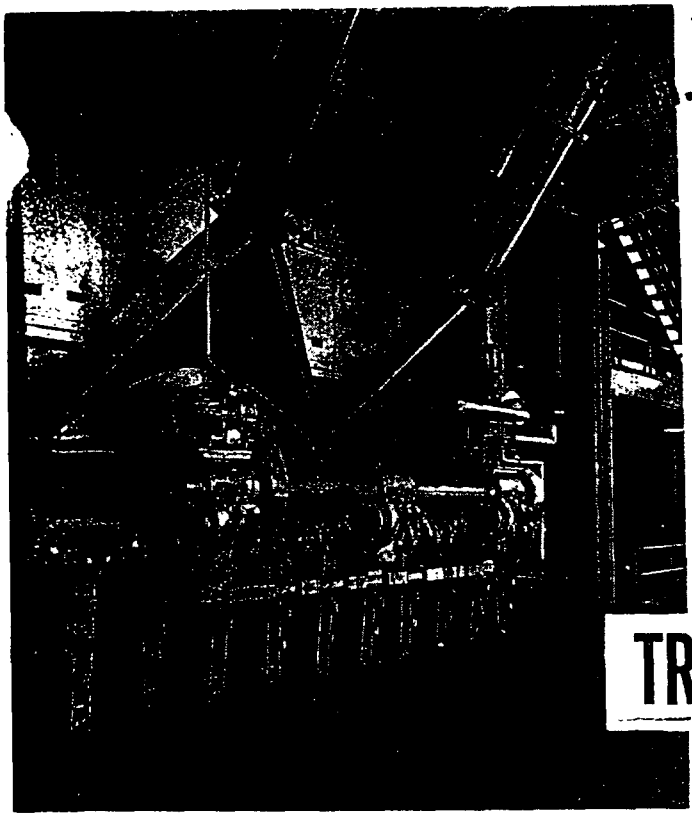
SMITH



Long range planning, heavy-duty equipment, dual drives, duplicate auxiliaries, thorough inspections, and plant cleanliness promote municipal plant's record of uninterrupted service and high economy. After 52 weeks continuously on the line, new 100,000 lb per hr boiler didn't even need to be washed down and total repairs on water-cooled stoker cost only $25!

PLAINTIFF'S EXHIBIT

RS-238

TROY (Ohio) CAN DEPEND ON

Stoker has dual drive (steam turbine and a variable speed electric drive) and is water cooled.

ALTHOUGH located immediately adjacent to the city's old power plant, the recent addition to Troy's electrical generating facilities actually constitutes an entirely new plant, modern and streamlined. Major equipment includes one 100,000 lb per hr steam generator, complete with air preheater and economizer, and two 5000 kw extraction-condensing turbine-generators. The new units were initially started up January 2, 1951, and on their first run were operated until April of that year. After a brief inspection they were put right back on the line.

Before the 4-drum, stoker-fired boiler was taken out of service again for inspection, it had carried the entire steam load for 52 consecutive weeks. At the end of that period, the unit was found to be free of scale, showed no pitting, and was so clean that it was not even washed down.

The 10 retort underfeed stoker is water cooled. Throughout the year it had required practically no maintenance and, during the time the boiler was down, it was placed in A-1 operating condition at a cost of only $25 for repairs. This amount is surprisingly low especially in view of the fact that temperature of the pre-heated air consistently ran as high as 285 F and sometimes over 300 F. As designed, maximum air temperature was to be 250 F.

Although numerous cost-incurring steps were taken to avoid outages in every way possible and the present load factor averages only 50% as the result of planning for the future and its increasing loads, efficiencies have been satisfyingly high and costs low. Outages have been practically nil. Boiler and furnace efficiency averages 79% (despite loads that sometimes dip to as lows as 25% of rating) and that is not far from the design efficiency at full load of 82.1%.

Turbine water or steam rates run less than 9 lb per kwh at full load, about 9.5 lb at half load, and not more than 10 lb at 25% load.

Costs Reduced

And in the face of generally rising prices, costs have been reduced. For example, the coal cost per kwh with the new equipment is $.004569, yet records show this cost was .007535 for the old plant in 1950. Cost of labor has also been reduced, largely as the result of labor-saving devices and application of automatic controls.

