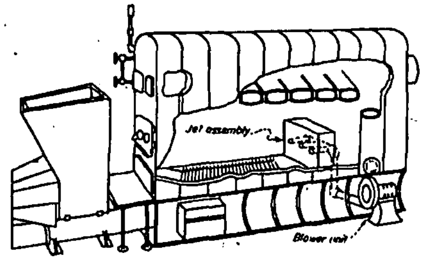
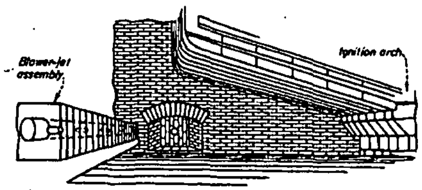
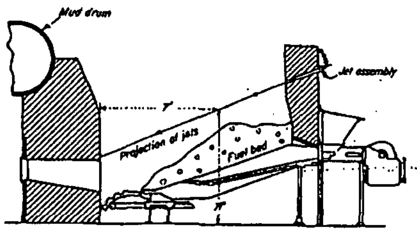


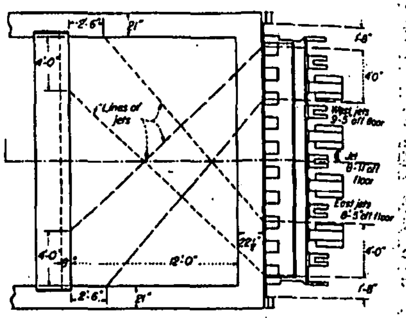
5 Bridgewall mounting above the fuel bed seems most practical for location of jets in sectional cast iron boilers



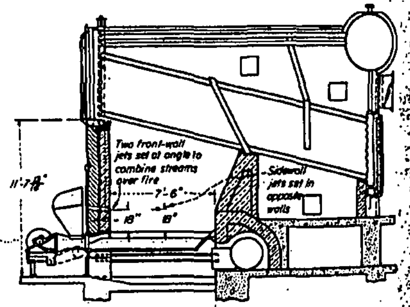
6 Front- or rear-wall mounting works with traveling grates. Rear jets, above, direct air into rich gas stream up front



7 Multiple retort stokers employ jets mounted in front wall and spotted to coincide with the individual retort spacing



8 Jet arrangements and angle of stream can be made to cover the full firebox or correct a localized smoking condition



9 Underfeed stokers often require jet penetration only the length of the fuel hump to cover the oxygen-short area

Abatement. A blower must be used to get necessary penetration.

One large utility running several power plants equipped 29 underfeed stoker-fired steam generators with various *forms of overfire air jets. Its practice* placed steam-actuated jets on all older boilers where (1) a limited operating life is foreseen (2) loss of steam imposes no makeup hardships.

In one setup, Fig. 7, four jets per boiler produced a definite improvement in smoke emission from 12 operating units. Six additional jets per boiler are going in to provide for overload conditions.

Another boiler-type at this same plant has five jets per boiler. These boiler-units have high settings and smoke difficulties have never been excessive. The jets were added to take care of peaks over and above the expected normal.

At still another plant 12 underfeed units operate with only two pairs of jets, set to give a diagonal throw, Fig. 8. To put in additional jets along the front wall meant a very expensive installation. Results have exceeded expectations and no more jets are planned.

One plant experienced makeup difficulties from a use of steam-actuated jets. They went to a blower-jet form of introducing overfire air. Fifteen ⅛-in. jets went into the front wall and twenty 1-in. jets into the rear. Fan pressure runs 30 in. wg. From a smoke standpoint the installation gives satisfactory results. But for efficiency considerations, the large air volume entering at the back *wall has an adverse* effect.

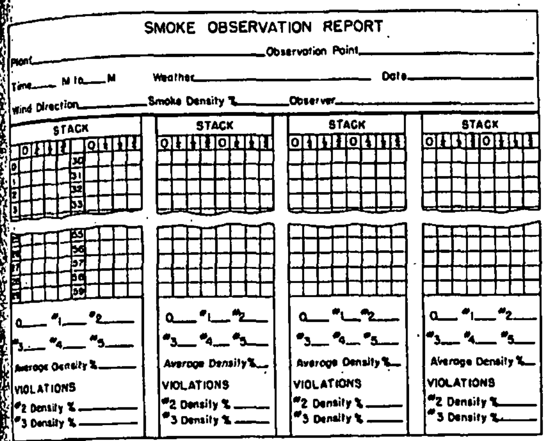
The next blower jet arrangement planned by this company gets around this objection by leaving out all rear-wall jets and putting in nine 1⅛-in. jets in the front wall to operate under a 20-in. wg fan pressure.

