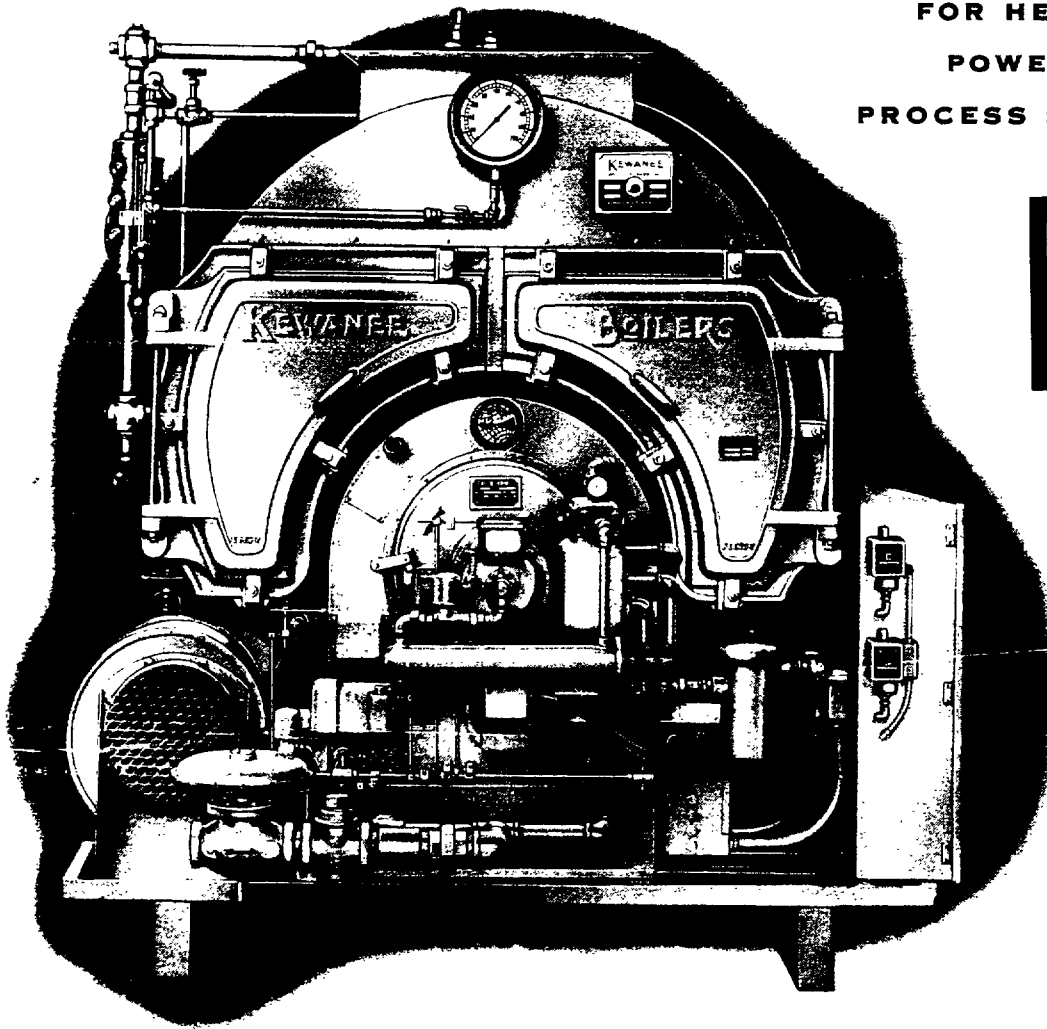


KEWANEE - RAY

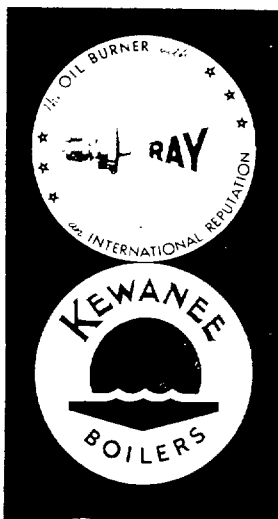
BOILER-BURNER UNIT

FOR HEATING
POWER AND
PROCESS STEAM



PLAINTIFF'S EXHIBIT

ASI-1232



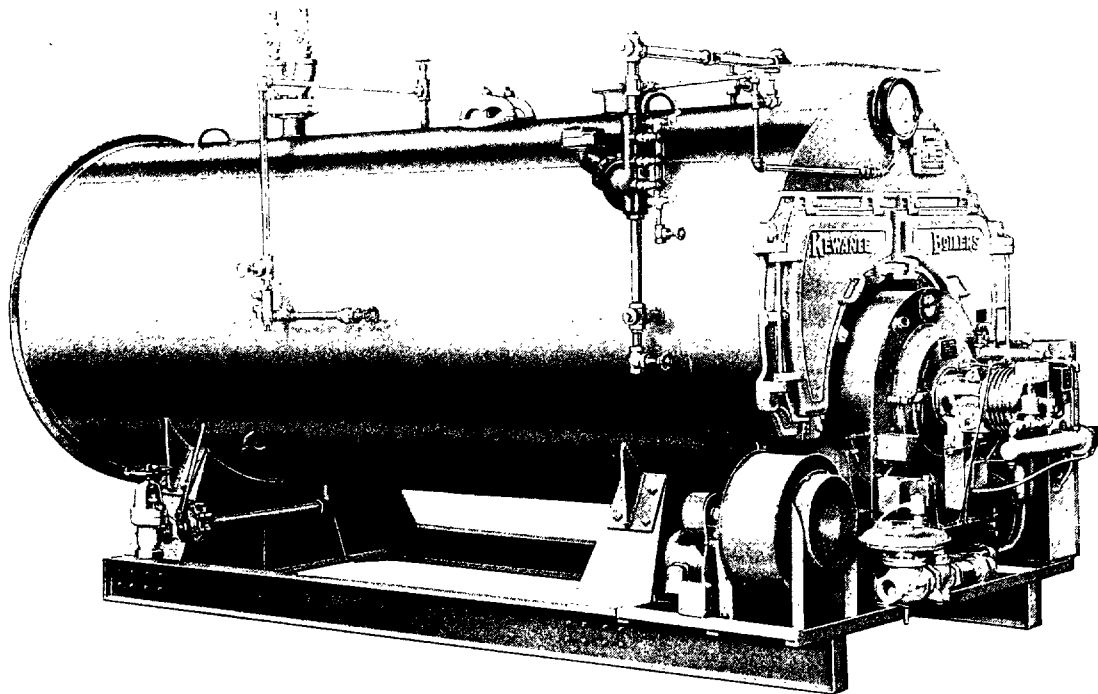
RAY OIL BURNER COMPANY

1301 SAN JOSE AVE. - SAN FRANCISCO 12, CALIFORNIA

KEWANEE-ROSS CORPORATION

101 FRANKLIN ST. - KEWANEE, ILLINOIS

28830



pre-engineered and
completely integrated
for balanced performance



BACKED BY A TOTAL OF 166 YEARS

28831



The Kewanee-Ray is not just another Boiler-Burner Unit! On the contrary—it is a product designed, engineered and built by two great companies . . . each a pioneer in its field. Each of the component parts has been completely integrated with all the others for greater efficiency and complete dependability of the entire unit.

Boilers were rather crude affairs some 85 years ago when the first Kewanee was built. In those days specifications were made more by guesswork than actual engineering knowledge and experience. And to be both safe and sure many of them were purposely made larger than needed and occupied more space and more head room than is practical in modern buildings and plants.

Through all the years Kewanee has set the pace in advancing new ideas of design and new and better methods of fabrication. Today, each of the many Kewanee types leads in its specific field.

Just a few years later . . . in 1872 . . . the Ray Oil Burner Company began its notable career as engineers, designers and makers of combustion equipment. Today *every third rotary oil burner in service is a Ray* which is convincing evidence that this pioneer company remains a leader in the industry.

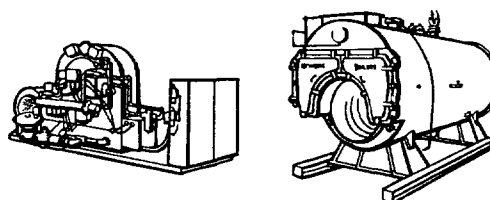
But the Ray and Kewanee engineering staffs did not stop with the designing and building of a burner and boiler. All controls needed for the boiler or burner . . . the valves, pumps, gauges, fans and other accessories, not manufactured by Ray or Kewanee, were carefully selected from the best—then tested in the complete units to be certain that every part would work in harmony with all the others.