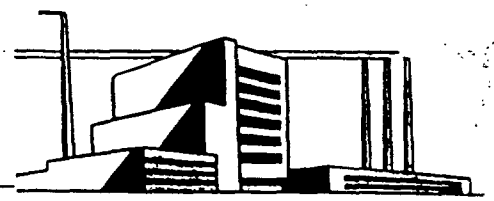
Future loads are always kept in mind. A 50-ton crane travels full width of the turbine room and is large enough to handle the heaviest piece of equipment contemplated. Plans now call for a 10,000 or 15,000 kw turbine-generator the next time, and footings are already in place for an extension that will house another large boiler. The present boiler feed pumps and water treating system are adequate for the future boiler, and the coal handling equipment is of large capacity and designed so that it can be readily extended. The condenser circulating water system also is capable of handling over double the present capacity after comparatively simple changes are made.

Preventive measures have figured prominently in this plant's record, a chief factor being the special effort made to keep all areas clean, unobstructed, and as attractive as permissable. All equipment is kept well painted, vacuum cleaners are provided, and even the boiler room gets mopped occasionally. Liberal use has been made of glazed wall brick and tile flooring—especially in the turbine room.

Auxiliary equipment — such as induced and forced draft fans—as well as the stoker, has been equipped with dual drives of electric motors and steam turbines as a precaution against a failure of the plant's electrical system. Drives are arranged so that, in event of an electrical failure, all steam driven auxiliaries could be kept in service and the boiler pressure maintained in order that the plant can be re-started immediately after an electrical outage is cleared.

Condensers, installed on a mezzanine floor below the new turbine-generators, are each built in two sections to allow cleaning one-half of a condenser while the turbine-generator is operating. In addition, all condenser auxiliaries—condensate pumps, circulating water

RS-000127
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AUGUST, 1952—VOL. 6, No. 2

editorial

Economics... Sound Government... Tea Parties

H. E. HOLLENSBE,
Editor

ALTHOUGH company officials have been giving considerable time and thought to programs designed to give employes a better understanding of the basic principles of economics, the programs have not been outstandingly successful, according to Lowell W. Herron, dean of the faculty, Clarkson College of Technology. "Economic illiteracy is still a characteristic of our population," maintained Mr. Herron in an address before an Annual Work Dynamics Conference. He believes that if programs of economic education are to be effective, they must emphasize a limited number of carefully selected economic principles as they operate for the individual in the short run. "What workmen really need is a tool kit of such economic principles which he himself can use."

Encouragingly, definite steps are being taken here and there to promote primary economic education—particularly with reference to taxes, which certainly affect everyone although many evidently do not realize the economic "bite" taxes take.

But, when confronted with the fact that today taxes now cost the average American family more than food and clothing, 1250 employes of the Johnson and Johnson Company decided the time had come to do something practical toward attaining more economical and efficient government. They organized a non-partisan "Sound Government Committee" to develop among the company's workers an "in plant" approach to good government. The program is voluntary and the company, while not endorsing the various views expressed, does offer company time for panel discussions, administrative and other help.

The committee determined early that it would not employ any of the numerous economic programs offered by management associations and universities and offers the following to indicate its goals:

Fair and just taxation
A sound dollar
Integrity in government
Support of Constitutional rights
Vigorous two-party political system
A resourceful and respected foreign policy.

Thus far the sound government committee is confined to white collar workers, but the work is expected to expand throughout the entire employe group and into the community. The usual employe lunchroom conversation now, aside from views on the presidential race, include the subject of taxes, the federal budget, basic economics, corruption, and inflation. Even the minority not wholly in sympathy with the movement attend the meetings to keep informed. Word is getting into the workers' homes too and news of the program reaches into every state of the Union through the company's salesmen. Letters and printed material received by the committee are evidence that many other "grass roots" programs are being started.

Coupled with taxes is the subject of economy in government; and Middletown, Ohio, is spearheading "The Middletown Tea Party" movement to make Americans more conscious of the need to minimize waste. In a few weeks the movement has spread to 15 different states (Philadelphia, Pittsburgh, New York, Chicago, Detroit, Los Angeles are some of the cities) and is still growing. Three of Middletown's young taxpayers thought up the idea and at a meeting of 35 selected Middletowners broached the tea party plan. They said the time had come to do more than "beef" about taxes and waste and asked each one present to write his representative and senator and protest.

