CHAPTER 23

# Inspection and Preparation

## 1. Inspection

The author is getting tired, *very tired,* of the mis-application of the word *survey** for *inspection.*

The installation of every oil burner requires careful preliminary thought and study. Conditions encountered are usually different for each installation, all of which must be carefully considered before deciding upon any particular outfit or whether to make an installation.

**Ques.** What preliminary precaution should be taken?

**Ans.** Do not recommend the installation of an oil burner (conversion) in a heating plant unless you have reasonable assurance that the plant is suitable for oil burning.

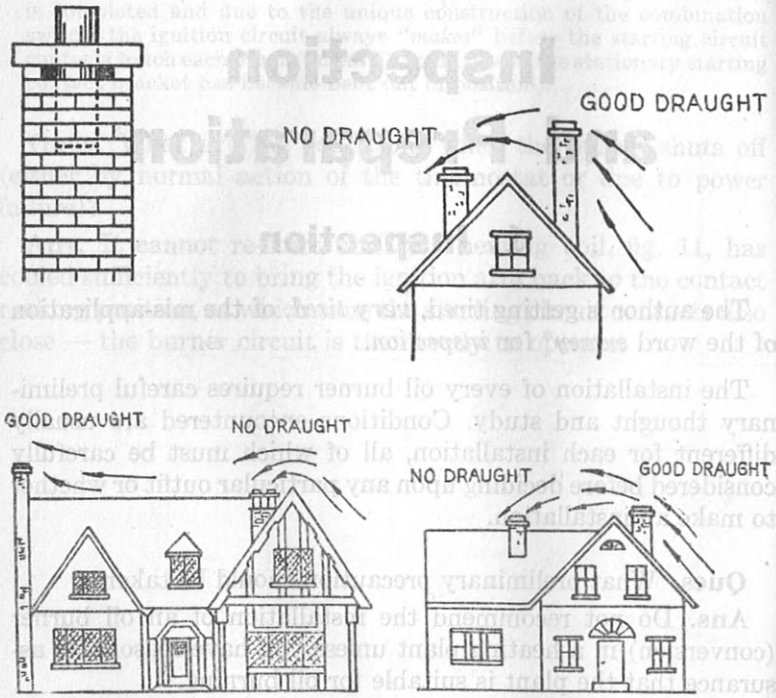
If by questioning the owner, it is apparent that the heating system has been and is satisfactory, it can be taken for granted that a calculation of the connected load is not necessary.

---

*NOTE.—Some ***language butcher*** started it with the usual result. When a Civil engineer with aid of surveying instruments and a rod man locates boundary lines, their lengths and directions on a piece of property, that is ***surveying.*** When an oil burner man goes into a basement to see what kind of junk it contains and what he is up against in installing a burner, that is ***inspection.*** However, language butchers are always on the job — *mark ye,* ***always.***

**Ques.** What is the first thing to inspect?

**Ans.** Inspect the boiler or furnace and determine its suitability for oil burning.




FIGS. 1 to 4—How down draughts are formed.

**Ques.** What should be noted about round cast iron boilers?

**Ans.** They show very poor efficiency, especially when operated with oil burners, unless there be four or five pancake sections.



## REQUIRED FLUE SIZES

### According to Branford

| Warm Air Furnace Capacity in Leader Pipe, Square Inches | | Hot Water Rating, Square Feet | | Steam (Direct) Rating, Square Feet | | Dimension Inches | Chimney Height Feet |
|---|---|---|---|---|---|---|---|
| To | | To | | To | | | |
| | 450 | | 700 | | 450 | 8 x 8 | 35 |
| | 800 | | 900 | | 600 | 8 x 9 | 35 |
| | 1,000 | | 1,100 | | 700 | 8 x 10 | 40 |
| | | | 1,500 | | 1,000 | 10 x 10 | 35 |
| | | | 2,500 | | 1,500 | 12 x 12 | 40 |
| | | | 4,000 | | 2,500 | 12 x 16 | 40 |
| | | | 5,800 | | 3,600 | 16 x 16 | 45 |
| | | | 7,300 | | 4,500 | 16 x 20 | 50 |
| | | | 8,700 | | 5,400 | 20 x 20 | 55 |
| | | | 10,000 | | 6,400 | 20 x 24 | 60 |
| | | | 12,000 | | 7,400 | 24 x 24 | 65 |
| | | | 14,000 | | 8,400 | 24 x 28 | 65 |
| | | | 15,000 | | 9,400 | 28 x 28 | 70 |
| | | | 17,000 | | 10,400 | 28 x 32 | 70 |
| | | | 19,000 | | 11,400 | 30 x 30 | 70 |