That the Kewanee-Ray Unit generates steam with new "highs" in efficiency is not surprising . . . for it is specifically designed and engineered to do a better job, whether used for high or low pressure steam or hot water heating.

Matched boiler and burner connections

The boiler arrives on the job mounted on steel skids extended at the front for mounting the burner. No special base construction is required. All refractories are integrally mounted at the factory, reducing to a minimum the labor required "on the job" to put the Unit into service.

Matching connections between boiler and burner are provided to facilitate the ease with which the burner can be mounted on the boiler. Only steam, water, electrical and fuel connections remain to be made and the Unit is ready to operate.



Delivery from two factories an important advantage

The boiler complete with all controls, piping and accessories is assembled and shipped from the Kewanee Plant . . . the complete burner comes in a separate shipment from the Ray Factory.

Because of its size and weight and incident difficulty of handling, the boiler should be on the building site before the

walls are up. Its construction is such that exposure to weather causes no damage. The mechanism of the burner and its controls being more delicate, it should not arrive until the building is enclosed.

When the Kewanee-Ray Unit is selected, both shipments can be timed to arrive on the job site when required.

OF COMBINED ENGINEERING EXPERIENCE



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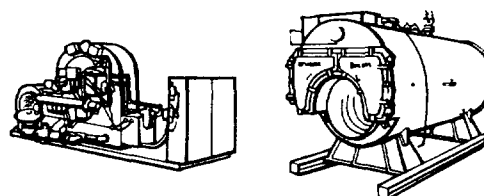
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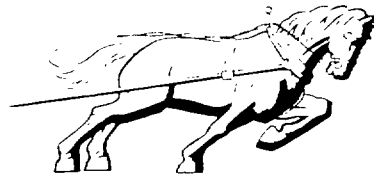
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OF COMBINED ENGINEERING EXPERIENCE



8.2 SQUARE FEET OF HEATING SURFACE

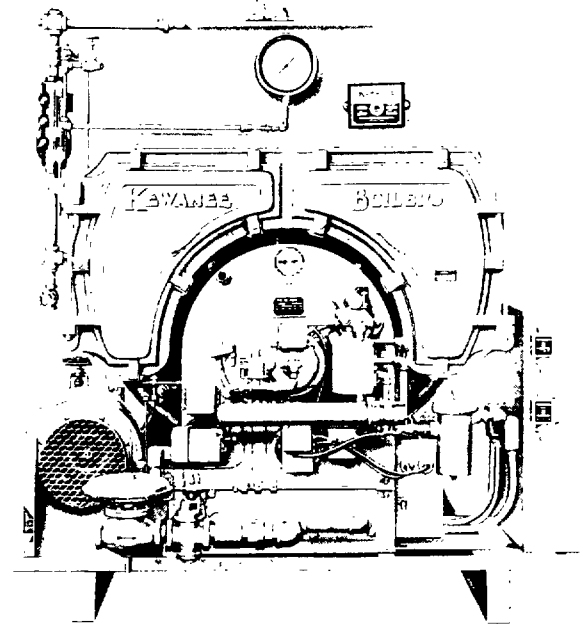
per boiler horsepower



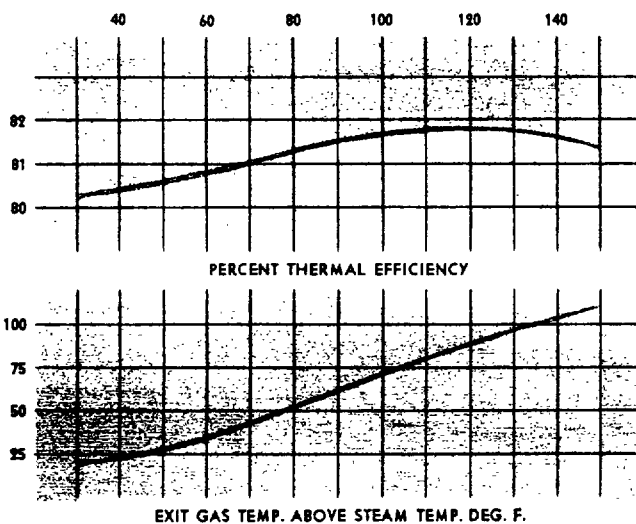
The oil or gas burner generates the heat. The boiler's job is to use that heat by transferring it to the water in the boiler to generate steam. Obviously . . . if the heating surfaces of the boiler are not of sufficient area to absorb all the usable heat . . . much of it will be wasted up the stack.

Generously proportioned heating surfaces have long been a distinguishing feature of all Kewanee Boilers. And in the Scotch type used in the Kewanee-Ray Unit 8.2 square feet of heating surface are provided for each horsepower of the unit's nominal rating.

Not only does this extra heating surface insure efficient transfer of the heat during normal operations, but it also provides sufficient surface to permit the boiler absorbing heat, even when fired, to produce 50% more than its nominal rated capacity.



CERTIFIED EFFICIENCY



Many tests prove the over-all efficiency of the Kewanee-Ray Unit . . . and an *efficiency of 80% is certified*. Actually, under normal "on the job" conditions, much higher efficiencies have been attained and maintained through a very wide firing range.

The charts at the left tell the story . . . showing an over-all efficiency of some 81½% at 100% of rating and over 81% even when the unit is being operated at 150% of rating. The comparatively low temperatures of stack gases prove that an unusually large proportion of the heat is picked up by the water in the boiler and usefully employed in generating steam.



OUTSTANDING FEATURES OF THE RAY BURNER

GENERAL DESCRIPTION

The Ray Forced Draft Burner, with multi-stage air control, is designed as a burner unit for the Kewanee Scotch type boilers.

This burner consists of a Ray direct or belt drive horizontal rotary oil burner with a dual pump and reservoir (of any desired specification) mounted directly on the front plate of a windbox and a specially designed low pressure, integrated gas burner. Standard equipment includes all piping on the burner unit; electronic safeguard system; air safety switch; multi-stage air register ring; completely wired control panel; forced draft fan; and a windbox with integral refractory lining sized to project into the boiler furnace tube opening.

A forced draft fan delivers air at constant pressure to the windbox which in conjunction with the air register ring provides a constant velocity type air stream to the combustion zone with high turbulence and a high turn-down ratio.

A totally enclosed control panel contains all the necessary switches, motor starters, relays and electronic control unit providing easy accessibility in one compact unit.

AIR REGISTER RING ASSEMBLY

The design and position of the "Air Register Ring" with its constant velocity characteristics imparts a high degree of turbulence to the secondary air stream with a consequent rapid rate of combustion and a high turn-down ratio. Evidence of top efficiency is provided by the high percentage of CO_2 attainable. Air pressure in the windbox remains substantially constant throughout the operating range of the "Air Register Ring."

HEAVY OIL OPERATION

The Ray Forced Draft Burner is designed for fully automatic operation with any grade of oil. For heavy oil operation using #6 and some #5 oils, a unit combination heater, pump and circulating oil system is supplied with thermostatic controls interlocked through the burner controls in the control panel.

SIMPLICITY OF CONSTRUCTION

The entire air control assembly may be readily removed exposing the gas manifold ring and providing a manhole opening of standard diameter for access to the combustion chamber ... as well as permitting easy inspection and adjustment of the air control unit. The totally enclosed control panel fits snugly alongside the boiler ... taking a minimum of space.

OTHER ASSEMBLIES

The foregoing description applies particularly to the combination burner with full automatic oil burning unit and gas burner. The forced draft air control unit may also be assembled in the following combinations: (1) Integrated low pressure gas burner. (2) Rotary type, motor driven, oil burner for any grade of oil and for manual, semi-automatic and fully automatic operation. (3) Combination of gas unit with any of the oil burners listed.





GAS AND OIL FIRING ... with complete air

COMBINATION GAS AND OIL BURNER

The Ray combination Gas and Oil Burner consists of the Ray Forced Draft Horizontal Rotary Oil Burner and the Ray Forced Draft, integrated Gas Burner engineered in a single unit...

