HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

HEATING SURFACES.

All radiators, box coils, flat coils, plate or pipe surfaces, arranged to warm the air of buildings, are heating surfaces.

The vertical tube radiator is now the accepted type of a first-class heater, and most all manufacturers have their own peculiar style with varying results as to efficiency, and the steam fitter or purchaser should use great caution in the selection of radiators.

The common return-bend-radiator, Fig. 1, is the most widely manufactured; it is not patented, and is second to no other vertical tube heater.

The construction is simple, a base of cast iron, A, being simply a box without diaphragms, with the upper side full of holes, about 2¼ inches from center to center, tapped right-handed; a pipe, B, for every hole, 2 feet 6 inches or 3 feet long, threaded right and left handed, and half as many return bends, C, as there are pipes tapped left-handed.

The manner of putting these heaters together is to catch the right-handed thread of two pipes one turn in the base, then apply the bend to the upper and left threads of the same two pipes, and screw them up simultaneously with a pair of tongs on each pipe, and a second person holding the bend with a wrench made for the purpose.

Steam fitters who buy bases and make only a few radiators to keep the boys at work when in the shop, should count each set of threads in, but they who make for the trade gauge their threads and pipes so as to always enter the base first. If the pair of pipes in any one bend are not plumb, screw the pipe at the side from which they lean a little tighter; this this will shorten that side and draw the bend over.

I will here explain the action of steam entering a radiator, as nearly all the patents on the so-called positive circulating radiators are to facilitate the expulsion of the air and the admission of steam.

The general impression among steam fitters is that when steam enters a radiator the air is backed up and confined in the top of the pipe, and so it will be when the pipe is single and closed at the top, without any of the usual means to get it down; *this is so*, although steam is not quite one-half the weight of air, and it may seem an anomaly to the scientific engineer.

When two pipes are connected at the top with a bend, or when there is an inside circulating pipe or diaphragm of sheet iron slipped into it, the air immediately gives way and falls in the pipes nearest the inlet first; but should there be no air valve on the radiator, the air will be crowded at first to the further end of the radiator, and should the system be a gravity circulation, without an outlet to the atmosphere, it will remain in the radiator, impairing its efficiency and often deceiving the novice, as it in time heats by contact with the steam; but when there is a thumb cock or air valve on the radiator, usually on the furthermost pipe from the inlet, the result is quite different. In the common return-bend radiator and others of good construction the action is direct, and the pipes heat consecutively, excepting, perhaps, the pipe the air valve is on and a few near it which sometimes heat ahead of their order, on account of the draught of the air valve.

Thus when the steam enters a well constructed radiator the air falls to the base and is driven out at the air valve, the pipe of which may be run down inside the base (as seen at D, Fig. 1), which will bring it into the lower stratum, drawing it off to the last.

This is the most simple test for a good heater, and any make of radiator that nearly always has a few cold pipes, sometimes in one part of the heater and sometimes in another, should be avoided.

Fig. 2 shows a device (patented) for making a return bend radiator positive. The pockets, A A, filling with condensed water, makes a seal which at times prevents the flow of steam along the base and forces it in a continuous stream through the pipes (see arrows in cut).

Figs. 3 and 4 show cross section of modifications of positive return bend radiators. Fig. 3 can be used as a vertical radiator only, but Fig. 4 can be used in any position from perpendicular to horizontal, as seen at Figs. 5 and 6, and is peculiarly adapted to indirect heating.

Single tube radiators welded, or closed at the top with a cap, with an inside circulating device, are also much used; some of them compare favorably with the return bend radiator, but are slower in heating.

Fig. 7 shows the first of this class put on the market. A is the cast iron base, B the welded tube, and C the septum of wrought iron slipped inside the tube and projecting an inch into the base. This heater depends on the gravity of the air for a circulation.

