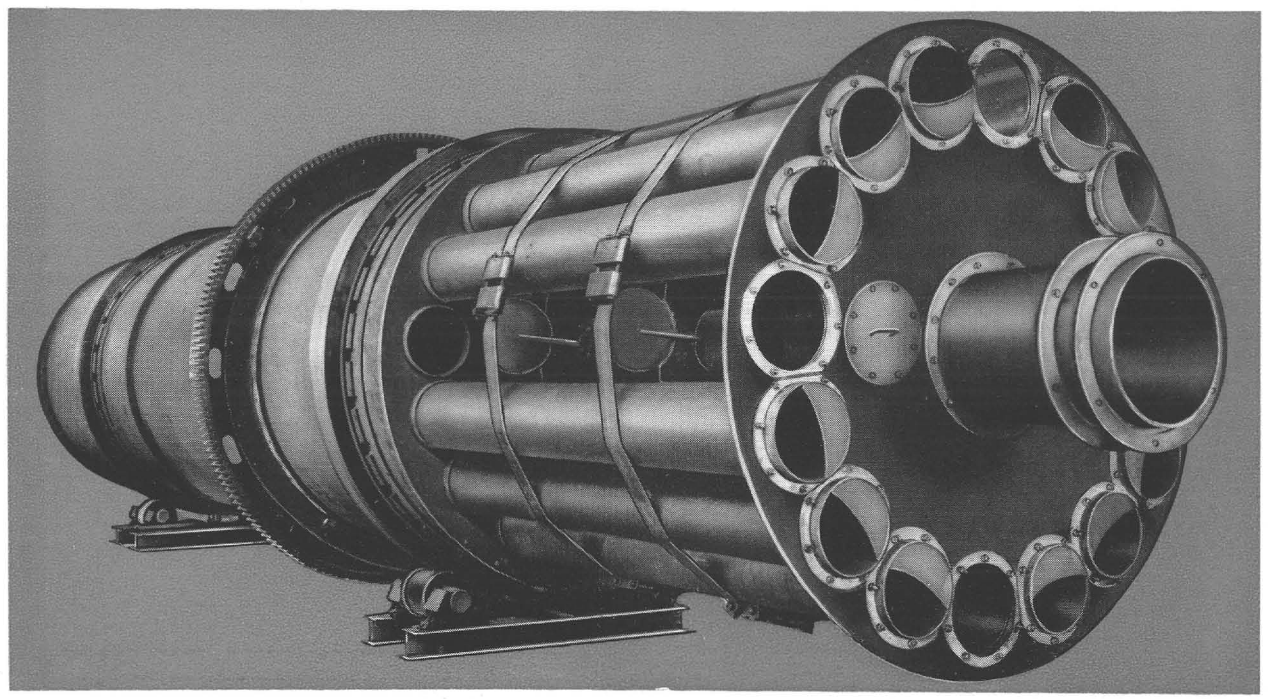
The Conventional Type (I) is a straight flow unit. About one-third of the shell, at the feed end, is lined with fire brick and suitable lifters are placed throughout the entire length to advance and shower the material. In some cases, chains are also employed to hasten transfer of the heat of the material to the cooling air, which travels counterflow.

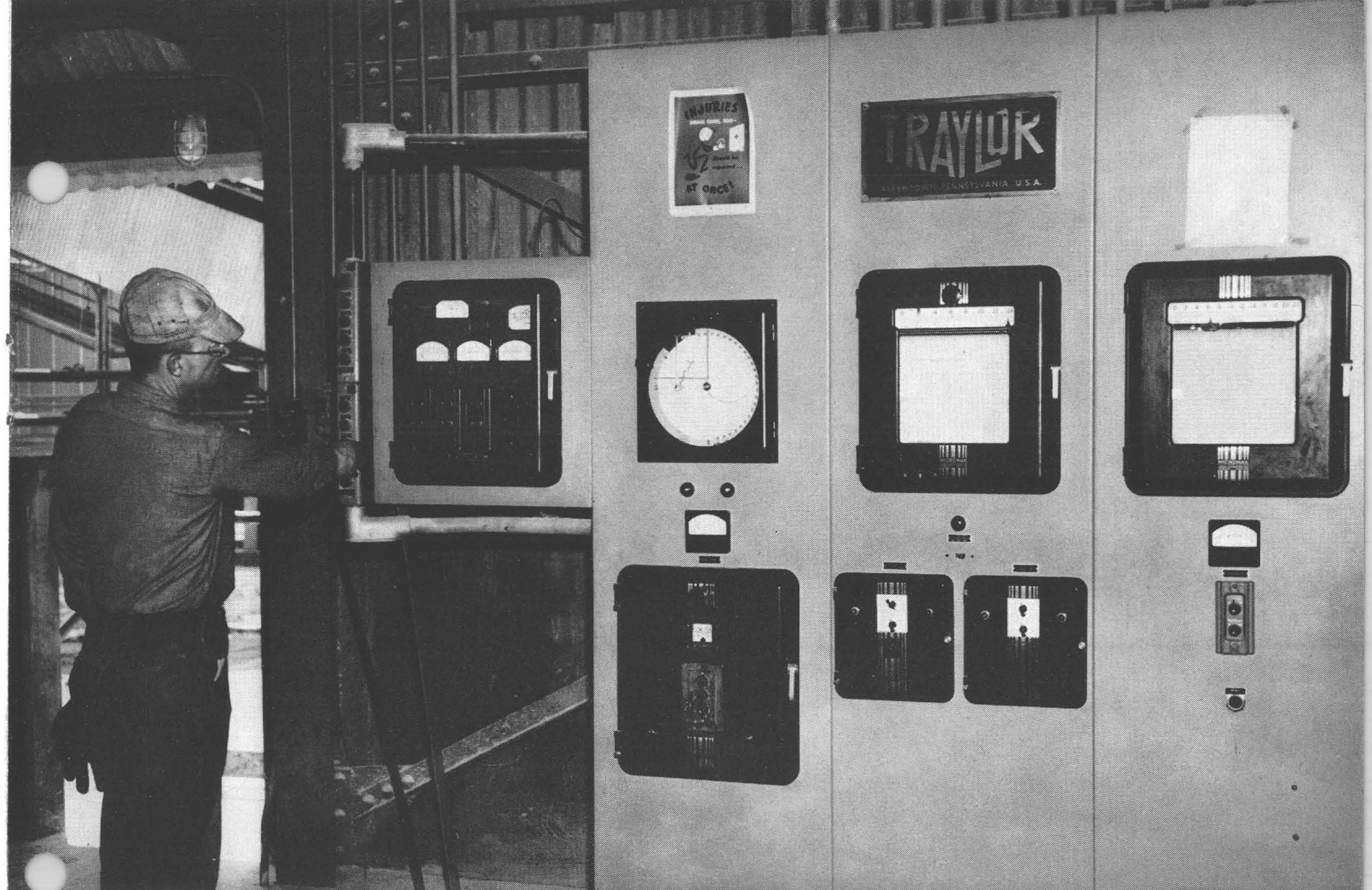
The Diaphragm Type Cooler (II) is also a straight flow unit.

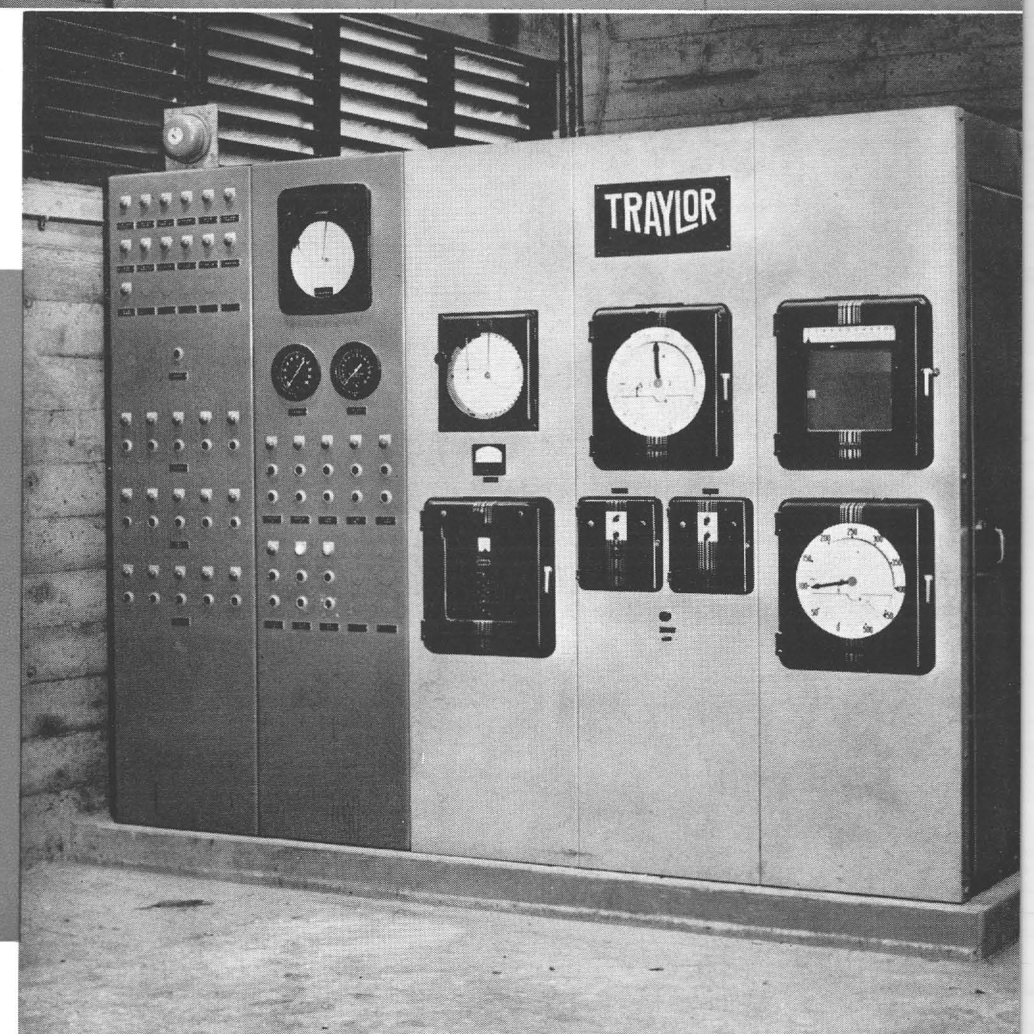
The length of the cooler is divided into three parts—a receiving chamber, a diaphragm section and a blank discharge end section.

In operation the material to be cooled is spouted into the receiving chamber and as it moves forward it is picked up by the compartments of the diaphragm section. In these compartments it is well showered and propelled forward by lifters and, in addition, it is constantly in contact with the chains in the compartments which serve to hasten the transfer of the heat of the material to the air.

The Multiple Tube Type Cooler (III) is a straight flow unit, designed for use in processes where it is desired to prevent the cooling air from coming in contact with the material, because of the harmful effect it would produce and for the elimination of dust.

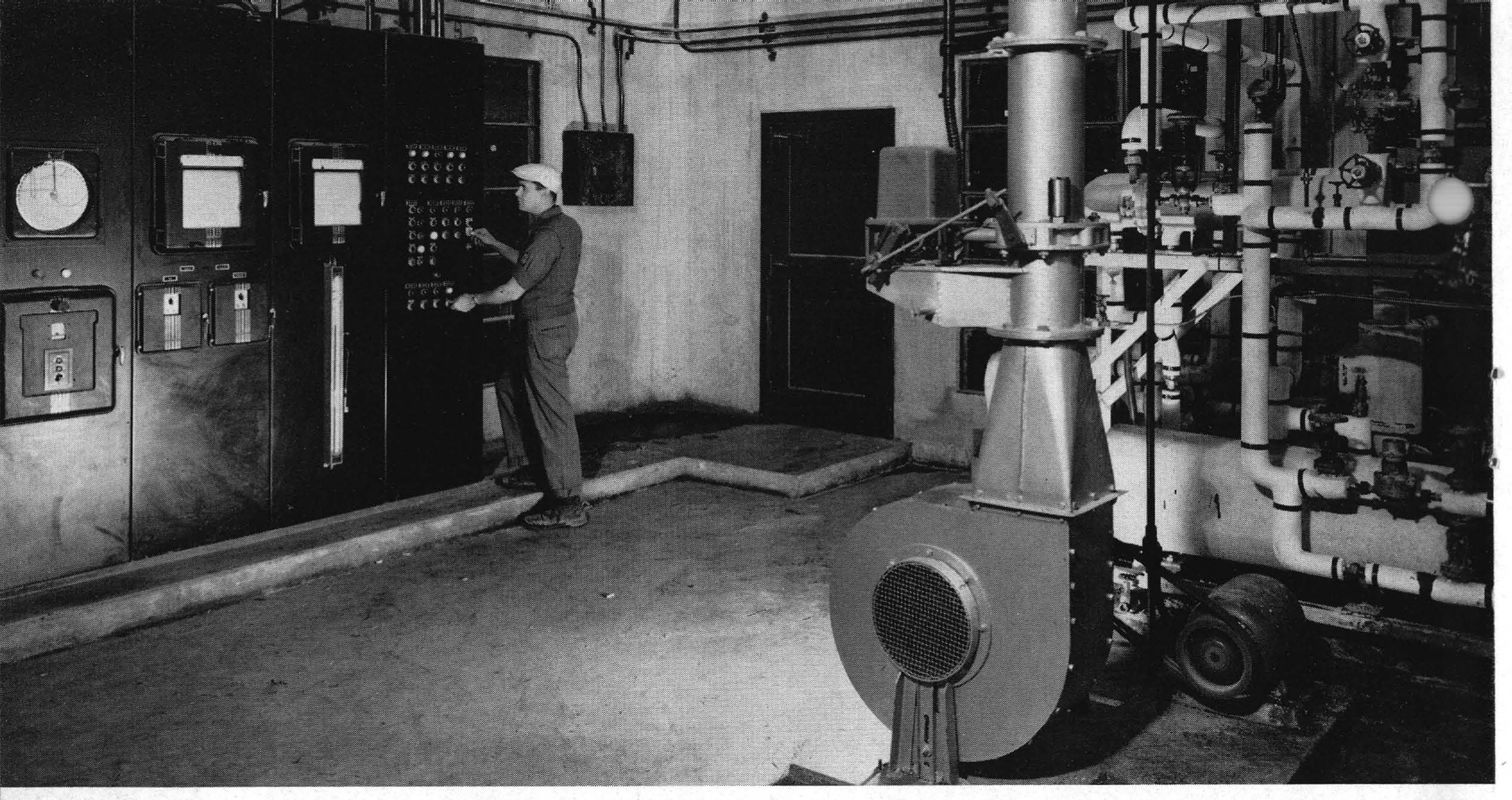






Central Control Panel—8'-6" dia. x 215'-0" Traylor Rotary Kiln.

Central Control Panel—7'-0" dia. x 250'-0" Traylor Rotary Kiln.



Central Control Panel—7'-0" dia. x 250'-0" Traylor Rotary Kiln.

CENTRALIZED KILN CONTROL

In modern practice it is advantageous to have closely controlled operation of the rotary kiln and other units. By this means it is possible to provide more productive efficiency, as well as lower costs for all processes, such as roasting, burning, firing, calcining, drying, sintering or nodulizing . . . in the production of lime, cement, manganese, nickel, aluminum, magnesium, zinc, tin, refractories, phosphates, dolomite or pigments. With close control of these processes, through centralized instrumentation, the product quality is improved, fuel economies are effected and kiln capacity is increased. This method of instrumentation also provides records for statistical analysis.

With Traylor centralized control, all instruments, gauges, indicators, recorders and other controls are located on a central panel on the firing floor, readily accessible for the operation of the kiln. Strip charts or round charts from the recording instruments give a clear picture of the complete kiln operation at all times. Performance is shown of the feed, product and fuel rates; burning zone and exit gas temperatures; draft conditions; air flow, kiln speed, etc.

Fuel savings and a high uniform production flow are brought about through automatic draft control, with indicators to show the entrance and exit gases and automatic adjustment of the stack damper it is possible to automatically maintain the proper flow of air for combustion. Typical instrument panels are illustrated on this and the facing page showing actual installations in operation.

The Multiple Tube Cooler is designed with a welded plate steel outer shell containing a number of tubes which are sealed at both ends against the entrance of any air except such small quantities as cannot be prevented from entering with the material being fed to the cooler.

In operation, the hot material is fed into the cooler feed chamber through a steel spout. As the cooler revolves, this feed chamber delivers the hot material into the tubes. The rate of progress of the material through the tubes is governed by the inclination at which the cooler is set, which is predetermined by the cooling requirements to be met and the capacity desired.

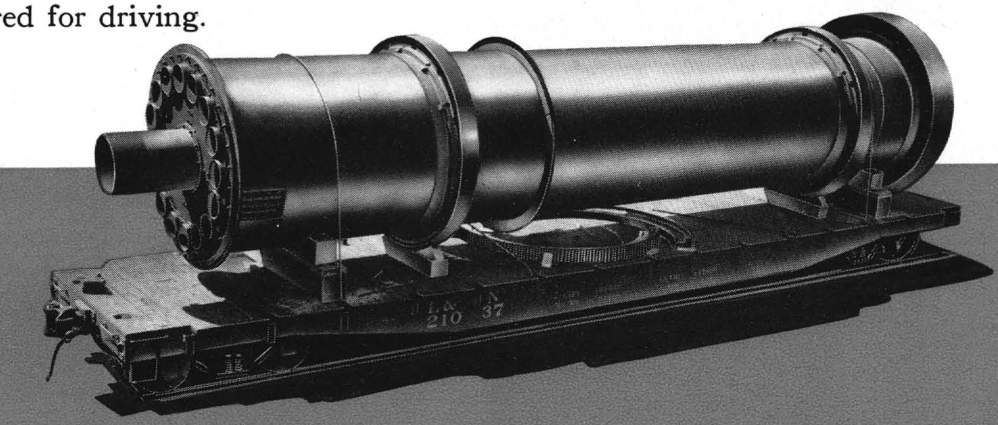
When the material arrives at the discharge end of the cooler it is spouted directly into a housing sealed against the entrance of air and the escape of dust from the inside.

The design of the cooler is such that parts are easily accessible and the load is so distributed that a minimum of power is required for driving.

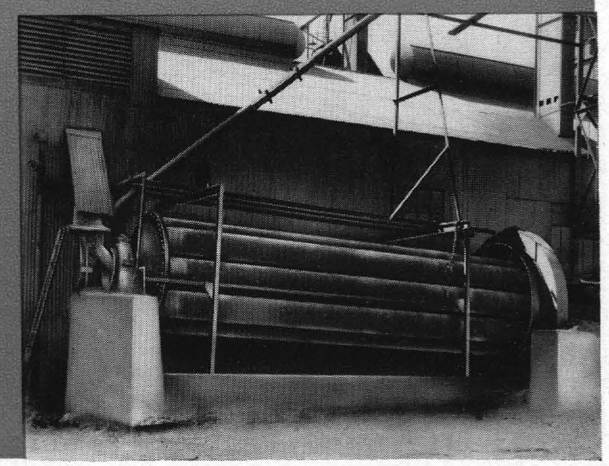
SPECIAL COOLERS

Traylor builds various special types of rotary coolers, among which are the Water-cooled and the combination Air and Water-cooled Multiple Tube Types.

In the water-cooled type the tubes are of welded heat-resistant steel construction and of a number and size to suit the capacity desired. These tubes are attached at each end to a steel plate tube head which is bolted to the supporting head. These supporting head castings are designed with oversize trunnions which support the machine in heavy water-cooled bearings. The feed end hood is fitted with a steel spout, carefully packed against the escape of dust, and a dust-tight spout is provided at the discharge end of the cooler. The machine is driven by a fully enclosed girth gear at the discharge end through a speed reducer.

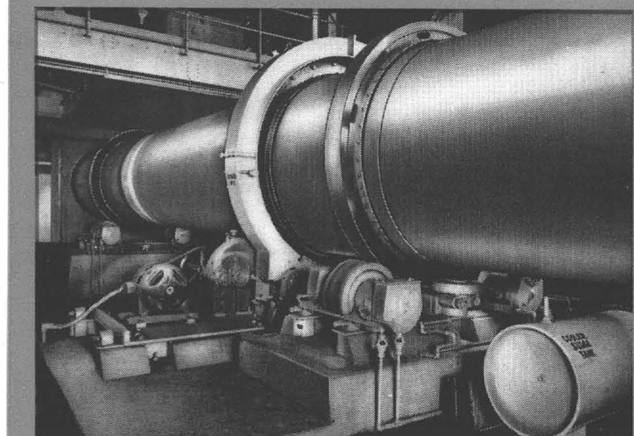


8'-3" dia. x 47'-0" Traylor Air-cooled Tube Cooler—one of 43 shipped to large aluminum producer in Alabama, U.S.A.

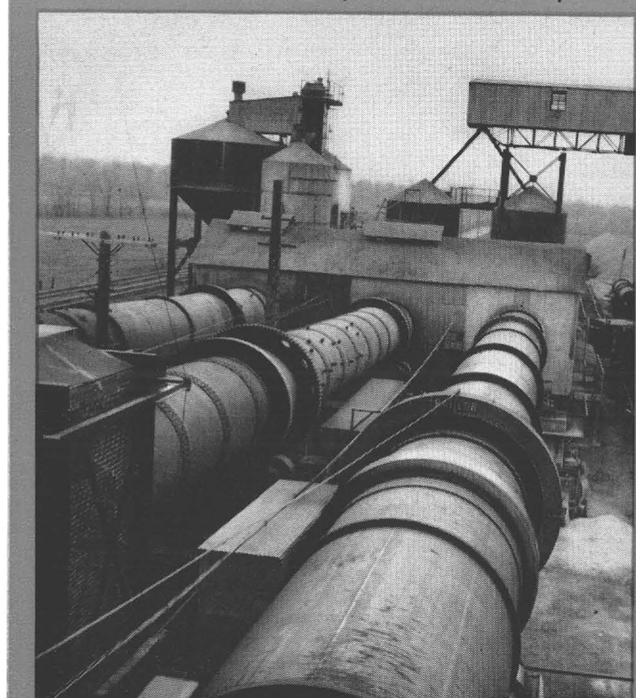


Traylor Water-cooled Tube Cooler —20" x 28'-0"—8-tube in plant of roofing granule producer in New Jersey, U.S.A.

In operation the material to be cooled is fed by spout into the feed end compartment and from there it flows into the open ends of the muffle tubes, traverses the tubes for a portion of their length where it encounters the diaphragm units where it is split up by these diaphragms into four separate shallow streams, each passing into one of the segmental compartments formed by the diaphragms with the walls of the tubes. During the rotation of the cooler the material is showered from one compartment to another through the openings in the diaphragms—this mixes and tumbles the material about and exposes all parts of it to the cooling surface of the tubes. These openings are staggered, relative to each other, along the length of each diaphragm. The material flowing through the openings in one diaphragm is interrupted by the next diaphragm, thus interrupting the travel of the material between the segmental compartments and causing the material to move a short distance forward along each diaphragm before it escapes onto the next diaphragm. This insures a suitable interval of contact between the material and the diaphragms and helps in the cooling effect.



7'-0" dia. x 65'-0" Traylor Rotary Cooler.
8'-0" dia. x 160'-0" Rotary Kiln in refractories plant.



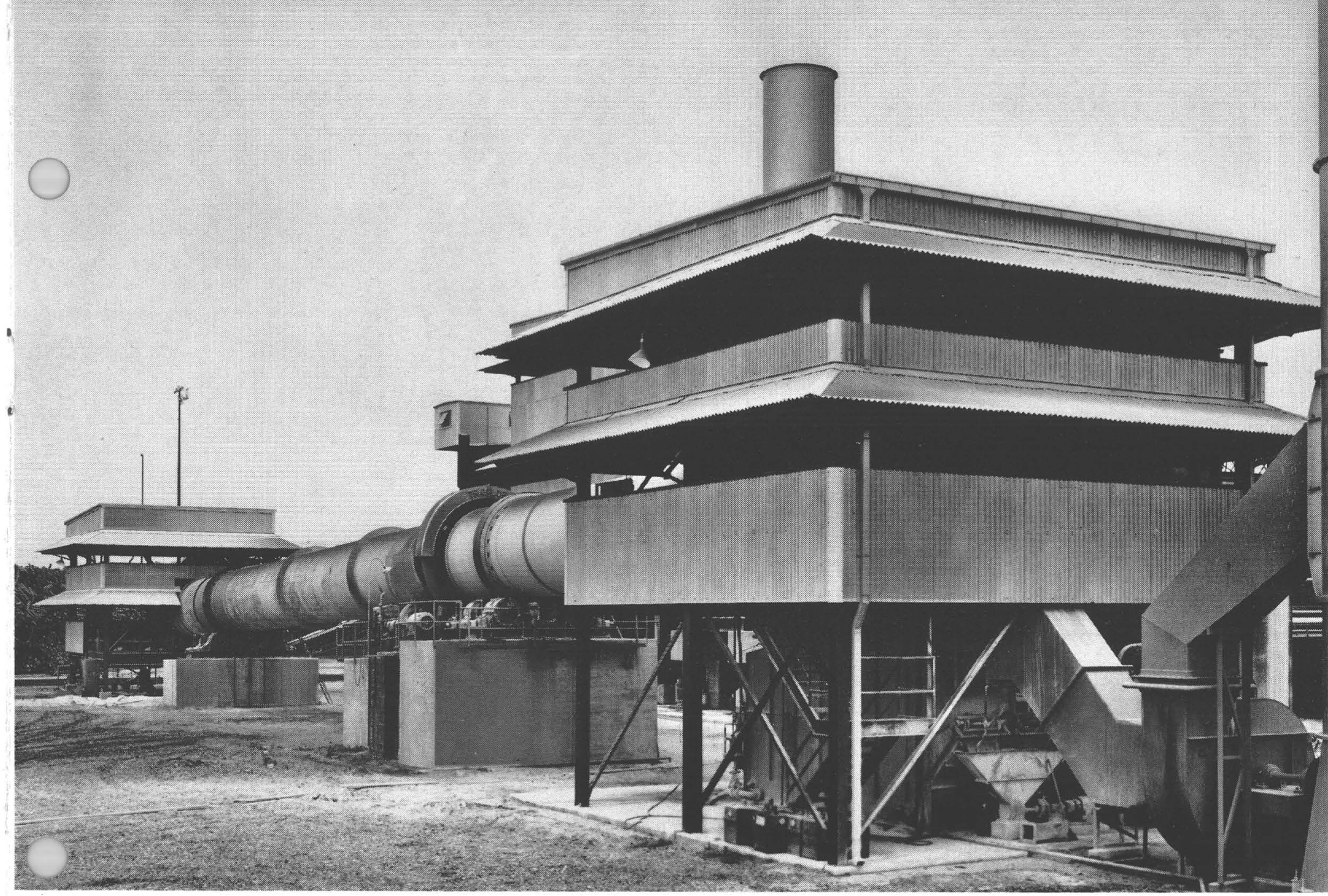
Throughout the travel of the material through the muffle tubes it is directly cooled by the spray pipes. These pipes, depending upon the design and effect to be secured, can be located below the cooler, through the center of the cooler or above the cooler to spray the tubes with water properly and help to cool the material rapidly.