A boiler of this type (according to Branford) provided with but two pancake sections, will probably not allow of more than 40% efficiency with oil, because the boiler offers then so little heating surface and flue travel; what little there is, is inefficient due to short circuiting in the large and short passages. Moreover the gas velocities will be so high that the gases of combustion will not be able to transfer their heat thoroughly before passing into the stack — often on a heavy load resulting in a red hot stack which not only is very wasteful of fuel, but constitutes a distinct fire hazard.

**Ques.** What fault is usually found with the boiler regardless of type?

**Ans.** Too small to heat the building without carrying a radiation load greater than its rated capacity.

**Ques.** What inspection should be given to the chimney?

**Ans.** It should be examined to make sure that it has no obstructions; that is, of sufficient size for the boiler and that the outlet is not located where it will be subjected to down draughts.

**Ques.** How are chimney down draughts formed?

**Ans.** Various causes are shown in figs. 1 to 4.

**Ques.** How about proper flue sizes?

**Ans.** The table on page 193, by Branford may be used as an approximate guide in the absence of boiler manufacturers' recommendations.

The sizes of chimneys in the table by Williams, page 62, are based on the following assumptions: 1. That the height of chimney is measured from the top of chimney to the level of the ash pit door of the furnace or boiler; 2, not more than 50% excess air for combustion (10% or more $CO_2$); 3, flue gas temperature 425° Fahr. or more at inlet of chimney; 4, length of breeching not over 10 chimney diameters; 5, no turns in breeching, etc. Chimney to extend at least 3 ft. above a flat roof and 2 feet above roof ridge.



**Ques.** In converting from coal to oil, what should be noted about a boiler which is inadequate for the job or in need of repairs?

**Ans.** It will not give satisfactory results after the burner is installed.

**Ques.** If certain parts or rooms of the building were difficult to heat when using coal for fuel, what is the usual result in converting to oil?

**Ans.** The same difficulty will most likely be present, or conditions rendered worse on steam systems.

**Ques.** Why?

**Ans.** The trouble is due to inadequate venting.

On inspection it will be found that the cheapest air valves were installed, mains improperly vented with smallest size (⅛ connection) valves—in some cases no valve at all.

See pages 229-246, Chapter 25, on "How to Vent a Conversion Job."

**Ques.** What should be considered with respect to the heating plant?

**Ans.** Check the amount of fuel used the previous year and determine if the heating plant be large enough and satisfactory.

Any defects should be called to the attention of the owner and proper repairs or alterations recommended. A furnace or boiler which is inadequate for the job or is in need of repairs will not give satisfactory results no matter what make burner is installed.

The oil burner only furnishes heat to the fire box. *From there the heating system must absorb and distribute the heat.*

