

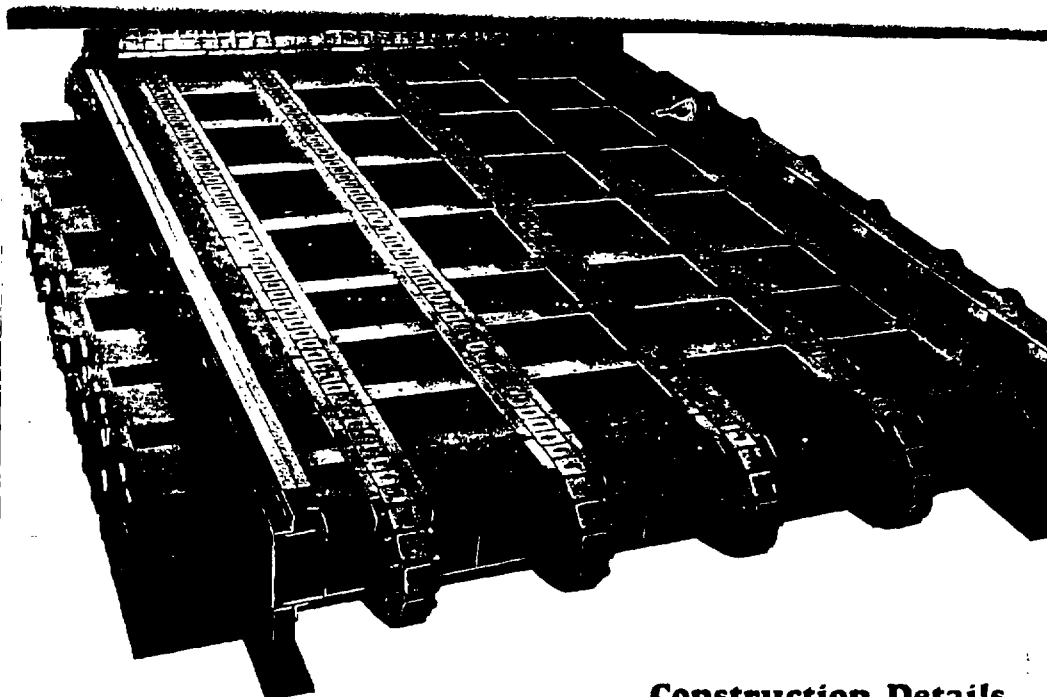
THE
RILEY
HARRINGTON
 FORCED DRAFT
 TRAVELING GRATE
STOKER

RILEY
 STOKER CORPORATION . WORCESTER, MASS.

Agents: New York, Chicago, St. Louis, St. Paul, Minneapolis, Detroit, Seattle, Baltimore,
 Philadelphia, San Francisco, Portland, Boston, Denver, Kansas City, St. Paul, Kansas City,
 Los Angeles, Atlanta, New Orleans.

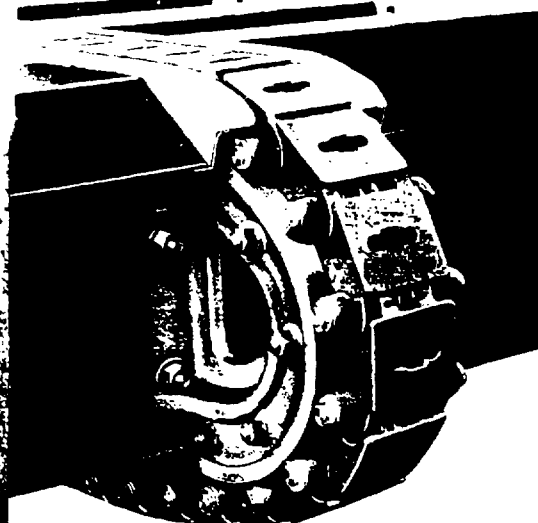
COMPLETE STEAM GENERATING UNITS

BOILERS . . . SUPERHEATERS . . . AIR HEATERS . . . ECONOMIZERS . . . WATER COOLED PUMPS
 CONVERTERS . . . BURNERS . . . MECHANICAL DRIVERS . . . STEEL PLATE INSULATED SETTINGS



RILEY HARRINGTON FRAME STRUCTURE
WITH GRATE SURFACE REMOVED

REAR TRACK ASSEMBLY SHOWING TRACK
BASE AND RENEWABLE TRACKS



Construction Details

The Riley-Harrington Stoker is a massive, heavy-duty machine. Each detail of its construction embodies great strength to insure long, continuous, trouble-free operation with a minimum of maintenance, resulting in maximum boiler availability.

Frame Structure

At the front of the Riley-Harrington Stoker rugged heavily ribbed cast iron side frames are used. (See illustration top next page.) A heavy welded structural steel girder is located at the rear. I-Beams and channels are used as longitudinal and transverse members. The substantial framework thus formed affords proper stability under all conditions of operation. Ample provision for expansion is provided, permitting the use of high preheated air temperatures without strain or distortion.

