Fig. 226 shows a small apparatus, made of galvanised sheet iron or of zinc, suitable for small greenhouses. The chief upright tube is 5 in. to 6 in. in diameter, with a flue-way up through it as shown; this flue is open to the

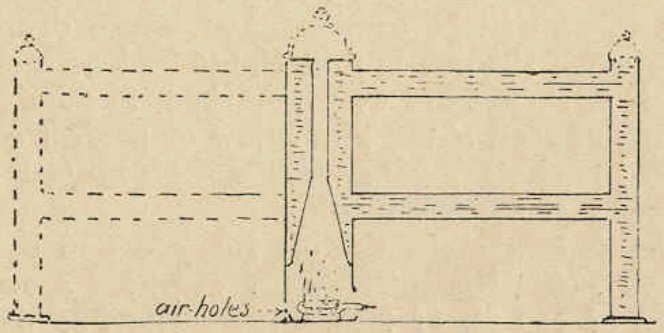


Fig. 226.—Gas-heated Apparatus for Small Greenhouses.

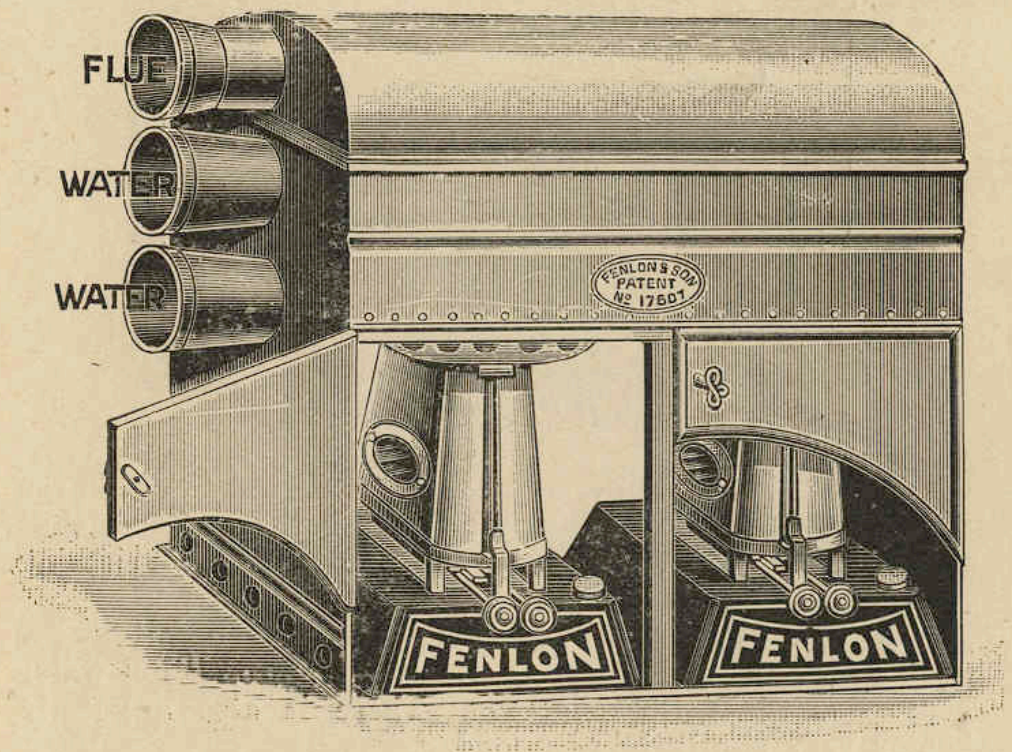


Fig. 227.—Fenlon's "Duplicate" Oil Furnace.

outside air. The cover to this tube is shown for ornament only. From this tube a pair of 2-in. tubes extend horizontally, and join an upright 2-in. or 3-in. tube, which has an open top, with loose cover, as the water is filled in

here, and it also serves as an air outlet. If desired, a pair of tubes can extend from the other side, as shown by dotted lines, or there can be four tubes on one or both sides instead of two. A small atmospheric ring burner will provide the heat, and this should stand in a zinc tray, as there will be condensed moisture drop from the flue tube when the gas is first lighted. There should be a row of air holes around where marked, to admit air to the ring burner on all sides, and allow of perfect combustion. For use in small greenhouses an oil-heated apparatus often gives satisfactory results.