Wherever the spray pipes are located the water discharges from different directions against the tubes and as they rotate out of the range of the water sprays and complete the path of rotation, the moisture evaporates from the outside of the tubes and accelerates the cooling action. Because this evaporation effect is important for the most efficient operation of the cooler, the tubes are preferably left uncovered and exposed to the air in order to promote the free circulation of air into contact with the tubes.

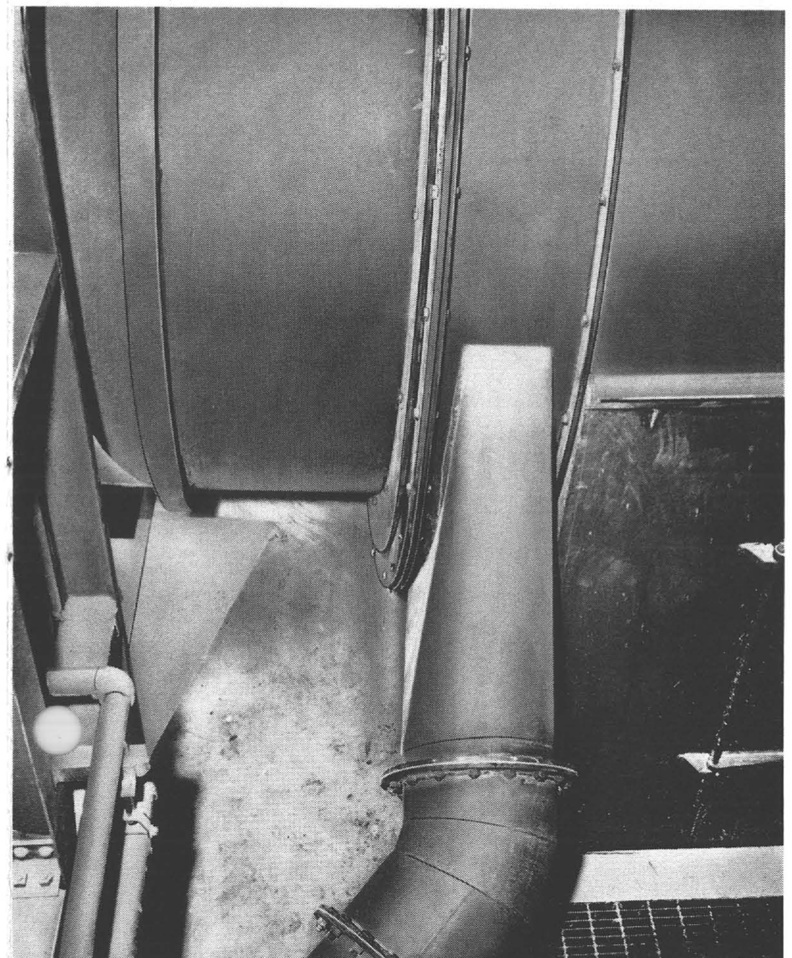
As the cooled material issues from the ends of the muffle tubes it is directed by a deflector piece out through the hollow trunnion and then into the discharge head. From the discharge head the material is led off by way of a chute.

Another design of these special coolers utilizes water, or both air and water together, as the cooling medium or mediums.

In operation, the hot material coming from the rotary kiln is fed through the spout, which is refractory lined, into the



9'-0" dia. x 175'-0" Traylor Rotary Lime Sludge Recovery Kiln at paper mill in Florida, U.S.A.



Discharge End Seals

Many rotary kilns are operated with an opening between the end of the kiln and the kiln hood. However, in order to control combustion in the kiln it is necessary that a seal be provided at this point. The photograph at the left shows a discharge end seal of the labyrinth type which is used in this instance to control the secondary air required for combustion. The secondary air enters the chamber which completely encircles the discharge end of the kiln, thereby distributing the air about the entire circumference of the kiln. This keeps the discharge end of the kiln and the nose ring segments cool and protects the end plates as well as introducing the secondary air equally around the flame for more efficient combustion.

AIR SEALS

In order to prevent, as much as possible, the infiltration of air, various types of air seals have been devised for both the feed end and discharge end of Traylor Rotary Kilns.

All Traylor Rotary Kilns are offered with a feed end air seal, unless otherwise specified.

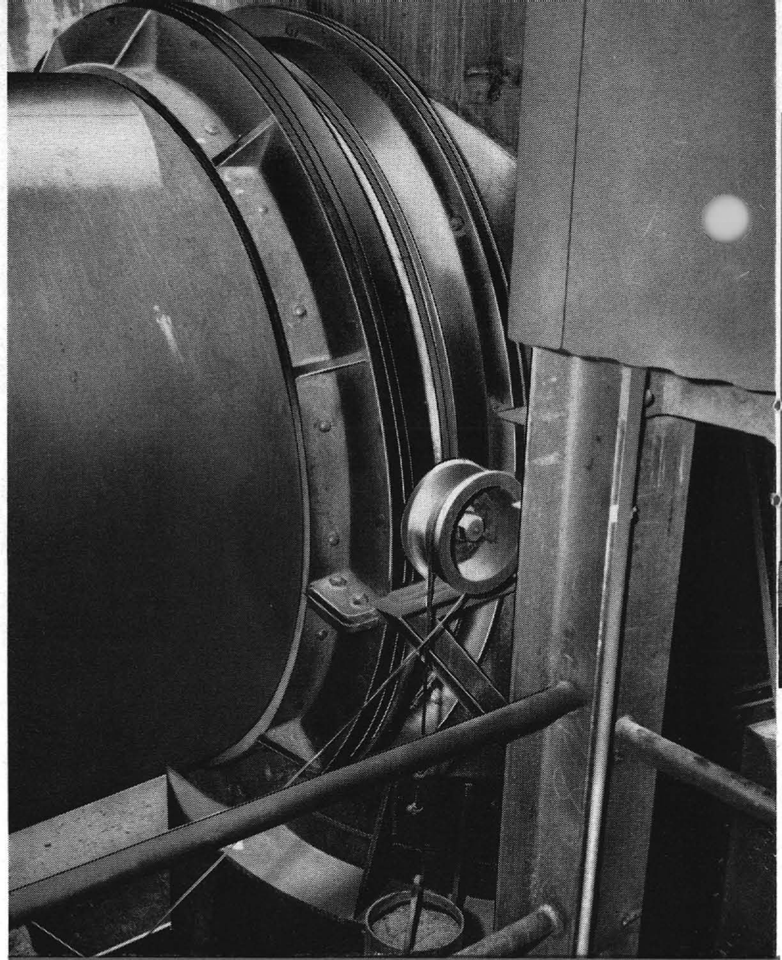
Discharge end seals are only included, when, after a study of conditions, it is decided that a seal at this point would be advantageous.

FEED END AIR SEALS

The standard seal for the cold or feed end of rotary kilns is illustrated in the top photograph.

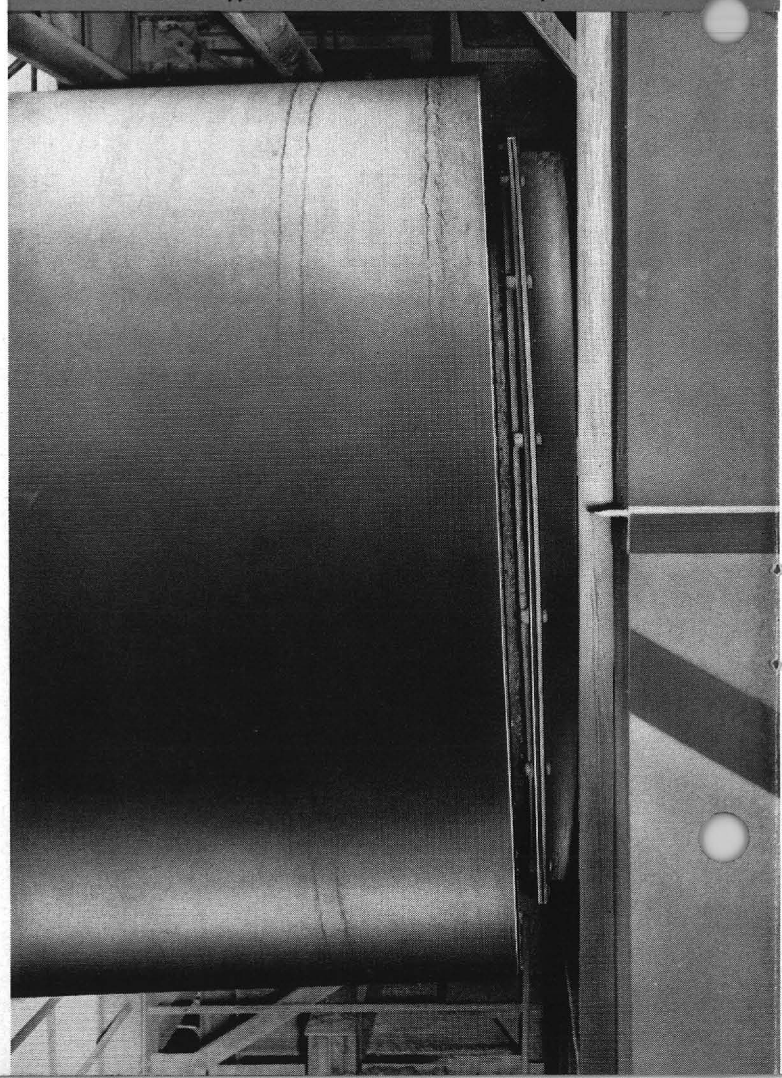
This consists of an angle-shaped nozzle bolted on the housing. One leg is bolted to the housing and the other placed on the same inclination as the shell. An angle-shaped machined floating seal ring casting fits over the nozzle. Wearing plates are bolted to the vertical face. The floating ring is mounted on rollers running on a track and supported on angle brackets. The rollers take a wire rope supporting a counterweight to keep the wearing faces constantly in contact. An angle ring with a machined vertical face is fastened to the shell. This has a segmental wearing ring bolted to its flange. The wearing rings run together, the one revolving with the kiln and the other remaining stationary.

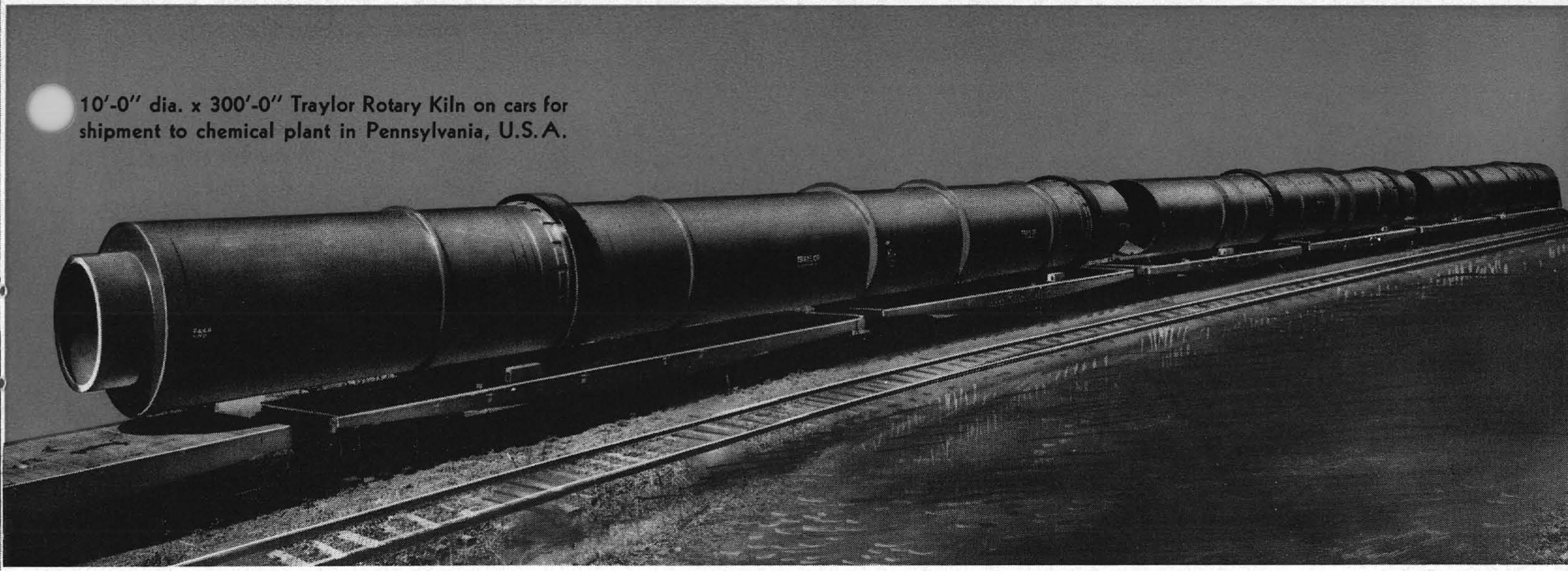
Another type of seal is the labyrinth type illustrated in the lower photograph. This seal consists of a nozzle bolted to the dust housing. A flange, placed on the same inclination as the kiln, is provided for bolting a seal plate to it. A labyrinth, formed by using two annular plates with a spacer between them, all held together with bolts, is mounted on the shell. A drive, consisting of a key welded to the shell and fitted to the labyrinth, is provided.



One type of Traylor Feed End Air Seal for Traylor Kilns.

Another type of Feed End Air Seal for Traylor Kilns.



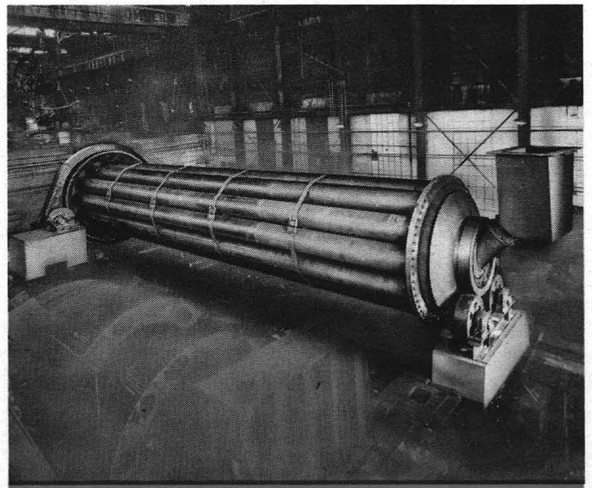


10'-0" dia. x 300'-0" Traylor Rotary Kiln on cars for shipment to chemical plant in Pennsylvania, U.S.A.

material-receiving compartment at the forward end of the drum. From this compartment the material flows into the inlet ends of the muffle tube.

During the period of travel of the material through the forward chamber of the cooling drum, the heat transmitted through the walls of the muffle tubes is carried off by the air by means of a fan of small capacity connected to the pipe leading off from the casing, is drawn into the chamber through the inlet ports and deflected across the tubes by the baffle ring. The highly heated material thus undergoes a gradual cooling and the air entering the casing is heated to a high temperature by reason of its passage into contact with the muffle tubes so that this air may be used in the burner of the kiln for supplying the air of combustion or may be piped to the coal pulverizing mill, such as is frequently provided in conjunction with coal-fired kilns, for drying and preheating the fuel in advance of its delivery to the burner.

The material, after passing through the forward compartment, enters the chamber where the tubes are exposed to the water spray. The spray pipe rotates with the drum and directs jets of water in various directions against the muffle tubes so that the tubes are showered with water throughout their entire period of rotation and the material is rapidly cooled. The water falling into the drum flows out through the drain slots into the basin located below the drum and this heated water may be pumped to other parts of the plant for use in boilers or other appropriate apparatus, or the water may be cooled for recirculation through the cooler.

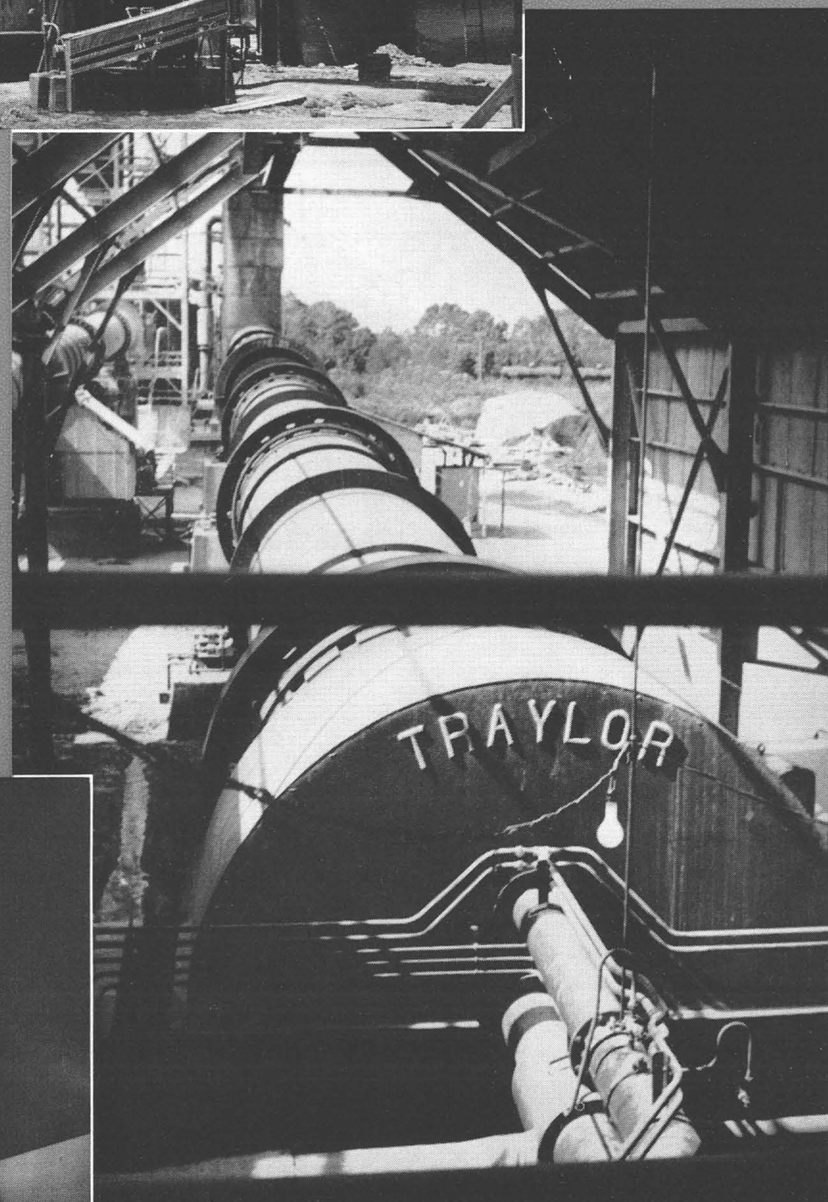


24" dia. x 56'-0" 12-tube Traylor Cooler

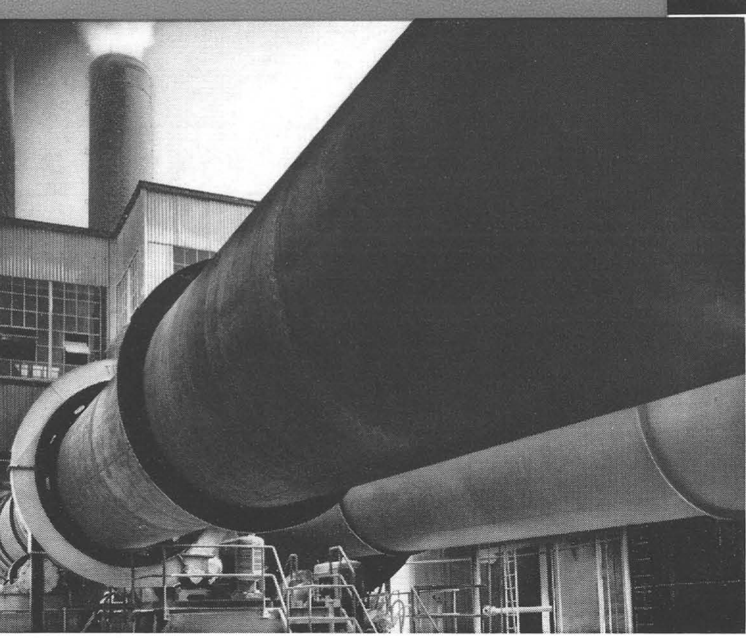
TRAYLOR ROTARY KILNS

Operating on limestone, oyster shells and recarbonated sludge and are

7'-0" dia. x 200'-0" Traylor Rotary Kiln in paper plant in Florida, U.S.A.

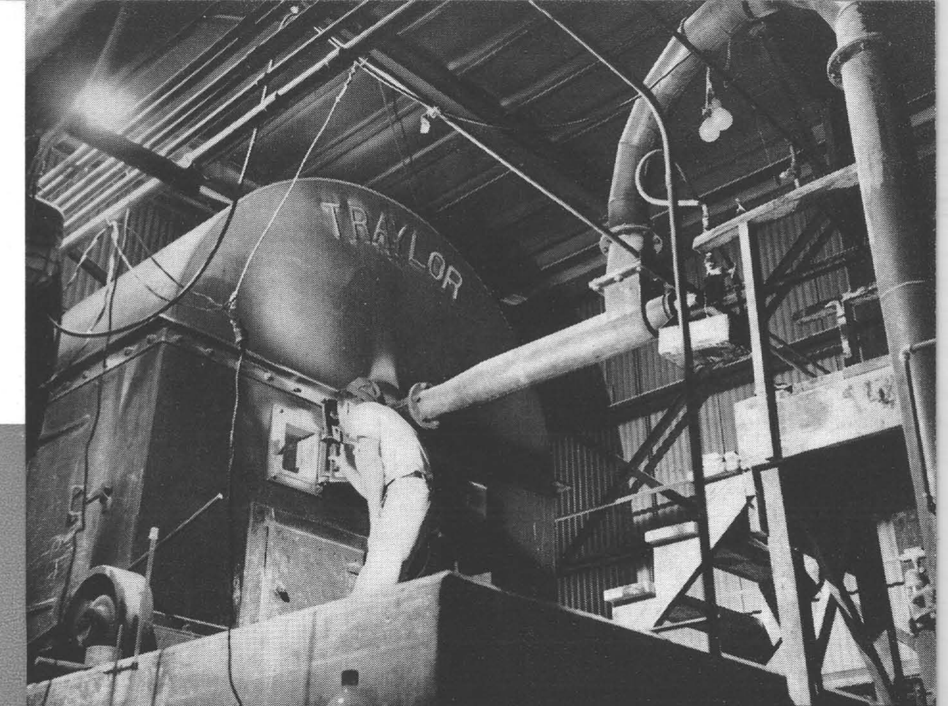


8'-0" dia. x 160'-0" Traylor Rotary Kiln in paper plant in Alabama, U.S.A.

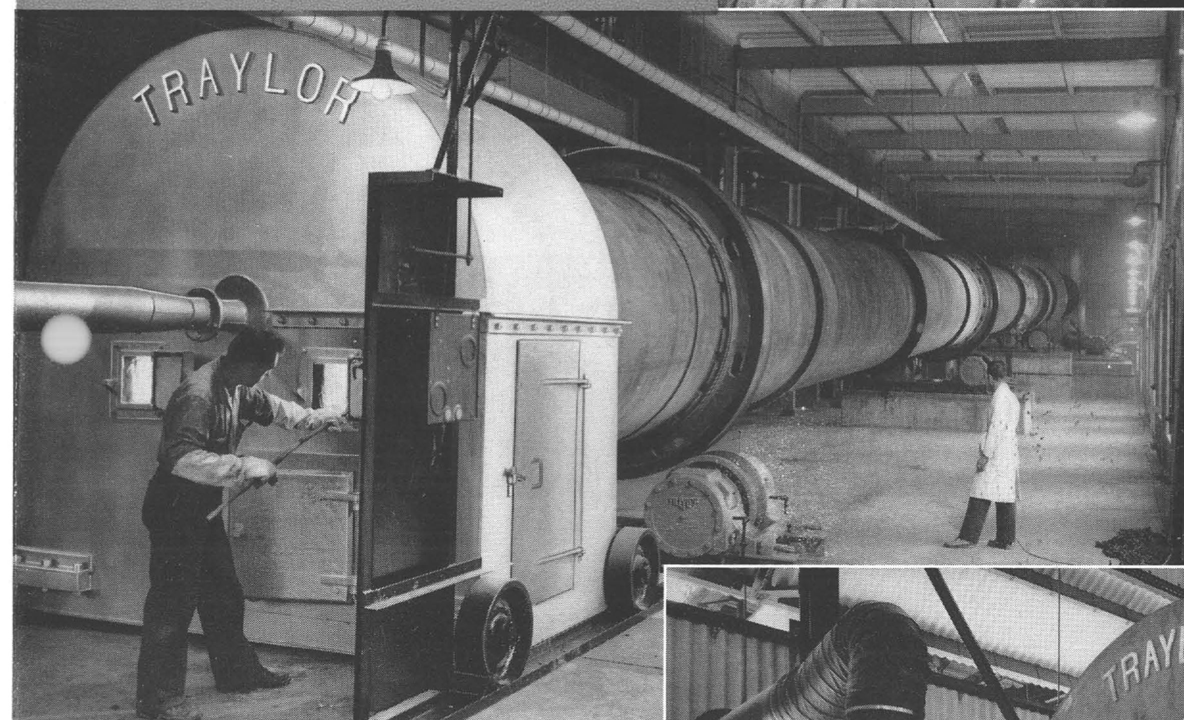


9'-0" dia. x 360'-0" Traylor Rotary Kiln in chemical processing plant in Louisiana, U.S.A.