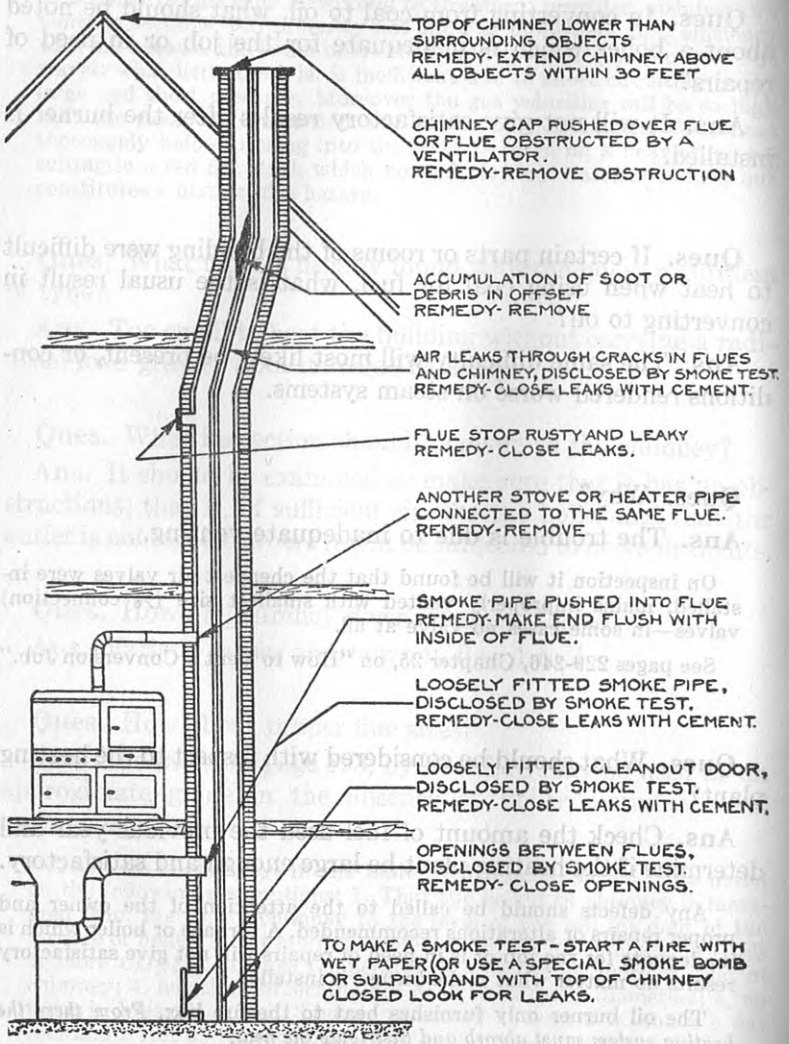



FIG. 5—Common causes of faulty draught.



**How to Determine Size of Burner Required.**—Oil burner men are not always expected to be expert on heating plant design, but there are a number of fundamental principles that are easily understood, and the more the oil burner man knows about heating plants, the more success he will have with his installations.

These instructions will point out the important points to look for in measuring up the load in a heating plant and its ability to do the work expected of it.

**Ques.** How do you determine the actual heating load on a boiler (steam, vapor, vacuum or hot water)?

**Ans.** Measure each radiator with a rule and add up the number of square feet of heating surface.

**Ques.** How is the number of square feet of heating surface (radiation) obtained?

**Ans.** The heating surface is listed according to height, number of columns and number of sections in the accompanying illustrations and tabulated in the tables.

**Ques.** How is the total obtained?

**Ans.** To total sq. ft. for radiators, add 25% if all piping be not covered with insulation. If covered add only 15%.

**Ques.** What additional allowance must be made?

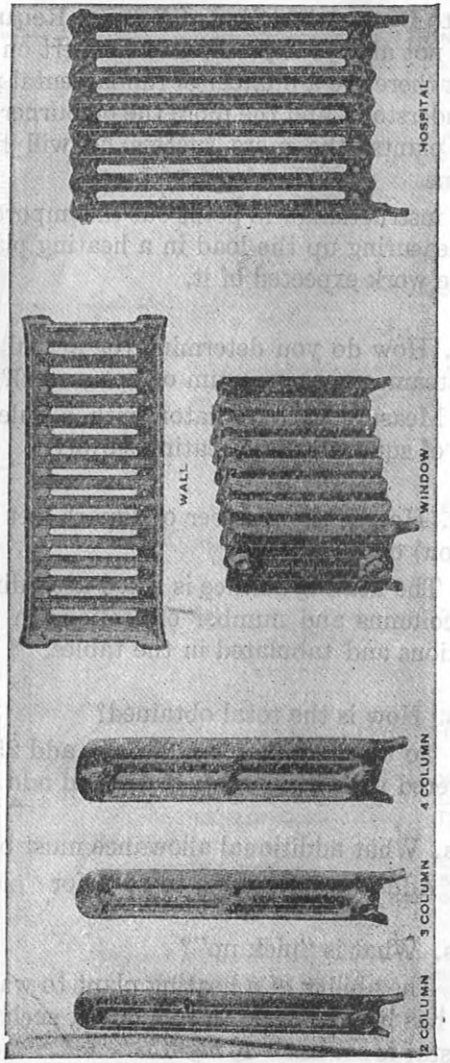
**Ans.** Add also from 10% to 20% for "pickup".