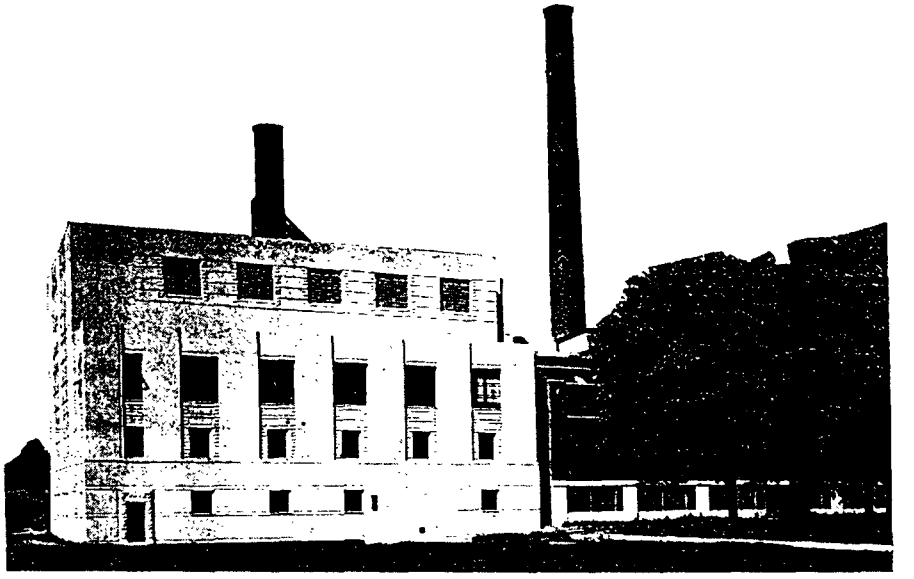
Writing such a letter automatically made the writers members of the new organization. Then each was asked to sign a certificate that he had written such a letter—and next (in a chain letter procedure) to induce 9 more fellow citizens to do the same. To date nearly 2000 signatures have been obtained and nearly as many letters written to Congressmen.

As explained by one of the founders the Tea Party is a little people's movement, one of its chief appeals being that it was not boss-inspired nor politically operated. All work together—merchants, labor leaders, labor, office workers, plant foremen, housewives, lawyers and teachers—regardless of political affiliations. At the start the group adopted the slogan: "Let's put the axe to tax-waste" and more recently: "We can lick waste with a 3c stamp."

Current political activities will no doubt serve to spread the ideas behind these two industrial movements, and tax reform and greater economy in government spending can be expected.

RS-000128
1/17/02
NUECES

MAURICE L. TUCKER,
Plant Superintendent,
and
MERRITT C. PASK,
Chief Engineer,
Municipal Light and Power Plant
Troy, Ohio



As shown, an entirely new building was built to house the new high pressure-high temperature equipment.

THIS POWER PLANT . . . .

pumps, and air injectors—have been supplied in duplicate so that any of the auxiliaries can be serviced while the turbine is in operation. The three circulating water pumps discharge into a common header to permit using any of the pumps on either condenser and to provide further flexibility.

Combustion Control

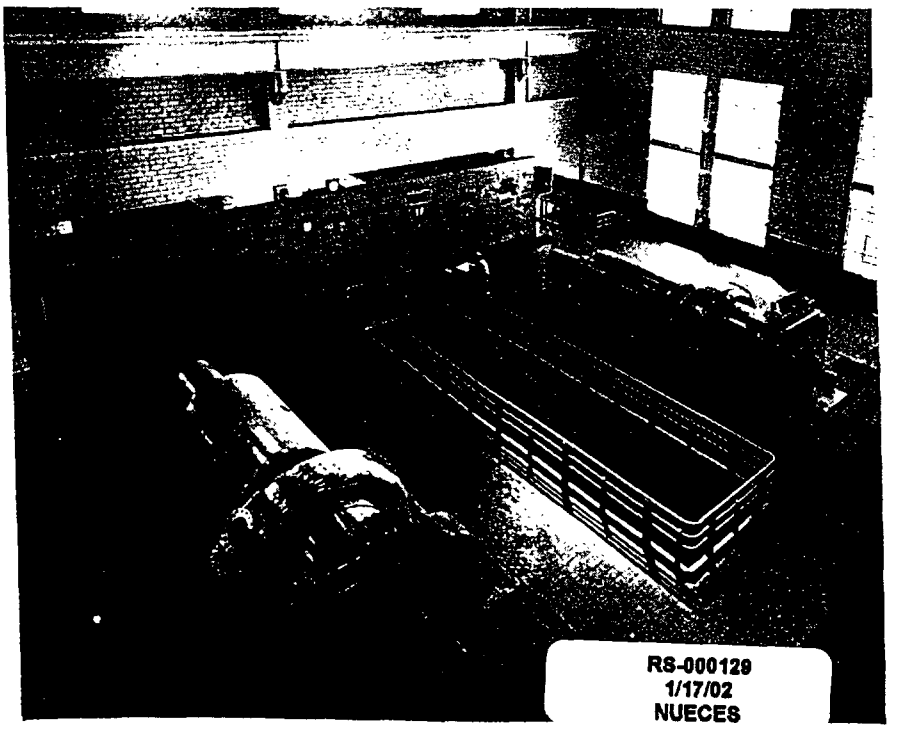
Automatic combustion control is employed, and a full complement of gages, indicating and recording instruments is mounted on the boiler control panel. In a successful effort to reduce friction and prevent lags as well as over-travel, antifriction bearings have been installed, instead of the usual sleeve bearings, on the lever arms and linkages of the combustion control system. Movements of the control system's elements are smoother and so sensitive that exceptionally accurate control is achieved. The boiler can also be controlled manually from the central control board.