Fenlon & Son make the oil furnace and boiler shown by Fig. 227. This is suitable for warming a conservatory by means of 150 ft. of 2-in. pipe. The flue passes along

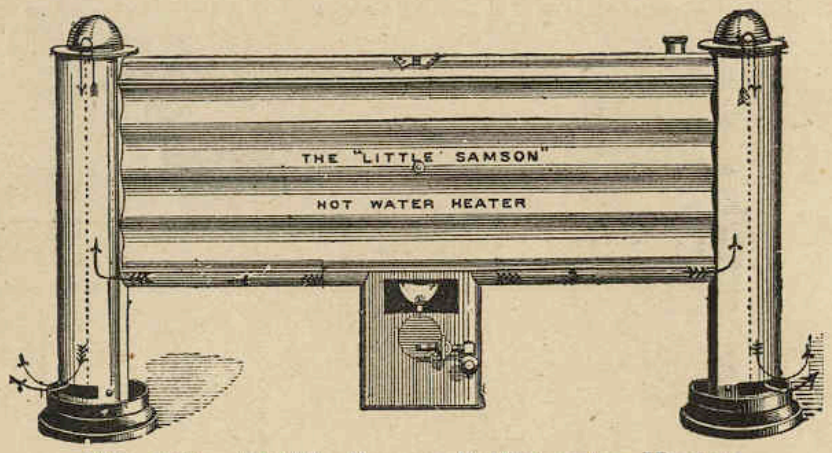


Fig. 228.—"Little Samson" Hot-water Heater.

the top of the flow pipe, and can be arranged to discharge at the opposite end to that where the boiler is fixed, thus utilising the whole length of the flue pipe for warming purposes.

The firm of Sam Deards makes a variety of oil-heated apparatus. One of these—the "Little Samson" hot-water heater—is shown by Fig. 228. There is also a hot-air heater very similarly arranged.

A simple hot-water apparatus fitted to the "Sunrise" stove, made by Rippingille's Albion Lamp Co., Ltd., is illustrated by Fig. 229. A complete oil-heated system of another kind made by the same firm is shown in Fig. 230.

The "New Excelsior" apparatus, made by Chas. Toope & Son, is made in two sizes, and has been found to give

satisfaction in small houses. This firm makes a variety of oil-heated hot-water apparatus.

An easily constructed heating apparatus, suitable for a small lean-to greenhouse, is shown in Fig. 231. This is made from two lengths of 2-in. zinc rain-water pipe, but it can be lengthened up to about 12 ft. without trouble by inserting the necessary pieces. A length of pipe is generally 7 ft. At 6 in. from one end cut out a V-shaped piece to form an obtuse angle, and another at the same distance from the other end on the opposite side of the pipe, finishing off the cut edges so as to enable them to mitre up well.

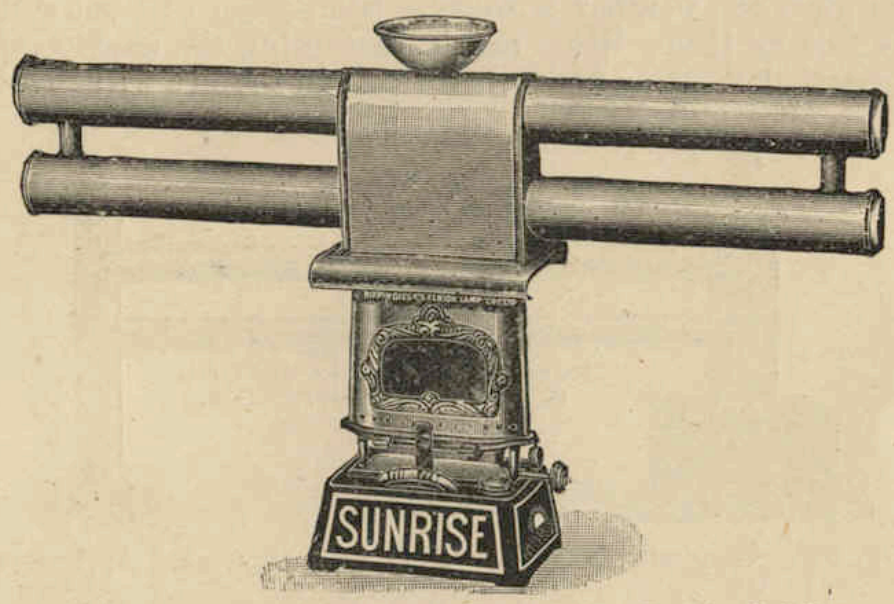


Fig. 229.—Hot-water Apparatus Heated by "Sunrise" Oilstove.

Make the two alike to fit together by slipping the bottom one into the top. A circular box A is then made from the patterns given in Fig. 232, X being the sloping portion to which the pipe is fixed. A strip of iron 2 in. in width fixed round the top of the box A would preserve the zinc from burning. To prevent down-blow, a shallow cone is fitted over the top. A square of glass must be removed from the roof, and replaced by a sheet of zinc with a hole cut in it to take the pipe. The whole is then secured to the side of the house with brackets; or it could be suspended from the roof. A duplex or other lamp placed under the box A will prove an efficient radiator. This

apparatus has maintained a temperature of 40° F. in a greenhouse 12 ft. by 7 ft., while the thermometer outside registered 2° of frost.