Fig. 8 shows another heater of this class which is positive in its action. A, cast iron base; B, diaphragm cast in base; C, welded tube; D, inside tube, open top and bottom and screwed into the diaphragm. The action of the steam can be seen by the arrows.

Fig. 9 shows a fire bent tube radiator very positive in its action.

Cast iron radiators are of two kinds, *plane* and *extended* surfaces.

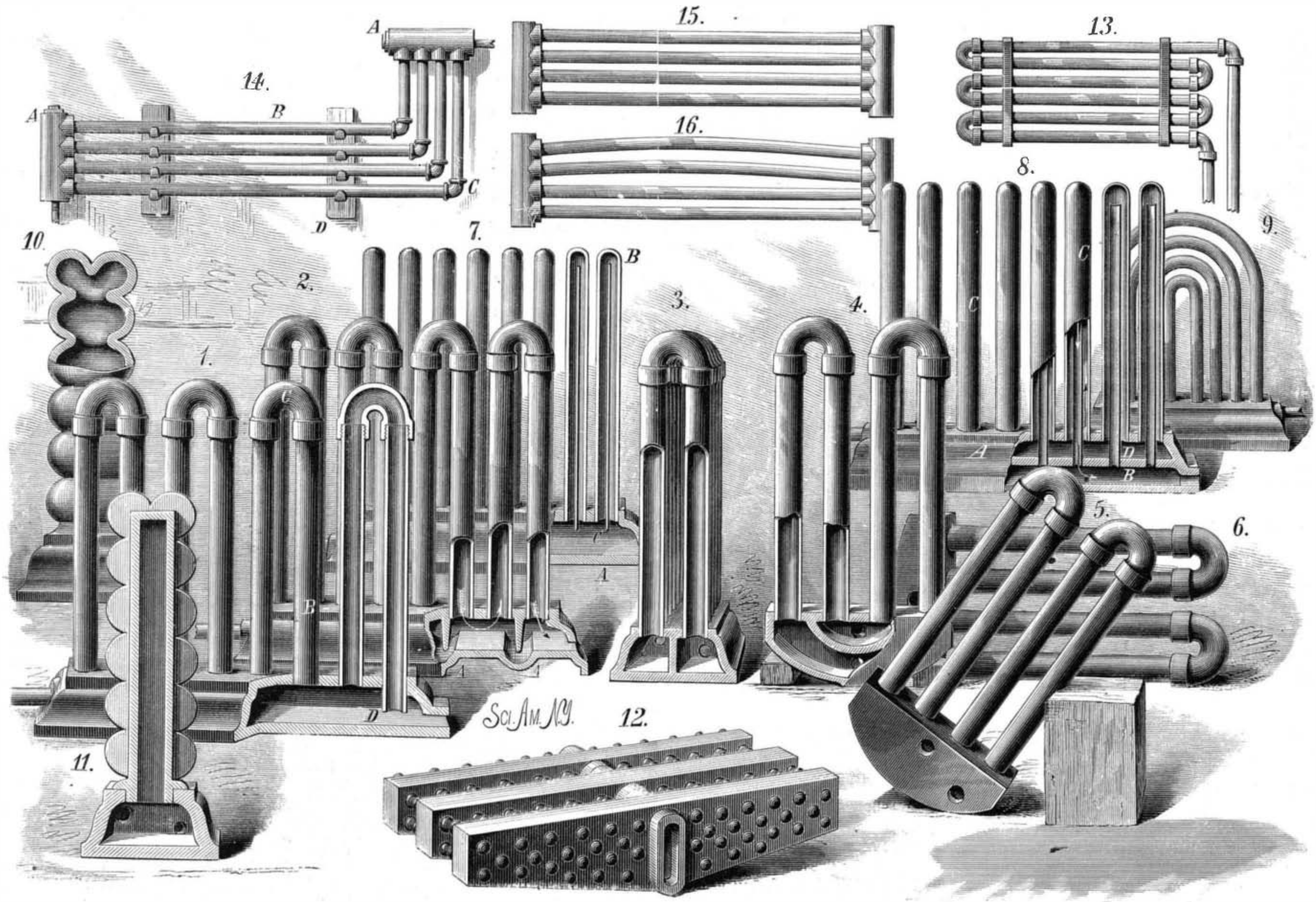
Plane surfaces, as the trade understands them, may be either flat round, or corrugated, provided the coring or inside surface of the iron corresponds and follows the indentations of the outside, as in Fig. 10, and all wrought iron heaters. Extended surface is understood when the outside surface of the heater is finned, corrugated, or serrated, with the inside straight, as in Fig. 11.