Boiler operators have 4 different ways for checking boiler water level, namely: by direct view; reflecting mirror placed on operating floor; illuminated water level indicator mounted on the boiler panel; or an illuminated water level recorder also mounted on the board.

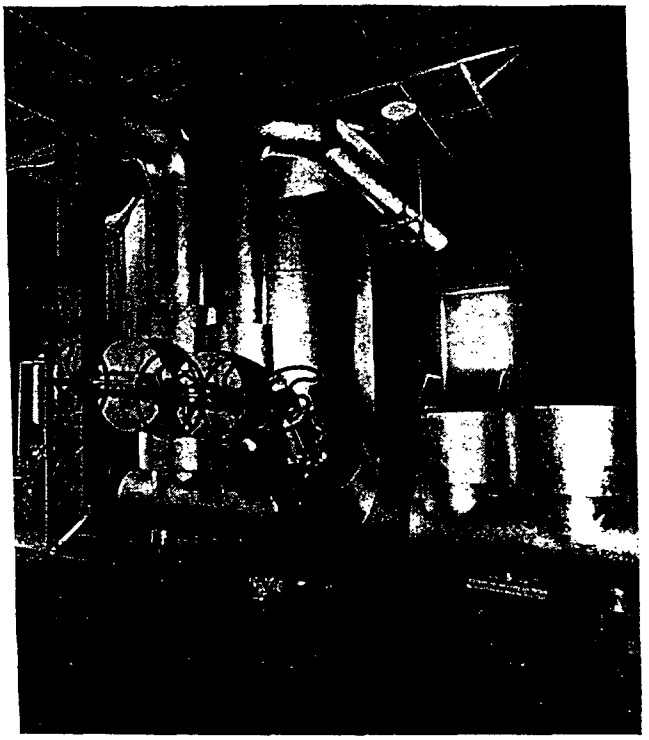
Designed for 675 lb pressure but being operated at 620 psi 790 F, the new boiler has 12,285 sq ft of heating surface in the boiler proper; 1959 sq ft in the water walls; 1790 sq ft in economizer; 7,660 sq ft in air heater, and 5,840 sq ft in the superheater. Both economizer and air heater are of the continuous tube type. Heat release in the furnace is 23,800 Btu per cu ft at 100,000 lb per hr.

Turbine-generators are duplicate 3600 rpm machines, generating 3 phase 60 cycle current at 13,800 volts and bleeding steam from 3 stages for low, medium, and high pressure feedwater heaters. Condensers are 6,500 sq ft, two-pass, divided water box units, producing vacuums of 1½ in. Hg absolute.

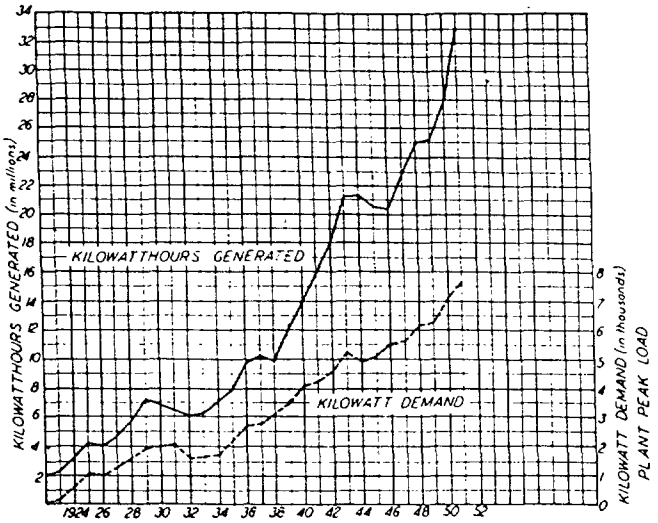
Boiler make-up averages only 2%, raw water, with hardness reduced to 3½ gr per gal, being obtained from city mains. Well water is also available when needed. The water is put through an automatic carbonaceous zeolite which can treat 54,000 gal between regenerations. A phosphate treatment, pumped directly into the boiler, is also utilized. Boiler water is tested every day by the plant's operators and every few months it is given a laboratory



Some idea of the expanse, cleanliness, and attractiveness of the whole plant can be gained from this view of the turbine room.