Change Fuels at the Flick of a Switch

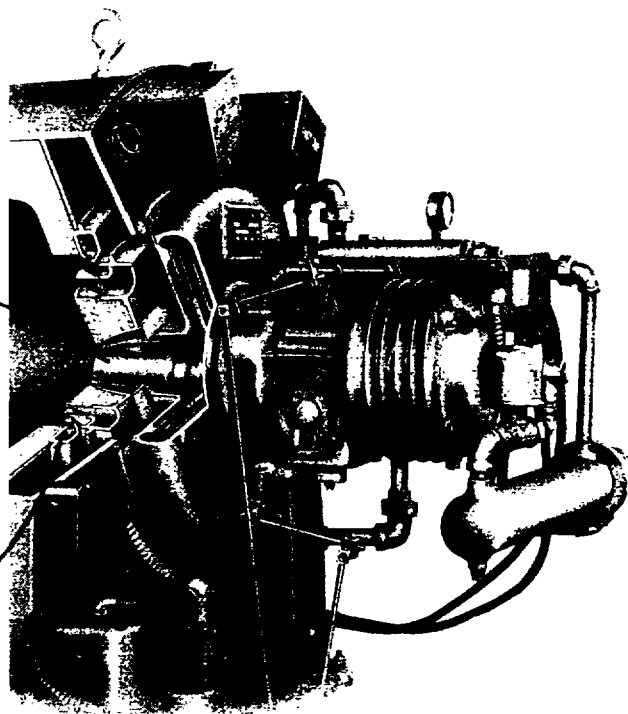
The change in operation from one fuel to another is accomplished by a flick of a switch. No mechanical operation is necessary. The gas burner stays in position on oil firing and the oil burner stays in position on gas firing.

HORIZONTAL ROTARY OIL BURNER

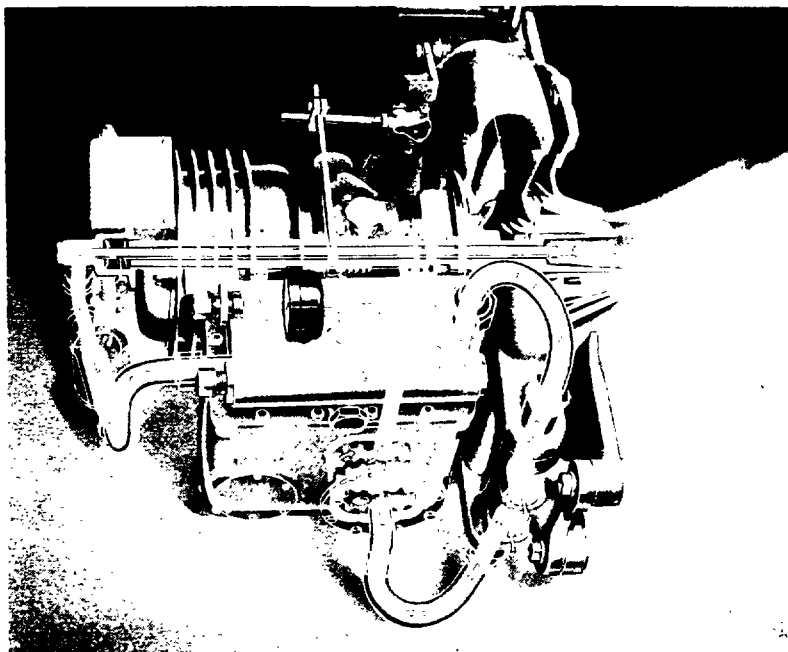
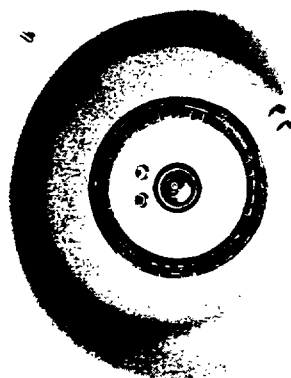
The Ray Rotary Oil Burner, FD-AR, is designed especially for forced draft application. It uses a completely new and different principle of air control and introduction. This *new* method of air control coupled with the Ray Viscosity Valve and the dual pump and reservoir system... which scientifically controls the volume of oil to the burner, regardless of temperature... makes the Ray Forced Draft Burner the leader in its field for fully *automatic... heavy oil operation* at top efficiency ratings.

INTEGRATED GAS BURNER

The specially designed low pressure gas manifold ring encircles the air stream providing maximum aspiration and mixing effect of the gas and air. The gas ring forms the throat of the forced draft air entrance and the gas is introduced through multiple drilled orifices around the throat. The secondary, high velocity, air stream passing over the orifices creates a suction which assists entry of the gas into the air stream ahead of the combustion zone. Thus the gas is not only pre-mixed, but high or low pressure gas supply may be utilized at top firing ratings and operation of the oil burner motor is not required. Equal gas distribution is assured by two gas inlets, one on either side of the manifold ring.



and fuel control



MULTI-STAGE AIR CONTROL

The furnace side of the FD-ARC burner shows the multi-stage secondary air control vanes which impart a high degree of turbulence to the secondary air stream with a consequent rapid rate of combustion. Gas is introduced from the outer circle of vanes where it is pre-mixed with the air. The oil atomizing cup and the angular vane nozzle, which controls the primary air for oil burning, are down in the center of the air register assembly.

Operation:

The Forced Draft Fan delivers the air to the windbox at substantially constant pressure. Secondary air is then metered by the Ray patented "Air Register Ring." Primary air, also furnished by the Forced Draft Fan, is monitored through the oil burner fan and angular vane nozzle . . . thus the pressure generated by the Forced Draft Fan is added to that of the fan on the burner for increased nozzle velocity and better oil atomization.

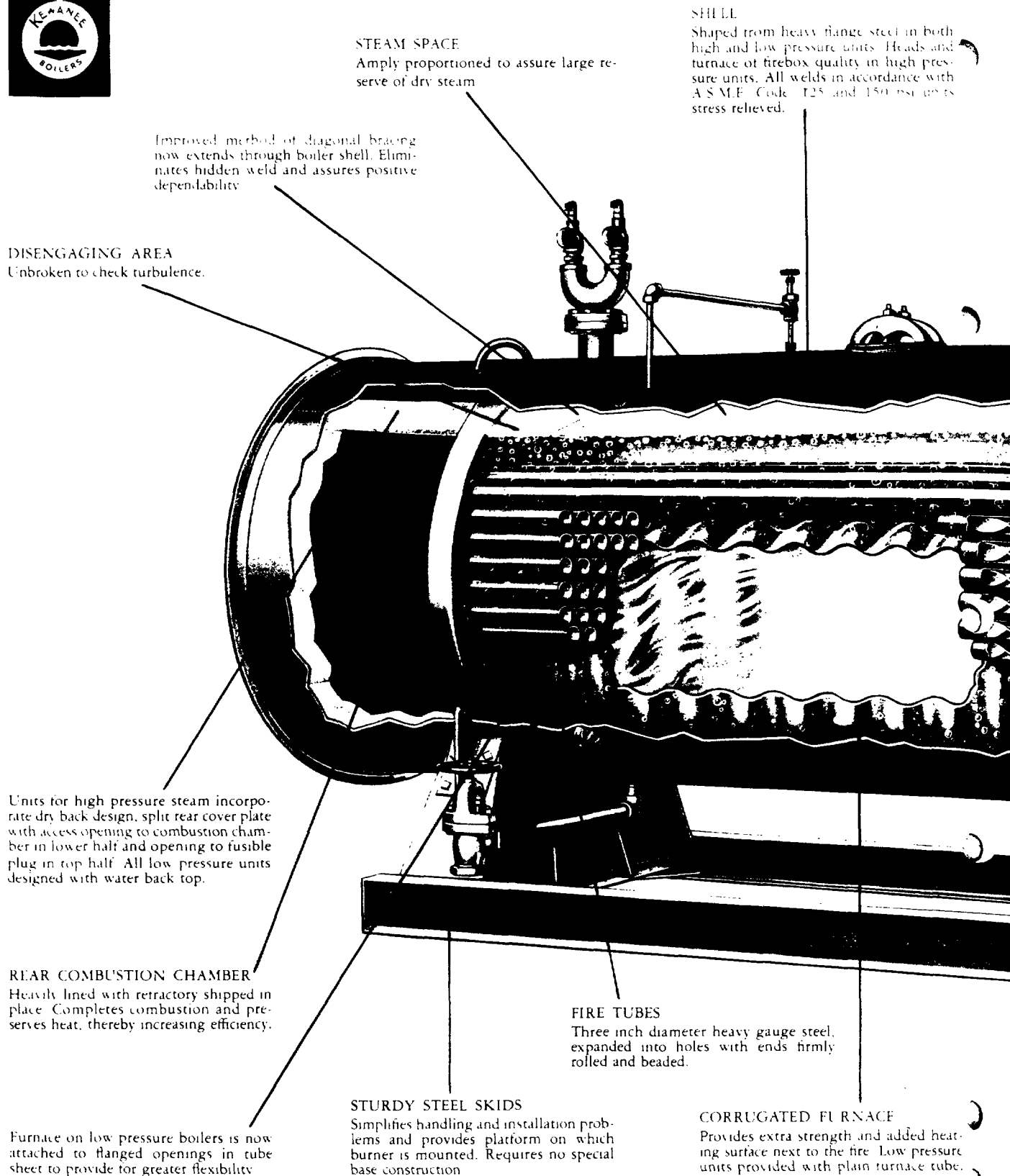
Efficient ratio of air to fuel is constantly maintained at all firing rates by the Ray Automatic Control System. This control system is operated by a fully modulating motor, positioning the interconnected Ray Oil Viscosity Valve, gas butterfly valve, primary atomizing air valve and secondary air register ring, regulating the fuel and air as the load demands.