**Ques.** What is "pick up"?

**Ans.** The ability of a heating plant to warm up the building after it has been allowed to cool down, such as happens when a thermostat is set back at night.

**COLUMN CAST IRON RADIATORS**

**Heating Surface in Square Feet on Table Following**




FIGS. 6 to 11—Various types of *column* cast iron radiators.



The total thus far determined is the total heating load on the boiler, to which must be added the heat required for domestic hot water if furnished by the boiler.

**Ques.** What allowance is made for hot water supply?

**Ans.** Figure 1 to 1½ sq. ft. of steam radiation for each gallon of tank capacity.

## RADIATION TABLE

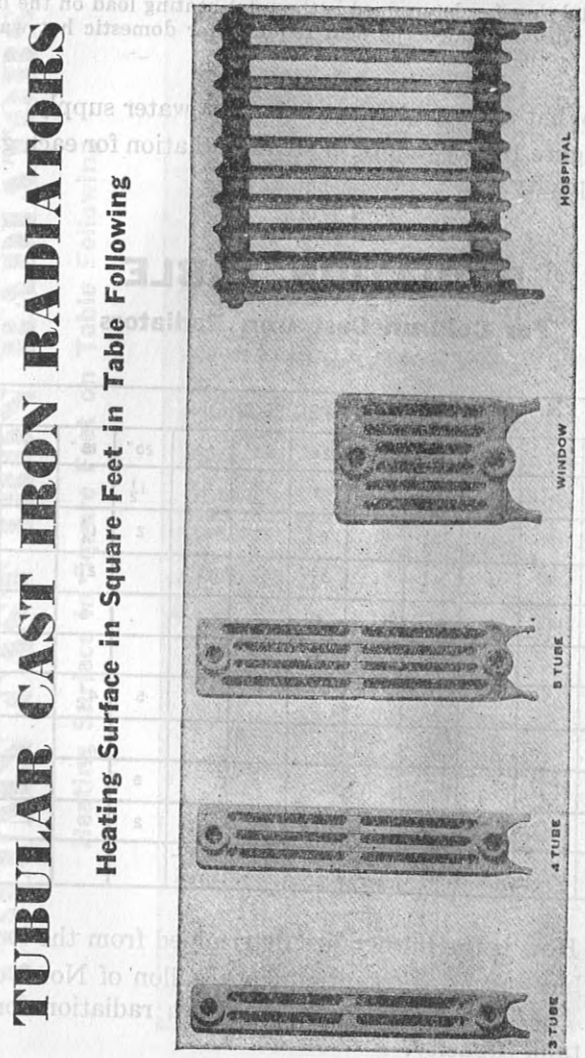
### For Column Cast Iron Radiators

Page 198

| SQUARE FEET PER SECTION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HEIGHT OF RADIATOR | 45" | 38" | 32" | 29" | 26" | 23" | 22" | 20" | 18" | 16" | 13" |
| SINGLE COLUMN | | 3 | 2½ | | 2 | 1⅔ | 1⅔ | 1½ | | | |
| 2 COLUMN | 5 | 4 | 3⅓ | | 2⅔ | 2⅓ | 2¼ | 2 | 1¾ | | |
| 3 COLUMN | 6 | 5 | 4½ | | 3¾ | | 3 | | 2¼ | | |
| 4 COLUMN | 10 | 8 | 6½ | | 5 | | 4 | | 3 | | |
| 5 COLUMN | | 10 | 8 | | 7 | | 6 | | | | |
| 6 COLUMN | | | | | | | | 5 | 4½ | | |
| | | | | | | | | | | | |
| WINDOW RADIATOR | | | | | | | | 5 | | 3¾ | 3 |
| 2 COLUMN HOSP. RAD. | 5 | 4 | 3⅓ | | 2⅔ | 2⅓ | | 2 | | | |
| WALL RADIATOR | | | | TOTAL 9 SQ. AREA | | | TOTAL 7 SQ. AREA | | | | TOTAL 5 SQ AREA |

**Ques.** How is the burner size determined from the load?

**Ans.** Under average conditions, one gallon of No. 3 oil per hour will heat about 300 sq. ft. of steam radiation for each gallon of tank capacity.