Upper steam header, which is in series with a lower steam header, is well insulated. Outlets for additional boiler at right.



Plant load curves from 1922 to 1951.

test. In summer condenser circulating water is chlorinated. Algae formerly caused so much trouble that the chlorinating equipment paid for itself within 6 months in labor savings alone.

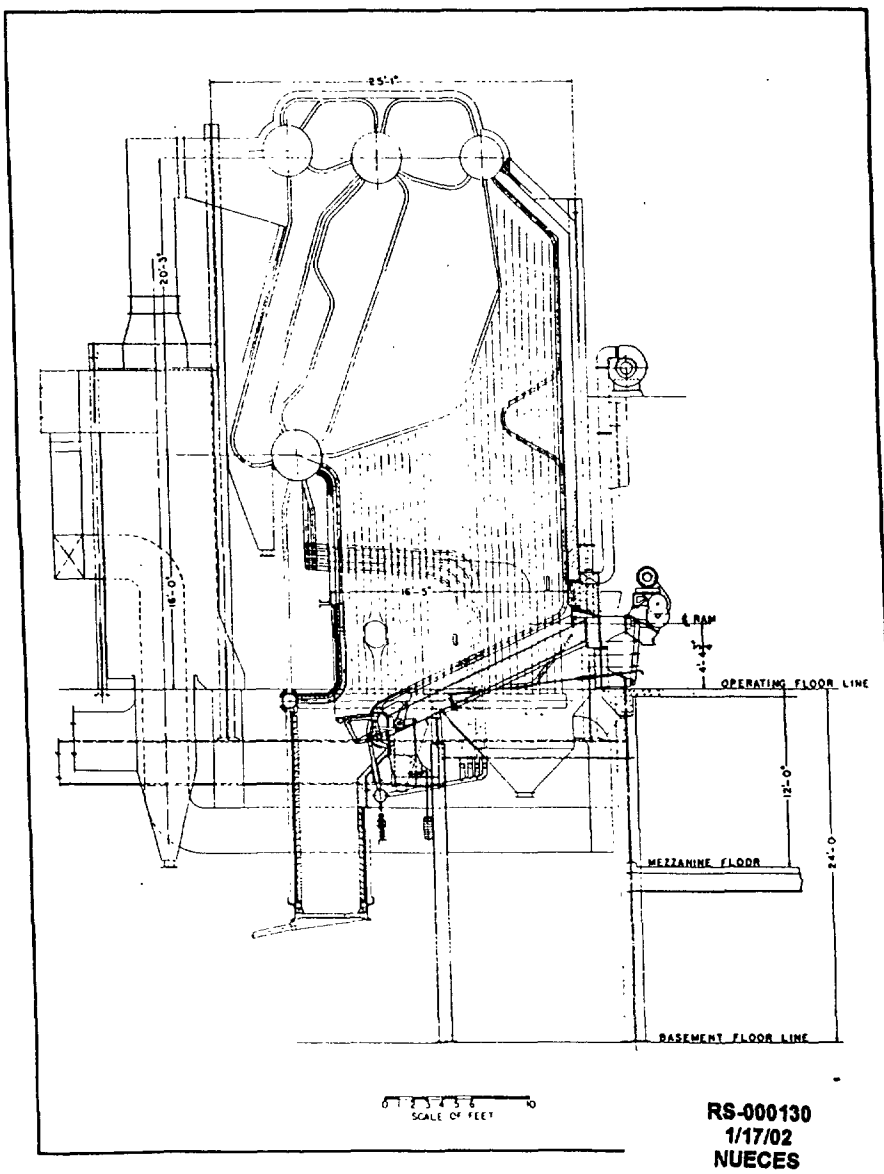
On its way to the boiler, feedwater is first heated by the low pressure feedwater heater, using 12th stage steam from the low pressure bleed point of the turbines, and then by a deaerating feedwater heater. The feed then goes successively through the medium pressure heater and the high pressure heater before it enters the economizer at a temperature around 325 F. With only high temperature water entering the economizer, the possibility of making a condenser of that unit is less and naturally little trouble is experienced when high sulphur coals are encountered.