VISCOSITY VALVE AND DUAL PUMP & RESERVOIR SYSTEM

The Ray VISCOSITY VALVE is a patented, exclusive feature of all Ray fully automatic heavy oil burners. It supplies the burner with a scientifically controlled volume of oil which is unaffected by changes in temperature or viscosity of the oil and maintains a controlled firing rate which varies only to meet changing load requirements.

The greatest advantage of the Ray VISCOSITY VALVE over similar devices for controlling the oil flow is that it accomplishes so much without any moving parts . . . it does not adapt itself to changes in viscosity; it makes the oil adapt its rate of flow to the needs of the burner. In the valve itself, there are no moving parts, no mechanisms to wear out.

An integral part of the Ray VISCOSITY VALVE system is the Ray Dual Pump and Reservoir. The dual, gear type pumps are submerged in a reservoir of oil with the primary pump drawing oil from the storage tank to the reservoir and the secondary pump delivering a constant volume of oil to the VISCOSITY VALVE. By allowing air to separate from the oil and be exhausted back through the return line, the reservoir eliminates the danger of flame instability and failure resulting from leaky suction lines or oil vapor formation.



STEAM SPACE

Amply proportioned to assure large reserve of dry steam

SHELL

Shaped from heavy flange steel in both high and low pressure units. Heads and turnace of firebox quality in high pressure units. All welds in accordance with A S M E Code T 25 and 150 psi units stress relieved.

Improved method of diagonal bracing now extends through boiler shell. Eliminates hidden weld and assures positive dependability

DISENGAGING AREA

Unbroken to check turbulence.

Units for high pressure steam incorporate dry back design, split rear cover plate with access opening to combustion chamber in lower half and opening to fusible plug in top half. All low pressure units designed with water back top.

REAR COMBUSTION CHAMBER

Heavily lined with refractory shipped in place. Completes combustion and preserves heat, thereby increasing efficiency.

FIRE TUBES

Three inch diameter heavy gauge steel, expanded into holes with ends firmly rolled and beaded.

STURDY STEEL SKIDS

Simplifies handling and installation problems and provides platform on which burner is mounted. Requires no special base construction

CORRUGATED FURNACE

Provides extra strength and added heating surface next to the fire. Low pressure units provided with plain turnace tube.

Furnace on low pressure boilers is now attached to flanged openings in tube sheet to provide for greater flexibility

STURDY HINGED FLUE DOORS

Held firmly in place with quick opening U-bolts and gasketed for permanent gas tight fit. Provides easy access to tubes for cleaning and inspection.

THE KEWANEE-RAY BOILER-BURNER UNIT

125-150 swp



WINDBOX

Distributes air to the secondary air control system and acts as the structural backbone of the burner unit upon which all the elements are mounted.

CONTROL PANEL

All controls for combustion are in the totally enclosed panel and include all necessary switches; motor starters; relays and the electronic control unit.

RAY DIRECT DRIVE

The Ray principle of Direct Drive with the air-cooled and totally enclosed motor mounted as an integral part of the burner on the main shaft.

RAY HORIZONTAL ROTARY ATOMIZATION

The Ray atomizing cup and angular vane nozzle are so constructed that the oil and primary air are discharged in opposite directions of rotation providing intimate mixing of air and fuel under absolute control at the nozzle tip.

AUTOMATIC GAS CONTROL VALVE

SECONDARY AIR CONTROL ASSEMBLY

Ray "patented air register ring" maintains constant air velocity at all firing rates.

INTEGRATED GAS BURNER

The gas ring forms the throat of the forced draft air entrance with the gas being introduced through multiple drilled orifices around the throat.

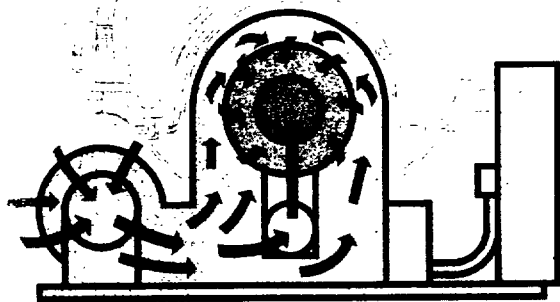
SPINNER BLADES

Located in all tubes swirl the hot gases against tube surfaces providing for maximum gas travel and assure maximum heat transfer.

FORCED DRAFT FAN



CONSTANT VELOCITY CONTROL OF THE AIR



Provides smooth, easy starts with high turn-down ratio and high CO₂ content; eliminates the use of high stacks . . . with proven HIGH EFFICIENCY RATINGS!

With the Kewanee-Ray Forced Draft Boiler-Burner Unit you will no longer have to depend upon high stacks and favorable barometric conditions for high efficiency at all firing rates. The forced draft fan delivers the air to the windbox under constant pressure at all ratings.

The Forced Draft Fan in coordination with the "Air Register Ring" provides for air admission, with a high degree of turbulence, at the point of combustion only and eliminates the necessity of any other draft control conventionally used.

Complete Control System, pre-wired in enclosed panel

Electronic Combustion Control System positively prevents operation under unsafe conditions and causes immediate shut-down in the event of flame failure. This system also monitors the complete firing cycle from pre-ignition purge through post-fire purge and checks the pilot and establishment of the main flame.

Terminal Strip . . . completely wired at the factory to controls and burner components.

Transformer for modutrol motor power supply.

High Limit Control on the end of the control panel starts and stops the burner unit according to the demand for pressure or temperature.

Gas-Oil Selector Switch for change-over from one fuel to another. No mechanical operation is necessary.

Circuit Breaker for the oil circulating pump.

Magnetic Starters with no-voltage and overload protection, stop and start the burner motor and forced draft fan motor in response to control demands. Optional equipment for boiler feed unit.

Three Disconnect Switches for the control circuit, the oil circulating pump and the burner and forced draft fan motors

Panel Doors protect controls and wiring from damage, dirt and water.

Modulating Control, mounted on end of panel, controls the operation of modutrol motor mounted on burner, for complete regulation of air and fuel supply.





More Engineering . . . More Material . . . More Experience

Make

Boilers different!

Ask any user, engineer, architect or heating or power contractor they will tell you that in their field Kewanee Boilers lead, as they have for nearly a century. That reputation has been earned by the true quality which is built into every Kewanee product.

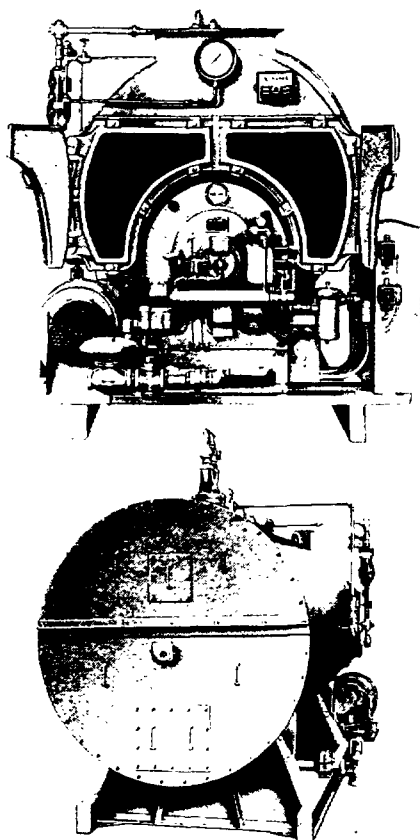
Kewanee *puts more* into its boiler so the owner *gets more* from them.