For direct radiation where the heater is placed in the room there is little or nothing gained by having the surface of the heater extended, and a steam fitter in calculating the extent of his heating surfaces should not take into consideration the whole outside surface of such a heater; he should simply treat it as if the projections were cut off, leaving a flat or plane surface.

For indirect heating (the coil to be under the floor or in a flue) the result is a little different when in comparison with shallow plane surface coils, where the air cannot stay long enough in contact with them to get thoroughly warmed, but presses into the room without hinderance. In this case the extended surface gives a better result, not because a square foot of the surface can transmit as much heat in the same time, but because it hinders the direct passage of the air, holding it longer in contact and preventing stratification.

The cast iron vertical tube radiator is a quick heater, the large size of the tubes causing large and few chambers, which expedites the expulsion of the air.

Fig. 12 shows stack of cast iron extended surface radiators for indirect heating.



Sheet iron radiators are used in very low-pressure heating, the commonest form of which is the flat Russia iron heater, seamed at the edges and studded or stayed in the middle, with a space of about ⅜ of an inch between the sides. They are used in a one pipe job.

COILS.

Coils are always made of wrought iron steam pipe and fittings, and though not considered an ornament are first-class and cheap heaters.

Fig. 13 shows a *flat coil*, which is a continuous pipe connected with return bends at the ends and strapped with flat iron, which is a very positive heater.

Fig. 14 shows a miter or wall coil. It is composed of headers or manifolds, A A; steam pipes, B; elbows, C; and hook plates, D.

There are many modifications of this coil, but one indispensable point in the making of it is, it must *turn a corner* of the room or miter up on the wall. The pieces from the elbows to the upper header are called *spring pieces*, they are screwed in right and left, and are the last of the coil to be put together.

If a coil is put together straight between two headers, as seen at Fig. 15, it will be like Fig. 16 when heated, and cannot be kept tight for a single day, the expansion of the first pipe to heat being a powerful purchase to force the headers asunder, and when it cannot do so it will spring them sidewise.

TO ESTIMATE THE AMOUNT OF HEATING SURFACE NECESSARY TO MAINTAIN THE HEAT OF THE AIR OF INCLOSED SPACE IN BUILDINGS TO THE DESIRED TEMPERATURE.

The ordinary rule-of-thumb way of the average pipe fitter is to multiply the length by the breadth of a room and the result by the height, then cut off two figures from the right hand side, and call the remainder square feet of heating surface, with an addition of from 15 to 30 per cent for exposed or corner rooms.

In the computing of heating surfaces there is much more to be considered, and it is evident the amount of surface necessary for a good and well constructed building will not be enough for a cheap and poorly put up one.

The cubical contents of a room occupies only an inferior place when estimating for large rooms and halls, and no place at all in figuring for small or ordinary office rooms or residences, which are heated from day to day throughout the winter.

Suppose a small room on the second floor of a three story building with only one outside wall, with no windows, but the whole furred, lathed, and plastered, with all the other rooms of the building heated and maintained to 70° Fah.; now place a portable heater in this room and keep it there until the room is heated to 70° also, then remove it. How long will it take to cool 10°? Answer, perhaps three hours. Now make a window without blinds, and you find it cools 10° in less than half the time. Why? Because the glass of the window being a good transmitter of heat, it is able to cool more air than the whole outside wall. You may now say: What about the inside walls and floor? Why, they actually help to maintain the heat in the room by conduction, etc., from the other rooms.