Flue gases enter the economizer around 560 F and leave around 460 F. They enter the air preheater around 460 F and leave at a temperature around 320 F. The steel stub stack is ceramic lined and extends 35 ft above the roof.

Coal

Coal now being burned is Ohio strip coal from nearby locations. It is usually washed and screened (although sometimes some raw, unwashed coal is received) and runs in size 1½ in. x 10 mesh. The fuel is usually wet and in the winter time it is treated at the mine with an anti-freeze solution that has eliminated the costly, time-consuming unloading jobs of former days when drills, pick-axes, steam lances, and other equipment had to be brought

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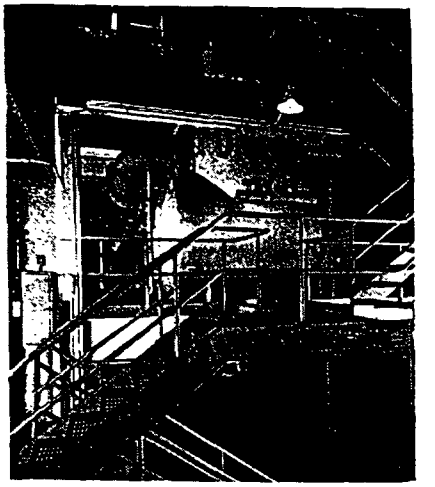


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Boiler cross-section indicates arrangement of the water-cooled 10-retort underfeed stoker.

LIST OF PRINCIPAL EQUIPMENT

Boiler—Babcock & Wilcox Co. (675# design pressure, 100,000# per hr output)
Stoker—American Engineering Co. (285 sq ft projected grate area, water-cooled, underfeed)
Economizer, air heater, superheater—Babcock & Wilcox Co.
Forced draft fan—Westinghouse Electric Corp. (136,200# of air per hr)
—motor & turbine—Westinghouse Electric Corp.
Induced draft fan—Clarage Fan Co. (164,000# flue gas per hr)
—motor & turbine—General Electric Co.
Boiler gage board and meters—Bailey Meter Co.
Combustion control—Hagan Corporation
Turbine-generators—General Electric Co.
Turbine gage board & meters—Bailey Meter Co.
Condensers—Ingersoll-Rand Co.
Coal handling—Link-Belt Co.
Coal scales—Stock Engineering Co.
Boiler feed pumps—Ingersoll-Rand Co.
Feedwater heater—Cochrane Corp.
Stage heaters—Griscom Russell Co. (med. & high)
—Alberger Heater Co. (low press.)
Water softener—Permutit Co.
Ash hopper—Allen-Sherman-Hoff Co.
Fly ash system—United Conveyor Co.
Steel stack—Posey Iron Works
Power piping—National Valve Co.
Crane—Euclid Crane Co.
Switchgear—General Electric Co.
Soot blowers—Diamond Power Specialty Co.
Continuous blowdown—Permutit Co.
Steam traps—Yarnall-Waring
Traveling screens—Link-Belt Co.
Overfire air fan—Buffalo Forge Co.
Valves—Crane Co.
—Linkenheimer Co.
—Manning, Maxwell & Moore, Inc.
Non-return valve—Edwards Valve Co.
Chlorinator—Wallace & Tiernan Co., Inc.



Deaerating feedwater heater, installed overhead on steel grating platform, can handle 250,000 lb of water per hr with 15% make-up.

into play while the cost of unloading soared.

Incoming coal flows by gravity from hopper-bottomed railroad cars into a track hopper. It is first conveyed over a magnetic pulley to remove tramp iron before being delivered to a crusher. Crushed coal is then delivered by a 35 ton per hr skip hoist to a 250 ton capacity bunker located over the firing aisle at the highest point of the boiler room. Coal flows (again by gravity, which is utilized wherever practicable) through two automatic coal scales, installed on metal flooring above the stokers, and then to the stoker hoppers. The latter are fed by chutes of special form to eliminate segregation of coal sizes and deliver the fuel uniformly. Over-fire air to promote turbulence is supplied by a small high pressure fan mounted at an intermediate level above the operating floor. The over-fire air jets are located in the front wall between the tubes of the stoker's water cooling system.