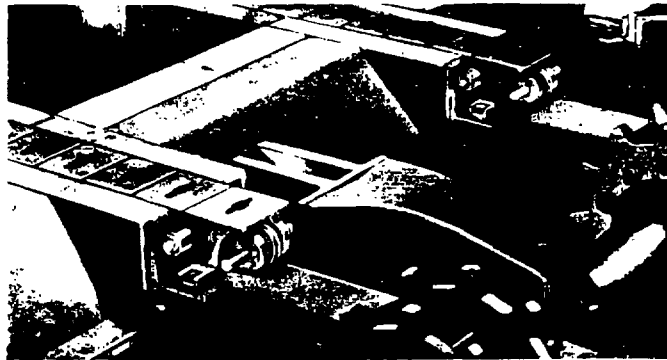
Rear Track

Massive cast iron track bases are bolted to the welded rear girder. Hardened alloy renewable tracks are then bolted to these bases. This construction insures low maintenance, as only the small easily renewed tracks need to be replaced. Simplicity of construction at the rear of the stoker subjects a minimum of parts to maintenance due to heat and ash.

AIR SEALS . . . Proper Air Sealing Important

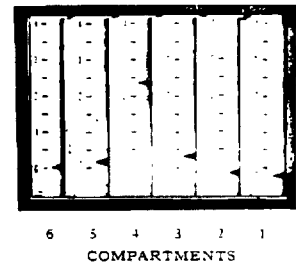
With forced draft traveling grate stokers, if highest efficiency is to be obtained, it is essential to be able to control accurately different pressures in the various air zones. To do this, adequate means must be provided to prevent air leakage from one air zone to another. The excellent sealing between zones of Riley-Harrington Stokers is well illustrated by the draft gage readings at the Otter Tail Power Company's Wahpe-

ton, North Dakota, plant, America's leading lignite burning installation. Note that even a negative pressure is indicated in zones 1 and 2 where dampers are closed. If excess air along the sides of the furnace is to be prevented, proper air sealing at the side walls is also necessary. Proper air sealing at the front of the stoker prevents blowing of dust and gases into the boiler room.



FRONT AIR SEAL

ZONE AIR PRESSURE



6 5 4 3 2 1
COMPARTMENTS

Front Air Seals

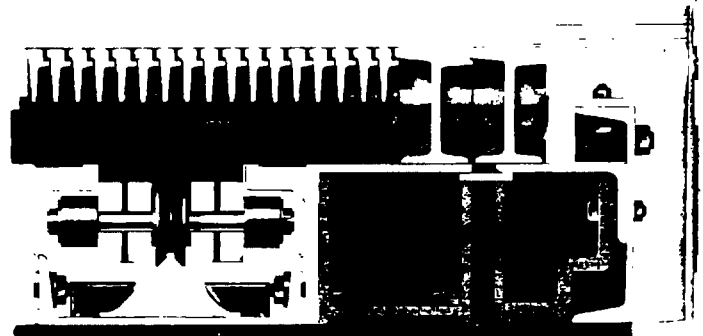
The space between the front of the first air compartment and the transverse members tying the two side frames together is definitely sealed against air leakage with sheet steel sealing plates as illustrated. The posi-

tiveness of this sealing is indicated by the fact that when covers are supplied for the stoker front a negative pressure exists on the inside of the cover—any air leakage, of course, would cause a positive pressure