It occasionally appears at first sight that a greenhouse can be economically heated from a kitchen fire or from a domestic hot-water apparatus. The chief defect of such an arrangement is that the kitchen fire will probably be out when the heat is most needed (3 to 5 a.m.), and at all times the heat of the house will be largely governed by the cooking operations. Some provision will also have to be made for the house *not* to be heated by the kitchen fire when the weather is warm. Stop-cocks will not suffice for this by themselves. Lastly (assuming the absence of a domestic hot-water system), the coil in the fire will involve

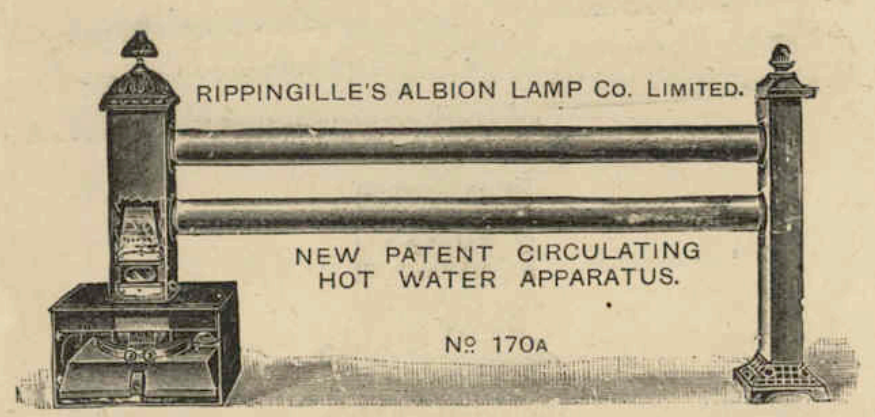


Fig. 230.—Rippingille's Albion Lamp Co.'s Oil-heated Apparatus.

burning nearly double the fuel. A small independent boiler would be as economical. Even where there is a hot-water system in the house, the extension is seldom a success, and it is never possible to afford warmth to the greenhouse when it most needs it—that is, about four o'clock in the morning, when the air is so very cold in winter. The only reliable plan is to take a branch from just above the cylinder, let this drop down to the pipes in the greenhouse, and then return beneath the floor to the boiler. Do not connect any taps to this circulation.

An old-fashioned way of warming a greenhouse is by means of the flue from the fire-hole carried round inside the greenhouse nearly horizontal. A conservatory even 50 ft. long can be heated by a flue, if, after the fire is

once started, the flue is not allowed to get cold. Each time it gets cool there may be some trouble in starting it. It is also necessary that the chimney should extend a sufficient height outside; it should be at least 20 ft. high at this part. It should be a 9-in. by 9-in. flue, as a smaller area would cause more friction—an important consideration in view of the length of the flue. The flue in the house should have a rise of at least 20 in. in the 50 ft.

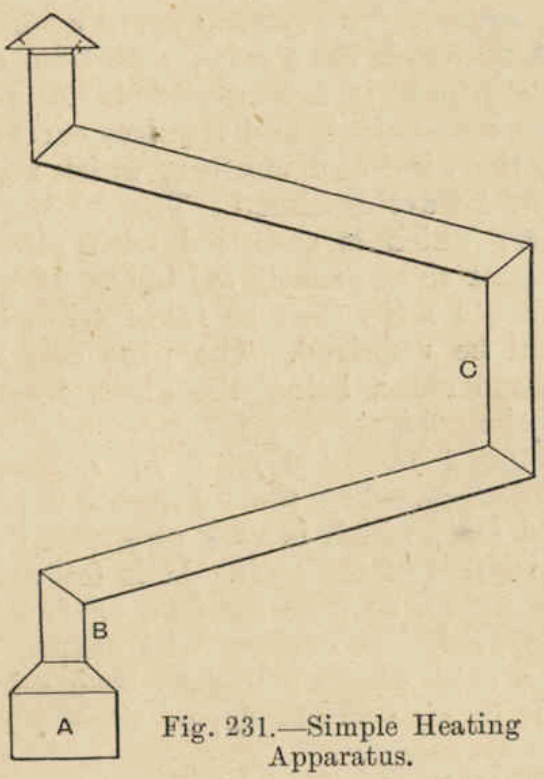


Fig. 231.—Simple Heating Apparatus.

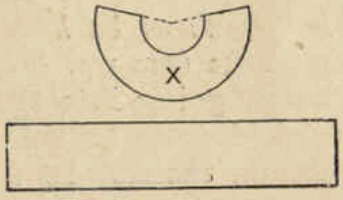


Fig. 232.—Pattern for Circular Box.