From drafting board to finished product . . . the experience and skill of Kewanee engineers has been continuously applied. First in the design and proportioning of all parts to be certain that each will work properly with all the others. Then by closely watching the boilers in process of construction and fabrication. And finally in tests that insure boiler performance as planned. Yes there is MORE ENGINEERING in each Kewanee.

MORE MATERIAL . . . the generous proportioning of all parts and the use of heavier steel plate not only insures more reliable ruggedness but equips each Kewanee to handle large overloads easily and efficiently.

MORE LABOR . . . examine any part of any Kewanee. Notice the faultless seams and welds, the smooth finish of castings, and the care with which each part is firmly fixed in its place. This extra care requires more labor, but it puts something extra in the boiler.

And back of all these is MORE ENGINEERING . . . a knowledge and "know how" which can only be obtained by many years of experience. These are the things which have built an enviable reputation for Kewanee . . . they are the "extras" you buy with every Kewanee Boiler that can't be converted into terms of dollars and cents.



Easy to clean . . . easy to inspect

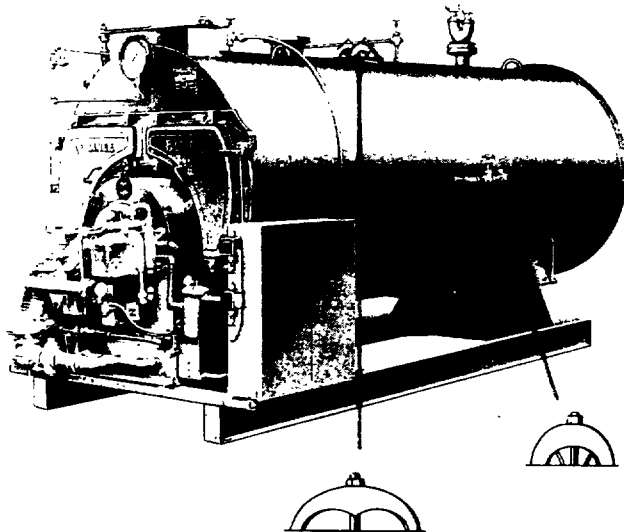
There are two sides to every boiler and every part of the Kewanee is easy to get at!

The large hinged doors at the front swing open, clear of the burner, providing easy access to the fire tubes from the front for ease of cleaning and inspection.

The entire back cover plate, constructed in two parts, can be completely removed for access to the rear combustion chamber and the rear end of fire tubes. Or the rear combustion chamber can be cleaned through the clean-out door at the bottom, without removing the cover plate.



COMPARE THESE QUALITY FEATURES



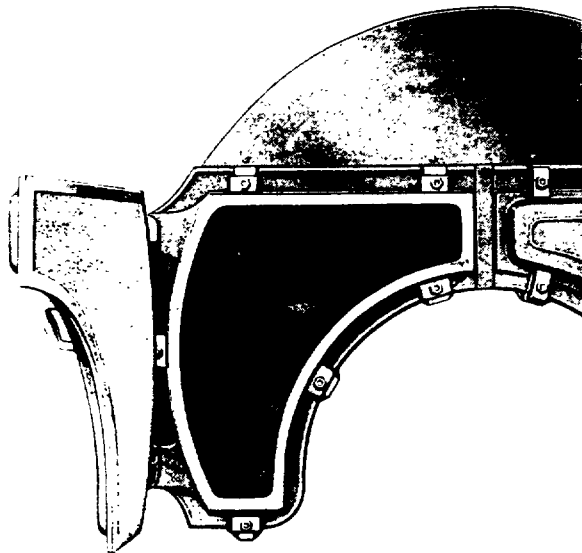
ACCESSIBLE WATER SURFACES

The water surfaces are just as easy to inspect and clean as the fire tubes.

A large manhole through the top of the boiler and adequate washout openings, properly placed, give ready access to the waterways. Fire tubes are widely spaced to make the outside of the tubes easily accessible. This spacing further frees and speeds-up the circulation of the water.

Carbon deposits inside the fire tubes . . . or scale lining the waterways . . . provides an insulation that makes it difficult for the heat to get through. So an unkept boiler . . . a dirty boiler . . . can't produce steam with full efficiency.

But with a Kewanee both fire tubes and waterways are easy to get at . . . an important feature that helps keep the boiler operating as it was built to perform.



GAS TIGHT FLUE DOORS WITH QUICK OPENING U-BOLTS

Leakage of heat through flue doors, or other openings, causes efficiency losses of considerable importance in many boilers.

Kewanees are made with permanent gas-tight doors . . . ground to a precision fit and sealed by a riveted woven asbestos tape gasket. Place a thin piece of tissue paper in the opening; shut the door, tighten the U-bolts, and it's impossible to pull the paper out without tearing it. Try it sometime yourself . . . you'll find the doors on Kewanee Boilers fit that closely.

Note, too, the thick insulating lining on the inside of the door that prevents warpage and provides a positive gas-tight fit throughout the life of the boiler.

A. S. M. E. CODE CONSTRUCTION . . . S. B. I. RATED

In construction Kewanee Boilers meet or exceed all the rigid code requirements of the American Society of Mechanical Engineers; as well as those of a well-known independent boiler inspection and insurance company.

The Kewanee-Ray Units are rated in accordance with the provisions of the Steel Boiler Institute Code . . . yet are certified to produce at least 50% more than this nominal capacity.

In addition, Ray Burners are built to rigorous standards to comply with all requirements of the Underwriters' Laboratories, Inc., and bear its seal of approval where required.





KEWANEE-ROSS CORPORATION

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

ELBERT M. PALMER
VICE PRESIDENT

BULLETIN 2374

KEWANEE, ILLINOIS

Jan. 22, 1954

BRANCHES & SALESMEN -

Subj: Kewanee-Ray
Boiler-Burner Unit

With this bulletin we are pleased to enclose the following:

1. Kewanee-Ray Boiler-Burner Unit Catalog..... 1031
2. Temporary Trade Price Sheet, effective Jan. 4, 1954, covering boiler for Kewanee-Ray Boiler-Burner Unit, high pressure steam only.
3. Temporary Trade Price Sheet, effective Jan. 4, 1954, covering boiler for Kewanee-Ray Boiler-Burner Unit, low pressure heating, 15# steam, 30# water.
4. Covering letter to Architects and Engineers.
5. Covering letter to Jobbers (Classifications 1 and 3).
6. Covering letter to the Trade.

We are not going to distribute the trade price sheets to the Trade or Jobbers at this time - you will note that in the letters released to them we have suggested that they contact you for price information. When the Trade and our Jobbers do become familiar with these units, we expect to give them published trade price sheets as we do on our other products. The Jobber's preferential is 10% based on the published trade price and before the addition of surcharge.

Again, the hard and ingenious work of two top engineering forces in their respective fields -- Kewanee and Ray -- have produced a unit that we know meets all requirements of a quality product and is one of the best and most practical in the field. Again, may we suggest that you first get acquainted with the Ray representative in your area. Have him tell you all the salient features of their equipment. At least know the main superior factors of the Ray firing equipment. Secondly, point out the superior features of Kewanee Boilers to him. You will sell the boiler assembly.

They will sell the firing equipment. We want to emphasize the importance of having both organizations out in the field endeavoring to get the Kewanee-Ray Boiler-Burner Unit specified. From previous experience we have found both the architect and engineer especially receptive to our specifications ... which is the outstanding factor attributing to the increasing success we have had in the boiler-burner unit field. Some engineers desire to fully detail their specifications. You will have material to hand them. Others desire to use a brief

Jan. 22, 1954

Subj: Kewanee-Ray
Boiler-Burner Unit

specification just mentioning the number, rating, pressure and type of unit. This can be done from the catalog data.

The designing engineer, architect or contractor may desire to estimate the cost of the boiler plant. You now have your trade price sheet for the Boiler of the unit. The prices on all boilers to be used as boiler-burner units must be figured from the enclosed price sheets because they contain certain special items. We will forward you prices on the various Ray firing assemblies to be used for estimating purposes only, just as soon as possible. When the job comes up for actual bidding, you will quote as you regularly do to the trade or jobber, and you will have the Ray representative quote on his equipment.

Specification sheets on both the boiler and the burner will be in your hands in the near future.