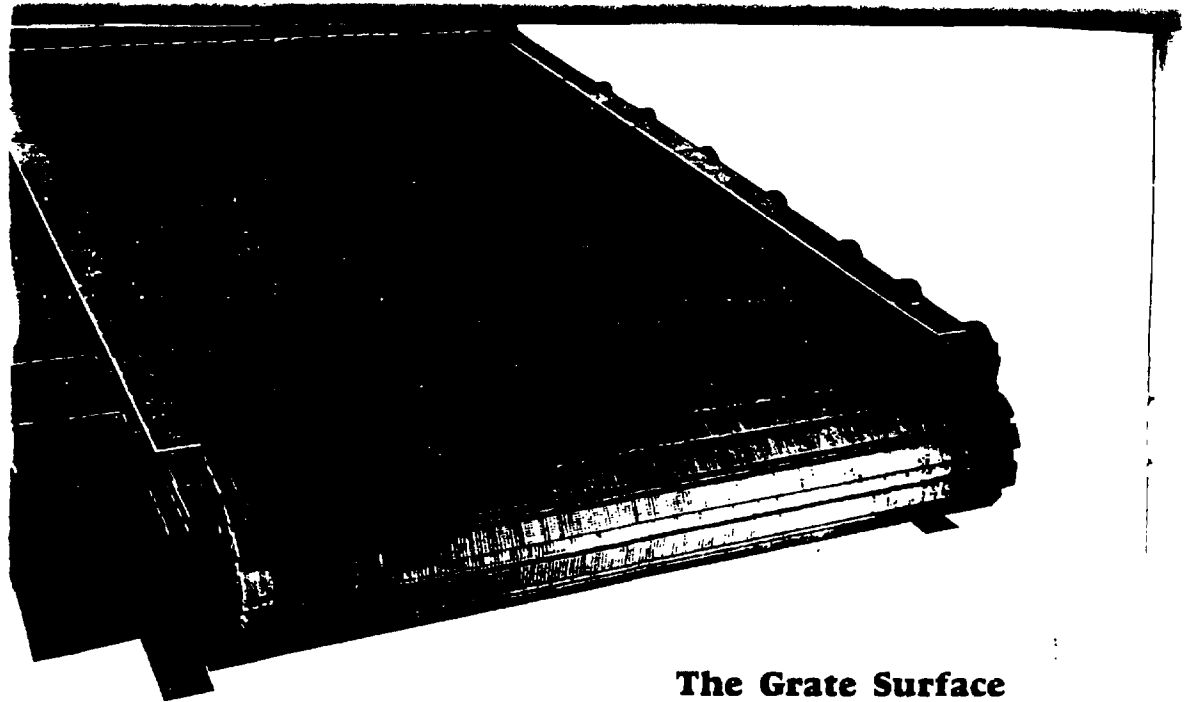
Side Air Seals

The longitudinal zone between the top side channel of the stoker frame and the chain air seals is sealed definitely against air leakage as illustrated. Before there could be any side wall air leakage with a Riley-Harrington Stoker, air would have to pass from the chain air seal to the side of the stoker and beneath two rows of sealing clips before it could get out at the side wall. Effectiveness

of the Riley-Harrington side air seals is proven by the absolute absence of side wall air infiltration



SIDE AIR SEAL

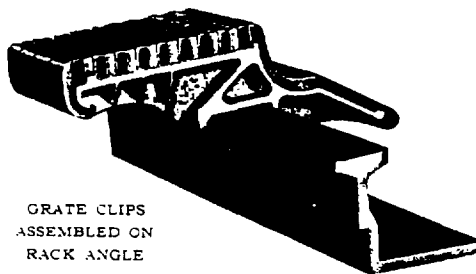


The Grate Surface

The grate surface is one of the most important parts of any stoker—it must afford uniform and proper air distribution over the entire stoker—must prevent siftings of fine coal particles to the air zones—must be able to stand the severe service to which it is subjected. These functions are admirably fulfilled by the Riley-Harrington Stoker grate surface.

The Riley-Harrington Stoker grate surface is made up of grate clips $\frac{1}{2}$ of an inch wide, affording 300 air openings per square foot of grate surface. Each and every clip is active—no blank locking clips or other air obstructing constructions are required. When the grate passes around the rear of stoker, each row of clips is separated from adjoining rows, cleaning grate surface and assuring proper air supply. The clips have overlapping edges, reducing siftings to an absolute minimum.

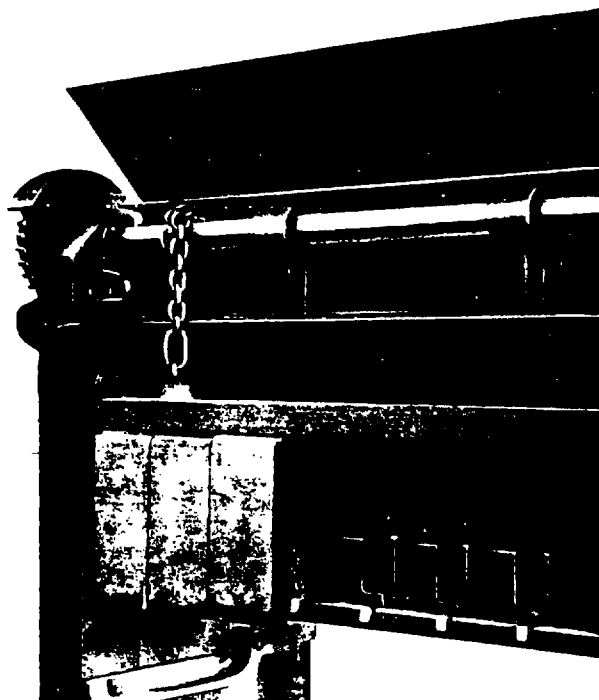
The grate clips are mounted on transverse racks which are bolted to the top of the heavy stoker chain links. The grate surface therefore merely supports the fuel bed and is not subject to any mechanical stress as is the case with chain grate stokers. This