Thus the windows are the first and most considerable item. Secondly, the outside walls, how they are plastered—whether on the hard walls or on lath and furring. Thirdly, the prospect—whether exposed or sheltered. Fourthly, is the whole house to be heated, or only part of it? and, lastly, what the building is to be used for.

TABLE OF POWER OF TRANSMITTING HEAT OF VARIOUS BUILDING SUBSTANCES, COMPARED WITH EACH OTHER.

Window glass	1,000
Oak and walnut	66
White pine	80
Pitch pine	100
Lath and plaster	75 to 100
Common brick (rough)	120 to 130
Common brick (whitewashed)	125
Granite or slate	150
Sheet iron	1,030 to 1,110

In figuring wall surface, etc., multiply the superficial area of the wall in square feet by the number opposite the substance in the table, and divide by 1,000 (the value of glass), the product is the equivalent of so many square feet of glass in cooling power, and may be added to the window surface and treated the same.

The following method has given good results and is not wholly empirical. The writer has used it for many years in preference to any other:

CLOCK OF AUSTRIAN DESIGN.

Divide the difference in temperature between that at which the room is to be kept and the coldest outside atmosphere, by the difference between the temperature of the steam pipes and that at which you wish to keep the room, and the product will be the square feet or fraction thereof, of plate or pipe surface to each square foot of glass or its equivalent in wall surface.

Thus: Temperature of room, 70°; less temperature outside, 0°; difference, 70°. Again: Temperature of steam pipe, 212°; less temperature of room, 70°, difference, 142°. Thus: 142÷70=0·493, or about one half a square foot of glass-heating surface to each square foot of glass or its equivalent. For each additional mile and a half in the average velocity of the wind above fifteen miles per hour add ten per cent to the heating surface.

In isolated buildings exposed to prevailing north or west winds there should be a generous addition of the heating surfaces of the rooms on the exposed sides, and it would be well to have it in an auxiliary heater, to prevent over-heating in moderate weather.

In windy weather it is well known to the observant that the air presses in through every crack and crevice on the windward side of the house; and should they take a candle and go to the other side of the house they will find that the flame of the candle will press out through some of the openings. Thus the air in a house blows in the same general direction as the wind outside, and forces the warmed air to the leeward side of the house; this is why the sheltered side of a house is often warmer in windy weather.

Conditions which tend to the warmth of a house in windy and cold weather without stopping the leakage of air under doors or around windows are: 1st, blinds on the windows inside; 2d, blinds on the windows outside; 3d, window shades and curtains; and, last, papered walls. The leakages are really blessings in disguise in houses which are not systematically ventilated.