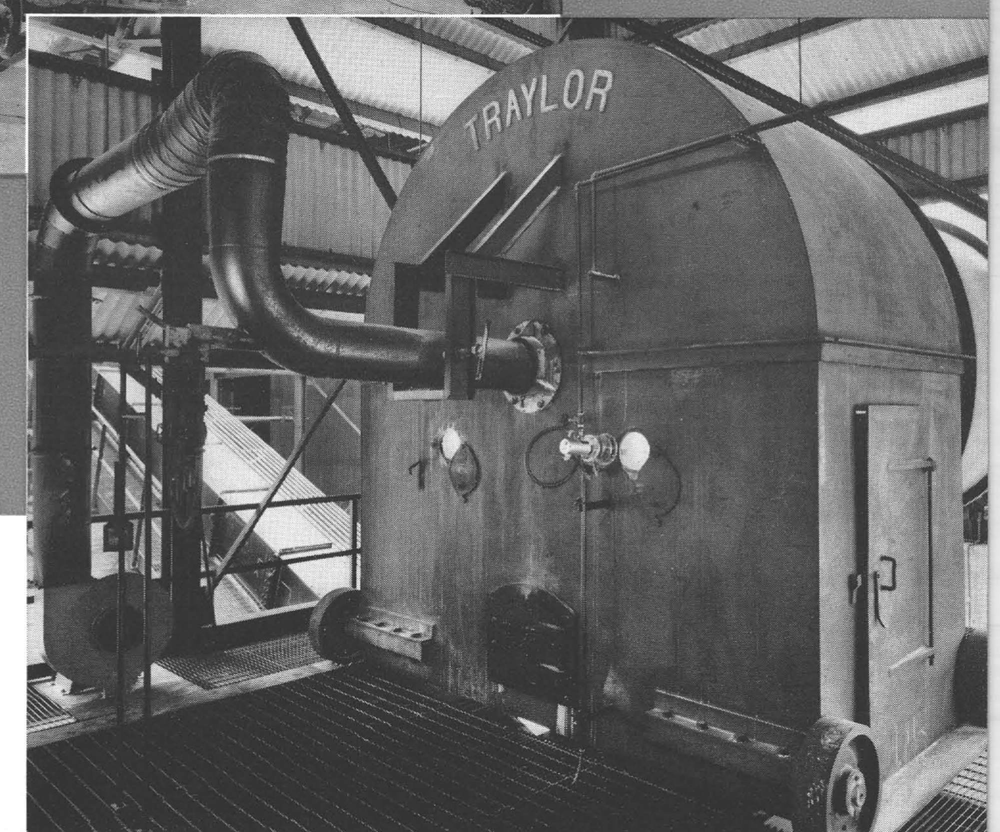
KILN FIREHOODS



Firehood for a 7'-0" dia. x 200'-0" Traylor Rotary Kiln at paper plant in Florida, U.S.A.



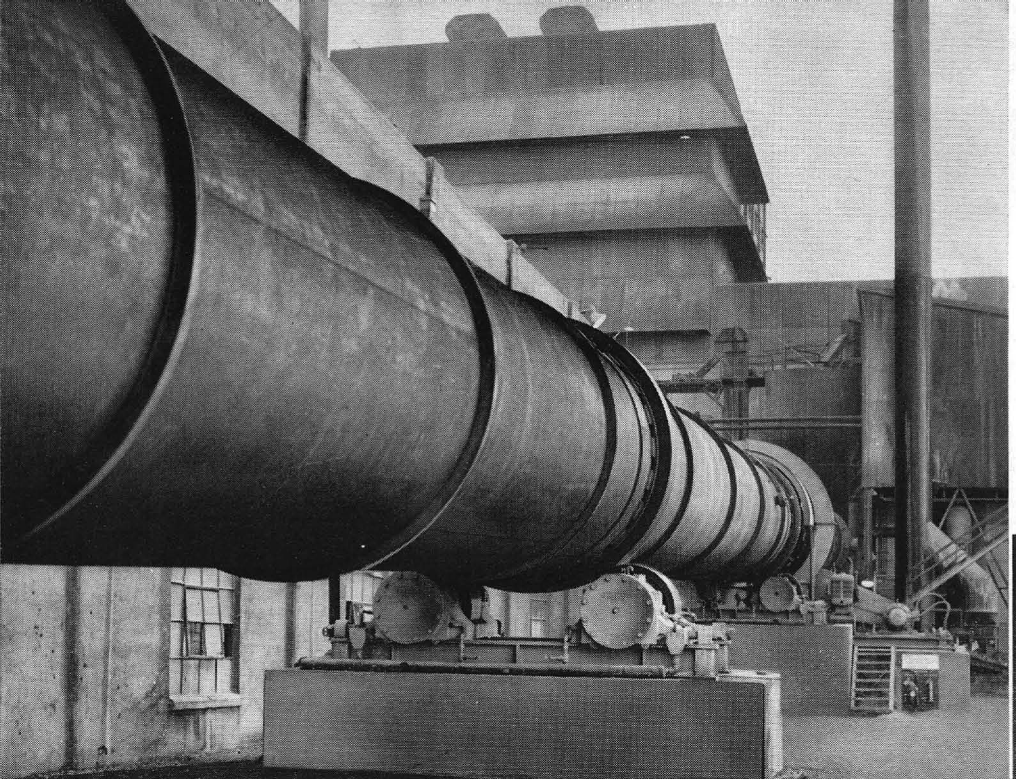
Firehood for a 7'-0" dia. x 250'-0" Traylor Rotary Kiln at paper mill in Washington, U.S.A. Note auxiliary panel board.



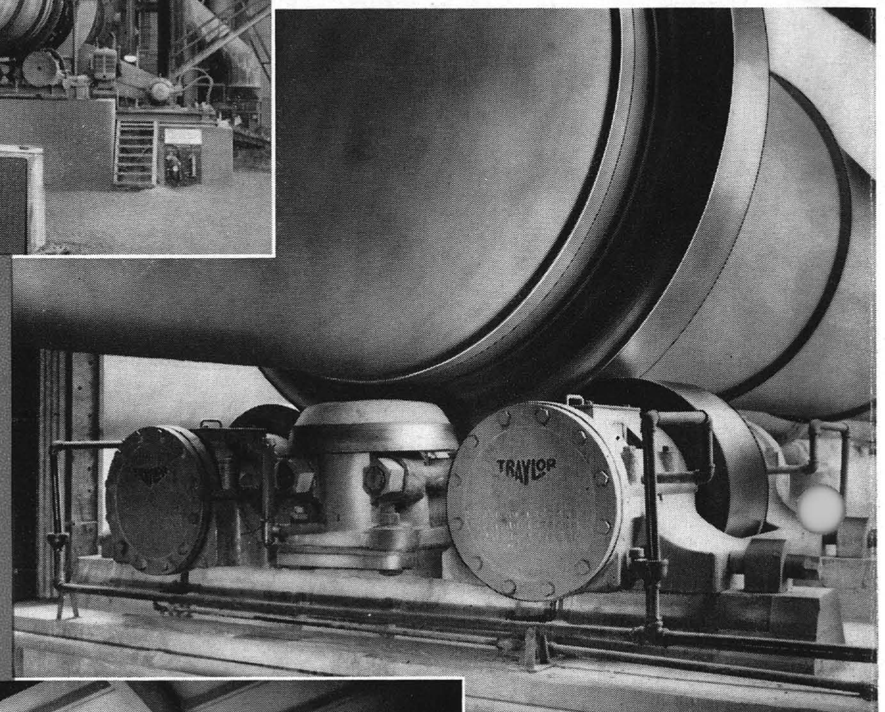
Firehood for a 9'-0" dia. x 175'-0" Traylor Rotary Kiln at a paper mill in Florida, U.S.A.

ROLLER SUPPORTS FOR PRODUCING LIME

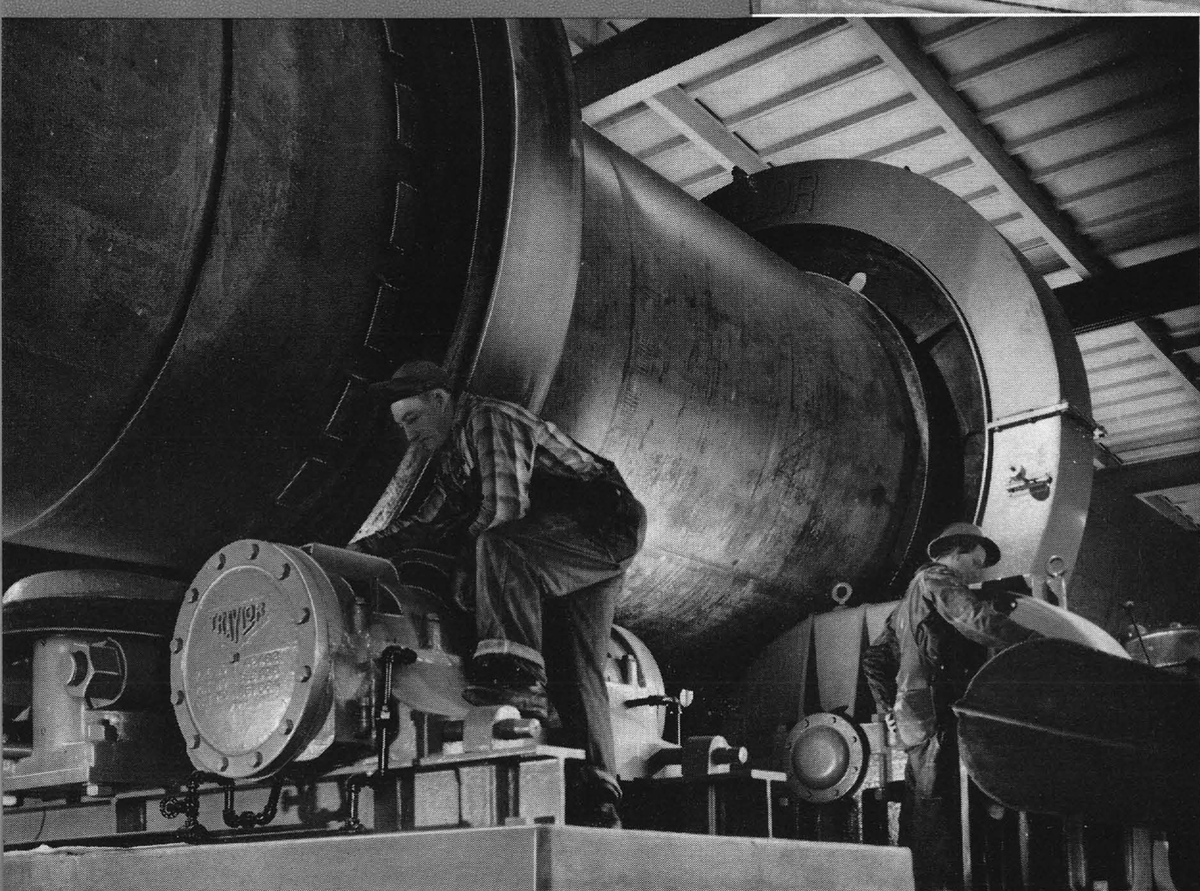
used in basic as well as in chemical processing plants.



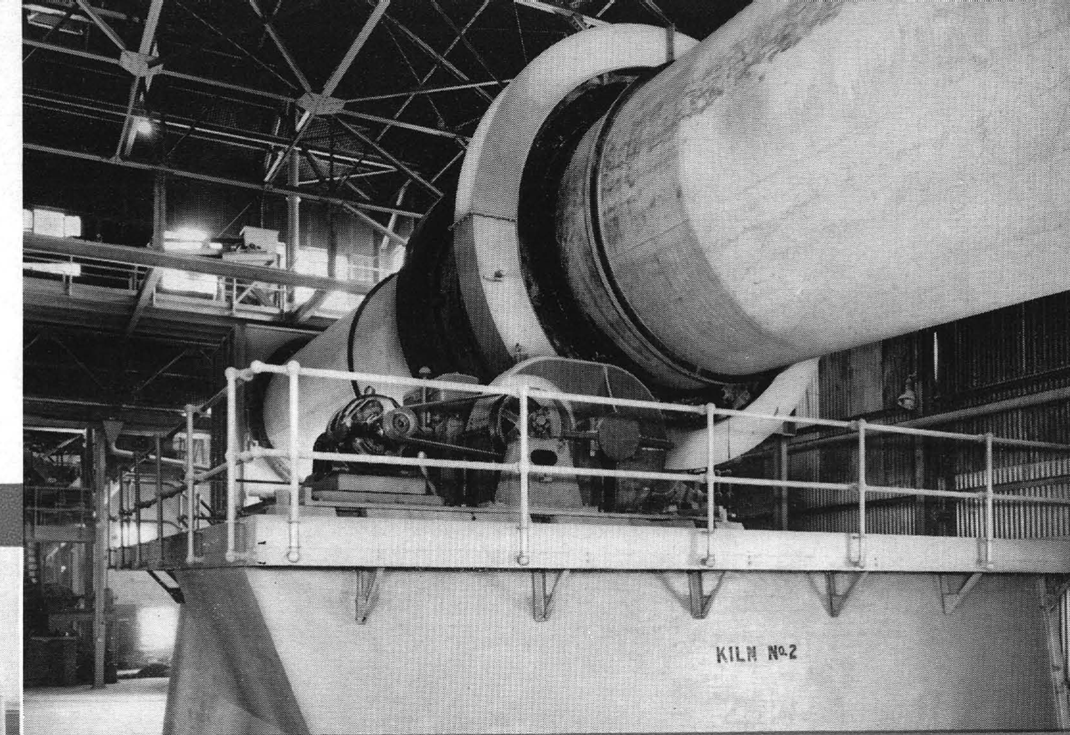
2 Roller Supports of a 4-support 7'-0'' dia. x 250'-0'' Traylor Rotary Kiln in paper plant in Washington, U.S.A.



Thrust roller mechanism of an 8'-6'' dia. to 7'-0'' dia. x 400'-0'' Traylor Rotary Kiln in lime plant in Central Pennsylvania, U.S.A.



Thrust roller mechanism and drive of a 7'-0'' dia. x 200'-0'' 4-support Traylor Rotary Kiln at paper plant in Oregon, U.S.A.



10'-0'' dia. x 150'-0'' Traylor Rotary Kiln in chemical processing plant in Ohio, U.S.A.

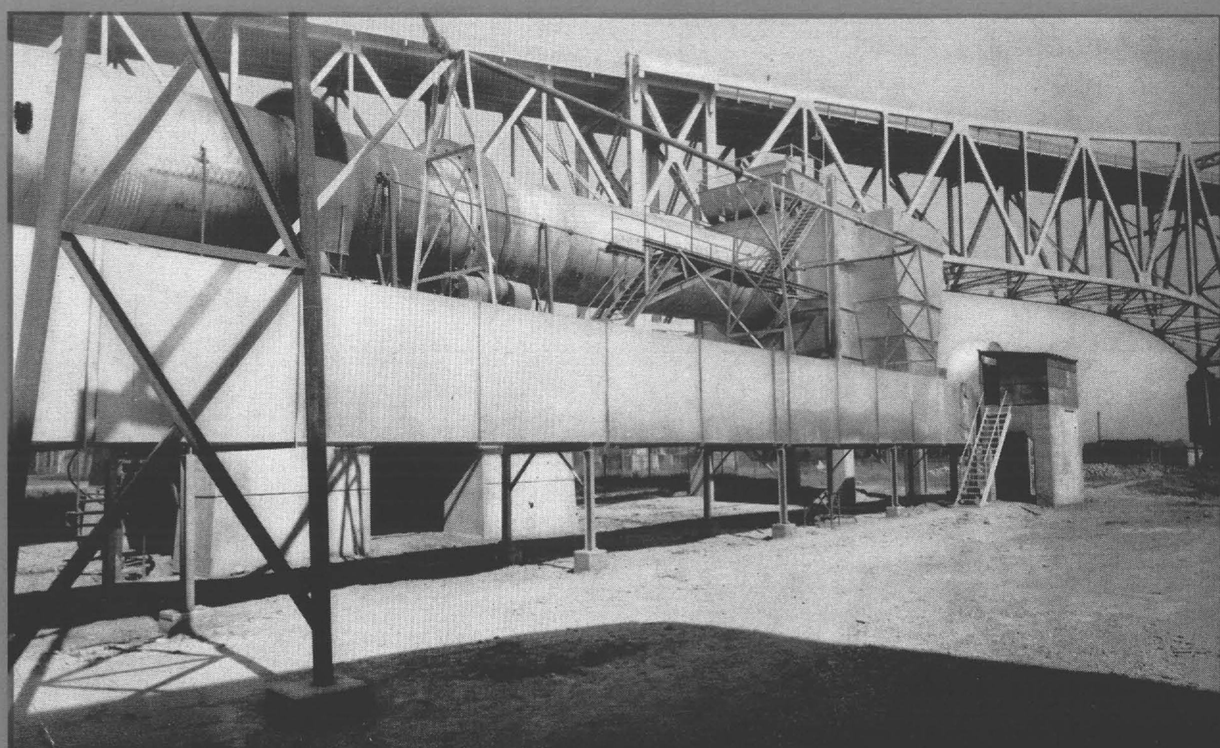
7'-6'' dia. x 315'-0'' and 7'-0'' dia. to 11'-0'' dia. x 190'-0'' Traylor Rotary Kilns in chemical processing plant in California, U.S.A.

2—8'-6'' dia. to 7'-0'' dia. x 400'-0'' Traylor Rotary Kilns in lime plant in Central Pennsylvania, U.S.A.

Because of the rapid cooling of the material in the spray chamber the cooler may be substantially shorter than heretofore when the cooling was done entirely by air, thus providing a more compact and lighter structure, requiring less power for its operation. Furthermore, sufficient heated air is reclaimed from the cooler to meet the normal needs of the plant.

Another form of a combination air and water-cooled cooler is illustrated on Page 20. In this cooler the material to be cooled is continously passed through a series of relatively thin-walled muffle tubes supported in header plates. The tubes are air-cooled throughout a portion of their length and water-cooled for another portion of their length. The air-cooled portion is enclosed within a housing or cylindrical drum, through which a stream of cooling air is passed, and the water-cooled portion of the tubes, located beyond the end of the housing, is exposed to a water spray further to promote the cooling of the material. The air is introduced into the housing under pressure through an intake conduit opening centrally through the back header plate and removed from the housing through an offtake conduit opening through the front header plate. The intake conduit is extended through the water-cooled zone of the cooler and exposed to the water spray for pre-cooling the air prior to its introduction into the housing. The water-cooled muffle tubes are located beyond the housing and open to the atmosphere so that the outside air is free to circulate into contact with the wet tubes and increase, by evaporation, the cooling of the tubes.

The weight of the cooler, in major part, is supported for rotation upon rollers mounted upon a concrete foundation. These rollers engage riding rings placed on the drum. The cooler is rotated by means of a ring gear and pinion driven by a motor through a speed reducer.

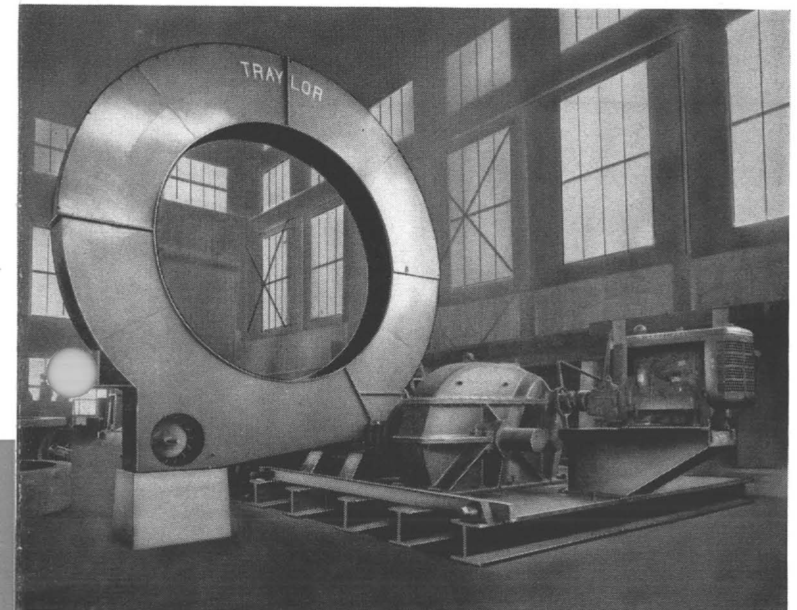


11'-1 3/4" dia. x 400'-0" Traylor Rotary Kiln in portland cement plant in Michigan, U.S.A.

GEAR GUARDS

Standard gear guards are made of steel plate and completely cover both the main gear and pinion and protect them from much of the dust and dirt.

Weatherproof guards, which completely enclose the main gear and pinion, are offered as special equipment, on special request.

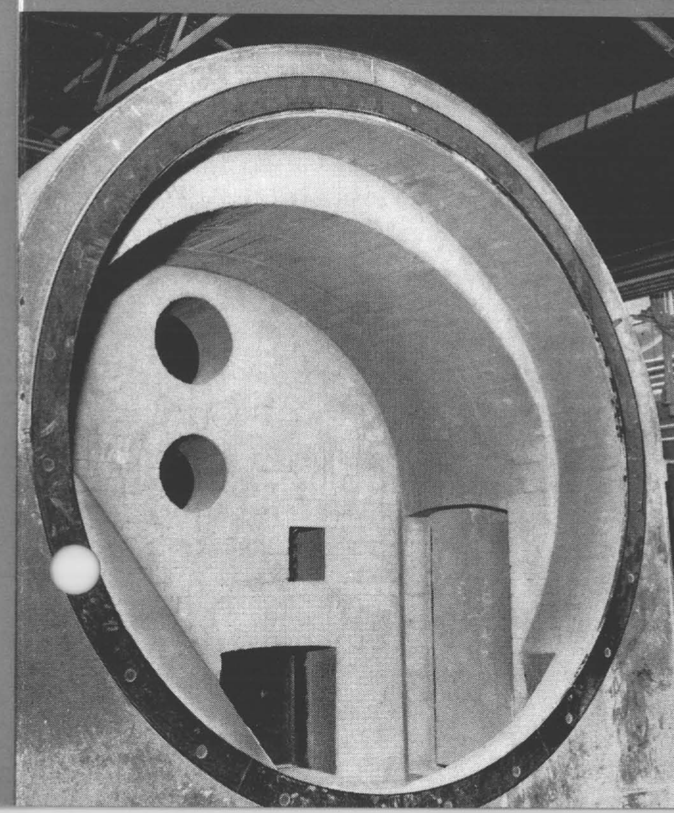


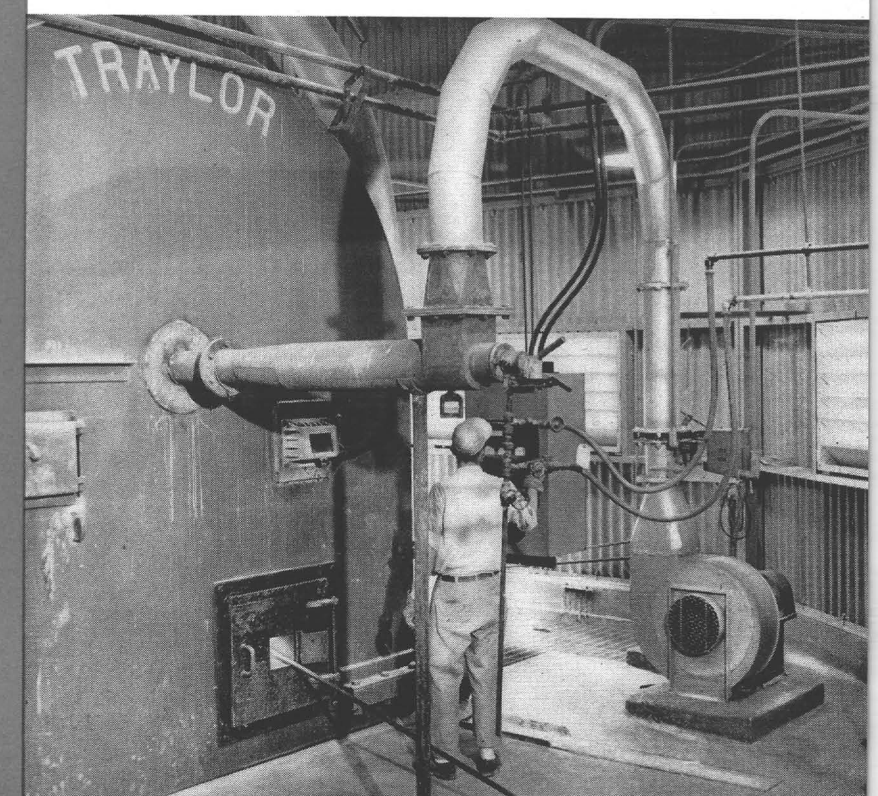
KILN FIREHOODS

The standard firehood for Traylor Kilns is made of steel plate of welded construction. It is made to size so as to allow the discharge end of the kiln to project inside of the hood so that the material is dropped directly into the discharge opening provided in the bottom. See illustration below.

In the front face there are openings for (1) the burner pipe, (2) clean-out door, (3) observation holes, (4) any other openings that may be required, such as secondary air pipe, radiation pyrometers, etc. It is also equipped with a clean-out door at the bottom of the front of the hood.

An access door is placed in the side of the kiln hood. This is large enough so that most of the refractory repairs and other necessary maintenance to the kiln can be made through this door. A door of this type makes it generally unnecessary to disconnect piping or roll the kiln hood backwards for normal maintenance and saves considerable time and expense.





Drive and auxiliary unit for a 7'-0" dia. x 300'-0" Traylor Rotary Kiln at paper mill in Florida, U.S.A.

for proper operation they should not have to be touched. With an adjustable base under the driving unit it is easy to compensate for wear, etc., by doing all of the adjusting at one point, namely, the drive base. See above.

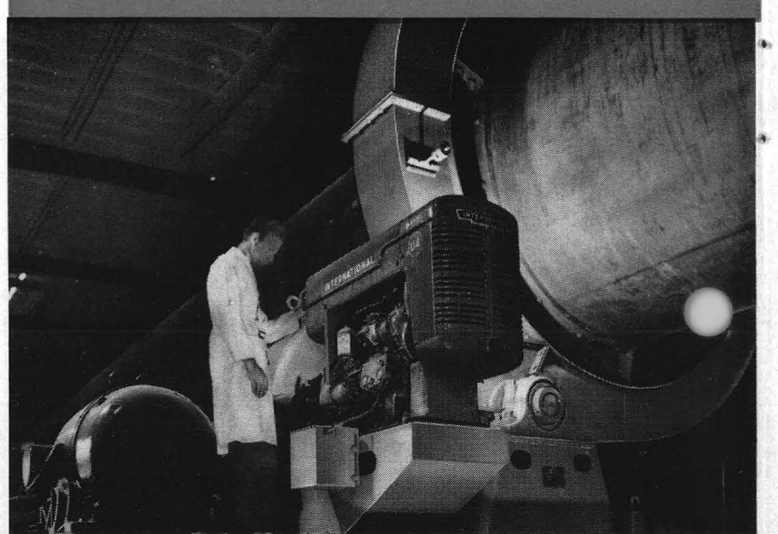
An auxiliary gasoline power unit, as shown in both photos, is recommended on all multiple support kilns to rotate the kiln at slow speeds in the event of power failure.

For rotary kilns or other rotary units with two supports it is not considered necessary to provide an adjustable base upon which to mount the driving unit for the reason that to keep the gears in mesh only two supports must be adjusted. Therefore, this type of drive is provided with a sole plate which is not adjustable.