KEWANEE-ROSS CORPORATION

EMP



FOR YOURSELF

NO. 1 WELD, X-RAYED AND STRESS RELIEVED

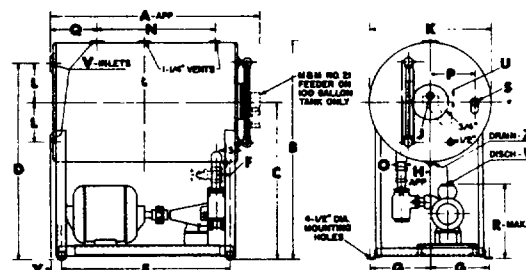
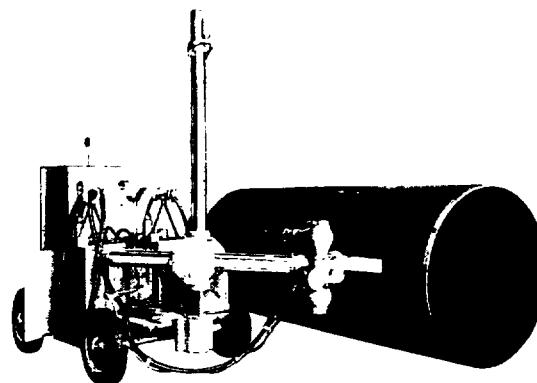
The dependability of welded joints, for both high and low pressure boilers has reached new heights. But to be even surer and safer, every welded seam that carries the full operating load in high pressure Kewanee is radiographed with a high voltage X-ray machine to detect possible blow holes due to gas pockets, faulty fusion or any other defects. Test specimens are then stressed to destruction to be certain that the strength and ductility of all joints meet specifications.

And in a modern *Stress Relieving Furnace*, Kewanee Boilers for high operating pressures are heated to a temperature of 1200° F. then allowed to cool gradually. All fusion welded joints are thus completely annealed and any locked up stresses relieved.

PUMP AND RECEIVER

If specified, a Boiler Feed Unit is included with the boiler shipment. This equipment is not attached to the boiler skids, allowing installation at the most convenient place. There are 13 sizes for units of 39 to 304 hp ... 125 and 150 lbs. wp.

The single pump unit is shown. Duplex Units, consisting of 2 pumps and 2 motors mounted on a single chassis with the tank, are also available. These Duplex Units are often advisable for stand-by purposes or with a battery of 2 boilers ... each boiler supplied by a separate pump.



BOILER FEED UNITS Dimensions — Inches

UNIT	A	B	C	D	E	F	G	H	J	K	L	N	O	P	Q	R	S	U	V	X	Z	PUMP SIZE	W
KXE	42	60	47 3/4	55 1/2	33	3 3/4	11 1/4	3 1/2	3/4	22 1/2	7 3/4	23	1 1/2	..	9 1/2	14 3/4	..	1 1/2	2 1/2	2 1/2	1	1130 - 1133	1
KXF	46	78	63 1/2	73 3/4	36	4 1/2	14	5	..	27	10 1/4	28	1 1/2	..	9	18 1/4	..	..	3	3	1 1/4	1143 - 1148	1 1/4
KXG	66 1/2	78	62	73	56	4 1/2	14 3/4	5 1/2	..	30	11	48	2	12	9	19 1/4	3/4	..	4	3 1/4	1 1/2	1251 - 1253	1 1/4
KXH	66 1/2	78	60	74 1/2	56	4 1/2	17 1/2	7 1/4	..	36	14 1/2	48	2	15	9	20 1/4	3/4	..	4	3 1/4	1 1/2	1255 - 1259	2
KXJ	66 1/2	78	56	73	56	6	20 1/4	8	..	42	17	48	2 1/2	15	9	21 1/4	3/4	..	4	3 1/4	1 1/2	2255 - 2257	2
KXK	90 1/2	78	56	73	78	6	20 1/4	8	..	42	17	72	2 1/2	15	9	18 3/4	1	..	4	4	1 1/2	2279 - 2283	2

SPECIFICATIONS AND CATALOG NUMBERS

UNIT NUMBER	KR78-3-5	KR79-3-5	KR80-5	KR81-5	KR82-5	KR83-6	KR84-6	KR85-7	KR86-7	KR87-8	KR88-8	KR89-9	KR90-9
Boiler Feed Unit Number ... 125 swp	KXE-10	KXE-12	KXF-11	KXF-11	KXF-12	KXF-12	KXG-20	KXG-8	KXH-20	KXH-22	KXJ-20	KXJ-20	KXK-20
GPM—Maximum 195° F.	7.9	8.9	10.5	12.6	15.4	18.2	22.4	27.3	32.2	36.4	45.5	54.6	63.0
Pump Number	1130	1131	1133	1133	1141	1141	1252	1255	1255	1255	2257	2257	2283
Motor Size	2-3450	3-3450	3-3450	3-3500	3-3500	3-3500	5-3500	7 1/2-3500	7 1/2-3500	10-3500	10-3500	10-3500	15-3500
Tank Capacity	60	60	100	100	100	100	200	200	250	250	350	350	500
Shipping Weight	550	600	650	650	650	650	850	900	1050	1150	1400	1400	1650
Boiler Feed Unit Number ... 150 swp	KXE-12	KXE-12	KXF-11	KXF-21	KXF-22	KXF-22	KXG-20	KXG-21	KXH-21	KXH-21	KXJ-20	KXJ-21	KXK-21
GPM—Maximum 195° F.	7.9	8.9	10.5	12.6	15.4	18.2	22.4	27.3	32.2	36.4	45.5	54.6	63.0
Pump Number	1131	1131	1133	1251	1252	1252	1252	2255	2255	2255	2257	2279	2282
Motor Size	3-3450	3-3450	3-3450	5-3500	5-3500	5-3500	5-3500	10-3500	10-3500	10-3500	10-3500	15-3500	20-3500
Tank Capacity	60	60	100	100	100	100	200	200	250	250	350	350	500
Shipping Weight	600	600	650	750	650	650	850	1050	1200	1200	1400	1550	1700

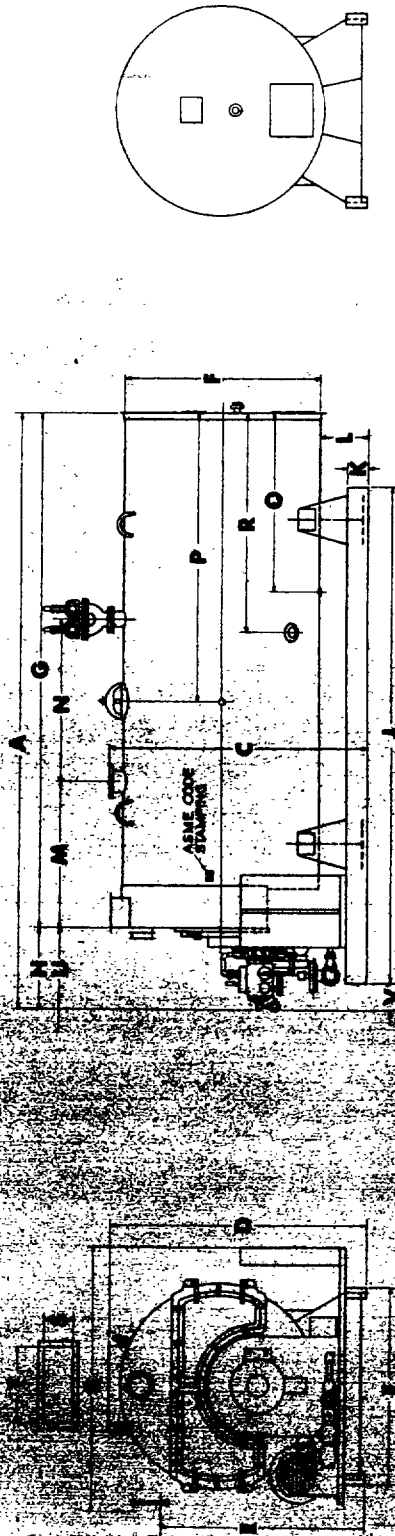
RATINGS, DATA AND DIMENSIONS

NOTE: When selecting Boiler-Burner Unit sizes, specify (a) Unit Number (last numeral in unit number indicates burner size), (b) Burner specifications (as enumerated below), (c) Operating Pressure, (d) Type (steam or hot water), (e) Gas Type and Pressure, (f) Boiler Feed Unit No. for high pressure units (optional).