Ash is discharged through an adjustable opening between the furnace wall and ash plates at the rear of the stoker into a ceramic lined ash hopper and quenched. Hydraulically operated gates on the bottom of the ash hopper can be opened periodically (usually twice a day) to dump the ashes into a city truck for ultimate disposal.

Fly ash is trapped at base of the stack, boiler outlet, and base of economizer and conveyed pneumatically to a large ash silo of vitreous tile. The silo is equipped with a device for wetting the ash and venting the air without creating a dust nuisance.

Standby

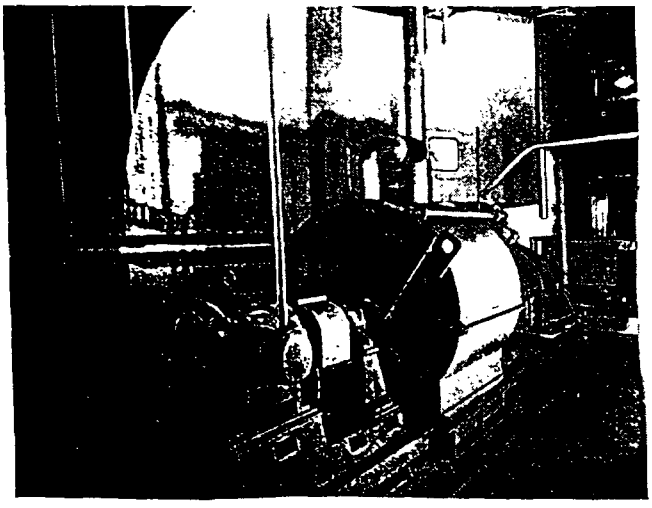
For standby one of the old boilers, rated 645 hp, is kept under low fire. It can generate 225 lb steam for operating one of the old 2500 kw turbine generators. All in all, 3 old boilers (525, 641, and 645 hp respectively) and 3 old turbine-generators (two of 2500 kw and one of 1000 kw capacity) are still in the old plant. A 3000 kva tie-in with the utility company is maintained. In an emergency this energy plus that of the standby unit can carry the usual load. Peak load of 7700 kw was hit last winter but for only a limited time. However, loads may vary from 2000 to 7000 kw within 24 hr.

In the turbine room the 13,800 volt switchgear consists of 17 cubicles with the generator control cubicles grouped for operating convenience. Recording meters, indicating instruments, and control switches are mounted on the front of the various panels. Spare cubicles for future use have been provided. Provision has been made to raise 4160 volt energy to 13,800 anytime the old standby plant must be utilized.

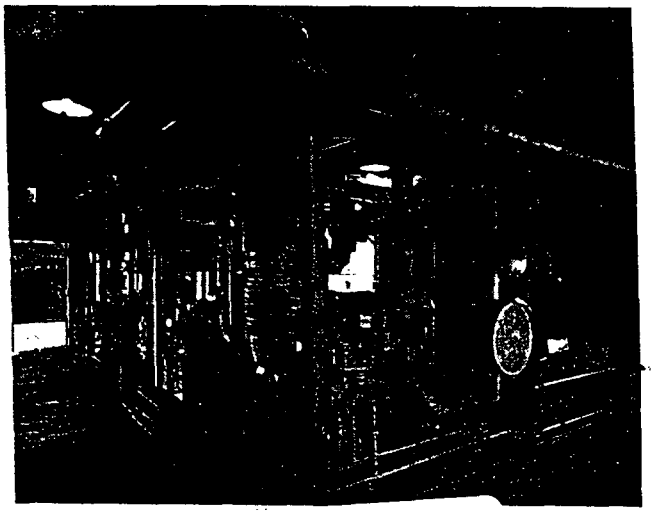
The plant is located on the Great Miami river, from which cooling water for the condensers is taken and passed through motor driven rotary screens in a new screen house to remove debris.

Consulting engineers were William C. Kammerer & Assoc., Cleveland.

Dual drives are provided for both the induced and forced draft fans. This is the FD fan.



Each feedwater pump is rated 400 gpm with 800 lb discarge head and 212 F water.



RS-000131
1/17/02
NUECES

GOOD INSULATION MAINTENANCE MAKES FUEL $ GO FARTHER

This article covers one of the most important phases of industrial maintenance. Various defects to look for in inspecting and existing installation are outlined, and the method given for determining the economic thickness of magnesia insulation.

IT'S NO secret that thousands and thousands of industry's dollars are being lost annually because of the lack or neglect of insulation on pipe lines. Unfortunately the causes of this condition are numerous—shortage of skilled manpower in maintenance departments, large volumes of supposedly more important work, sheer neglect—to name but a few.