GRATE CLIPS
ASSEMBLED ON
RACK ANGLE



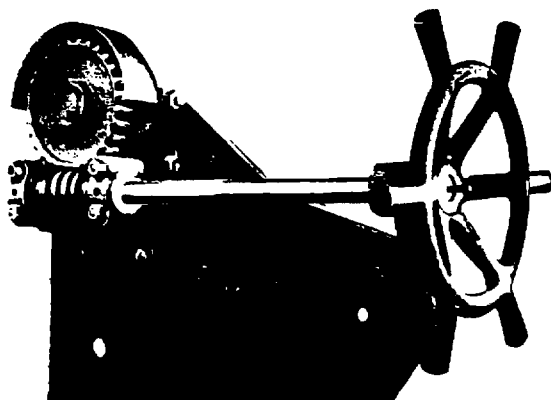
CROSS SECTION
OF GRATE CLIPS



The Fuel Gate

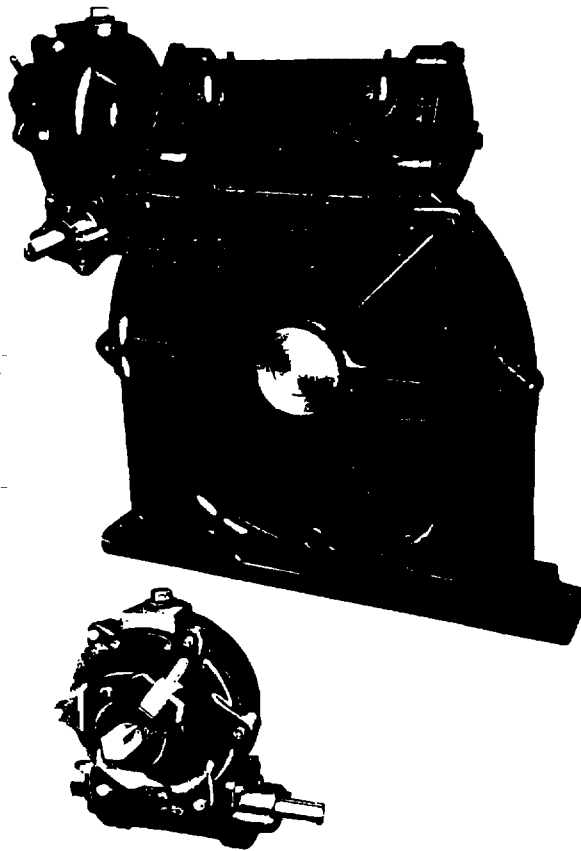
The fuel gate consists of one or more heavy cast iron gate sections. When of more than one section, the sections are securely spliced together. The furnace side of the gate is protected by special fire brick tile which are supported by gate shoes held to the gate by wedges. The protecting tile also extends over the nose of the gate shoes to protect them.

The gate opening can be adjusted from approximately 2 inches to 15 inches with corresponding variation in depth of fuel bed. An indicator, located at the front of the stoker, shows the amount of gate opening.



Gate Lifting Mechanism

The depth of the fuel bed is controlled by adjusting the height of the gate. The gate lifting mechanism consists of a worm gear reduction operated by means of a large handwheel at the front of the stoker where it is readily accessible. A position indicator shows the extent of gate opening. For wide stokers, lifting mechanisms are provided on both sides of the stoker.

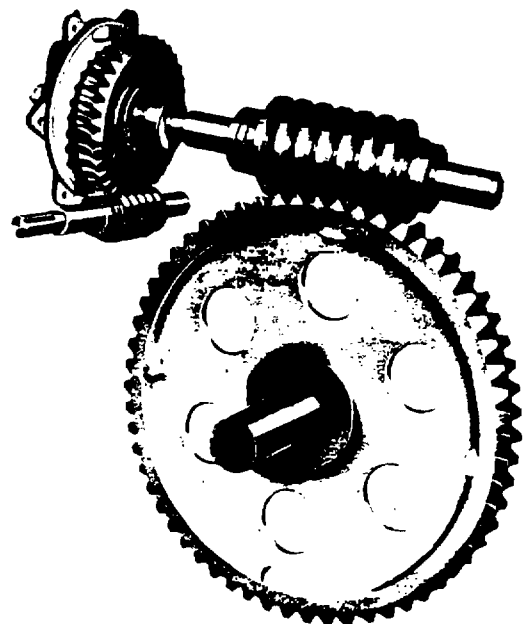


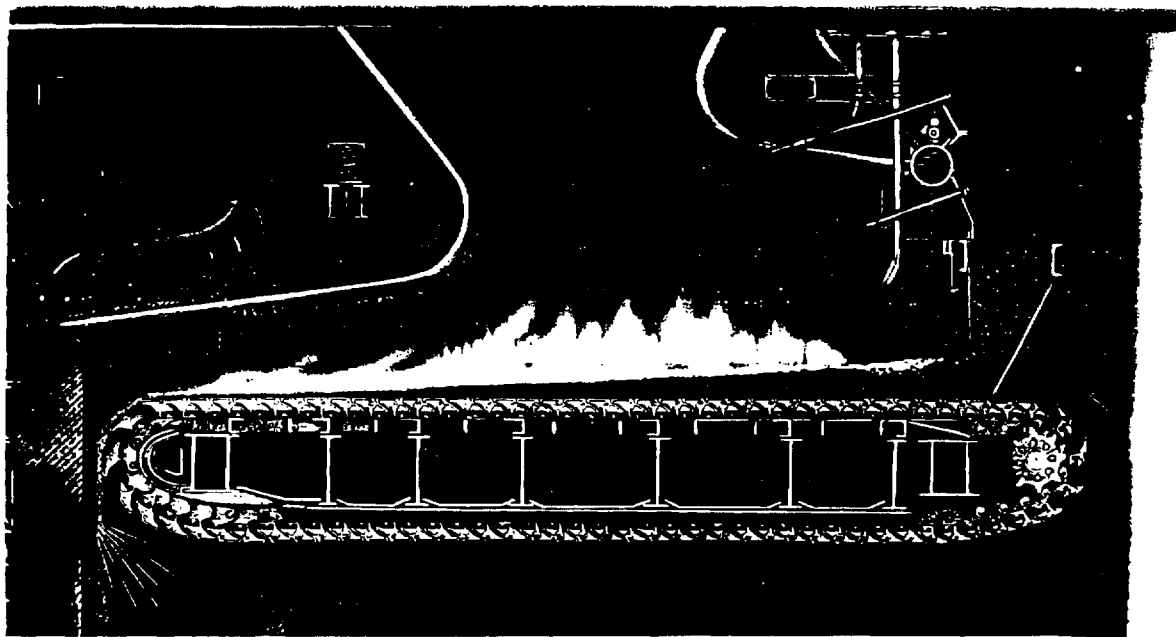
The Drive

The Riley-Harrington Stoker drive is a double worm and gear reduction unit. Hobbed gears and worms are carefully machined to give perfect contact between teeth of worms and gears. Roller thrust bearings are used on main worm shaft and roller thrust bearings on the intermediate worm shaft. Bearings for all shafts and gears are of large proportions to assure long life. The reduction gears are housed in an oil and dust proof rugged cast iron housing. Proper lubrication is obtained through oil reservoirs in the main and intermediate gear chambers and by pressure grease fittings.