In flue making or building, it is absolutely necessary that everything shall be thoroughly sound and air-tight, so that all the air that enters the chimney shall first go through the fire. Provision must be made to sweep the flue and chimney, and the sweeping doors must fit tight. It is also very necessary that a door be put at the base of the vertical chimney, so that lighted shavings or some other source of heat may be thrust in to start the draught. There will be no draught until the vertical chimney becomes hot. The smoke and gases coming from the flue will keep the chimney hot and the draught good when once it has got in this

condition. Instances sometimes occur in which a small stove—a pilot it is called—has to be connected at the foot of the vertical chimney, and a fire kept in this for an hour or more to get the draught properly started whenever the chimney gets below an efficient temperature.

The remainder of this chapter will be occupied with brief statements of problems and difficulties that have actually been met with in practical hot-water work, accompanied by hints as to how they have been solved :—

*A glass house, 10 ft. square, for growing early cucumbers, is to be heated.*—A boiler to burn coke, with 3-in. or 4-in. cast-iron hot-water pipes, is recommended. A gas boiler would not prove so economical, and requires careful fixing to shelter it from the wind and weather, which may cause it to light back or be extinguished. The "Loughborough" type of boiler, which is supplied with pipes, etc., complete, would appear to be exactly suitable. If the height of the house averages 7 ft., then 35 ft. of 4-in., or 46 ft. of 3-in., pipe will be required. The pipe can be carried along two or three sides, below the glass, where the house is expected to be coldest.

*A glasshouse, 12 ft. by 9 ft. by 6 ft. 6 in. average height is to be heated cheaply.*—Try the "Ivanhoe" apparatus (see pp. 114 and 115), which is very compact, the boiler going into the thickness of the wall. It is fed and stoked from outside the house, so that no dust or fumes escape inside. 20 ft. to 24 ft. of surface will ensure a temperature of 50° on a cold winter's night. Two 4-in. pipes along the lowest 12-ft. side would do, or three 3-in. pipes.

*A lean-to greenhouse, 12 ft. by 12 ft. by 10 ft. 6 in. average height, is to be heated just sufficiently to protect plants and stock from frost; a temperature of 40° F. on a winter night is sufficient.*—To obtain this in a lean-to house of the size given, 44 ft. of 4-in. pipe will be needed. This can be run as four rows along the front, that is, the wall farthest from the high wall that the greenhouse leans against. Pipes along the sides (ends) and against the high wall will not be needed.

*A lean-to greenhouse, 18 ft. long by 4 ft. 6 in. wide, for tomato growing, is to be heated; what is the best apparatus?*—For a house 18 ft. long a Loughborough

coke-burning boiler with hot-water pipes running from it is best. Two 2-in. pipes along the low side (farthest from the wall the house leans against) will be ample, and with a fair-sized boiler the fire need not be replenished oftener than twice in twenty-four hours.

*A conservatory of* 1,950 *cub. ft. contents* (515 *sq. ft. of glass*) *contains three rows of* 4-*in. pipes; a suitable boiler is required.*—The piping (which amounts to 120 ft.) will afford a temperature of 65° when the outside temperature is at freezing; and 65° is a good temperature for a conservatory. A vertical cylindrical independent boiler, if the stokehole is large enough, will give good results, as the furnace can be filled up with coke, and this will last through the night easily without attention. Nothing less than a boiler of 200 ft. size should be used in order to obtain good results with moderate firing; and with this size the boiler should have a hopper top, capable of holding the quantity of fuel needed for running the boiler from nine to ten hours at night. A No. 6 size " Star " boiler should answer the purpose. If there is no stokehole use the Loughborough type of boiler, which will effect a considerable saving in the cost of fixing.

*A boiler is required capable of keeping up a good heat in a lean-to greenhouse,* 25 *ft. by* 10 *ft., and of burning for thirteen hours* (*from* 6 *p.m. to* 7 *a.m.*) *without requiring attention.*—The fire is expected to remain alight for an unusually long time, but the desired result may be obtained by employing a larger boiler than would in ordinary circumstances be used. In other words, the boiler, etc., must be capable of holding a larger store of fuel. Any kind of upright boiler will do. But although the house only needs 80 ft. of 4-in. pipe, yet a boiler 42 in. high by 16 in. diameter should be used, to accommodate the fuel. The " Star " boiler is made with a hopper on top expressly to hold extra fuel, but it needs a small house or shelter to itself, as it is not of the type that is built into the wall.

*It is required to design a glasshouse and its heating system suitable for the raising of pineapples.*—For growing pineapples practically any shape and size of greenhouse will be suitable, provided it can be kept hot enough. A broad lean-to kind is the best, as its side wall can be