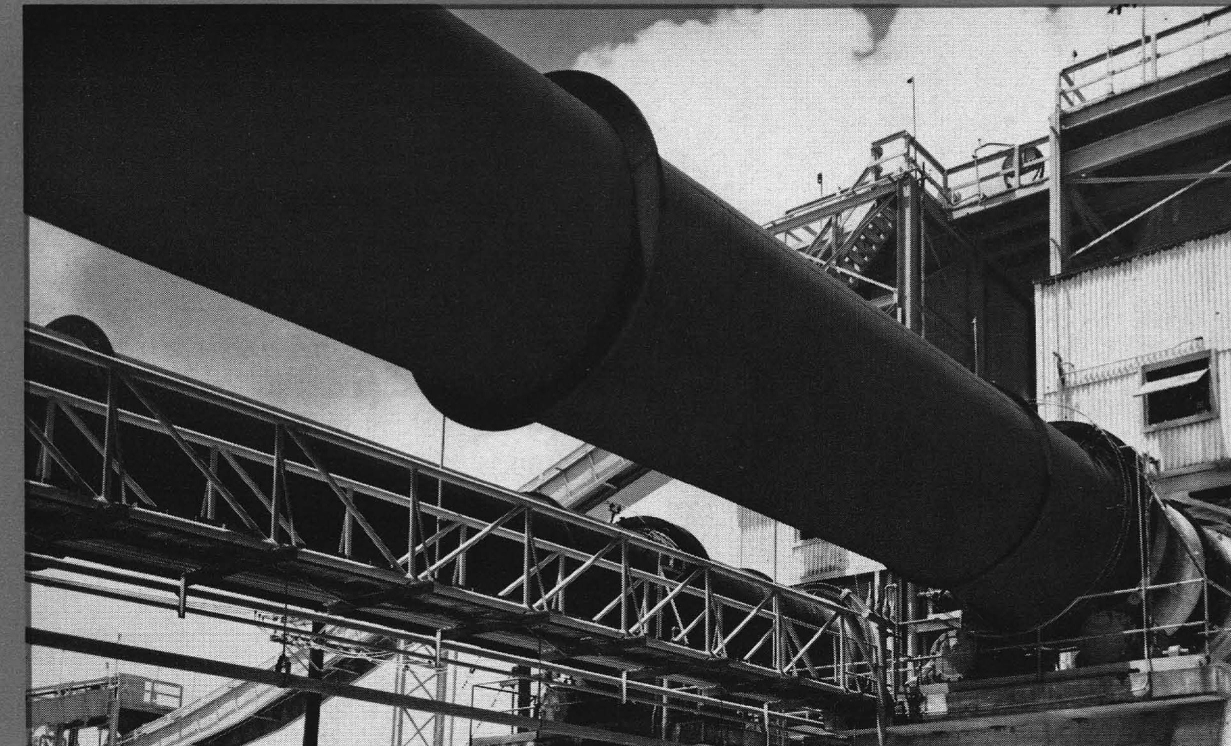
All drives may be arranged for direct connection to the motor through a coupling or provided with a V-belt drive.

Several other designs of drives are employed for special operating conditions.

Auxiliary drive on a 7'-0" dia. x 250'-0" Traylor Rotary Kiln in paper mill in Oregon, U.S.A.



2—8'-0" dia. x 300'-0" Traylor Rotary Kilns in chemical processing plant in Texas, U.S.A.



ROTARY DRYERS

Traylor Rotary Dryers are similarly constructed to Traylor Rotary Kilns and Traylor Rotary Coolers. In the fabrication of the shell, design and assembly of the riding rings, supporting rollers and girth gears, the same care and precision methods of manufacture are employed.

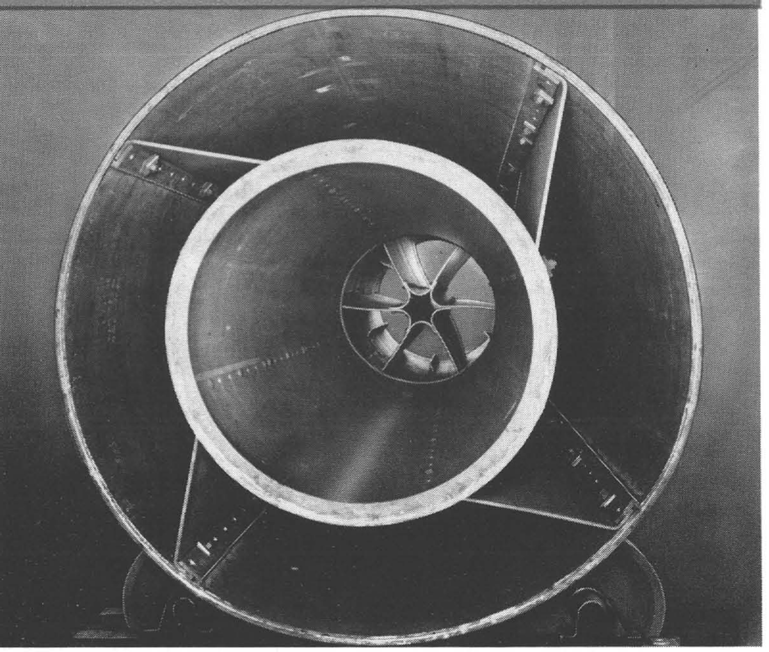
Traylor Rotary Dryers are of two types—Indirect Fired and Direct Fired. The first named is for use in drying materials that must not be contaminated by the products of the combustion of the drying fuel, or in cases where the gases of the material being dried, such as coal, might ignite from the sparks of combustion. The Direct type, which is the more efficient of the two, is used in cases where the restrictions mentioned do not apply.

Traylor Indirect Fired Dryers are of three designs—(I) with inner and outer shells, (II) with a single shell completely enclosed in a stationary housing of brick or other construction, and (III) with a number of tubes contained within an outer shell. In any of these designs, a firing chamber is provided, under or at the feed end of the dryer, using any type of fuel.

In the double shell dryer (I) the material being dried is contained in the outer shell, while the gases pass through the inner shell to its end, which is slightly inside of the end of the outer shell. At that point all danger of "flashing" from sparks having passed, the gases enter the outer shell, reverse their direction and flow countercurrent to the material, to the exit point at the feed end of the dryer.

In the housed dryer (II) the gases surround the single shell containing the material and enter the shell at the discharge end after danger from "flashing"

9'-0" dia. x 70'-0" Traylor Dryer for cement plant in Chile, South America.

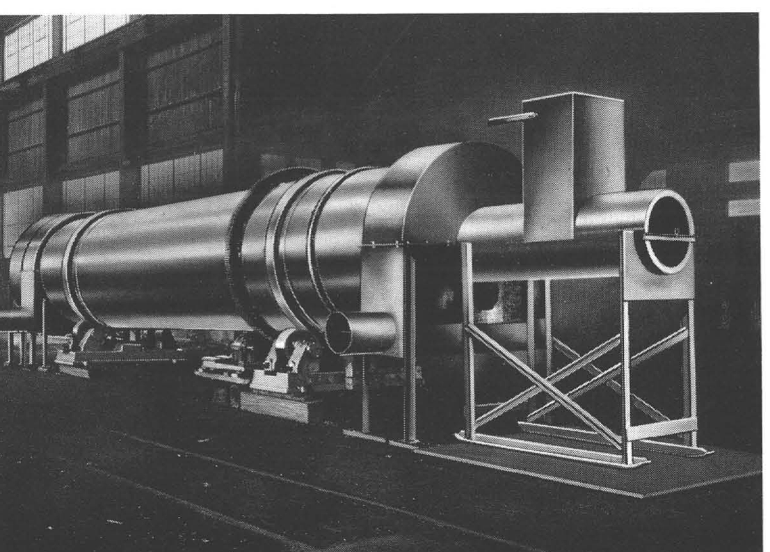


is past. Then the gases flow countercurrent to the material, to the exit point at the feed end.

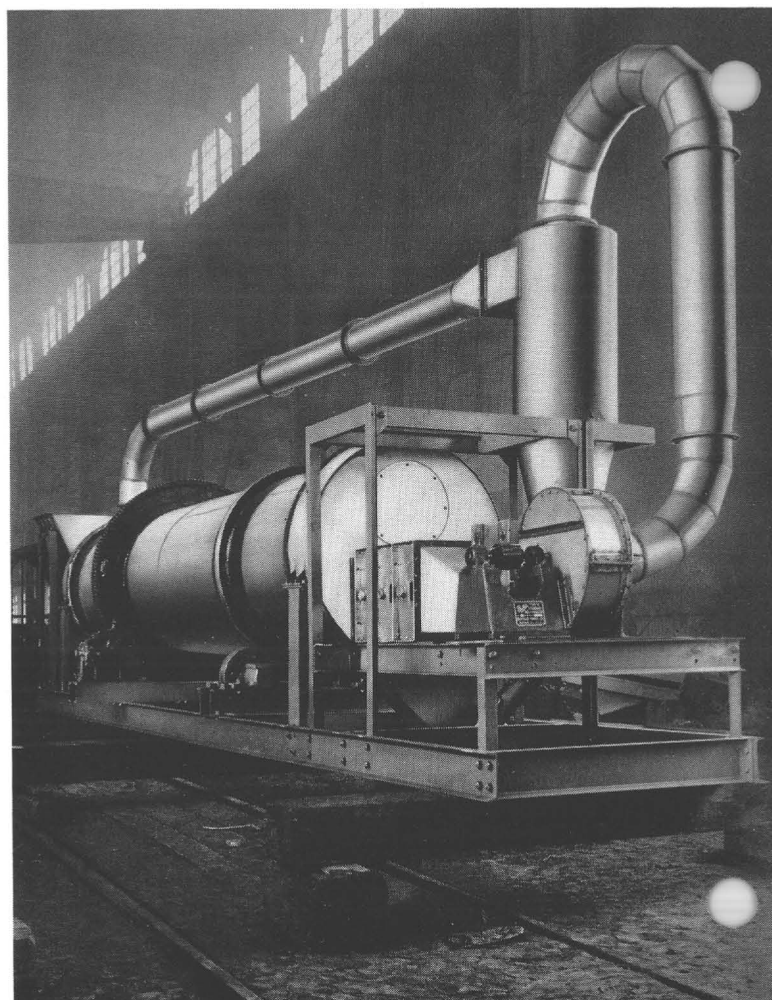
The tube dryer (III) is of a construction similar to the multi-tube cooler described on Pages 20 and 21 of this bulletin and is designed for handling materials which might become contaminated by contact with the combustion gases.

In all of these designs, lifters, set in a sharp spiral, are provided at the feed end of the dryer, to facilitate entry of the material into the shell, and others, set at a lesser angle, throughout the balance of the shell, to shower it freely while advancing.

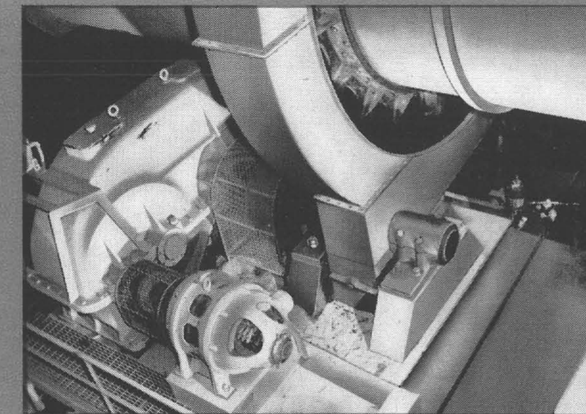
Traylor Direct Fired Dryers, or those into which the heat is introduced directly, are of two general designs—(I) those having a furnace at the discharge end open to the shell and (II) those having an inner brick-lined fire tube projecting for some distance in from the discharge end. In the first of these designs (I) the furnace may be of the stationary type, arranged for coal, oil or gas firing, or the furnace may have the form of a portable combustion chamber, attached to the discharge end of the dryer with a suitable air seal. Combustion chambers may be arranged for pulverized coal, oil or gas firing.



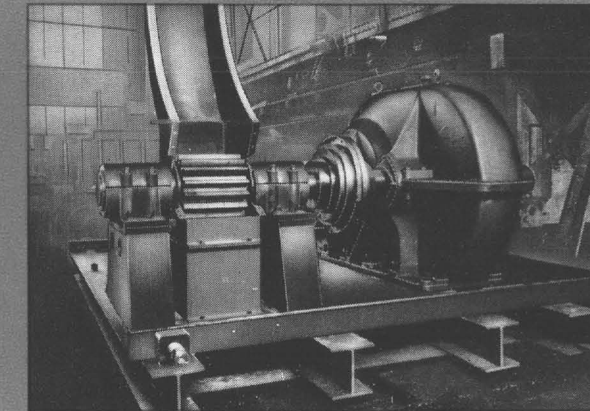
6'-6" dia. x 35'-0" Traylor Special Dryer for chemical processing plant in North Carolina, U.S.A.



4'-0" dia. x 20'-0" Traylor Special Dryer for chemical processing plant in Argentina, South America.



Drive of an 11'-0" dia. x 400'-0" Traylor Rotary Kiln, showing jackshaft mounting of pinion with bearings on each side.

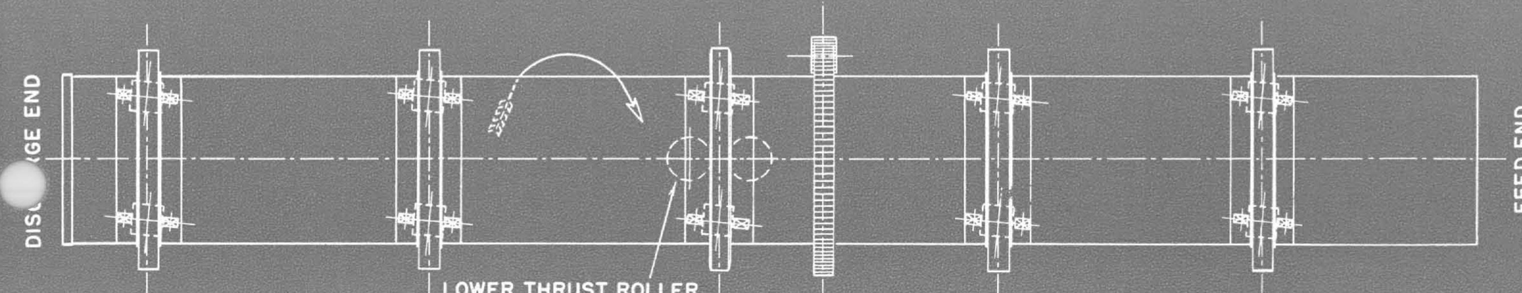


Shop view of jackshaft pinion mounting with the gear guard removed.

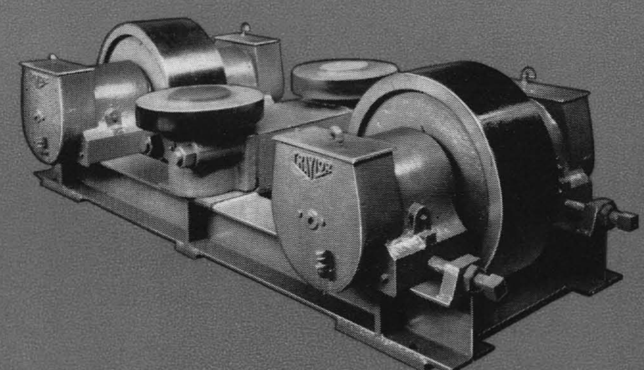
KILN DRIVES

Rotary units are revolved by means of a train of spur gears. The main or girth gear of a rotary kiln is mounted on an inverted section gear-holding flange, made in halves and usually of cast steel, and is fastened to the shell close to the thrust riding ring, which is located near the middle of the kiln to maintain proper longitudinal mesh with the pinion. The teeth are machine-generated with high addendum and the gear flange is faced on both sides, making the gear reversible so that both faces of the gear teeth may be used. The main pinion is of cast, forged or tool steel with low addendum machine-generated teeth and is fitted and keyed to the slow speed shaft extension of the speed reducer or mounted on a jackshaft connected by a coupling to the slow speed shaft of the reducer. All gears are of heavy proportions to take care of shock load, wear and life expectancy.

The use of long kilns for fuel economy requires a multiple number of riding rings and supporting rollers. For efficiency in operation, provision should be made to adjust the main gear and pinion without regard to the level of the kiln shell or adjustment of the supporting rollers. Therefore, an adjustable base is recommended as standard construction under the complete driving mechanism unit. It is difficult to keep the gear and pinion in proper mesh by changing the roller supports as once these supports are set



Each kiln is equipped with one set of thrust rollers located near the middle of the kiln.



Support mechanism for coolers, dryers and slakers.

7'-6" dia. x 315'-0" Traylor Rotary Kiln for lime burning in South American mining plant.

obtained. With this type of construction the two bearings must maintain perfect alignment with the shaft, regardless of the point on the surface of the roller where the maximum pressure is exerted by the moving kiln.

The base of each bearing is cored out to hold a large supply of oil and is water-jacketed for cooling the oil.

The oil is lifted by means of a bucket wheel which delivers it to a distributing pan so as to flood it over the entire length of the shaft. The design of this oil well and the oil distribution are shown in the drawing on Page 7.

One set of roller bearings in each kiln assembly is always equipped with a pair of thrust roller bearings (one horizontal roller on each side of the riding ring or tire) to prevent the kiln moving uphill or downhill. Standard practice is to counteract this movement or end thrust by a slight adjustment or skewing of the supporting rollers. (See below). However, the thrust bearings can be designed to carry the full thrust of the kiln with the supporting rollers running parallel.

The thrust rollers in most instances are conical to insure true rolling contact on the riding ring which is tapered on both side faces. They are large in diameter and have wide surfaces so that the full face of the roller is in contact with the tire at all times.

Traylor also makes three other designs of roller supports which are used on dryers, coolers and slakers—one is a self-oiling type—another a grease lubricated type and the third is fitted with double Timken bearings—for either oil or grease lubrication.

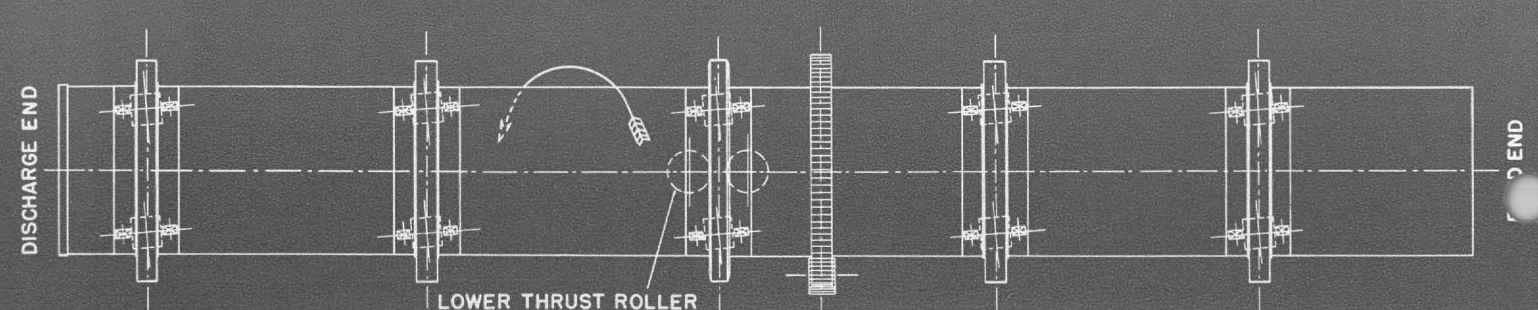


Diagram showing method for adjusting roller supports to prevent uphill or downhill movement of the kiln.

In the second of the designs mentioned (II) the fire tube communicates with a furnace, or it may be used as a combustion chamber with a burner for pulverized coal, oil or gas. The function of the fire tube is to project the heat further into the dryer toward the feed end than is possible without it in order to aerate and cool the material passing through the annular chamber surrounding the fire tube.

Traylor Dryers of the two designs just described are divided into chambers by diaphragms, except for a short distance just inside of the feed end, which is blank and brick-lined. Lifters are welded to the diaphragms and the shell is provided with inclined lifters for advancing and turning the material as has been described previously.

Any Traylor Dryer providing for counterflow of the combustion gases, except the last one described, may be arranged for parallel flow, to meet special conditions, by locating the furnace at the feed end.

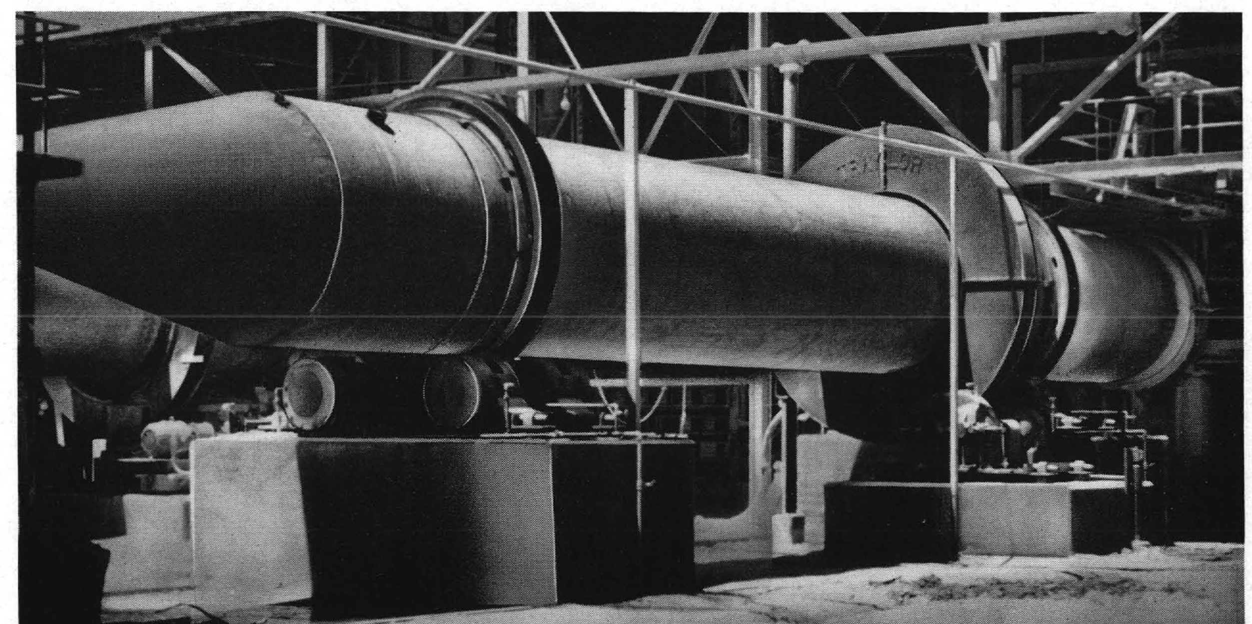
All Traylor Rotary Dryers are designed for use with the usual dust chamber and stack. An exhaust fan may also be provided at extra charge.

SLAKERS

Traylor Lime Slakers are of the rotary double shell or drum type and designed to handle either cold lime or lime as it is discharged from the kiln at temperatures up to approximately 1800°F. These slakers are also designed to produce, in the first step, a lime putty, and in the second step, to dilute the lime putty to milk of lime of any consistency desired. The actual slaker temperature and the diluting temperatures are mechanically controlled by thermocouples placed in the lime putty zone and in the milk of lime discharge. The slaker not only controls the settling rate of the resultant particles of lime but also acts as a classifier to eliminate grit or sediment, and discharge it from the system. All Traylor Slakers are built to specification and to fit the particular job for which they are intended.

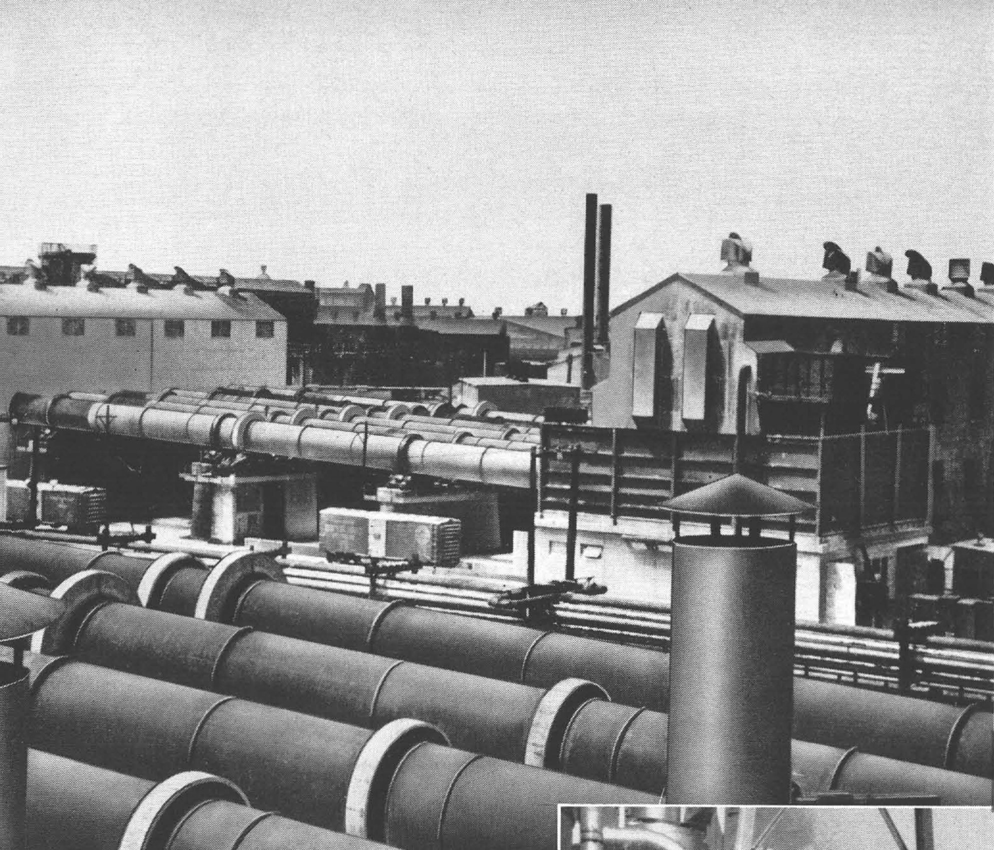
The brief specifications following will serve to acquaint the reader with the construction of these slakers.

The main shell or drum is made of heavy steel plate of the same full welded construction as all Traylor Kilns, Coolers



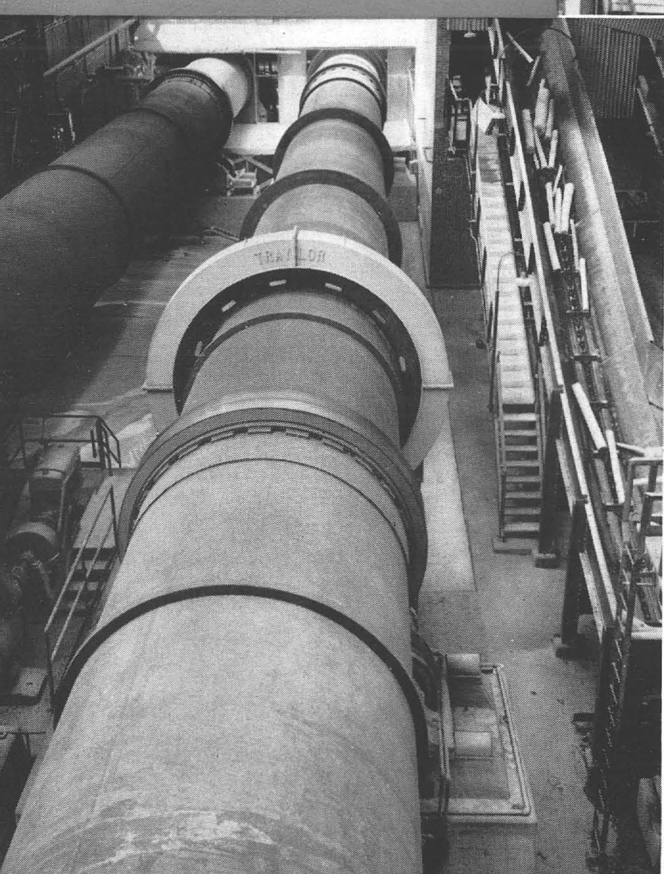
One of two 7'-0" dia. x 69'-0" Traylor Rotary Slakers in chemical processing plant in Louisiana, U.S.A.