UNIT NUMBER	KR78-3-5	KR79-3-5	KR80-5	KR81-5	KR82-5	KR83-4	KR84-5	KR85-7	KR86-7	KR87-8	KR88-8	KR89-9	KR90-9
SBI Rating — Horsepower	39	44	52	61	74	87	109	130	152	174	217	261	304
Steam per Hour — 212° F	1350	1500	1800	2100	2560	3010	3750	4510	5260	6010	7510	9010	10510
Btu per Hour	1313	1459	1750	2040	2479	2916	3643	4373	5100	5830	7286	8743	10200
EDR Steam	5470	6080	7290	8500	10330	12150	15180	18220	21250	24290	30360	36430	42500
EDR Water	8750	9720	11640	13600	16530	19460	24380	29150	34000	38860	48570	58280	68000
Certified Output Rating*	59	66	78	92	111	131	164	195	228	261	326	392	456
Firing Rate — Oil gph*	16	18	22	26	31	37	46	54	64	73	91	110	127
Gas Btu/hr	3440	3740	4490	5000	6080	7115	8930	10720	12500	14290	17860	21430	25000
Heating Surface	332	358	429	484	579	675	852	1011	1171	1331	1649	1967	2285
Furnace Volume	45.8	48.4	57.9	62.4	79.8	97.5	110.2	141.1	151.7	174.0	217.0	262.9	308.8

* Fuel burning rates based on 150,000 Btu oil.

** Output ratings based on 80% overall efficiency and 60 cycle operation at sea level.



(feet-inches)

UNIT NUMBER	KR78-3-5	KR79-3-5	KR80-5	KR81-5	KR82-5	KR83-4	KR84-5	KR85-7	KR86-7	KR87-8	KR88-8	KR89-9	KR90-9
A — Length Overall	14-8	15-1	14-1	15-3 1/2	15-8	17-4	18-4	19-6	21-5	20-7	21-8	23-7	23-6
B — Width Overall	4-11	4-11	7-4	7-4	7-7	7-7	7-10	8-4	8-4	9-2	9-2	10-3	10-2
C — Steam Supply Height	6-8	6-8	7-2	7-2	7-8 1/2	7-8 1/2	8-2 1/2	8-8 1/2	8-8 1/2	9-2 1/2	9-7 1/2	10-3 1/2	11-0 1/2
D — Smoke Outlet Height	6-4	6-4	7-0	7-0	7-4	7-4	8-0	8-4	8-4	9-0	9-4	10-0	10-9
E — Water Line Height	5-5	5-5	5-10	5-10	6-1 1/2	6-1 1/2	6-5 1/2	6-9 1/2	6-9 1/2	7-1 1/2	7-7	7-11 1/2	8-8
F — Boiler Diameter — Base Width	4-4	4-4	5-0	5-0	5-4	5-4	6-0	6-4	6-4	7-0	7-4	8-0	8-6
G — Boiler Length	11-8	12-7	11-7	12-9 1/2	13-2	14-10	16-1	16-7	18-7	17-9	18-11	20-0	20-1
H — Front of Unit to Boiler	3-4	3-4	3-6	3-6	3-4	3-4	3-5	3-11	3-10	2-10	3-9	3-7	3-5
J — Base — Length	11-3	12-3	11-2	12-4	12-7	14-3	15-4	15-6	17-4	16-7	17-7	18-9	18-10
K — Height	0-4	0-4	0-6	0-6	0-8	0-8	0-8	0-10	0-10	1-0	1-0	1-0	1-3
L — Floor to Boiler	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-11
M — Steam Supply	3-4	3-4	3-1	3-7	3-8	4-2	4-9	4-10	5-4	5-5	5-5	5-6	5-7
N — Safety Valve	3-4	4-3	4-3	4-4	4-5	4-3	5-0	5-0	5-4	5-4	5-4	5-4	5-4
O — Blow-off	4-0	4-0	4-0	4-0	4-3	4-3	4-5	5-4	5-4	5-4	5-4	5-4	5-4
P — Feed Water, each side	4-7	4-7	4-4	4-4	4-4	4-3	4-3	4-3	4-3	4-3	4-3	4-3	4-3
R — Return 15 lb w/p, each side	4-4	4-4	4-4	4-4	4-4	4-4	4-4	4-4	4-4	4-4	4-4	4-4	4-4
S — Smoke Outlet — Width	0-10	0-10	0-10	0-10	0-10	0-10	0-11	1-1	1-1	1-2	1-2	1-4	1-4
T — Length	1-4	1-4	1-8	1-8	2-4	2-4	2-8	2-8	2-8	2-8	2-8	3-2	3-2
U — Tube Replacement Space	7-2	8-1	6-11	8-1 1/2	8-2	9-10	10-9	10-8	12-8	11-7	12-7	13-4	13-5
V — Front of Unit to Base	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-9	1-8	1-8	1-7	2-4	2-2

Vent Size	dia	1-2	1-3	1-4	1-5	1-7	1-8	1-10	1-11	2-0	2-2	2-4	2-6
Safety Valve Capacity — over 15 lb swp	lb steam per hr	2576	3432	4000	4844	5720	7144	8576	10000	11432	14288	17144	20000
— 15 lb swp	lb steam per hr	1610	2145	2500	3040	3575	4445	5360	6350	7145	8930	10715	12500
Steam Supply Size — 15 lb swp**		0-4	0-8	0-8	0-8	0-8	0-8	0-8	0-8	0-8	0-10	0-10	0-10
— over 15 lb swp***		0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-8	0-8	0-8
Blow-off Size		0-1/2	0-3	0-3	0-3	0-3	0-3	0-3	0-3/2	0-3/2	0-3/2	0-3/2	0-3/2
Return Size		0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4
Outside Surface to Cover	sq ft	145	180	200	230	260	305	340	380	390	440	500	530
Approx. Weight — 15 lb swp	lb	9900	10400	11200	12000	12600	13200	13800	14500	15200	16000	16800	17500
— 15 lb swp***	lb	10500	11000	11800	12600	13200	13800	14500	15200	15900	16800	17500	18200
— 15 lb swp***	lb	11100	11700	12400	13100	13700	14400	15100	15800	16500	17300	18000	18700

** 150 lb American Standard Flange.

*** 300 lb American Standard Flange.

**** Add 300 lb for pump and heater.

to the boiler.

STANDARD EQUIPMENT (125 & 150 lb STEAM) — Pressure controls, steam gage and cock, low water cut-off, safety valve(s), water column with water-gage glass and three gage cocks, piping and fittings for attaching trimmings to the boiler.

STANDARD EQUIPMENT (30 lb WATER) — Pressure controls, safety valve, pump, condenser, water temperature control, water relief valve, low water cut-off, piping and fittings for attaching trimmings to boiler.

SAFETY VALVES — Boilers over 15 lb swp — Number and size varies with valve setting. All boilers having 500 sq ft or less of heating surface furnished with one valve. Boilers having more than 500 sq ft of heating surface furnished with two or more valves. Manufacturer reserves the right to use separate outlets or yokes as conditions require.

Boilers 15 lb swp — One or more valves furnished depending on required capacity.

FD BURNER SIZES AND MAXIMUM CAPACITIES*

STEAM CAPACITIES	EQUIV. BHP	STEAM LB/HR	BURNER MOT. HP	FD FAN MOT. HP	GAS PRESS. "W.C."	GAS PIPE SIZE CONN.
1/2" 150 lb swp	43	340	1	1/4	4	3"
1" 150 lb swp	119	405	1	1	5	3"
1 1/2" 150 lb swp	160	480	1 1/2	1 1/2	7	3"
2" 150 lb swp	240	630	2	2	7	4"
3" 150 lb swp	340	840	3	3	8	4"
4" 150 lb swp	440	1050	4	4	10	4"

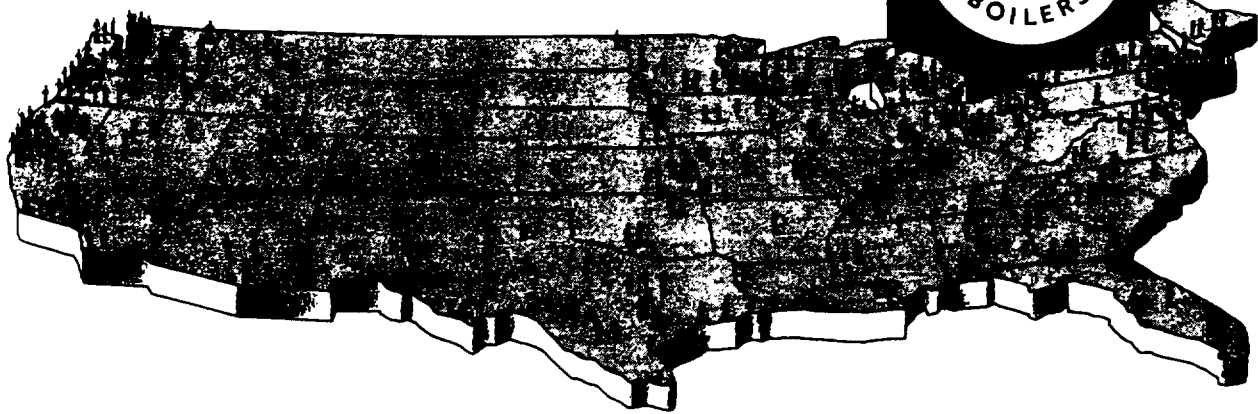
* Based on 15 lb steam pressure and sea level.