Safety Device

Connection between the intermediate gear and main worm shaft is through driving and driven couplings assembled on the main worm shaft. These two couplings are tied together by means of a shearing pin. This pin shears if there is any obstruction to the grate travel, permitting the intermediate gear to operate freely without movement of the main worm and gear. This safety device affords protection for all moving parts of the drive and stoker. It is located at the front of the drive where it is readily accessible.





OPERATING CHARACTERISTICS

Undisturbed Fuel Bed

To burn efficiently fuels of high ash content and low fusion temperature on any stoker, it is necessary to keep an undisturbed fuel bed. With the Riley-Harrington Traveling Grate Stoker, the fuel is carried from the fuel gate at the front to the ash discharge at the rear, without agitation or disturbance of the fuel bed. No agitation or weaving can occur because the grate surface is definitely supported over the entire length by strong longitudinal members.

Progressive Combustion

Combustion takes place progressively from ignition at the front to complete combustion near or at the rear where ash is discharged continuously. The fuel is completely burned out uniformly across the stoker, resulting in low ash pit loss. With the Riley-Harrington Stoker, divided into compartments or air zones, and with proper air sealing between zones, air pressures are correctly maintained at all points of the fuel bed for most efficient operation. The design of the grate surface assures uniform air distribution.

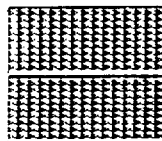
High Efficiency

A few examples of actual and guaranteed efficiencies with Harrington Stokers—

	Actual	Guaranteed
Ohio Salt Co., Rittman, Ohio	85.3%	83.8%
Iowa State College, Ames, Iowa	85.48%	83.7%
Container Corporation, Chicago, Illinois	79.55%	77.6%
Hercules Powder Co., Kenilworth, N. J.	81.0%	78.0%

Correct Air Distribution

Correct distribution of air under comparatively low air pressures is a major requisite to obtain maximum efficiency. The grate surface of the Riley-Harrington Stoker is made up of grate clips less than one inch wide. There are over 35 grate clips, providing over 300 air openings, for each square foot of grate surface. Each and every grate clip is active. There are no blank locking clips and no air obstructing constructions beneath the grate surface. The fuel bed is active over the entire surface—there are no black dead

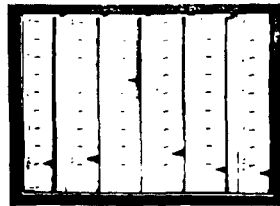


300 Air Openings per sq. ft.

spots or streaks. With 300 air openings per square foot, uniform distribution of air at low pressure is obtained and all blow torch actions eliminated. The ability to obtain desired burning rates at comparatively low air pressures reduces to a minimum the carry-over of fine fuel into the boiler passes.

Positive Air Sealing

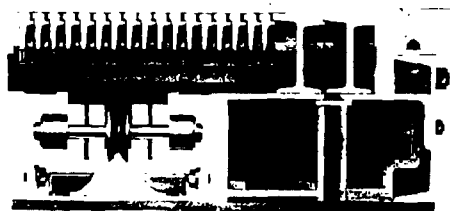
Air at different pressures is required throughout the length of the stoker for efficient performance. To maintain the desired air pressure in the various air zones under varying boiler steaming rates it is necessary to have positive air seal between the zones. The compartment and chain air seals with the Harrington Stoker definitely seal one compartment from the other.



The effectiveness of this sealing is indicated by draft gage readings at the Otter Tail Power installation at Wahpeton, where even a negative pressure is indicated in those zones where air dampers were closed.

No Side Wall Leakage

In order to prevent excess air entering the furnace along the side walls where the fuel bed offers less



resistance to air passage, it is necessary to maintain low air pressures at the side walls beneath the grate surface. To accomplish this, positive air seals must be provided at the side walls. In addition to definite air sealing, the side clips used with Riley-Harrington Traveling Grate Stokers are non-air admitting. These features prevent air leakage at the side walls.