TRAYLOR KILNS IN CHEMICAL PROCESSING PLANTS



2 batteries of 9'-6" dia. x 250'-0" Traylor Rotary Kilns in chemical processing plant in Arkansas, U.S.A.

11'-0" dia. x 100'-0" Traylor Rotary Kiln in chemical processing plant in California, U.S.A.



8'-0" dia. x 160'-0" Traylor Rotary Kilns in paper mill in Alabama, U.S.A.

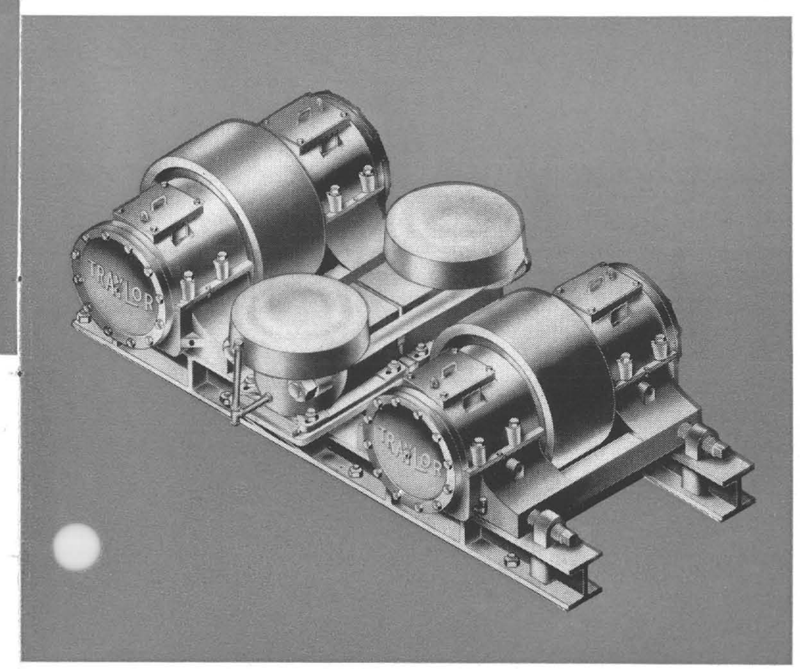
in number, depending upon the length of the kiln. We recommend, for use on kilns, coolers, dryers and slakers, the "full-floating" type of tire. The special mounting of these tires holds them securely in place relative to the roller supports but permits them to float free of the shell as it contracts and expands. Traylor tires have wide faces and are made of machined steel. They are either cast steel box section or cast or forged steel solid section.

It is necessary, at times, to replace worn or broken tires. To eliminate the necessity of cutting the kiln shell to remove the tire, rewelding and realigning it after the new tire is installed, sectional tires have been designed by Traylor engineers. One of these is a tire cast in two pieces with the abutting joints machined so as to form a self-locking joint. Another is made in four pieces, divided into halves circumferentially, and each of these halves divided longitudinally with tongue and groove joint.

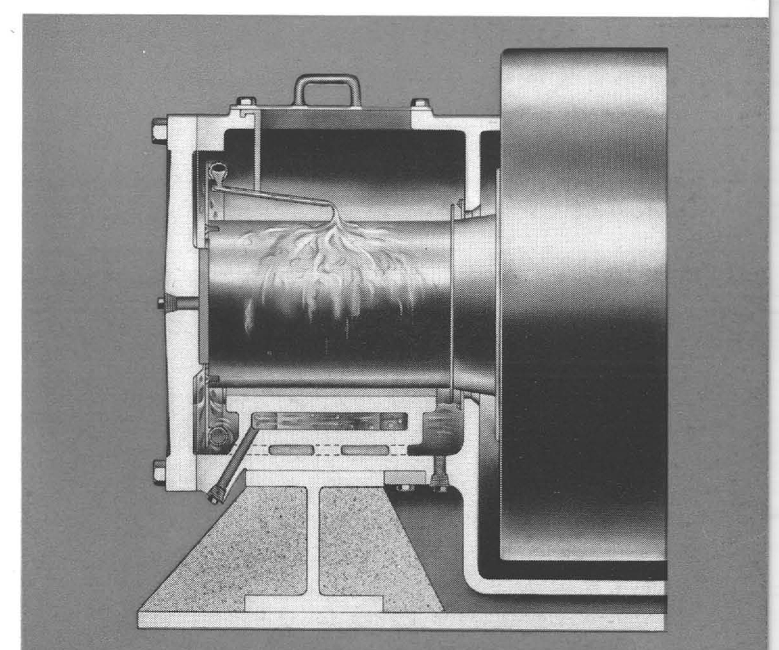
ROLLER SUPPORTS

The efficiency of modern rotary kilns is due, in no small measure, to the roller supports on which they run. Easy alignment, continous operation and low maintenance are highly important for modern heavy multi-support rotary kilns. Traylor engineers pioneered in the design and perfection of the easy aligning, single roller supports, used on Traylor Rotary Kilns, Coolers, Dryers and Slakers.

The standard roller support is the two-roller type, as illustrated below, made with cast steel or forged steel rollers mounted on forged steel shafts. The bearing bases are cast integrally and are very heavy. Note that each of the two bearings supporting the roller are tied together so that a rigid mounting is



Thrust roller mechanism which is located near the middle of kiln.



View of oil reservoir and oiling mechanism distributing oil over the shaft in a Traylor Single Support Roller Bearing.

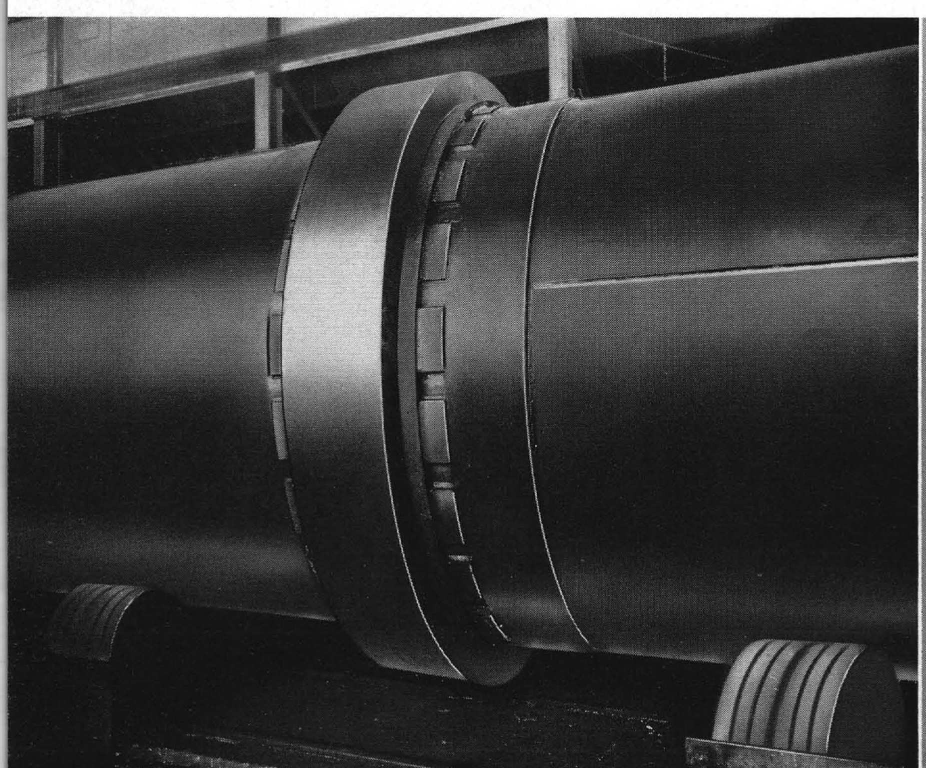
Kiln section mounted on cars ready for shipment. Note—riding rings and gear flange assembled in our plant. Shell is ready to place on support rollers.

TIRES OR RIDING RINGS

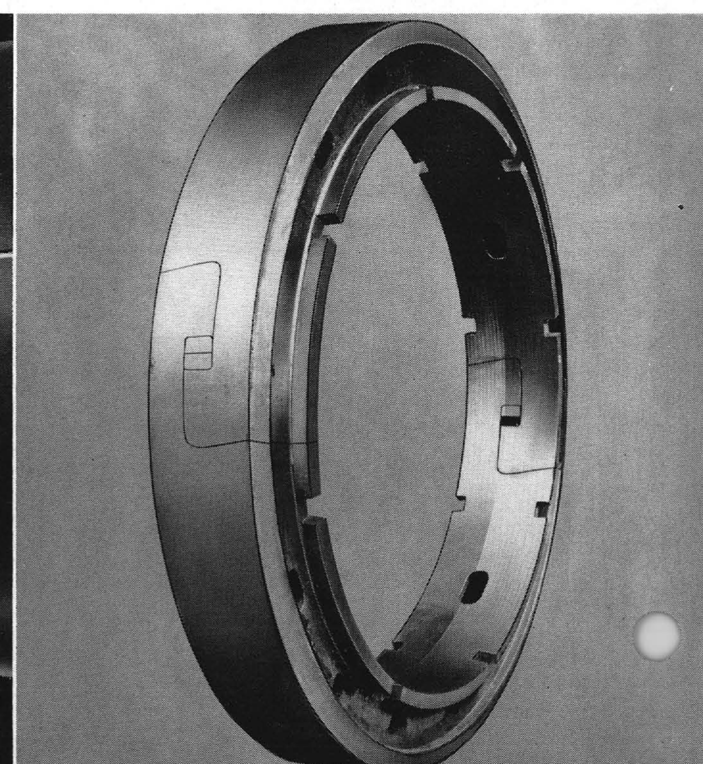
Heavy machined steel tires or riding rings are a very necessary and important part of every rotary kiln, especially on the longer multi-support kilns which are being used to a greater extent in many of the process industries.

The type of tires or riding rings supplied with a Traylor rotary unit is selected after a study has been made of the conditions under which it must operate. Traylor equips all of its kilns and other rotary equipment—coolers, dryers and slakers—with the best type of tires for the service which the machine is to render.

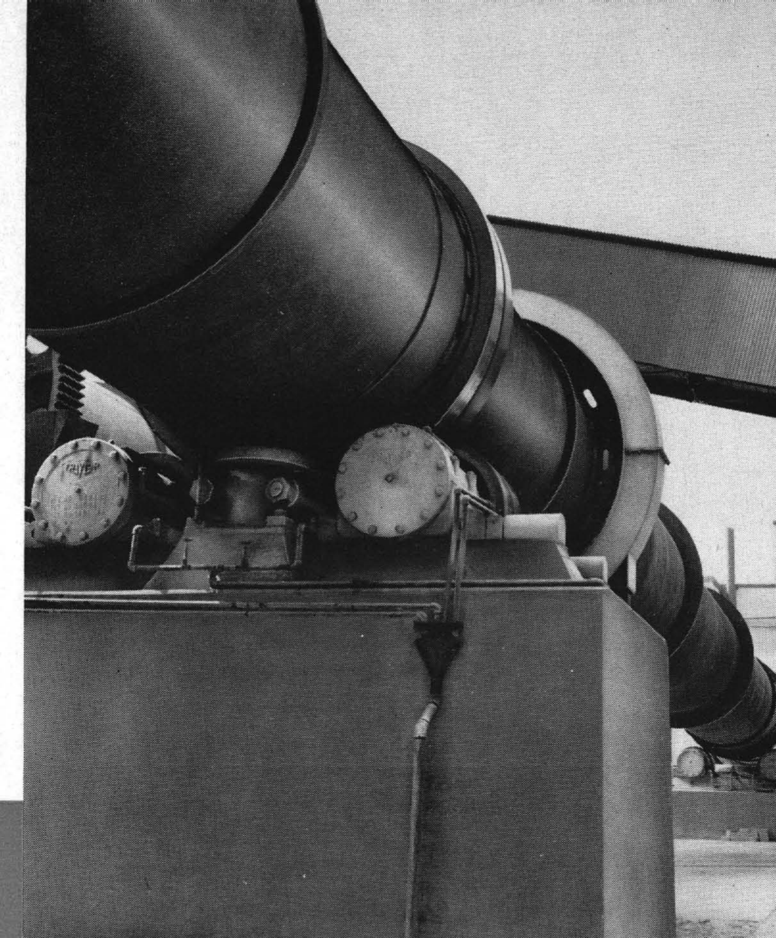
The tires or riding rings are two or more



Full floating tire mounted on kiln shell. Note extra thickness of shell on which tire is mounted.

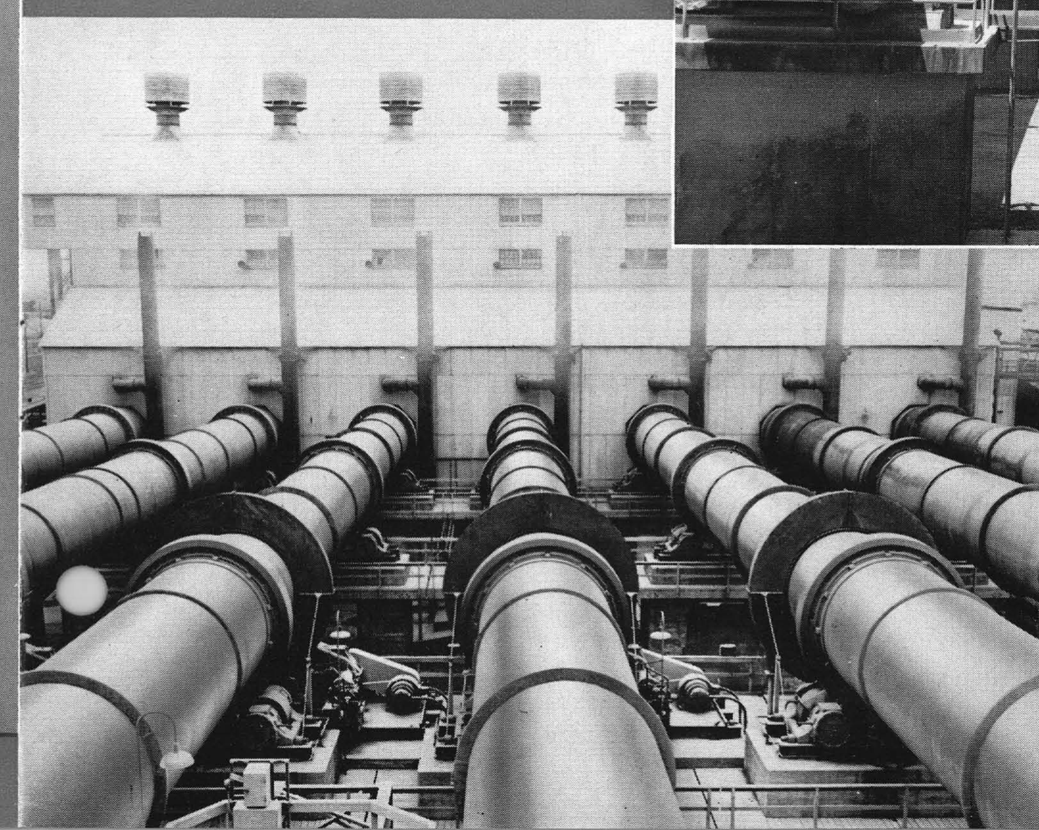


Patented two-piece—sectional—repair riding ring.



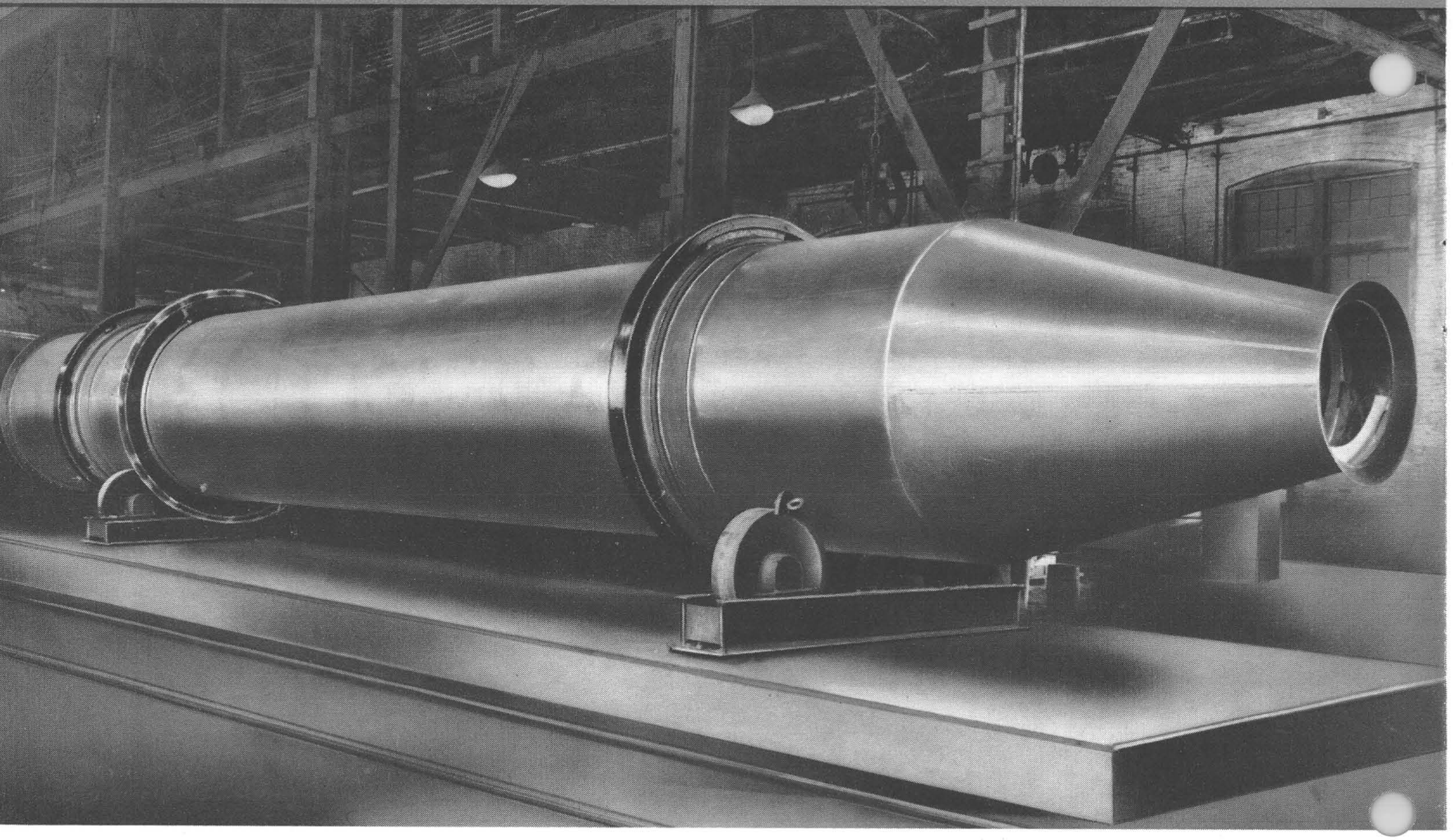
8'-0" dia. x 160'-0" Traylor Rotary Kiln in paper plant in Alabama, U.S.A.

2—8'-0" dia. x 300'-0" Traylor Rotary Kilns in chemical processing plant in Texas, U.S.A.



7—9'-6" dia. x 250'-0" Traylor Rotary Kilns in bauxite plant in Alabama, U.S.A.

6'-6" dia. x 57'-0" Traylor Rotary Slaker.



and Dryers and is straight and true. Inside the feed end there is a concentric cylinder made of thick plates. This cylinder is rigidly fastened to two sets of four bent bars riveted to the outer and inner shells.

At a properly determined point from the feed end of the shell is a continuous spiral flight made of bars welded to the outer shell and extending into the annular space between the inner and outer shells a suitable distance. This flight is spaced at one foot pitch. The height of the flight varies from two inches high at the feed end to six inches high at the discharge end.

A feed head, with an adequate opening, is provided in the feed end. It is fitted with a drip flange.

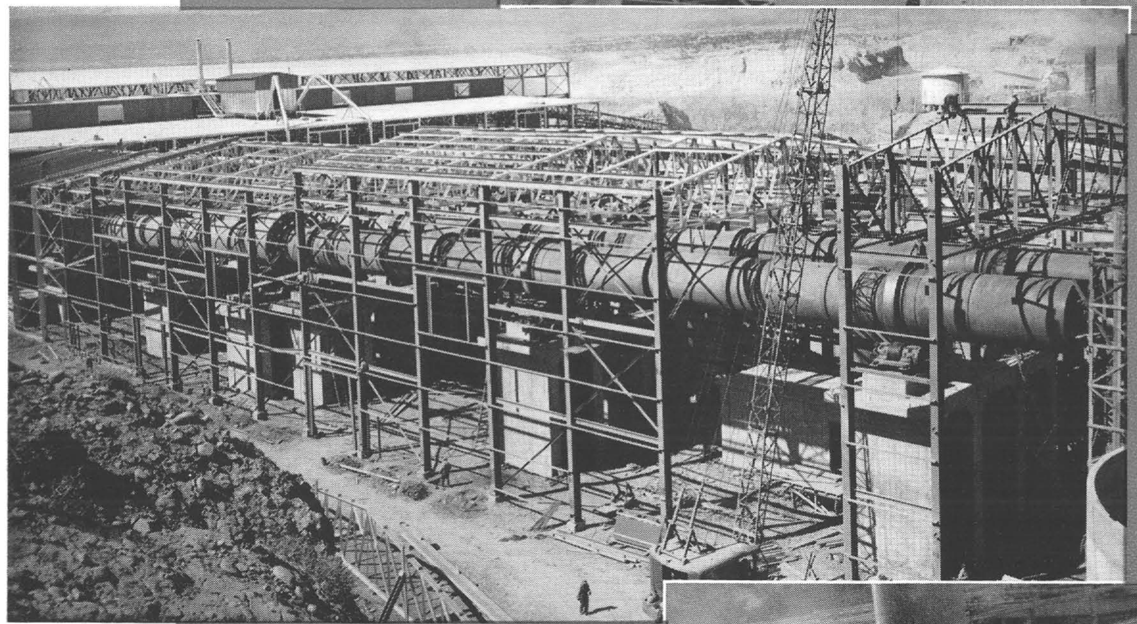
The conical section at the discharge end has an opening at the small end. It is provided with a drip flange to prevent water running down the outside of the shell. A continuous conical flight is welded into this cone.

A series of short lifters is welded to the inside to move the cones toward the discharge end. These are really interrupted helixes. All parts of Traylor Slakers which are exposed to the liquid are of stainless steel, the outer shell being 10% stainless clad, one side (inside) only.

The drum is provided with a sufficient number of cast steel riding rings, which are securely wedged and welded to the stiffener plates on the shell. The tire nearest the feed end is beveled on the sides to suit the thrust rollers. These tires are carefully turned, bored and faced.

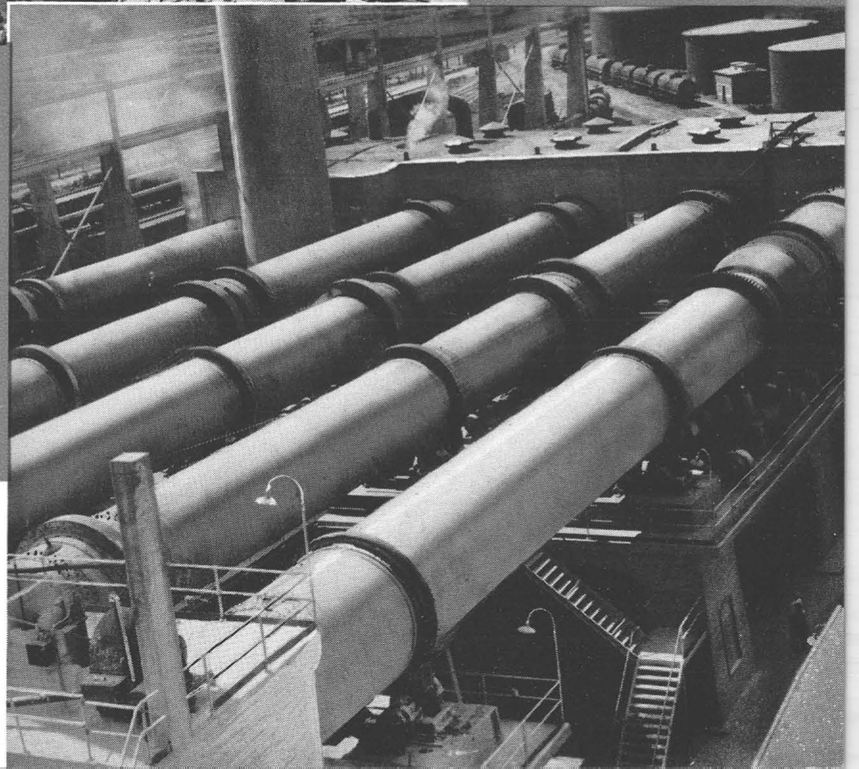
The supporting rollers are large in diameter, to obtain suitable bearing con-

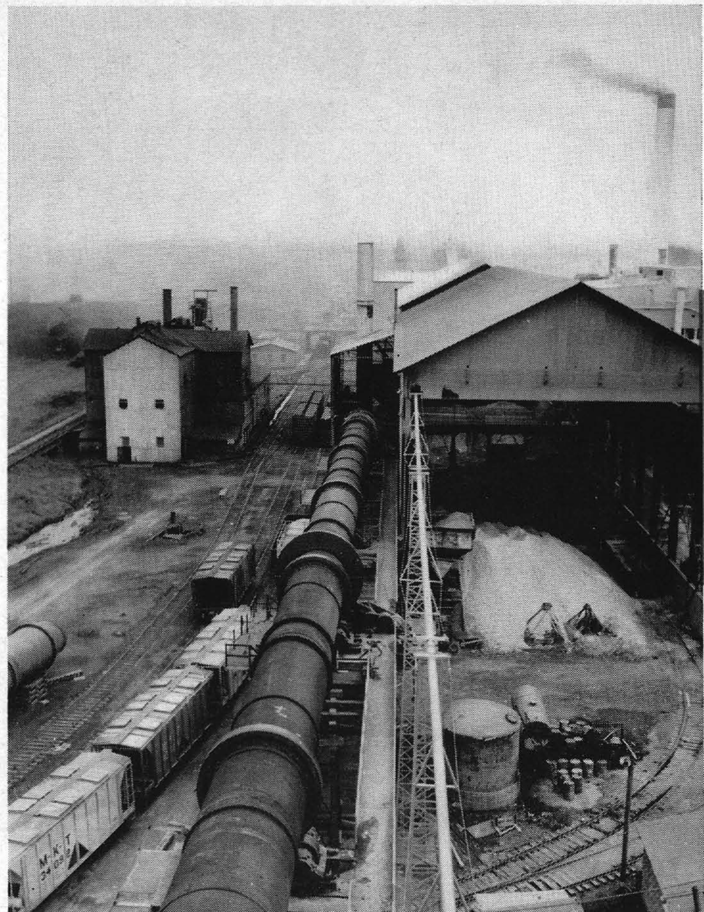
Two 9'-6" dia. x 377'-0" Traylor Rotary Kilns in a portland cement plant in Southern Texas, U.S.A.