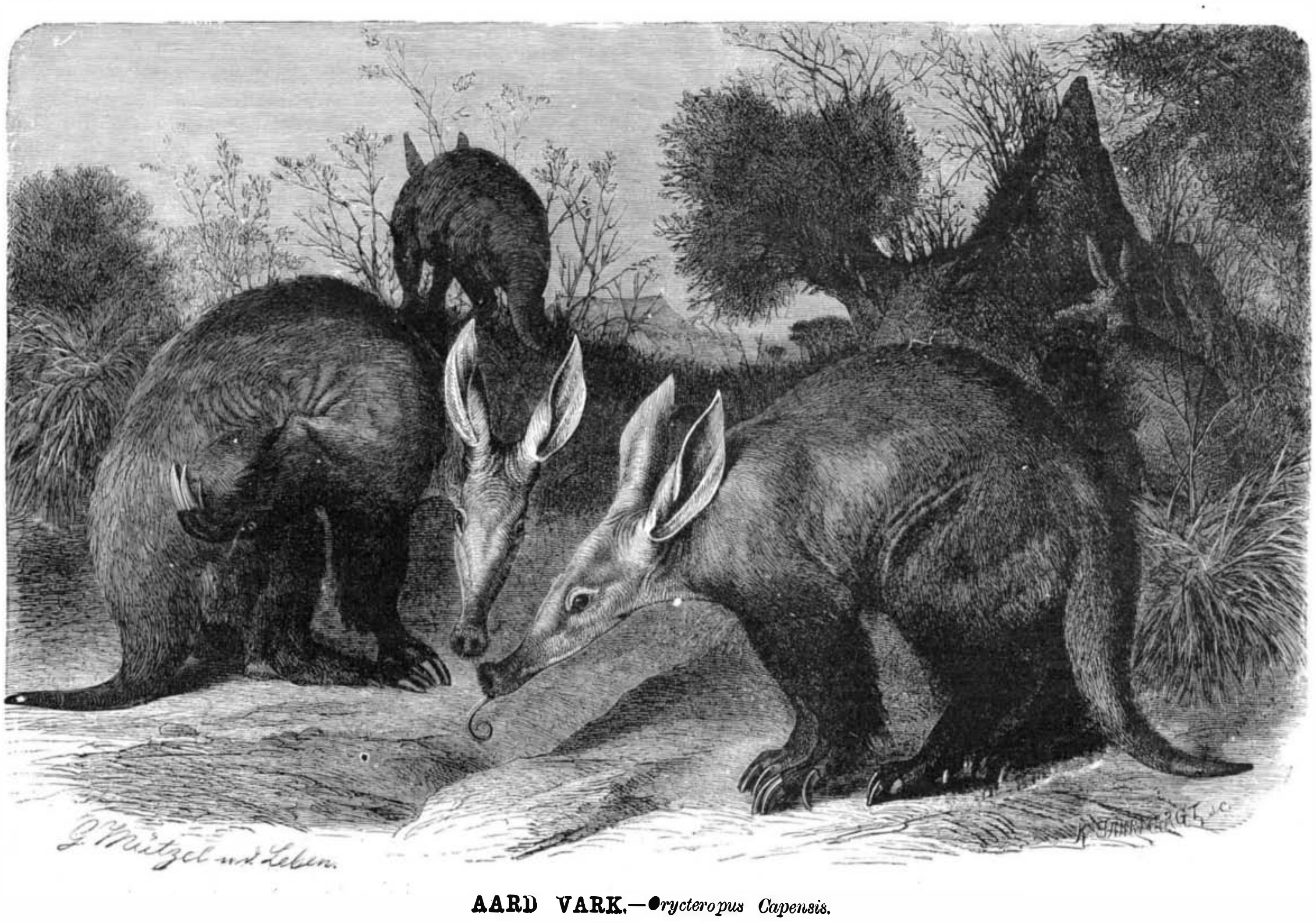
Lead or zinc paint should not be used on heaters; several coats of lead paint may destroy their heating power from fifteen to twenty per cent. Ocher and oil, or varnishes mixed with color, are the least harmful.

A NOVEL CLOCK.

On this page we illustrate a handsome clock of Austrian manufacture, which makes no pretense of being anything other than what it is, and in which the design and ornament are studied with due reference to the use for which it is intended. The simplicity of the design is offset by elaborateness in the detail of the decoration, which is rich and well conceived. In the panels of the dome is some very fine work. Above the dome is an open belfry, containing a bell and hammer. With this arrangement the vibration of the metal, when the hours are struck, is not muffled, but rings out clearly and with distinctness. Another feature, companionable or distracting, according to one's mood, is the pendulum swinging across the face of the dial, attracting the eye by its mute motion to the ever-advancing hands and to the significant legend inscribed above them.

THE AARD VARK.

The aard vark, or earth hog, is a native of Southern Africa, and is a very curious animal. The skin of the aard vark is not protected by scales or plates like those of the



AARD VARK.—*Orycteropus Capensis.*