Low Ash Pit Loss

To maintain low ash pit losses it is necessary that the fuel be thoroughly consumed uniformly across the stoker—a uniform square cut-off of the fire must be obtained. This is obtained with the Riley-Harrington Stoker because of effective air sealing and effective utilization of the entire active grate surface, eliminating dead spots and streaks in the fuel bed which would carry large quantities of combustibles to the ash pit. Tests have indicated as low as 3% to 5% combustible in the ash with Riley-Harrington Stokers with boiler ratings over 250%



Photo of stoker in operation showing well burned out ash

Low Sifting Loss

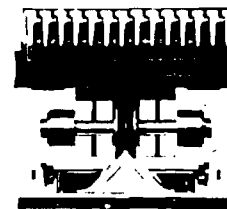
If large quantities of fuel sift through the grate surface, serious sifting losses occur unless these siftings are returned to the furnace to be reconsumed. The Riley-Harrington Stoker is the only traveling grate stoker using overlapping non-sifting grate clips



Carefully conducted weighed tests have proven that siftings from a Riley-Harrington Stoker even when burning fine sizes of anthracite is less than 1/4 of 1% of the fuel burned. This means that over 800,000 pounds of fuel would have to be burned on the stoker to cause one ton of siftings.

Low Power to Drive

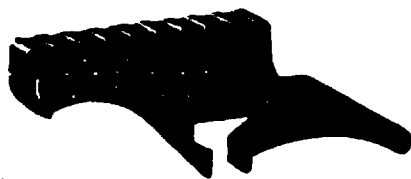
Net efficiency is also affected by the power required to drive the stoker and forced draft fan. As there is no sliding friction with a Riley-Harrington Stoker, little power is required to drive it. As air pressures required are also comparatively low, power to drive the forced draft fan is low.



The Harrington Stoker Rolls

Grate Clips of Rugged Design

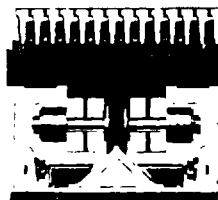
The construction of the grate clip gives them unusual strength against mechanical breakage. As the grate clips merely support the fuel, mechanical break-



age is practically nil, all mechanical motion being imparted by the rugged chain links which are located in a cool zone over six inches before the grate surface.

Roller Chain Principle

The driving mechanism of chain links, side and center rollers and sprockets is based on the roller



chain principle—all sliding friction being eliminated—resulting in low maintenance of these parts. Special alloy chain pins and rollers are used to further reduce maintenance. There are no moving sprockets or other mechanisms at the rear of the stoker where they would be subjected to heat and ash. The driving sprockets and reduction gear are located at the front of the stoker in a cool, clean atmosphere.

In the design of each part of stoker, consideration has been given to maintenance in order to assure reliable, economical operation over years of service.

Ease of Repair

As every moving part to the stoker is either located at the front or comes to the front with each revolution of the stoker, all moving parts are readily accessible and replacements are easily made. Grate surface parts can be easily replaced while stoker is in opera-

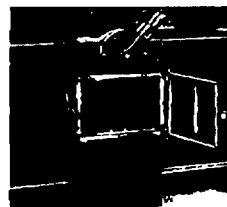
tion. The superstructure of the stoker is so rugged that it requires little or no attention. Air seals are heavy, rugged castings which scarcely ever require attention. About the only parts in the furnace which



might require replacement are the rear tracks. These tracks are special alloy material, requiring but infrequent replacement and are small in size so that they are easily and cheaply replaced.