Showing erection of two 10'-0" dia. x 400'-0" Traylor Rotary Kilns in portland cement plant in Colorado, U.S.A.

13'-0" dia. to 10'-0" x 200'-0" Traylor Rotary Kiln in Southeastern California, U.S.A. portland cement plant.

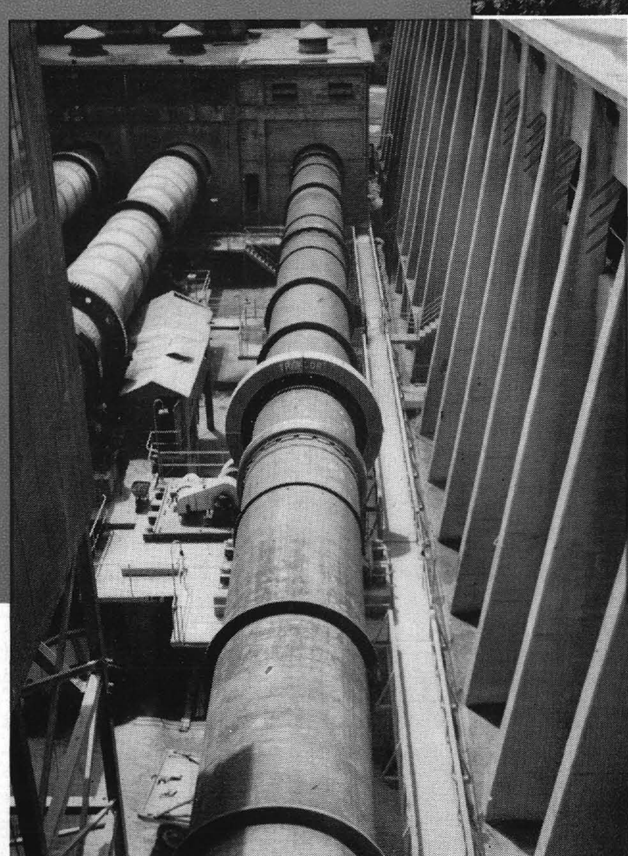




CEMENT KILNS

9'-6" dia. x 375'-0" Traylor Rotary Kiln in a portland cement plant in Oklahoma, U.S.A.

Plant view showing a 9'-6" dia. x 250'-0" Traylor Rotary Kiln in a portland cement plant in South Carolina, U.S.A.



In the plant of another Oklahoma, U.S.A. portland cement manufacturer, a 10'-0" dia. x 250'-0" Traylor Rotary Kiln.

tact with the tire. They are made of cast steel, carefully annealed, machine-finished and pressed on the shafts. The shafts are made of low carbon forged steel, annealed, and are increased in size in the center.

A flange is riveted on the shell to which the gear is attached. It is turned, faced and drilled to templet to receive the gear.

The drive consists of a girth gear made in halves, carefully machined and faced on both sides so that the gear may be reversed to use both faces of the teeth. The main pinion is keyed to the slow speed shaft of the reducer. The girth gear and main pinion are enclosed in a sectional housing.

The speed reducer is provided with outboard bearings for the heavy shaft and is fitted with a coupling for connecting to the motor.

The motor, speed reducer and outboard bearings for the speed reducer are all mounted on a steel sole plate.

The illustrations on Pages 29, 32 & 33 show representative installations and shop assemblies of Traylor Rotary Slakers.

HOT MATERIAL CONVEYORS

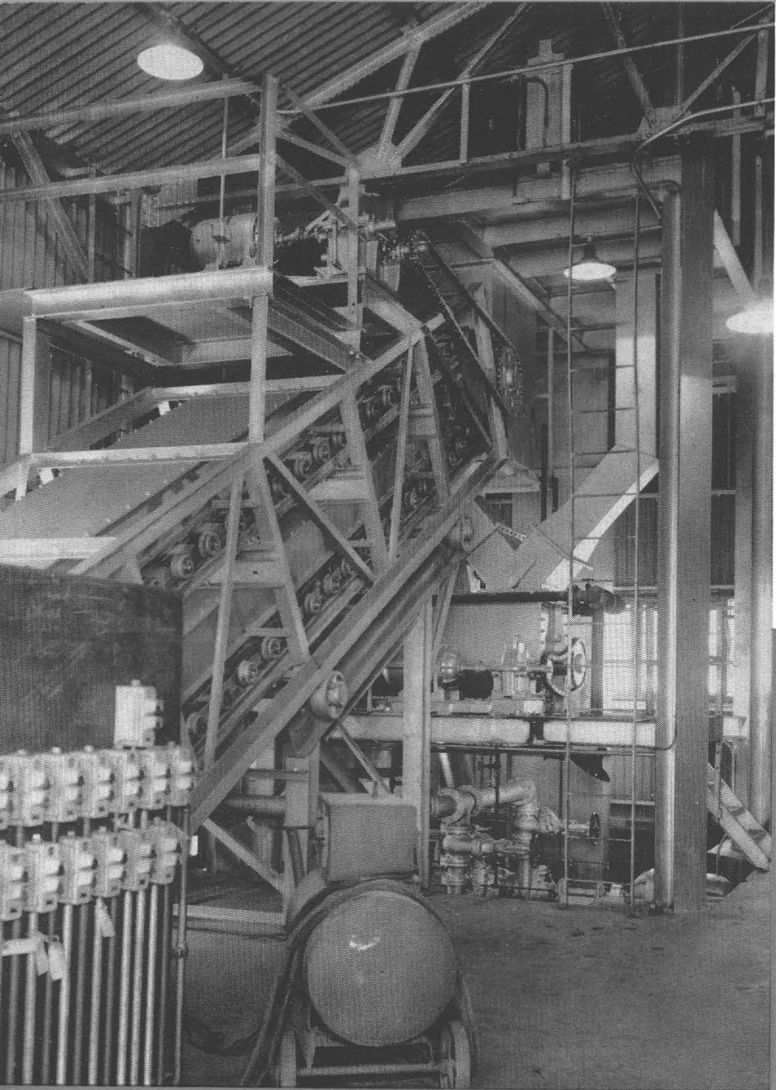
When rotary kilns are to be installed close to sea level or the water table level or when drainage is a problem, such installations, in order to keep the entire plant above the water level, would involve massive construction and expensive foundations to erect the kiln at an adequate height so that the hot material could be properly discharged into a cooler or slaker. For installations involving these problems a special hot materials conveyor has been developed which is illustrated on Page 34.

From these illustrations it will be noted that the conveyor consists of heavy cast heat-resisting metal buckets which move on axles connecting each bucket. The axles are equipped with flanged wheels which operate on rails.

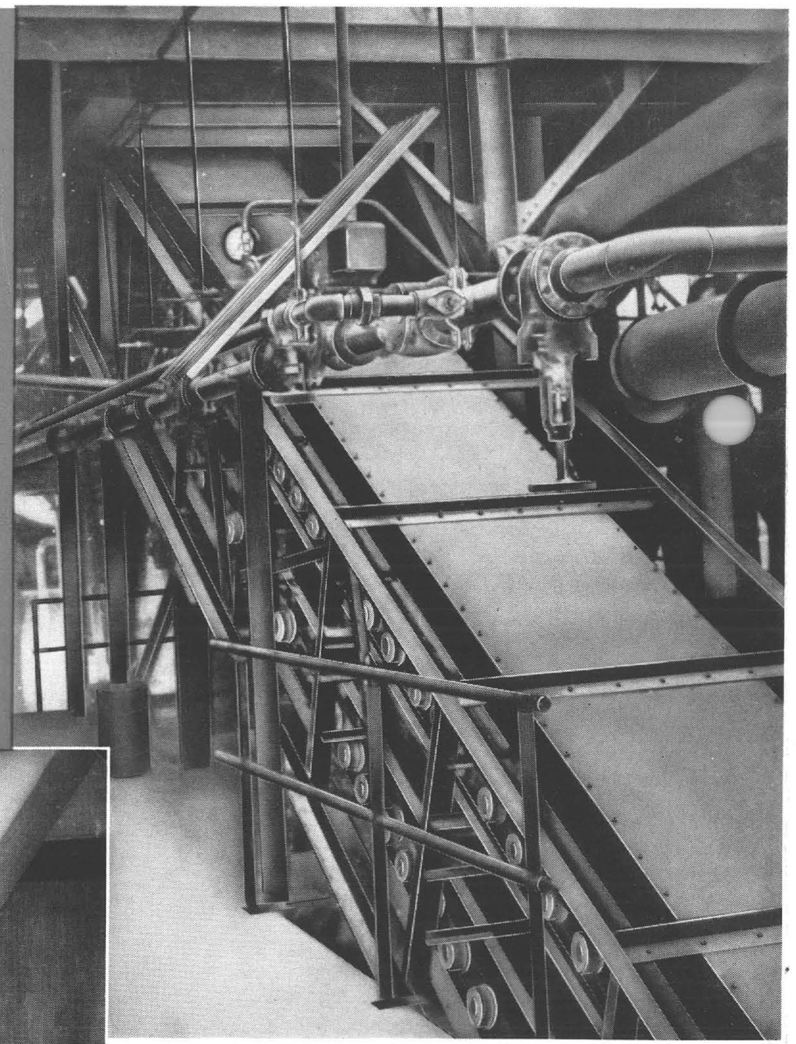
By the use of a conveyor of this type it is possible to erect the feed end of the cooler or slaker on approximately the same level as the discharge end of the kiln. In this way the excess costs of construction are eliminated.

6'-6" dia. x 57'-0" Traylor Rotary Slaker shown on preceding page installed in paper manufacturing plant in Louisiana, U.S.A.

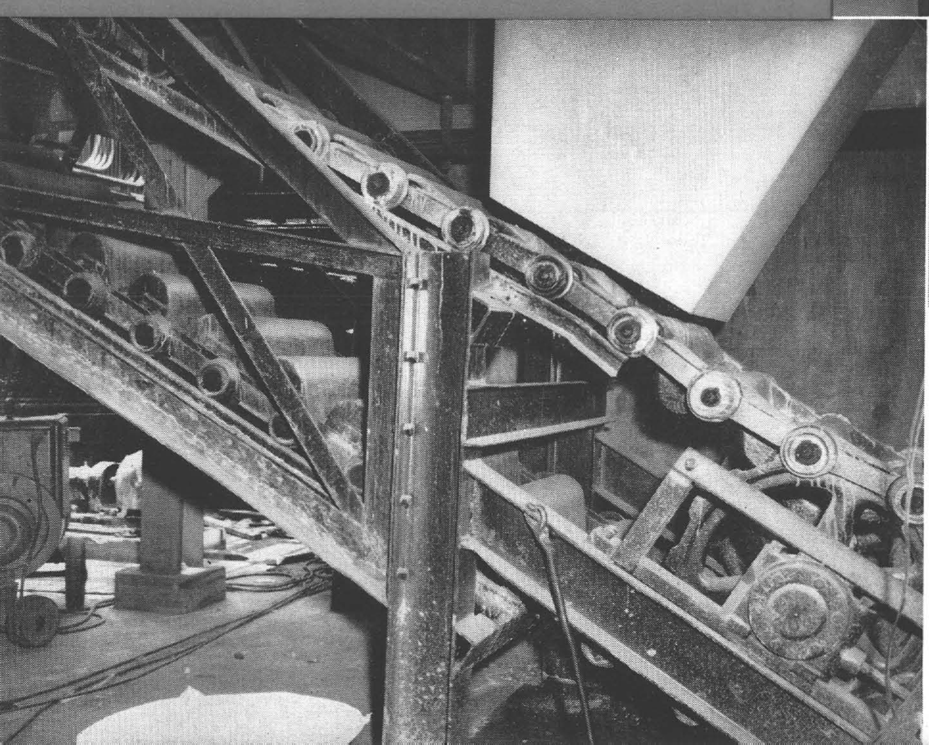
TRAYLOR HOT MATERIAL CONVEYORS



Traylor Hot Material Conveyor with 24" wide pans in paper mill in Louisiana, U.S.A.



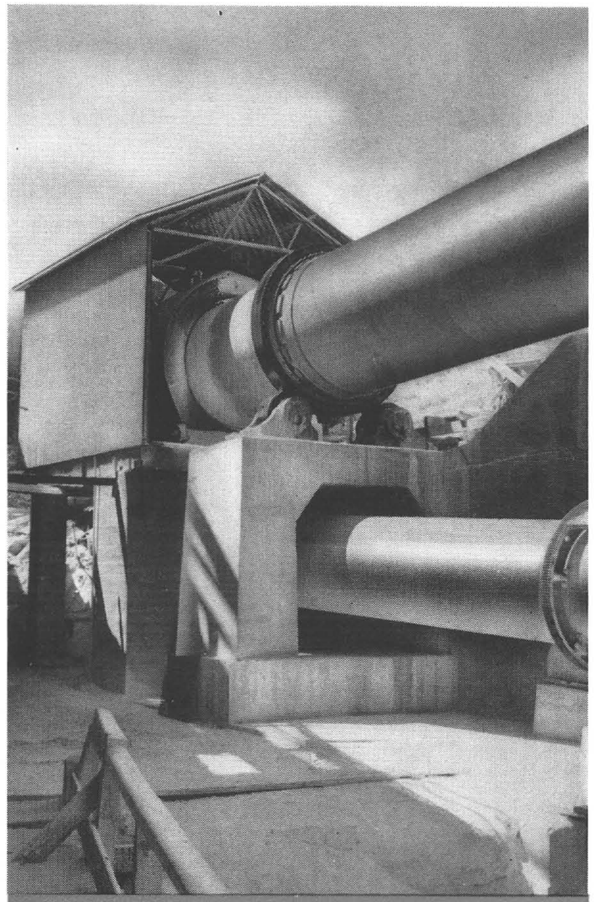
Traylor Hot Material Conveyor with 32" wide pans in chemical processing plant in Louisiana, U.S.A.



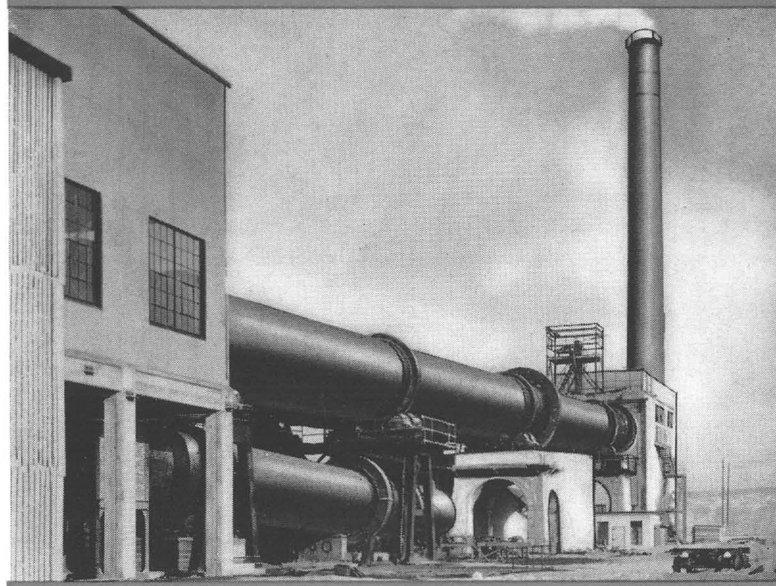
Traylor Hot Material Conveyor with 32" wide pans in paper mill in Virginia, U.S.A

tion, Traylor engineers secure all of the pertinent information about the process and the product. They study every step of the process in which the proposed kiln is to be used. Then, from their past experience and records of operating data covering several hundred rotary kiln installations and the results of the study made, our engineers design the kiln of the best type and size which will produce the right product with the greatest economies in fuel and operation.

There are also many additional factors which are taken into consideration by Traylor engineers in making up the drawings and specifications. From these factors are determined such necessary parts as the best type of roller supports—the proper drive—the right kind of air seals to be used . . . either on both ends or only one end of the kiln, etc. and etc. Taken all in all, it is careful engineering from start to finish which assures Traylor kiln users that they have the best in thermo-processing equipment.



A 6'-0" dia. x 120'-0" Traylor Rotary Kiln with a 4'-0" dia. x 36'-0" Traylor Rotary Cooler in a lime plant in Southern California, U.S.A.



An 11'-3" dia. x 240'-0" Traylor Rotary Kiln and a 9'-0" dia. x 95'-0" Traylor Rotary Clinker Cooler in a portland cement plant in Washington, U.S.A.

KILN SHELLS

All Traylor kiln shells are made of quality steel plate of a thickness suitable for the service for which intended, with the necessary reinforcing bars, brick retaining rings, feed heads and discharge ends.

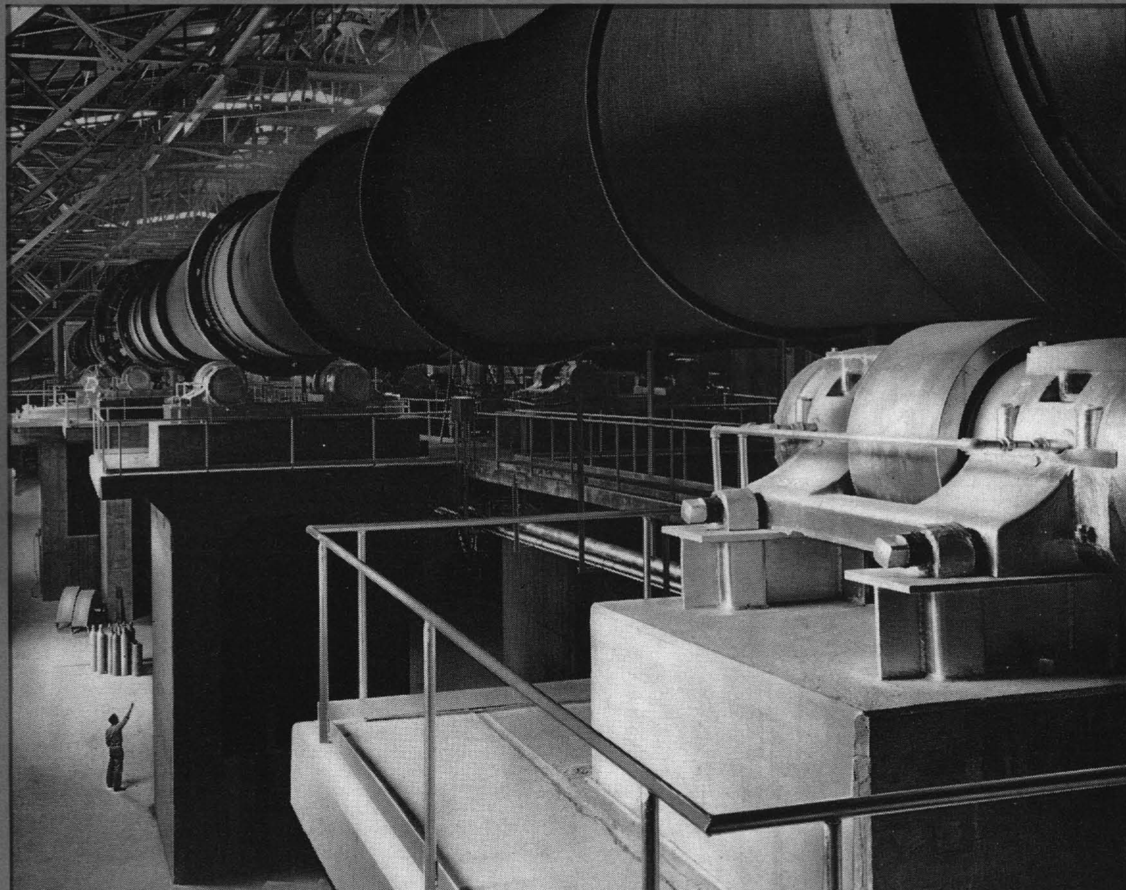
The sections on which the riding rings are mounted are made of heavier plate than the balance of the shell.

All shop joints are automatically welded.

The field joints are provided with the necessary clamps and bolts for aligning before welding.

Chain of the proper quantity and size is included for wet process kilns.

In all cases where transportation limitations permit, Traylor Rotary Kilns are shipped with riding rings and gear flange assembled (See photo on Page 6), ready to place on the support rollers. The shell is shipped in as few a number of sections as is practicable. The joints between the shell sections are welded in the field.



One of two 10'-0" dia. x 400'-0" Traylor Rotary Kilns in a portland cement plant in Colorado, U.S.A.

An example is the rotary kiln. Originally designed for use by and in the portland cement industry, where it increased production, produced a more uniform product and reduced costs per barrel of cement, the function of the rotary kiln and the results that could be obtained through its use were not long in being recognized by many other industries, and it was soon included in various manufacturing processes, thereby replacing other less economical types of equipment formerly used.

Examples are the utilization of the rotary kiln in the sulphate pulp industry, also in many mineral industries where they have changed over to the use of rotary kilns.

Present trends indicate an even greater and wider future use of rotary kilns in the process industries. This wider use of rotary kilns is due to continual improvements made in the efficiency of kilns, to which Traylor engineers have made many contributions.

With the steadily increasing demand upon process industries for greater production, the rotary kiln offers many technical and economic advantages. No other method has equalled the performance of a rotary kiln from the standpoint of capacity, continuous production and lower maintenance.

A partial list of materials processed in rotary kilns appears on the inside front cover of this bulletin.

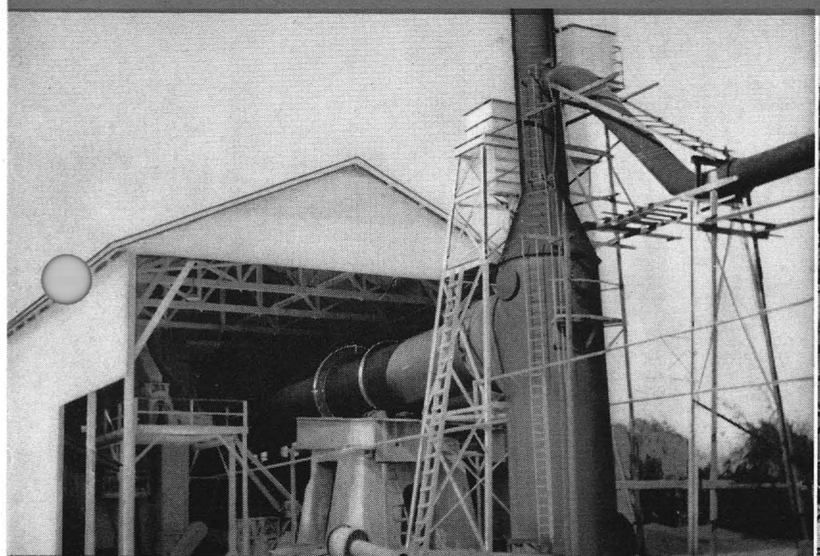
A rotary kiln must give long periods of continuous service, therefore, it is very necessary that sound engineering design and careful analysis of the work it is to do precede the actual construction of the machine so that when finally installed in the plant of the user it can be depended upon to operate with greatest efficiency.

Before proceeding to design a kiln for installation in a thermo-processing opera-

A FEW OF THE TRAYLOR ROTARY KILN FOREIGN INSTALLATIONS

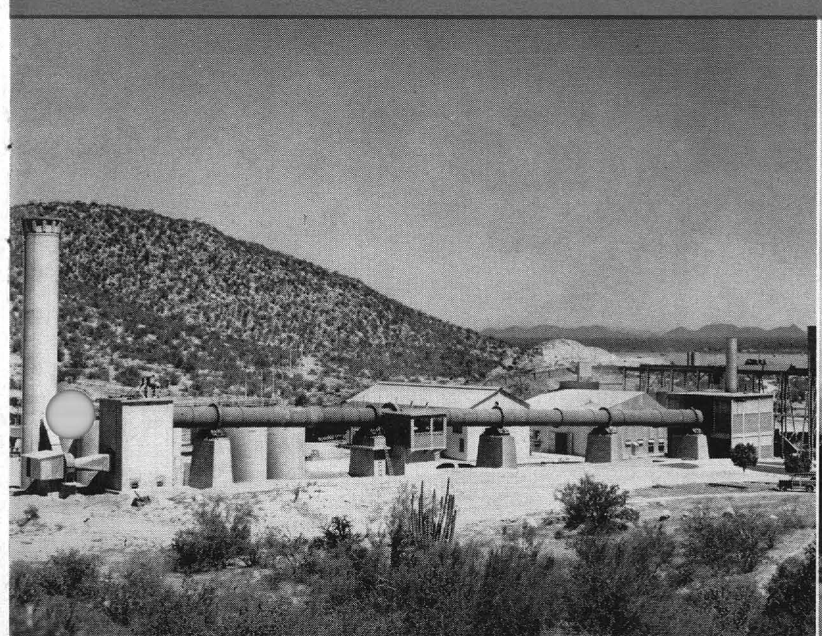
9'-0" dia. x 175'-0" Traylor Rotary Kiln in bauxite plant in British West Indies.

6'-0" dia. x 80'-0" Traylor Rotary Kiln in sugar refining plant in Hawaii.



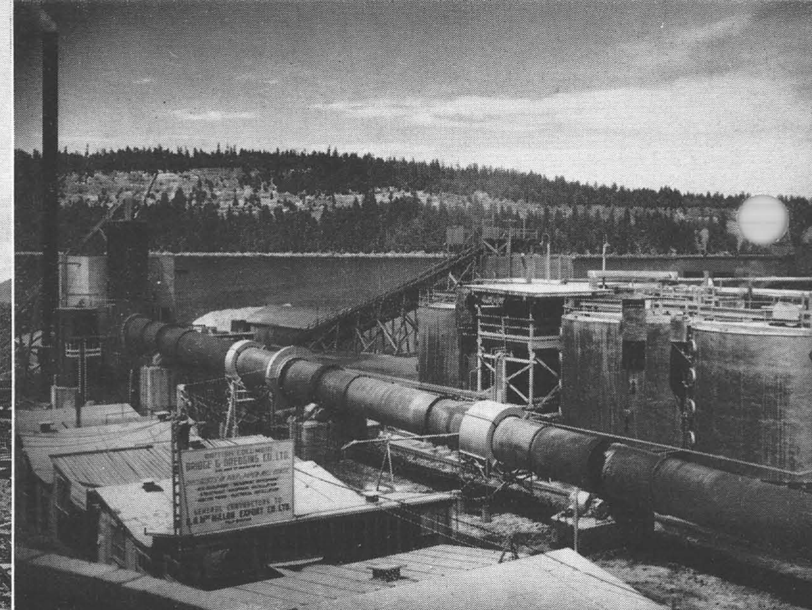
9'-6" dia. x 250'-0" Traylor Rotary Kiln in chemical processing plant in France.