A municipal system reports a set of thirteen 1⅛-in. venturi tube nozzles machined from cast-iron operating on two 150,000-lb-per-hr, 425-psi, 700-F underfeed-stoker-fired steam generators. These jets use a blower rated at 6000 cfm with a static pressure of 14-in wg. Actual operating conditions require only 1250 cfm at 10 in. to get a penetration length of 8 ft plus.

Center line of the nozzles stands 5 ft 9 in. above the top line of tuyeres at the furnace front. Nozzles aim at a point 3 ft 2½ in. above the bottom line of the tuyeres at the furnace rear. Center nozzle is 8 ft 11 in. from side water-wall edges. *Nozzle spacing is 12 in.,* center to center, and outboard nozzles mount 1 ft 11 in. from side waterwalls.

Cost of Jets. How about relative installation costs of blower jet against steam jet? Only comparison available places steam jets at present-day prices, including engineering and overhead items, to run between \$80 and \$110 per jet. Blower-jet assemblies available range from \$194 for set of 4¾-in. nozzles to \$925 for 16 of 2½ in.

Now for some field experience on results. The municipal job described above is felt by the plant operators to give a 2 to 4% improvement in boiler efficiency, considerably reduced soot de*posit in the rear passes,* a higher furnace temperature and a resulting lower flue-gas temperature. Jets operate continuously and no disturbing effect has been produced on the combustion control.



10 Actual jet performance can be determined only by setting up regular procedure for taking smoke observations. Above form enables observation of four stacks

Table I—Figures on Several Plants Under Observation

Plant	Stacks	Observations	Smoke density, %	Ringlemann, % No. 2	Ringlemann, % No. 3	Jets
Sta 1......	1, 2, 3, 5, 6, 7, 8...	139	24.6	31.4	11.3	None
Sta 1......	4.................	11	5.3	3.0	0.0	Blower
Sta 2......	1 and 2..........	57	24.9	24.9	1.3	None
Sta 3......	North............	32	15.2	3.7	0.0	Steam
Sta 4......	A, B..............	68	20.0	17.4	3.3	Steam
Sta 4......	C.................	34	9.7	6.7	0.6	Steam

Table II—Readings Collected From 48-Hour Test
Blower jets were turned on and off alternately every half hour

	With jets	Without jets
Smoke density, %....	7.0	32.7
Ringlemann No. 2, %.	0.0	51.2
Ringlemann No. 3, %.	0.0	12.2
Steam, lb per hr.......	97,400	96,200
Outlet-gas temp, F....	789	788
Boiler outlet, CO_2, %.	11.9	12.6

One organization, a strong believer in the value of overfire jets, has instituted a regular procedure of taking smoke observations. Each observation covers a full hour with readings every 15 seconds, a total of 240 readings per observation. Fig. 10 shows a form it worked up for recording observations from four stacks at one time. Table I gives an interesting set of collected figures on several plants under observation. At Station 1 eight identical boilers operate with separate stacks. One boiler, No. 4, put in blower jets for results shown.

Stacks under observation in Station 2 serve ten boilers. But most smoke offenses here occur during banking periods and it is felt that methods other than jets must be applied to improve smoke emission.

The North stack at Station 3 handles the output of 12 boilers equipped with diagonal jets. Usual smoke emission, before jet installations, ran between 40 and 60% density.

Twelve boilers with four jets per boiler discharge through two stacks, *A* and *B*, on Station 4. Six additional jets are going in each boiler to cut down on smoke emission.

The last listed series of data at Station 4 on stack *C* record the results of five diagonal jets per boiler added to three boilers whose output was fairly free of smoke before the jet installations. No marked improvement shows. This seems to indicate that jet-installa*tions apply particularly where* a heavy smoking condition prevails.

Table II lists the readings collected from a 48-hr test where blower jets were turned on and off alternately every half hour. Observations were taken for a total of eight hours.

Blower-jet operation, judging from results recorded by this 48-hr test, cause a definite drop in CO_2 in the exit flue gas, possibly because additional excess air introduced over the fire (1) reduces percent of unburned combustibles (2) increases nitrogen and oxygen readings.

Operating the Jets. Smoke indicators are a must for helping the fireman decide whether jet action is needed. Most indicators suffer from a tendency of the lens to become dirty and give false readings. A dustproof box, covering both sending and receiving instruments, filters air drawn in around the instruments and keeps the lens clean.

For further practical information on applications, we refer you to the *Technical Report No. VII*, written by W S Major, of Bituminous Coal Research, Inc, and R B Engdahl, of Battelle Memorial Institute.