FIGS. 12 to 16—Various types of tubular cast iron radiators.



Refer to table of capacities given by manufacturer of the burner to be used and pick out the size corresponding.

**Useful Data.**—According to "Nu-way": To find equivalent steam radiation when the hot water radiation is known, divide the hot water radiation by 1.6.

## RADIATION TABLE

### For Tubular Cast Iron Radiation

| | SQUARE FEET PER SECTION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEIGHT OF RADIATOR | 45" | 38" | 36" | 34" | 32" | 30" | 26" | 23" | 20" | 19" | 17" | 16½" | 14" | 13½" |
| 3 TUBE | | 3½ | 3½ | 3⅔ | 3 | 3 | 2⅓ | 2 | 1¾ | | | | | |
| 4 TUBE | | 4¼ | 4¼ | | 3½ | 3½ | 2¾ | 2½ | 2¼ | | | | | |
| 5 TUBE | | 5 | 5 | 5 | 4⅓ | 4⅓ | 3½ | 3 | 2⅔ | | | | | |
| 6 TUBE | | 6 | 6 | | 5 | | 4 | 3½ | 3 | | | | | |
| 7 TUBE | | 8 | 7 | | 6¾ | 5½ | 4¾ | 4¼ | 3⅔ | | 3 | 3¼ | 2½ | 2⅔ |
| | | | | | | | | | | | | | | |
| WINDOW | | | | | | | | | 3⅔ | | 3 | | 2½ | |
| SECTIONS 3 LONG | | | | | | | | | | | | | | |
| HOSPITAL 3 TUBE | | 3½ | | | 3 | | 2⅓ | | | | | | | |

**Example.**—If a building have a total of 600 sq. ft. hot water radiation, this is equivalent to

600 ÷ 1.6* = 375 sq. ft. steam radiation.

*NOTE.—Repeated tests have shown that *the amount of heat given off by ordinary cast iron radiators* **per degree** *difference in temperature between the steam (or water) in the radiator and the air surrounding same, to be about 1.6 B.t.u. per sq. ft. of heating surface per hour.*

To find the equivalent steam radiation when the area of warm air pipes is known, divide the number of sq. ins. of warm air pipe area by 1.4.

**Example.**—If a building have a warm air furnace whose total area of warm air pipes is 800 sq. ins., this is equivalent to:

$800 \div 1.4 = 571$ sq. ft. steam radiation.

**Figures to remember.—**

1 sq. ft. steam radiation = 1.6 sq. ft. not water radiation.

1 sq. ft. steam radiation = 1.4 sq. in. of hot air pipe area.

I gallon hot water storage = about 1¼ to 1½ sq. ft. steam radiation.

240 *B.t.u.* = amount of heat given off by ordinary cast iron radiators per sq. ft. of heating surface per hour average.*

*NOTE.—This is true for steam at 2½ lbs. pressure (220°) surrounding air 70° Fahr. (220—70) 1.6=240 B.t.u.

## 2. Preparation

Before installing an oil burner, the heating system should be carefully inspected for defects and cleanliness.

**Ques.** What attention should be given to the boiler?

**Ans.** All flue passages and heating surfaces should be thoroughly cleaned so that the maximum amount of heat generated may be absorbed.

Soot or ash is a good insulator, and accordingly should be removed. On a conversion job the damper should be removed. The boiler or furnace should be examined for air leaks and in the stack connection to chimney. If leaks be found, they should be sealed with suitable compound. Remove ash pit door, door frame and grate. Do not throw away unless by directions of the owner.