9'-6" dia. to 8'-0" dia. x 300'-0" Traylor Rotary Kiln in portland cement plant in Mexico.

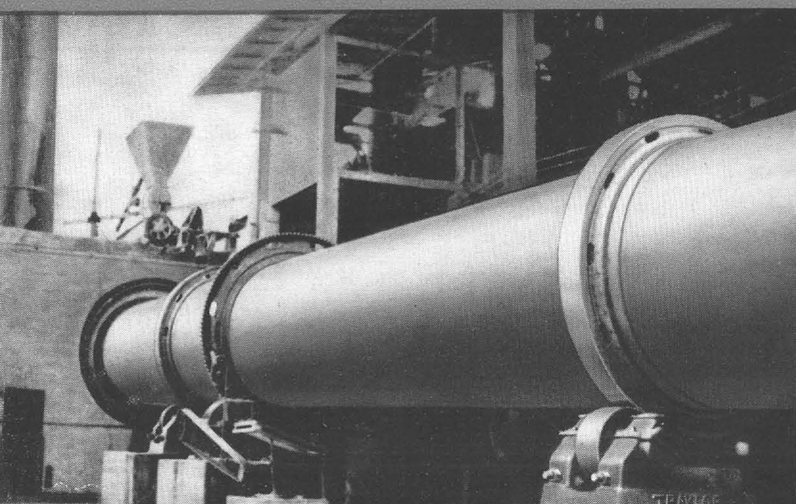


7'-0" dia. x 200'-0" Traylor Rotary Kiln in paper plant in British Columbia, Canada.

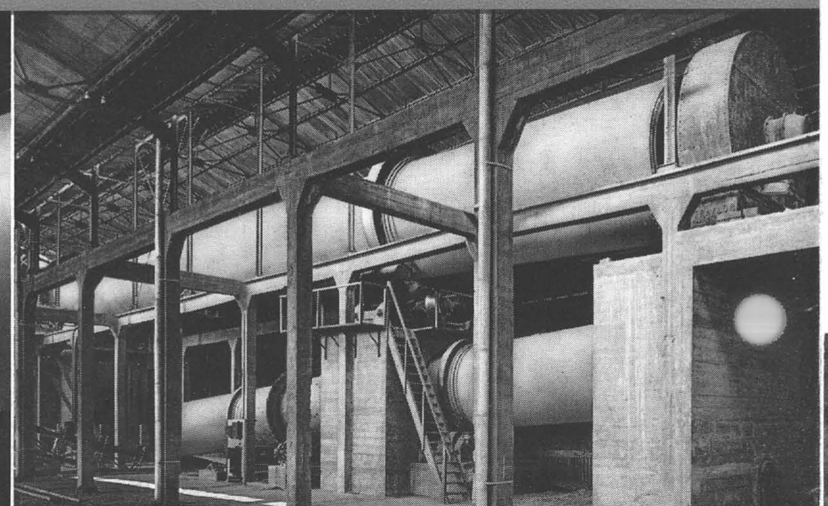
7'-6" dia. x 315'-0" Traylor Rotary Kiln, Chile, S. A.



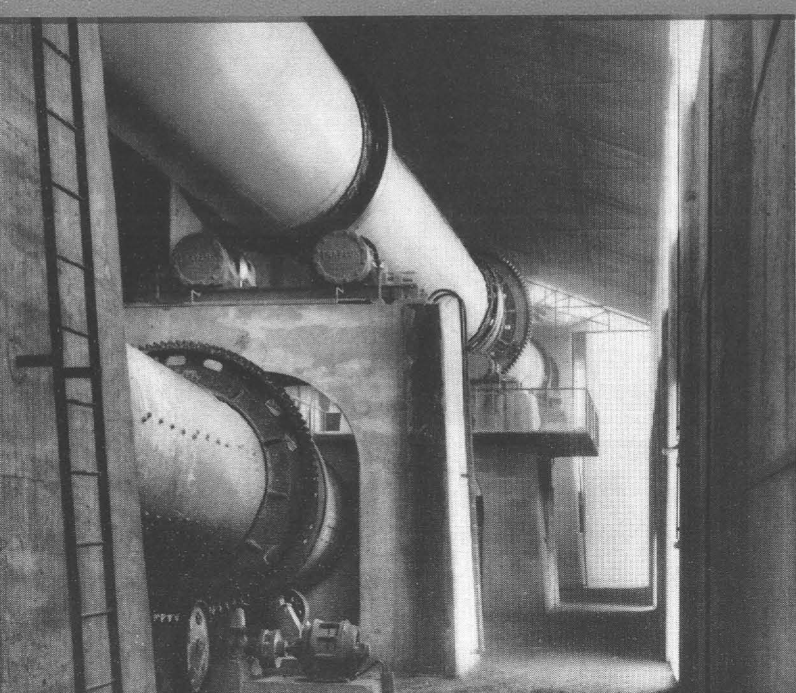
7'-0" dia. x 250'-0" Traylor Rotary Kiln in a paper plant in British Columbia, Canada.



7'-0" dia. x 70'-0" Traylor Rotary Kiln in cement plant in Venezuela, S. A.



10'-0" dia. x 170'-0" Traylor Rotary Kiln and 7'-0" dia. x 70'-0" Traylor Rotary Cooler in cement plant in Chile, S. A.



7'-0" dia. x 200'-0" Traylor Rotary Kiln and 6'-0" dia. x 60'-0" Traylor Rotary Cooler in cement plant in Argentina, S. A.

7'-0" dia. x 315'-0" Traylor Rotary Kiln in mining plant in Chile, S. A.

ROTARY KILNS, COOLERS, DRYERS and SLAKERS

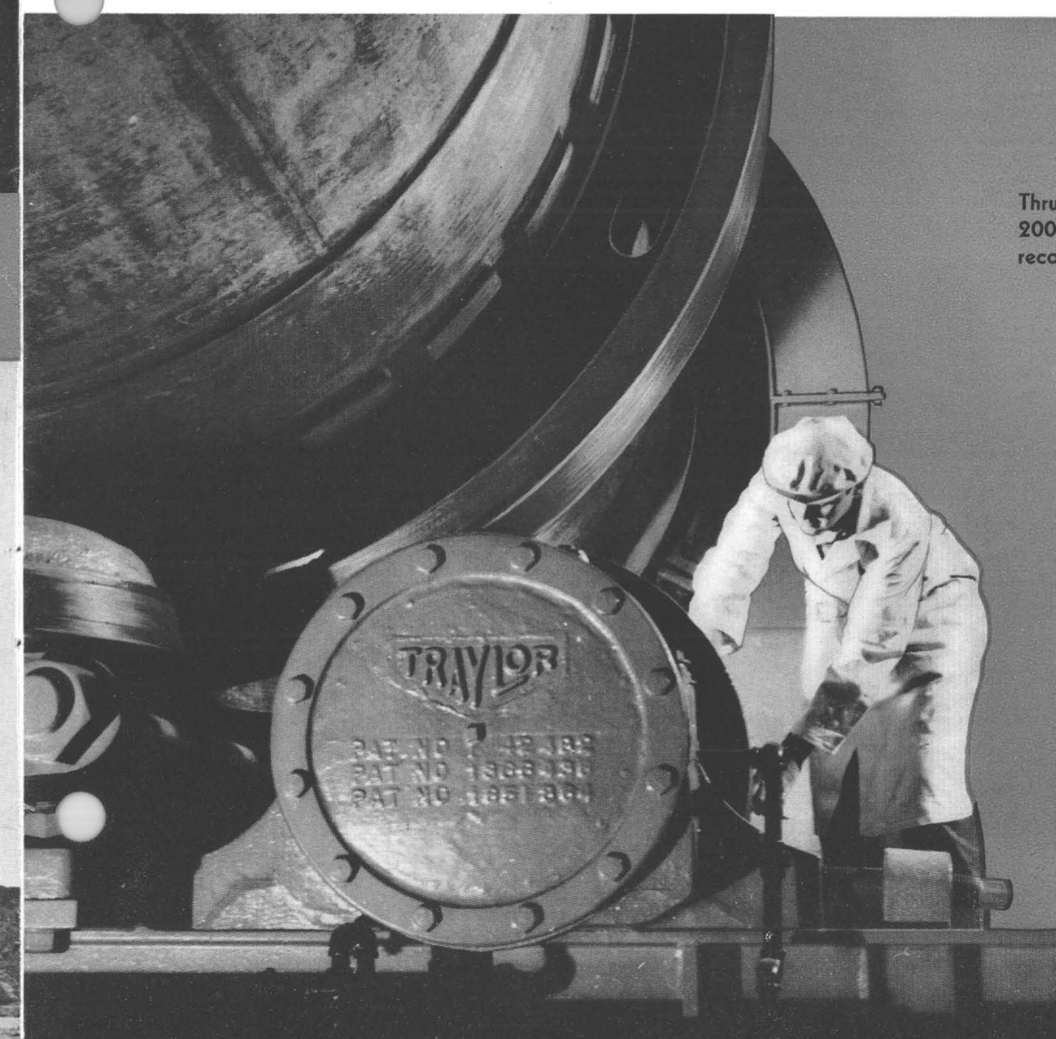
For fifty years Traylor has been one of the leaders in the advancement of rotary kilns and has engineered and developed a large number of major improvements.

Rotary kiln performance has been greatly improved with Traylor Single Support Type Roller Bearings—all welded steel shells—feed and discharge end seals—heat recuperating chain systems for wet process kilns—improved kiln feeders—kiln controls—drives and many other innovations.

During this time Traylor engineers have acquired a background of unusual experience in designing and building hundreds of rotary kilns. Soundness of design and high standards of Traylor craftsmanship have won the confidence of all industries in which rotary kilns are applicable.

The photographs in the following pages show many kinds of Traylor Rotary Kiln installations, also brief descriptions of the designs and special features which make Traylor Rotary Kilns, Coolers, Dryers and Slakers the preferred choice of engineers and operators.

It is not unusual for a machine, which has been designed, engineered and built for the requirements of one industry, to have its advantages recognized in other industries and be adopted for use in processes for which it was not originally designed.



Thrust roller supports on a 7'-0" dia. x 200'-0" Traylor Rotary Kiln for lime sludge recovery in a paper mill in Oregon, U.S.A.

Traylor PROCESSING AND MINING MACHINERY

Rotary Kilns for	Calcining—Cement (Wet or Dry Process)—Lime from Limestone, Oyster Shell or Carbonate Sludge for Paper Mills, Sugar Mills & Chemical Plants · Roofing Granules · Bauxite · Magnesite · Dolomite · Gypsum · Clay · Expanded Aggregate · Vermiculite · Manganese · Petroleum Coke · Black Ash · Spodumene · Lithopone · Boron Roasting and Chloridizing—Gold · Silver · Iron · Titanium · Potassium Salts · Sodium Aluminum Sulphate Volatilizing—Mercury · Zinc Fuming (Waelz Process) Sintering—Iron Ore · Phosphate Rock Nodulizing—Manganese Ore
Rotary Coolers for	Cement · Lime · Alumina · Magnesia · Petroleum Coke · Slag · Ores · Chemicals
Rotary Dryers for	Clay · Iron · Frit · Salts · Coke · Tin Oxide · Dolomite · Chips · Antimony · Sand · Limestone · Ilmenite · Slag · Coal · Bauxite · Copper · Zinc Residue · Gypsum · Ammonium Sulphate · Manganese · Phosphates
Crushing Machinery	Gyratory Crushers (Type TC for primary service, Type TY for secondary service) · Jaw Crushers (5 Types—M · H · HB · R · S—for primary service) · Crushing Rolls (3 Types—A · AA · Four Tension Rod—for secondary service)

Feeders Apron · Grizzley (Stationary or Reciprocating) · Slurry · Table

Mills Wash · Pug · Rod · Tube · Ball · Compartment (2, 3 or 4)

Scrubbers Oyster Shell · Rock · Ores

Casting Machines Circular or Straight Line for Anodes · Cathodes · Wire Bars · Pigs

Furnaces Zinc · Lead · Copper Matting

Machinery for Cement Plants · Gravel Plants · Lime Plants · Sand Plants · Slag Plants · Slate Granule Plants · Concentrating Plants · Cyanide Plants · Milling Plants · Copper Converting Plants · Lead Refining Plants · Smelting Plants

A Traylor LEADS TO GREATER PROFITS

Traylor ENGINEERING AND MANUFACTURING CO.

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Traylor

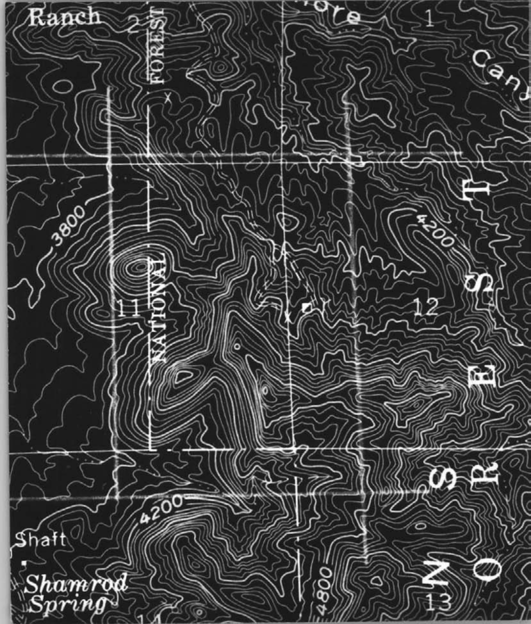
TRAYLOR ENGINEERING AND MANUFACTURING COMPANY
ALLENTOWN, PA., U. S. A.

Traylor

KILNS
COOLERS
DRYERS

BULLETIN 1115

TRAYLOR ENGINEERING AND MANUFACTURING COMPANY, ALLENTOWN, PA., U. S. A.



Ranch
2
FOREST
1
Canyon
NATIONAL
3800
4200
11
12
Shaft
Shamrod
Spring
4800
13

ENP ① 20.80 % SiO_2 MLS Composite

ENP ② 11.85 ~~20.80~~ Lowers Hole - Spec. taken by E Zeller

ENP ③ 4.90 ~~#85~~ " " Pointed out by Lowe as good material

ENP ④ 3.55 Welded contact - MLS side

ENP ⑤ 0.75 " " CM side

VALLEY LABORATORIES
Incorporated
Telephone Alpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

REPORT

Nature of Specimen: Limestone

Date: 12-22-60

Laboratory No.: A60354-1

Date Received: 12-20-60

Submitted By: E.N.Pennebaker
for: Thomas A. Goodnight, Phoenix, Ariz.

Report Telephoned

Tests Made: as listed

RESULTS

	Percent
Calcium Oxide (CaO)	29.12
Carbon Dioxide (CO_2)	20.10
Magnesium Oxide (MgO)	11.88
Silicon Dioxide (SiO_2)	20.80

Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan

Michael J. Sullivan

VALLEY LABORATORIES

Incorporated

Telephone ALpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

REPORT

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Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan

Michael J. Sullivan

VALLEY LABORATORIES
Incorporated

Telephone ALpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

AMERICAN COUNCIL OF INDEPENDENT LABORATORIES INC.

REPORT

Nature of Specimen Limestone

Date 12-22-60

Laboratory No. A60354-2 -- A60354-5

Date Received 12-20-60

Submitted By E.N.Pennebaker
for: Thomas A. Goodnight,
Phoenix, Ariz.

Report Telephoned

Tests Made (SiO_2)

RESULTS

Sample Markings	Percent SiO_2
E N P - 2	11.85%
E N P - 3	4.90%
E N P - 4	3.55%
E N P - 5	0.75%

Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan
Michael J. Sullivan

VALLEY LABORATORIES
Incorporated

Telephone ALpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

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Nature of Specimen Limestone

Date 12-22-60

Laboratory No. A60354-2 -- A60354-5

Date Received 12-20-60

Submitted By E.N.Pennebaker
for: Thomas A. Goodnight,
Phoenix, Ariz.

Report Telephoned

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Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan

Michael J. Sullivan

VALLEY LABORATORIES
Incorporated
Telephone ALpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

REPORT

Nature of Specimen Limestone

Date 12-22-60

Laboratory No. A60354-2 -- A60354-5

Date Received 12-20-60

Submitted By E.N.Pennebaker
for: Thomas A. Goodnight, Phoenix, Ariz.

Report Telephoned

Tests Made (SiO_2)

RESULTS

Sample Markings	Percent SiO_2
E N P - 2	11.85% } Loc-Hole
E N P - 3	4.90%
E N P - 4	3.55%
E N P - 5	0.75%

Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan

Michael J. Sullivan

VALLEY LABORATORIES
Incorporated

Telephone Alpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

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Silicon Dioxide (SiO_2)	20.80

Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan

C O P Y

XXXXXXXXX

TX 6-9936

October 20, 1962

Mr. Herbert Plaxton
Suite 2103 Star Bldg.
80 King Street West
Toronto 1, Canada

Re: Tuscon Lime

Dear Mr. Plaxton:

Enclosed is a preliminary report by Jack Ballam, the engineer that we sent up to Colorado School of Mines to observe the large scale furnace run.

As you will note from the report, the "Pilot Plant" test was completely satisfactory and the results very encouraging. The dust loss was amazingly low, less than 4%, the product produces was of good grade, plus 97% CaO, and calcining was accomplished at a relatively low furnace temperature. Also it was not necessary to screen ou the fines before furnacing.

Mr. Lewis's report from the Colorado School of Mines will of course be much more in detail and more conclusive. I thought you would be interested in having Ballams report while awaiting to hear from Mr. Lewis. His report will probably take several weeks to complete.

Very truly yours,

G. A. Freeman

cc: Mr. J. D. Mason
Mr. E. N. Pennibaker

GAF/vf

PRELIMINARY REPORT ON CALCINING TEST AT COLORADO SCHOOL OF MINES, GOLDEN, COLORADO

The sample, except for about 300#, was crushed through 3/4" screen and head sample cut out. No fines were not screened out ahead of furnacing. Head assayed as follows:

CaO	55.16%	
CO2	43.2	Loss on ignition - LOI 43.3%
SiO2	1.13	
R2O3	0.24	
MgO	0.05	(less than 0.05%)
H2O	0.1	(cumputed by ign. loss - CO2)

MgO is being rerun by more accurate method. This is exceptionally low for most limestones.

The H2O was on the pulverized head sample and is not accurate for kiln feed. It is being rerun on kiln feed sample from a sealed drum.

MnO is being rerun as first sample showed only trace.

The kiln is 18' long and 16" in diameter with a slope of 4.9%. This is slightly more than 5/8"/ft. It is turning at 3/4 RPM which gives a periphial speed 3.1 ft/min. A 2" dam at the discharge end holds the feed bed at about 10% of the furnace cross-section. With 150#/hr feed with density of 100#/cu ft, this gives a retention time of 100 min. This compares favorably with the 95 min retention time computed by formula.

The kiln is fired by a natural gas burner at the discharge end, and gasses are evacuated by a variable volume blower. Temperature was held close to 2000 degree F at the decrepitation point which was about 5' from the discharge end of the kiln. Feed rate was 150#/hr by spreading a weighed amount of feed along a measured section of a constant speed belt. Product was collected and cooled in metal containers which were emptied into tared steel drums which were sealed and weighed. Product and dust samples were taken hourly and placed in clean sealed jars.

No successful efforts were made to get gas consumption and efficiency readings as the proper equipment was not immediately available and the results would be meaningless for any other kiln. Most of the dust loss occured where the material dropped from the belt into the feed breeching and is assured to be almost completely uncalcined material. There was also a small amount of steam at this point. The exhaust stack showed no visible dusting although a small amount was evident on the roof adjacent to the stack at the end of the run. A sample of this material was collected and appeared to be mostly calcined particles. Analysis of this dust is being made.

The hourly product samples will be composited and final analysis made. Four samples at different temperature ranges were run immediately so a preliminary material balance could be made. These ran as follows:

Sample	°F Temp range	% CO_2
A	1830 - 1880	0.25
B	1990 - 2020	0.04
C	2010 - 2110	0.06
D	2030 - 2150	0.06

These assays are exceptionally low and indicate an almost perfect burn with relatively low temperatures. The normal temperature in commercial plants range from 2200 - 2300 degree F for complete calcining. This is probably largely due to the high radiant heat transfer because of no dusting in the kiln. It was noted that the atmosphere in the kiln was clear at all times, with no dust clouds to hinder the transfer of radiant heat.

In the material balance, the CO_2 remaining in the product may be ignored, as the assay for CO_2 in the head sample is not accurate to that degree.

Material Balance	lbs
Total feed to kiln	9590
Wt of product obtained	5065
Difference (H_2O - CO_2 - Dust)	4525
LOI (43.3 x 9590)	4153
Difference - Dust	372 - 3.9% of feed

The assays on the composit product sample will be more accurate but the head assays indicate a product in excess of 97% CaO can be expected.

Mr. Lewis pointed out that there were no detrimental factors appearant and several items were very beneficial: to wit;

(a) The dust loss is unusually low due to the material breaking down into grains instead of dust.

(b) The material calcines at approximately 300 degrees F lower than in normal practice.

(c) The grade of the product is as high or higher than is normally produced.

(d) Judging from this ore sample, it appears that it will not be necessary to screen out the fines, as is more normally done, due to the mined ore breaking down to a grandular product rather than dust. This would constitute a substantial saving in cost.

A more conclusive and detail report will be made by Mr. Lewis when final assaying and testing is completed.

Respectfully submitted,

VALLEY NATIONAL BANK

WILLETTA & FIRST ST. OFFICE 1400 NORTH FIRST STREET PHOENIX, ARIZONA

January 10, 1963

Dear Penney:

Enclosed is the Colorado School of Mines report on Rotary Kiln Calcination of Limestone Sample for Tucson Lime and Chemical Company.

Regards.

Cordially,

Tom

Tom Goodnight

Enclosure

CO_2 — 40.85

CaO — 52.08

MgO — 1.48

SiO_2 — 3.4

Loose Piece Of Marble From Small HILL on WEST

VALLEY LABORATORIES

Incorporated

Telephone ALpine 2-2782 • Post Office Box 4153 • 242 South First Avenue • Phoenix, Arizona

REPORT

Nature of Specimen Limestone

Laboratory No. A60339-1

Submitted By Thomas A. Goodnight
Phoenix, Arizona

Tests Made As listed

Date
12-8-60

Date Received
12-3-60

Report Telephoned

RESULTS

	Percent
Calcium Oxide (CaO)	52.08
Magnesium Oxide (MgO)	0.48
Silicon Oxide (SiO_2)	3.40
Carbon Dioxide (CO_2)	40.85

Respectfully submitted,

VALLEY LABORATORIES

Michael J. Sullivan

Michael J. Sullivan

COLORADO SCHOOL OF MINES RESEARCH FOUNDATION, INC.

GOLDEN, COLORADO

October 8, 1962

Mr. J. D. Mason
4730 West 2nd Avenue
Vancouver 8, B. D.

Dear Mr. Mason:

Please excuse our delay in replying to your letter of September 23, 1962. In the interim, the truck of limestone has been received here in good condition, a few experimental batch calcinations have been made on the material and I have talked with Mr. Freeman, particularly with reference to one of your engineers' being present for all or part of the pilot burn.

As matters now stand, we expect to begin this run October 15th, and complete the run in about a week's time. I will advise with Mr. Freeman in advance of startup so that the engineer can schedule accordingly. Before starting the pilot burn, we have found it desirable to make a few mechanical changes to the rotary kiln and, hence, the delay.

We note from your letter of September 23, 1962, that your organization has decided to embark directly on Phase II of the recommendations of our letter of August 15, 1962, and we have set up our program here accordingly. However, it has been necessary to run a few preliminary burns in our batch rotary furnace in order to select an optimum size for feed to the pilot kiln. This has been selected as all passing a 3/4" square opening. The bulk of the truck shipment is, therefore, being crushed to -3/4" with dust and fines remaining in the crushed product. Our preliminary batch burns indicated that during calcination practically all of the limestone charge decrepitated to less than 1/8", thus rendering it useless to remove fines from the charge ahead of calcination.

In my opinion, this decrepitation characteristic is actually advantageous in that it should, therefore, not be necessary to screen out fines in a commercial operation and this fact eliminates the production of "quarry screenings", which is usually a necessity in commercial lime burning operations. In other words, the only significant loss of limestone quarried should be that which is lost as dust or fines during calcination.

We have selected -3/4" material based on a few preliminary batch calcinations, since this size seems to produce the most uniformly burned quick lime. We tried a -1-1/2" feed but found that the larger pieces did not decrepitate fast enough to properly blend with the bulk of the calcining charge. Should you undertake a commercial operation, the top size might be the subject of some experiment in the commercial kiln, as to whether to select 1-1/4", 1", or 3/4", but the important aspect, in our opinion, is that fines need not be removed ahead of calcination.

In line with your request, we are very pleased to herewith transmit our usual contract form covering Phase II, as outlined on pages 3 and 4 of my letter of August 15, 1962, to you. This relates specifically to running the -3/4" limestone you have furnished through a pilot size gas-fired rotary kiln to accomplish two objectives, namely: (1) determination of yield of quick lime product, and (2) preparation of a sizeable quantity of quick lime product for market evaluation, or other use, as you may desire. In accomplishing these objectives, we would base product yield on the (a) weight of limestone feed to the kiln, (b) the loss of CO_2 gas, based on limestone and quick lime analysis, and (c) the weight of quick lime product discharged from the kiln. We would not attempt to recover stack dust quantitatively, but would take samples of stack dust during the calcination in order to gain some knowledge of the chemical analysis and physical characteristics of the dust. The quick lime product would be packaged in tight steel drums and retained by us, pending your further advice.

As I have indicated to you, we estimate our charges, including seven (7) days' operation of the pilot rotary kiln to accomplish the foregoing objectives, would not exceed $4000. We have therefore indicated a $4000 charge in our contract forms transmitted herewith. However, even though the laboratory phase studies have been eliminated, it has been necessary to run a few preliminary batch burns, as I have indicated, and the $4000 estimate, therefore, now contains no allowance for contingencies. Mr. Freeman has indicated that product yield is the primary objective and that it might not be necessary to process the entire 10 tons of limestone through the pilot rotary kiln once we are satisfied that the kiln is in balance, the materials balance is sufficiently accurate, and possibly only 4 or 5 tons of lime stone has been fed.