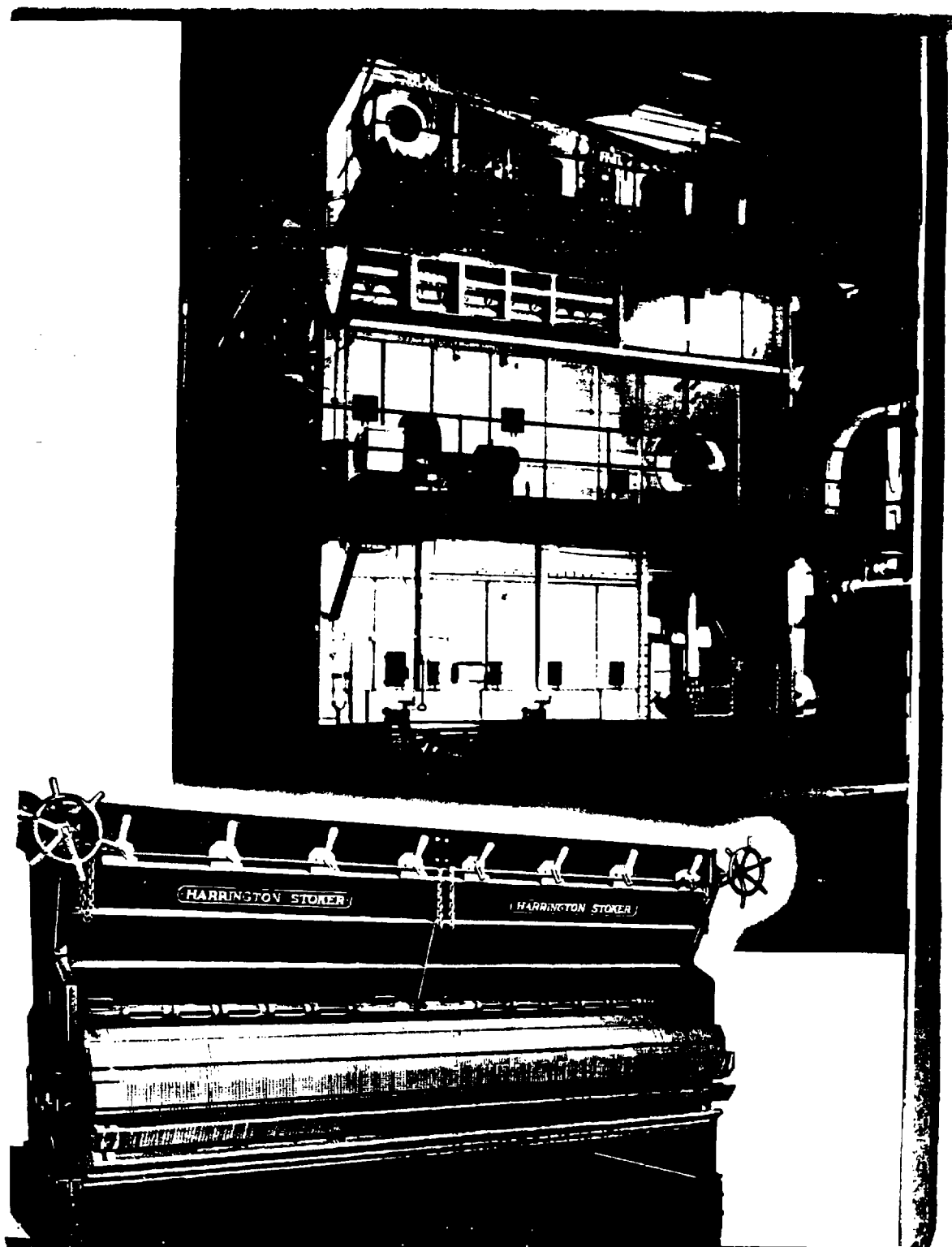
Access to Air Zones

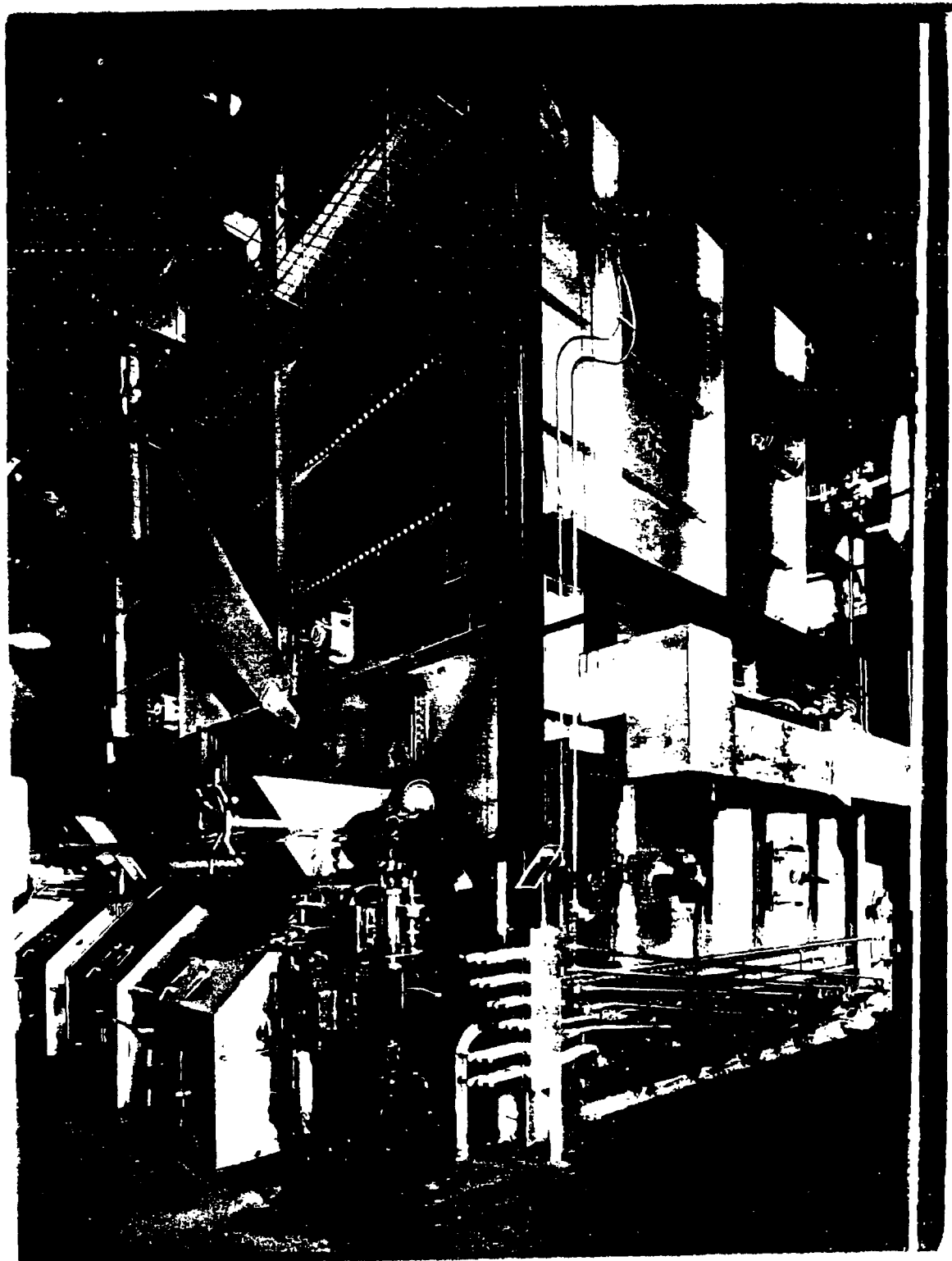
The construction of the air zones and air zone dampers is such that access can be had to any zone while the stoker is in operation, without stopping the stoker. Access is readily had by doors located on the operating floor level.