Few plant and maintenance engineers need be reminded of the importance of adequate insulation to control heat losses, but an occasional reminder regarding the importance of maintaining pipe insulation in tip-top condition is often in order. The following paragraphs outline the principal points a maintenance man should cover in order to achieve the most from every insulation dollar.

Uncovered Lines or Fittings

1—An inspection of lines should be made regularly to see that all sources of heat loss are properly insulated. This refers specifically to recent additions or alterations to existing lines.

In general, when a new installation is made by an outside contractor, the job is usually complete including the finished insulation. But when a plant's maintenance or construction crews make the installation, for some reason or other, the men are frequently pulled off the job and rushed to another just when a few more days would complete insulating the installation. The thought is always: "We'll come back and finish it in a few days." Perhaps the maintenance supervisor's intentions are sincere, but the few days often stretch into months and in many cases, the job is never completed. For this reason, it is fairly common practice, and a most satisfactory one, to relieve plant personnel of installation and maintenance, and arrange a contract with an insulating company. Such contracts can be arranged to suit the needs of any size plant.

In the incomplete installations mentioned in the foregoing paragraphs, the parts of the insulation most frequently neglected are the valves and fittings—tees, ells, flanges, and so on. Perhaps one reason for their neglect is that they require a little more time and effort than the straight runs. However the latest methods developed and recommended by the insulation manufacturers have been simplified greatly and the lack of time is no longer a valid excuse.

Valves and fittings for piping 3½ in. diameter or less are generally insulated with asbestos cement to the same total thickness as the adjacent pipe insulation. However for larger diameter lines, the valves and fittings are covered with block or sectional covering as shown in Fig. 1. As indicated by the illustrations, the latter method makes it possible to remove and replace the unit without too much difficulty or too much damage to the adjacent pipe insulation.

Insulation Thickness

2—Thickness of existing insulation should be evaluated from time to time. This has become increasingly important in recent years, since industry has experienced many changes in operation with concurrent increases in operating temperatures. In many cases, the high costs of fuel may warrant an increase in insulation thickness to maintain maximum efficiency.

For years, many engineers have used the following rule-of-thumb for determining the required insulation thickness: 1/2 in. of insulation for every 100 F operating temperature. This formula is adequate for rough estimates only, and should not be followed in preparing the final specifications.

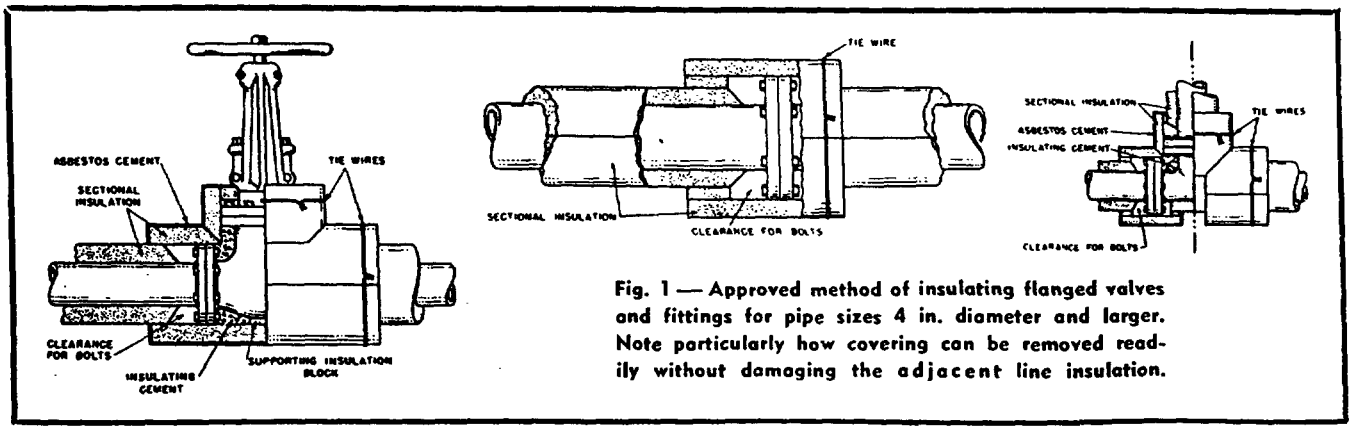


Fig. 1 — Approved method of insulating flanged valves and fittings for pipe sizes 4 in. diameter and larger. Note particularly how covering can be removed readily without damaging the adjacent line insulation.

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