Since one of your engineers will be present for at least part of the calcination, our thought is that he or I could check with you or Mr. Freeman about midway in the calcining operation, if we believe the $4000 estimate will be exceeded if all the limestone is calcined. I am sure the overrun of the present estimate would be modest, if any, and you could then decide as to whether the operation should be continued to consume all the limestone, or stopped.

I trust the foregoing proposal and explanation is adequate for the purpose intended, and that you will find the enclosed contracts in order. If so, please so indicate by having one of the copies duly executed and returned for our files. On the other hand, if you find changes are necessary, please return the contracts, with your suggestions. Meanwhile, we are considering the work as officially authorized and are moving right ahead on the job.

Best regards,

C J Lewis

C. J. Lewis
Director of Research

CJL/arh
encs

P. S. In a separate letter, I am writing to you concerning the market survey. I feel we are unusually well qualified to make this, particularly since I have had over 15 years in the quick lime sales field; and we hope we will also be favored with this assignment.

cc: Dr. E. N. Pennebaker ✓
Mr. G. A. Freeman

COLORADO SCHOOL OF MINES RESEARCH FOUNDATION, INC.

GOLDEN, COLORADO

August 15, 1962

Mr. J. D. Mason
4730 West 2nd Avenue
Vancouver, B.C.

Dear Mr. Mason:

We have your letter of August 9, 1962, and are now in position to comment further on the subject, particularly with reference to your letter of July 17, 1962, to me.

We have reviewed our report to Transarizona Resources, Inc. of February 10, 1960. We note that the report indicated that the sample materials exhibited the properties of chemical grade high calcium limestone; both samples decrepitated upon being burned to quick lime; but that the resulting quick lime appeared to be of a good chemical grade except as to color and possibly a somewhat higher silica content than the normal quick lime of commerce. If memory serves me correctly, I seem to recall that either you or Mr. Freeman subsequently advised me that the market then in mind for the quick lime product would not make an issue over color and could probably tolerate the somewhat higher silica content.

With these thoughts in mind, we are pleased to offer the following suggestions, which may be considered as our proposal for further evaluation.

1. A composite of the plus 1/2" material from the assay office should be entirely satisfactory for further small scale burning tests. We assume this composite would come as near to being a representative sample as anything you might send. The 1/2" size is quite satisfactory but the composite, as you make it up for any further work, should contain all fines and dust of fracture. If the assayer has screened out the fine material, then it would be preferable to send us the remaining half of the core and allow us to split and process half of this and send you back the remaining quarter.

2. We recommend that we perform a chemical analysis on a reprssentative sample of this material as a matter of routine, in order to be sure that our methods check against those of your own assayer. We would then calcine a batch or two of the material in our rotary smelting furnace, as was done in the case of the work covered by our February 10, 1960 report, in order to determine the burning characteristics and physical and chemical properties of the resulting quick lime. For this study, we would hope to have a 100-lb. representative sample-- although, if sample is scarce, we could get by on a minimum of 50 pounds.

3. The essence of this proposed study would be practically identical with that expressed in the fourth paragraph of the first page of the February 10th, 1960 report, except that we would pay little or no attention to the item of screenings rejects, unless you should specifically so request. In essence, then, our laboratory scale evaluation of the sample would be in terms of,

   (a) Chemical analysis

   (b) Burning characteristics

   (c) Chemical quality of resulting quick lime, and

   (d) Slaking characteristics of resulting quick lime

4. We would consider the foregoing suggested work as Phase I of the broader study suggested by your letter of July 17, 1962. We estimate we could complete this proposed Phase I study within about 6 weeks from receipt of the sample, and for charges not exceeding $2500, including a brief report. We would make every effort to hold these charges to a minimum and might be able to do the work for less than half of this estimate if we find the new sample is practically identical with the material used for the former project 591107.

Phase II of this study would then relate directly to the fourth paragraph of your July 17th letter. Although we do not have a pilot size rotary kiln on our own premises at present, we do have ready access to a direct gas fired refractory lined rotary kiln in our immediate vicinity. This kiln is approximately 18 feet in length, I. D. 1.25 feet, with adjustable pitch and variable speed of drive. This kiln can produce between one and two tons of quick lime per 24-hour day, using a limestone which does not decrepitate. We hesitate to estimate its production on a material which does decrepitate and for this reason believe it very important that a sizable quantity of your material be put through this practical sized rotary kiln unit. Assuming that this kiln would handle about 100 lbs. per hour of feed limestone, it should require about a week to process between five and ten tons of the large composite sample.

5. We suggest, therefore, that since you have men available at present to get the large bulk sample out that you proceed to do this and arrange to deliver up to 10 tons of the material to us in Golden, as convenient. This suggestion is based on the assumption that since you already have men available on the location, it is worth the gamble to get the large composite out, even though the next round of laboratory testing has yet to be completed.

6. If you have facilities available, we suggest this large sample be crushed to all pass a 2" square opening before delivery to us. The fines and dust should be left in the sample. If you do not have the necessary crushing and screening facilities, the sample should be broken to at least about 6" maximum size in order to facilitate our further crushing of the material here.

7. We estimate our charges for operating the kiln on an around-the-clock basis for 7 days would not exceed $4000, and if production were better than expected, this estimated charge would be considerably lower. At present, we are in position to undertake this commercial burning after September 15th, but would, of course,

not wish to make the pilot run until the proposed Phase I studies were completed. We would store the finished quick lime product in tight steel drums.

There is also a possible Phase III study which we would like to propose to you in view of the third paragraph of your letter of August 9, 1962 to me. Since our last contact, we have added a Market Analyst, Dr. Wilbur B. Pings, to our staff. Dr. Pings' market survey work over the past year has been very well received by our sponsors involved. He is in position to examine the market situation for the quick lime production, in terms of usages, consumption, competition, freight rates and other pertinent market items, and we are very pleased to offer his services for this purpose. We believe, although it is premature to attempt an accurate estimate as to the cost of market survey, from past experience, that this could be completed for charges in the range of $2500 to $3000 and I would be very glad to pursue this item with you, should you be further interested. As you may know, I experienced nearly 15 years in the lime industry, particularly with technical field services relative to markets, and between Dr. Pings and myself, I believe we could do a satisfactory job on your potential quick lime production.

From the foregoing proposed three phases of study, you will note that our total budget estimate now indicates a maximum of $9500, subject to further refinement with reference to the possible market survey. We are presently in position to undertake Phase I studies immediately; the pilot burning operation as of September 15th, as already indicated; and we could, should you desire, initiate the market survey any time after September 3rd.

I trust the foregoing covers the essence of the situation and will serve as an adequate reply to your letters of July 17th and August 9th. If we are privileged to undertake all or part of this proposed study, I will be glad to submit our usual contracts, tied to this proposal letter. On the other hand, if you find that major changes in the scope of the work as outlined are necessary, please do not hesitate to let me know.

Assuring you of our desire to be of every possible cooperation, and looking forward with interest to your further advice, I am

Sincerely yours,

C. J. Lewis
Director of Research

CJL/arh

cc: Mr. G. A. Freeman

COLORADO SCHOOL OF MINES RESEARCH FOUNDATION, INC.

GOLDEN, COLORADO

November 15, 1962

COPY

Mr. J. D. Mason
President
Tucson Lime & Chemical Co., Inc.
4730 West 2nd Avenue
Vancouver 8, B. C.

Dear Mr. Mason:

The report on the recent calcining operation is almost completed, but I find I will not have an opportunity to polish it until I have returned from Los Angeles, November 26th.

I would like to do this personally in view of my background in lime and the orientation which I can give to the report. However, if for any reason you urgently need the report, please call Mr. James L. Drobnick who will expedite the item during my absence.

Meanwhile, I am enclosing with this letter and its copies, a brief summary sheet containing the most pertinent data.

Sincerely yours,

C. J. LEWIS

C. J. Lewis
Director of Research

CJL:eh
Enc.

cc: Mr. G. A. Freeman
Dr. E. N. Pennebaker

SUMMARY

Preliminary batch tests were made on the limestone to determine the optimum size for the actual kiln operation. From these two runs it was decided to use a minus 3/4 in. material, without removal of fines, as feed to the kiln.

Nine tons of the limestone sample were crushed and sized to pass a 3/4 mesh screen, sealed in barrels for easier handling and to prevent the adsorption of moisture.

The kiln was heated for 6 hours before the feed was introduced. The starting feed rate was 100 lb. /hr., but this was soon raised to 150 lb. /hr.

The shakedown portion of the operation was 8 hours. Normal operation lasted 62 hours. Total feed, product, and calculated dust loss are:

Feed	9600 lbs.
Product	5065 lbs.
Cal. dust loss	374 lbs.
% dust loss	3.9%

Samples of the product were taken on an hourly basis. Average analysis and quality of quicklime product was as follows:

			Quicklime Analysis	
Kiln data:	Length	18'		
	I. D.	16"		
	% Load	10.1%	CaO	96.90%
	r. p. m.	3/4	SiO_2	2.47%
	Slope	4.48%	R_2O_3	0.40%
	Retention time	90 min. (approx.)	CO_2	0.38%
	Average temp.	2000° F. to 2100° F.	LOI	0.40%

The only operational difficulties encountered were mechanical, and were easily taken care of.

Metals Engineering Company

BOX 597
CASA GRANDE, ARIZONA

PHONE ~~TEMPLE 6-8441~~
PHONE TEMPLE 6-5436
TE 6- 9936

October 19, 1962

Mr. E. N. Pennibaker
Box 817
Scottsdale, Arizona

Dear Mr. Pennibaker:

Enclosed is a copy of the last Assay Certificate for composite assays.

Following are the elevations of the drill holes:

Hole #1	4450 Elevation
" 1 A	4455 "
" 2	4505 "
" 3	4463 "
" 4	4465 "
" 5	4473 "
" 6	4455 "
Tunnel center	4450 "

The large test run is completed at Colorado School of Mines and Mr. Lewis advised that the results were very good. The total dust lost was less than 4% and they were able to calcine 200-300 degrees below average required temperatures.

Sincerely yours,

G. A. Freeman

TELEPHONE
MUTUAL 4-6411

1158 MELVILLE STREET
VANCOUVER 5, B.C.

July 9th, 1962.

Strutzell's -
analcite deposit

Mr. E. N. Pennebaker,
Consulting Geologist,
Scottsdale, Arizona.

Re: Mt. Fagan Lime.

Dear Mr. Pennebaker:

The drilling program on Mt. Fagan has been completed, or at least six holes are finished. When all assays are obtained it might be advisable to drill a couple of more fill in holes.

I have logged and split the first three holes, all of which contained economic good sections of white marbalized lime. Assays for the first hole averaged 53% Ca O for 280' balance not assayed yet.

As per our discussion we spotted five holes 200' apart but added a sixth hole directly above the tunnel which gave us a three hole vertical section at this point.

Expect to return to Arizona in about a week. Will complete logging and splitting.

When all assays are available will contact you, so that you can go over the results and give us your recommendations.

Yours very truly,

J. D. Mason.

JDM:amc

J. D. Mason.

September 20, 1962

Mr. Herbert Tlaxton
80 King Street West
Toronto, Ontario
CANADA

Dear Mr. Tlaxton:

At the request of Mr. J. D. Mason I have recently checked the drill core from his exploration of the Mt. Fagan limestone deposit south of Tucson, Arizona. When all of the analyses are in, I shall prepare geologic sections and an estimate of tonnage and grade.

From the information now available I am favorably impressed with the drilling results. There appears to be a substantial amount of limestone running from 50 to 52% of CaO, with about 2.0% of silica and about 0.20% of ferric oxide as impurities. These figures, of course, are preliminary and subject to correction when all of the analyses are at hand.

The better sections of the limestone (or marble) are rather coarse in grain, and grinding and burning tests will be required to determine amenability to commercial treatment.

Yours very truly

E. N. Pennebaker

ENP:mc

cc - Mr. J. D. Mason
Mr. T. A. Goodnight

September 28, 1962

Mr. J. D. Mason
4730 West Second Avenue
Vancouver 8, B.C.
CANADA

Dear Mr. Mason:

I received today from Vancouver two copies of each of the following drawings of the Mt. Fagan limestone area:

Diamond drill hole plan
Section A-A
Section along hole No. 5

I have not yet received any additional assays nor a statement from Mr. Jacobs regarding just what is meant by the "CaO" on his certificates.

When all these data are at hand, along with the sections of the remaining drill holes, I shall proceed with the job.

Cordially yours

E. N. Pennebaker

ENP:mc

October 20, 1962

Mr. J. D. Mason
4730 West Second Avenue
Vancouver 8, B.C., CANADA

Dear Mr. Mason:

I have received today from Mr. Freeman copy of assay certificate covering some 8 composite samples from the Mt. Fagan drilling. I have not had time to check my records but assume that this completes the assay returns to come in. I also received a list of collar elevations for the drill holes.

Colorado School of Mines Research Foundation has sent me a copy of a preliminary memorandum under date of October 8. I expect their final report of the test returns will be in shortly.

I believe that there are also a few more cross-sections to come in to me.

I am leaving tomorrow for examinations in California and Nevada but expect to return on October 30. I hope all of the material is available to me then so I can complete the assignment. After November 25 I expect to be fully occupied on other work for at least four months.

Cordially yours

E. N. Pennebaker

ENP:mc

cc - Mr. J. D. Mason
Mr. Herbert Tlaxton
Mr. T. A. Goodnight

March 1, 1961

Mr. M. R. Prestridge
P.O. Box 613
El Paso, Texas

Dear Mr. Prestridge;

Enclosed are various data on the Mount Fagan marble (or limestone) deposits near Tucson. (These are also known as the Sabado deposits and the Helvetia lime deposits.)

In one folder is a report by Mr. J. D. Mason, a Canadian engineer apparently quite familiar with the lime business. I suggest that you read this first as it includes some discussion of possible markets.

Following this in the same folder is a report on test work on the rock conducted by the Colorado School of Mines Research Foundation. You will observe that certain problems were encountered, but you will also note that a high-calcium quicklime was produced that would be suitable as a reagent in metallurgical plants. (I regret that the Thermofax made such a faint print.)

In the other folder is my report based on two weeks' field mapping.

The tonnage possibilities must be determined by drilling, but the chances are good for developing enough rock at moderate depth to keep a 200-ton per day quarry going for 15 or 20 years.

The deposit needs to be sampled by drilling to determine the average silica content, although lime for metallurgical reagents will tolerate a small amount of this impurity.

The owners are reputable Phoenix business men, including Mr. T. A. Goodnight, manager of the Valley National Bank branch at 1400 N. First Street, Phoenix; Mr. Kemper Marley, well-known rancher in Arizona and Sonora; and Mr. Bud Cooper, rancher and ranch appraiser for Valley National Bank. They have put the property together but don't know the lime, quarry, and building products business. They hesitate about spending any money for drilling and test work and are ready for a deal with an experienced operator.

over

I have no interest in the property, direct or contingent.

If you are interested I shall be glad to arrange a meeting with you and Mr. Goodnight and a visit to the property.

With best regards to you, Max, and Ray Moore,

Yours sincerely

E. N. Pennebaker

ENP:mc

May 1, 1961

Mr. M. R. Prestridge
P.O. Box 613
El Paso, Texas

Dear Mr. Prestridge:

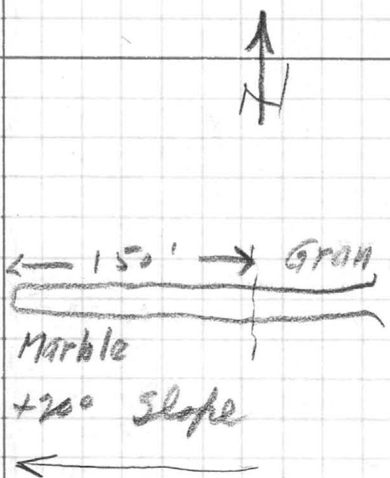
On March 1 I forwarded you various data on the Mt. Fagan limestone deposits near Tucson. If you are now finished with these reports, I would appreciate their return to my files; otherwise you are most welcome to keep them longer.

With best personal regards to you and Max,

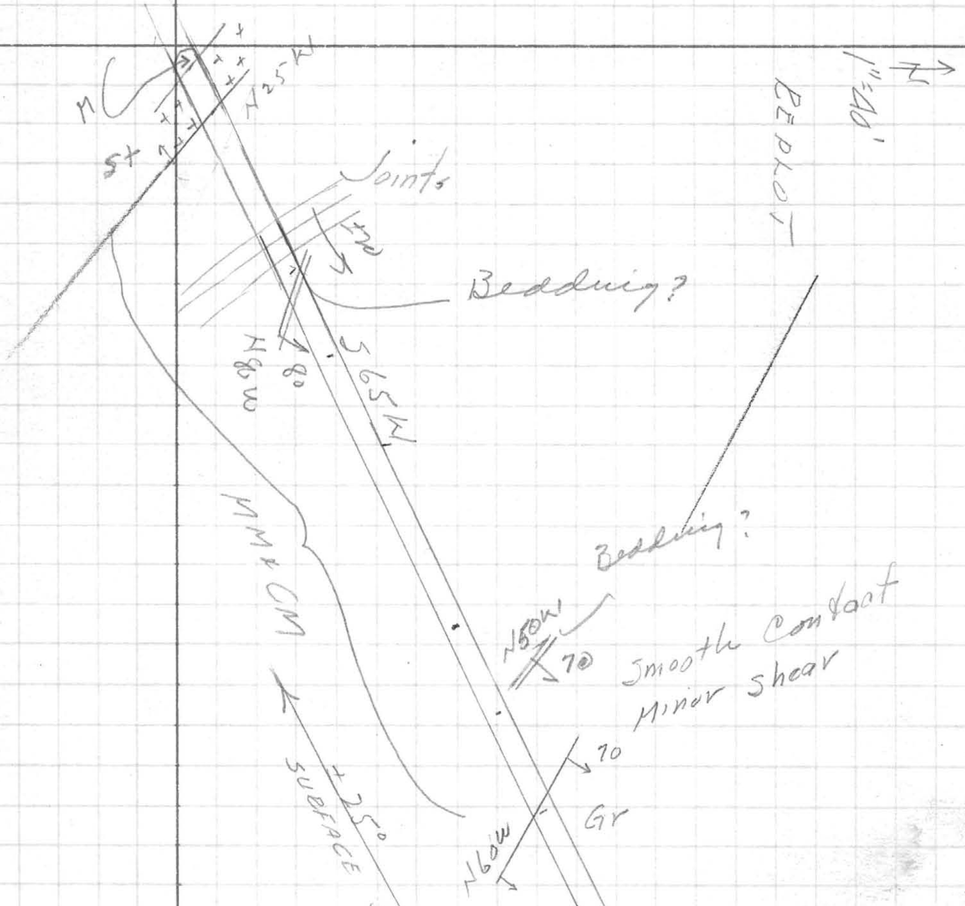
Yours sincerely

E. N. Pennebaker

ENP:mc



G & Tourea —
Administration
Bldg



1"=40'
REPLOT
N25W
Joints
Bedding?
N80W
80
S65W
MM+CM
Bedding?
N60W
70
Smooth contact
Minor shear
70
Gr
N60W
65
+25° SURFACE SLOPE
Gr
Gr

White Rock #13
Sept 3-1966
50 ft to S &
1450 to N
Alfred P. Nelson

At Qzte Saddle

Near Base

Zone of dark gray mable

±25' Strat. T.

±200' Up -

Several feet of Silicates

Tb-Ch-Ls

Layers of ch 1/4" to 3/4" thick & up to 2"

Commonly make up 25% to 75% of rock -

Brownish weathering & minor Fe stains in cuts

=

DARK BLUE LS

Certain beds W. of 1/4 Cor. have abt. Ch

=

Chert in CM occurs as irreg blobs & as veinlet & migration along fractures m Ls -

± 50' uphill from SEC of

S-S- mLs is sandy & siliceous

& scratches pick

Carries some lacey chert —

Silicates ? also

Is mLs an incipient marbleization

of a sandy blue Ls ?

In Steep Block ?

N16W to dump
N42E to Ocotillo
} Big, irreg. ch in CM - first appearance

Beds N65W - Steep to N?

Beds ±N65W Dip ±70N

N17W to dump
N36E to ocotillo
CM & MM - Gray steaks

±75' to S. are two line stakes on a N80W line

This is ± axis of overturn or Flat Fault, which strikes westerly for ±750' @ ±N60W

To N. marble looks good in steep block. Only minor chert

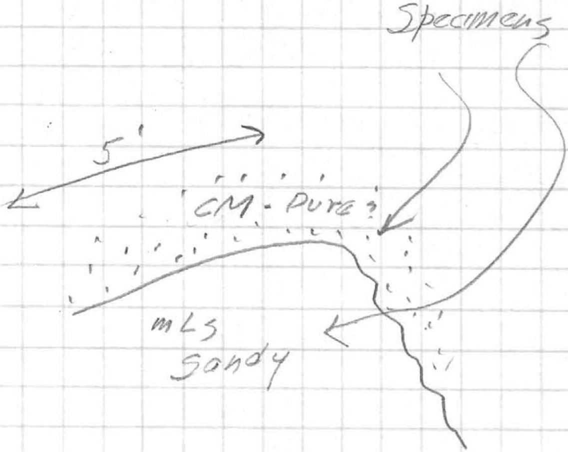
To S, presumably in flat block, CM looks good at least 100' Than P.O. Some ep - stain up here

N26E to ocotillo
N75E to upper freo
In steep black-
CMeMM - N70W - 80° ± N dip
AXIS or FF ± 15' S

N60E
±100'
Abt. min
sk, rch
Dense lg
Dike

N32W to SE -B-1
N17½E to ocotillo
} Abt. Qtz to

PLAN



LAUER'S CUT –

G FM zone in m Ls

Goes ±30' to N, then lacey ch.

Spec – of "good" material from

cut will scratch pick.

There are coarser patches

in cut.

TUNNEL PORTAL TO $\frac{1}{4}$ COR

VA = $-12\frac{1}{2}$

WATER IN SHAFT

± 60 FT BELOW LOWER ADIT

OR ± 40 FT BELOW NEARBY GULCH

Line of Sampling
±N60E

A- Western 50' measured on slope. Westernmost 15' carries a few chert nodules

B- 2nd- 50' uk more considerable med-x gray marble in this sample

C- Next 50' up hill Mostly CM-white

D- Next 50' uphill Ditto

E – Next ~~55~~ 50' up slope
Smooth outcrops
of white CM – G
poor sample –

Surface Samples -

Above Hole #5

350' slope distance

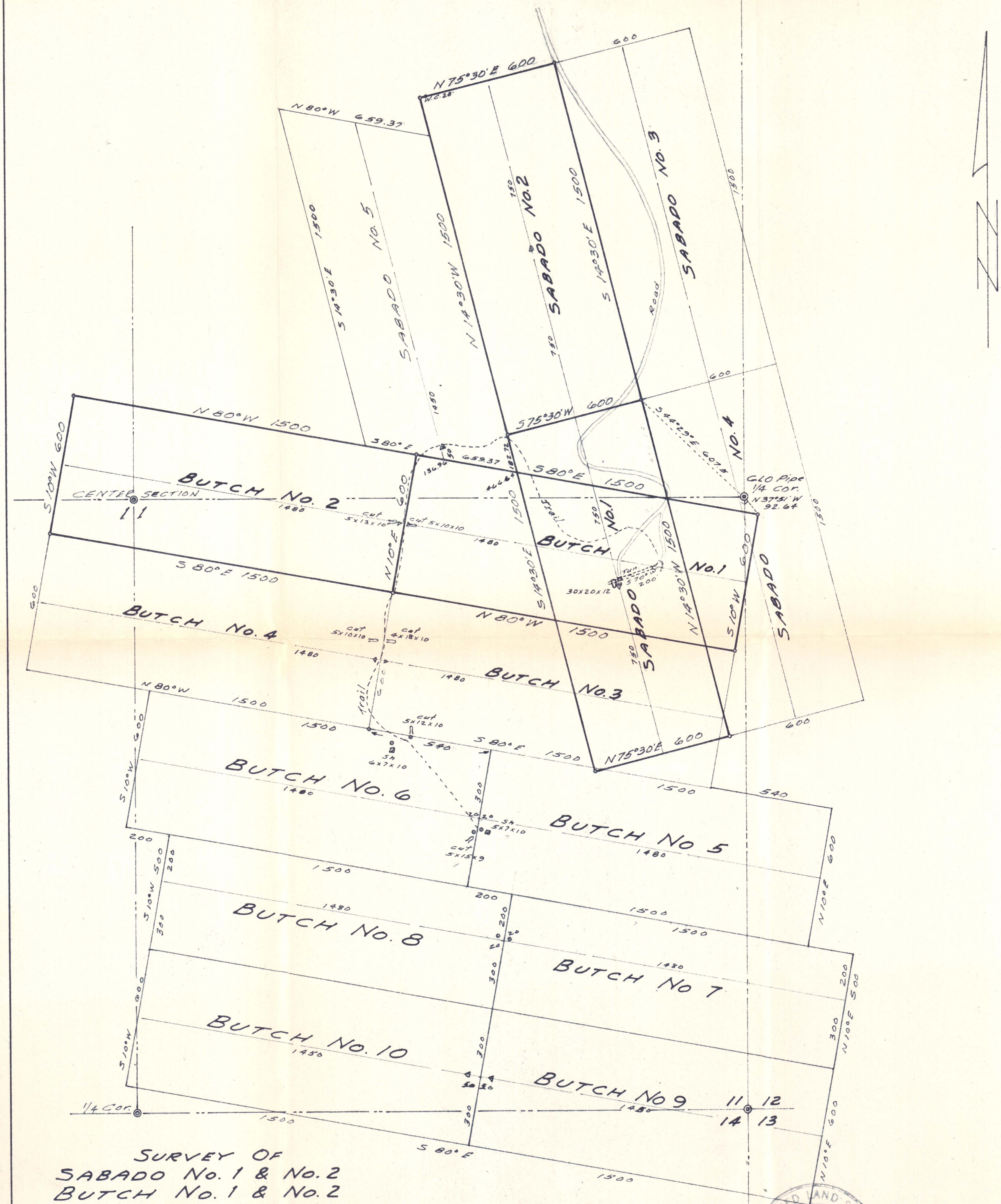
40° ± Slope ±60# chips.

CaO = 52.7% CaO

Above tunnel

150' slope distance

53.4% CaO



SURVEY OF SABADO No. 1 & No. 2 BUTCH No. 1 & No. 2 IN SECTIONS 11 & 12 T. 18 S., R. 15 E. HELVETIA MINING DIST. PIMA CO. ARIZ.

SCALE 1" = 300' SEPT. 1960

T. A. Goodnight - Claimant

E. H. Jenkins

Registered Land Surveyor 2306
Mineral Surveyor B.L.M.

REGISTERED LAND SURVEYOR
CERTIFICATE EXPIRES
E. H. JENKINS
DEC. 31, 1960
ARIZONA, U.S.A.

M 202