BURNER SPECIFICATIONS (All Modulating, Fully Automatic)

FUEL	BURNER
Combination #5 oil and gas	FD-ARC-144
Combination #5 & #4 oil and gas	FD-ARC-134
Combination #2 oil and gas	FD-ARC-104
#5 oil	FD-AR-144
#5 & #4 oil	FD-AR-134
#2 oil	FD-AR-104
Gas, high or low pressure	FD-G-104

STEAM CAPACITIES	COMBINATION #5 OIL & GAS FD-ARC-104	COMBINATION #5 & #4 OIL & GAS FD-ARC-134	COMBINATION #2 OIL & GAS FD-ARC-144	#6 OIL FD-AR-144	#4 & #5 OIL FD-AR-134	#2 OIL FD-AR-104	GAS L & H PRESSURE FD-G-104
1/2" 150 lb swp	X	X	X	X	X	X	X
1" 150 lb swp	X	X	X	X	X	X	X
1 1/2" 150 lb swp	X	X	X	X	X	X	X
2" 150 lb swp	X	X	X	X	X	X	X
3" 150 lb swp	X	X	X	X	X	X	X
4" 150 lb swp	X	X	X	X	X	X	X
5" 150 lb swp	X	X	X	X	X	X	X
6" 150 lb swp	X	X	X	X	X	X	X
7" 150 lb swp	X	X	X	X	X	X	X
8" 150 lb swp	X	X	X	X	X	X	X
9" 150 lb swp	X	X	X	X	X	X	X
10" 150 lb swp	X	X	X	X	X	X	X
11" 150 lb swp	X	X	X	X	X	X	X
12" 150 lb swp	X	X	X	X	X	X	X
13" 150 lb swp	X	X	X	X	X	X	X
14" 150 lb swp	X	X	X	X	X	X	X
15" 150 lb swp	X	X	X	X	X	X	X
16" 150 lb swp	X	X	X	X	X	X	X
17" 150 lb swp	X	X	X	X	X	X	X
18" 150 lb swp	X	X	X	X	X	X	X
19" 150 lb swp	X	X	X	X	X	X	X
20" 150 lb swp	X	X	X	X	X	X	X
21" 150 lb swp	X	X	X	X	X	X	X
22" 150 lb swp	X	X	X	X	X	X	X
23" 150 lb swp	X	X	X	X	X	X	X
24" 150 lb swp	X	X	X	X	X	X	X
25" 150 lb swp	X	X	X	X	X	X	X
26" 150 lb swp	X	X	X	X	X	X	X
27" 150 lb swp	X	X	X	X	X	X	X
28" 150 lb swp	X	X	X	X	X	X	X
29" 150 lb swp	X	X	X	X	X	X	X
30" 150 lb swp	X	X	X	X	X	X	X
31" 150 lb swp	X	X	X	X	X	X	X
32" 150 lb swp	X	X	X	X	X	X	X
33" 150 lb swp	X	X	X	X	X	X	X
34" 150 lb swp	X	X	X	X	X	X	X
35" 150 lb swp	X	X	X	X	X	X	X
36" 150 lb swp	X	X	X	X	X	X	X
37" 150 lb swp	X	X	X	X	X	X	X
38" 150 lb swp	X	X	X	X	X	X	X
39" 150 lb swp	X	X	X	X	X	X	X
40" 150 lb swp	X	X	X	X	X	X	X
41" 150 lb swp	X	X	X	X	X	X	X
42" 150 lb swp	X	X	X	X	X	X	X
43" 150 lb swp	X	X	X	X	X	X	X
44" 150 lb swp	X	X	X	X	X	X	X
45" 150 lb swp	X	X	X	X	X	X	X
46" 150 lb swp	X	X	X	X	X	X	X
47" 150 lb swp	X	X	X	X	X	X	X
48" 150 lb swp	X	X	X	X	X	X	X
49" 150 lb swp	X	X	X	X	X	X	X
50" 150 lb swp	X	X	X	X	X	X	X
51" 150 lb swp	X	X	X	X	X	X	X
52" 150 lb swp	X	X	X	X	X	X	X
53" 150 lb swp	X	X	X	X	X	X	X
54" 150 lb swp	X	X	X	X	X	X	X
55" 150 lb swp	X	X	X	X	X	X	X
56" 150 lb swp	X	X	X	X	X	X	X
57" 150 lb swp	X	X	X	X	X	X	X
58" 150 lb swp	X	X	X	X	X	X	X
59" 150 lb swp	X	X	X	X	X	X	X
60" 150 lb swp	X	X	X	X	X	X	X
61" 150 lb swp	X	X	X	X	X	X	X
62" 150 lb swp	X	X	X	X	X	X	X
63" 150 lb swp	X	X	X	X	X	X	X
64" 150 lb swp	X	X	X	X	X	X	X
65" 150 lb swp	X	X	X	X	X	X	X
66" 150 lb swp	X	X	X	X	X	X	X
67" 150 lb swp	X	X	X	X	X	X	X
68" 150 lb swp	X	X	X	X	X	X	X
69" 150 lb swp	X	X	X	X	X	X	X
70" 150 lb swp	X	X	X	X	X	X	X
71" 150 lb swp	X	X	X	X	X	X	X
72" 150 lb swp	X	X	X	X	X	X	X
73" 150 lb swp	X	X	X	X	X	X	X
74" 150 lb swp	X	X	X	X	X	X	X
75" 150 lb swp	X	X	X	X	X	X	X
76" 150 lb swp	X	X	X	X	X	X	X
77" 150 lb swp	X	X	X	X	X	X	X
78" 150 lb swp	X	X	X	X	X	X	X
79" 150 lb swp	X	X	X	X	X	X	X
80" 150 lb swp	X	X	X	X	X	X	X
81" 150 lb swp	X	X	X	X	X	X	X
82" 150 lb swp	X	X	X	X	X	X	X
83" 150 lb swp	X	X	X	X	X	X	X
84" 150 lb swp	X	X	X	X	X	X	X
85" 150 lb swp	X	X	X	X	X	X	X
86" 150 lb swp	X	X	X	X	X	X	X
87" 150 lb swp	X	X	X	X	X	X	X
88" 150 lb swp	X	X	X	X	X	X	X
89" 150 lb swp	X	X	X	X	X	X	X
90" 150 lb swp	X	X	X	X	X	X	X
91" 150 lb swp	X	X	X	X	X	X	X
92" 150 lb swp	X	X	X	X	X	X	X
93" 150 lb swp	X	X	X	X	X	X	X
94" 150 lb swp	X	X	X	X	X	X	X
95" 150 lb swp	X	X	X	X	X	X	X
96" 150 lb swp	X	X	X	X	X	X	X
97" 150 lb swp	X	X	X	X	X	X	X
98" 150 lb swp	X	X	X	X	X	X	X
99" 150 lb swp	X	X	X	X	X	X	X
100" 150 lb swp	X	X	X	X	X	X	X

(1) See instructions for gas drive (BR).
(2) See instructions for oil drive (BR).
(3) See instructions for gas drive (BR).



It has been oftentimes said that a product is only as good as the name and reputation of its maker. To this we might add still another test of real worth...predicated on the standpoint of service.

Not only is the Kewanee-Ray Boiler-Burner Unit backed by the outstanding reputations of two famous names in the industry, but by an extensive service organization that combines the skills and experience of the field representatives of both companies. This close availability of Kewanee-Ray service is added insurance that your specifications and investment is fully protected.

There is a Kewanee or Ray representative near you. Should you be unable to locate him in the yellow pages of your telephone directory, call or write the Kewanee or Ray factory.

In addition, Ray Oil Burner Company is represented by over 300 dealers located in every major city throughout the world...each equipped to provide competent engineering facilities and complete factory certified service, no matter where you are.

Ray dealers are perfectionists, of long experience, who demand quality and peerless performance far in excess of any commercial standard. That is why, today, "Every Third Rotary Oil Burner in Service is a Ray."