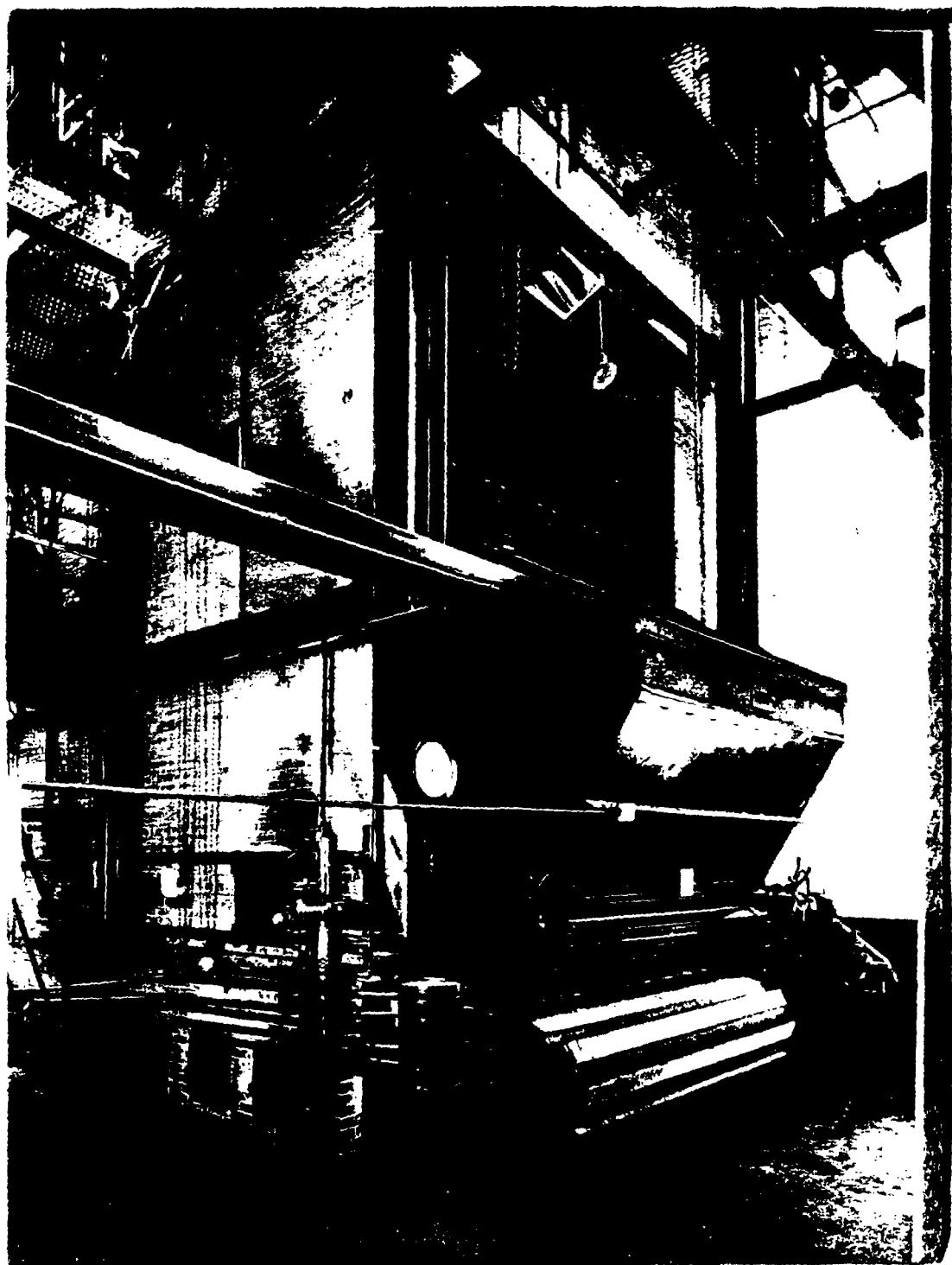


Low Auxiliary Power

Low driving power is required, first because of the efficiency of the main driving worm gear reduction. Second, because all moving parts roll—sliding friction being eliminated—the chains actuating the grate surface rolling on both upper and lower tracks. Low fan power is required because low air pressures are required under the grate surface and because the stoker structure permits free passage of air to the grate surface.







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One 80,000 lbs. per hour Riley Steam Generating Unit fired by 18'0" x 19'0" Riley-Harrington Stoker

Pounds of Steam hr.
Efficiency
CO₂
Loss due to Unburned Comb
Air Pressure—Stoker Zone

80,000 lbs.
83.3' .
14.2' .
15' .
25''

Moisture	15.44%
Volatile	32.68%
Fixed Carbon	33.26%
Ash	18.62%
BTU as fired	9282 B.T.U.

15 44'
32.68'
33 26'
18 62'
9282 B.T.U