**Ques.** What attention should be given to the stack?



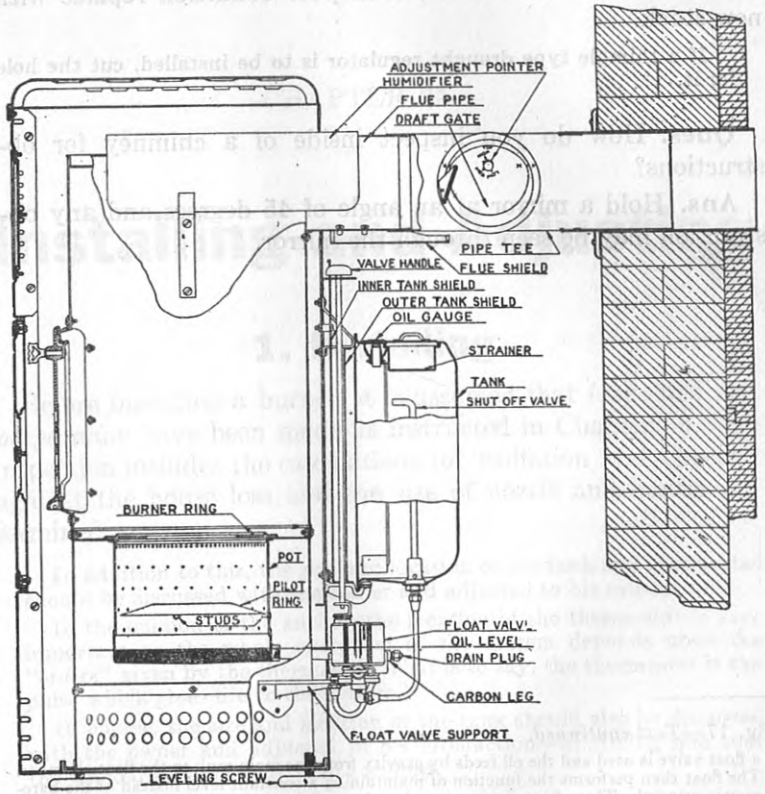



FIG. 17—Pot burner installation showing fuel system and stack. ***In making the original installation,*** certain regulations of the Underwriter's Laboratories and the various local authorities must be considered. Heaters using pot burners require more draught and no manual damper should be installed. ***The draught regulator*** supplied with these heaters is adjustable with marking High-Med.-Low on dial. By setting the pointer to High, the draught will be increased (provided the chimney will give more draught as indicated by the gate still swinging inwardly at least one quarter way) and the capacity without smoking can be increased up to the limit of the valve capacity which has been set at a safe amount for the particular heater. ***In general,*** however, it is recommended, that the regulator be set at Medium which will give the most efficient operation. ***Oil feed system:*** The tank is fixed in place and fills at the top. It is not air tight. To control the oil level,

**Ans.** Remove and clean; if in poor condition replace with new stack.

If a thimble type draught regulator is to be installed, cut the hole for it.

**Ques.** How do you inspect inside of a chimney for obstructions?

**Ans.** Hold a mirror at an angle of 45 degrees and any obstruction may be seen through the mirror.

Fig. 17—*Text continued.*

a float valve is used and the oil feeds by gravity from the main tank to the float chamber. The float then performs the function of maintaining a constant level instead of the barometric principle. These floats are equipped with a safety mechanism. If the float fail, the oil rises and trips a weight or spring causing float needle valve to close tightly and prevent further flow of oil. To restart lift long reset lever. If desired oil flow can be stopped by pushing down on short lever which manually trips the valve. If float keep tripping there is probably dirt under the valve seat and float chamber can be cleaned by removing cover. To clean float inlet needle and seat, remove nameplate, spring and trip lever. Turn float needle 90°, lift out and wipe point with cloth. Clean seat with soft wood stick, replacing needle in same position it was before removal and replace trip lever, spring and nameplate. To clean metering stem and seat, remove nameplate, handle and stem guide. Turn stop clockwise to clear stem. Remove metering stem and clean with cloth. Remove spring and clean metering seat with soft wood stick. Replace parts in reverse order to their removal. Very important: Do not use metal tools or abrasives when cleaning the seats and needles in this valve.