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REVERTIBLE DRAFT FLUID-FUEL-BURNING HEATER WITH SAFETY PILOT DRAFT

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FIG. 1.

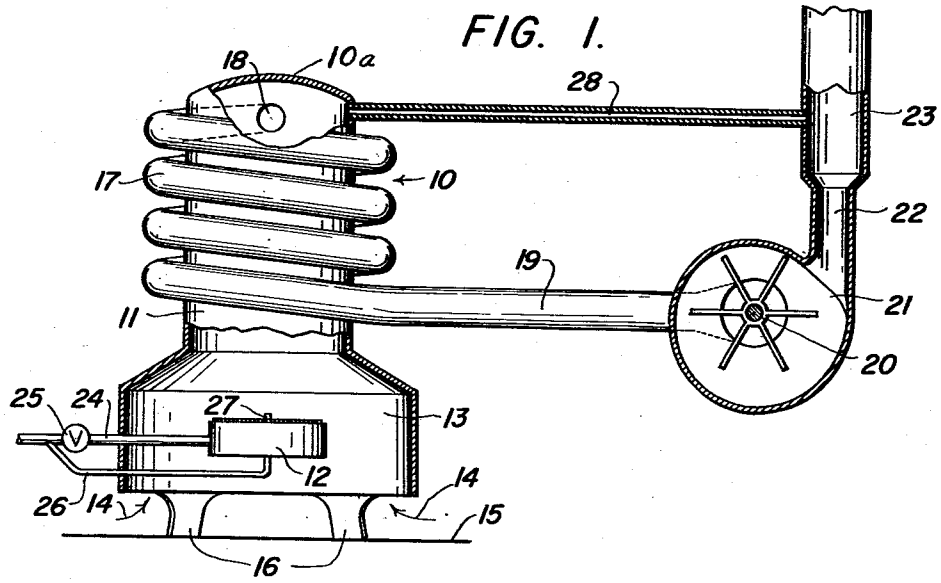


FIG. 2.

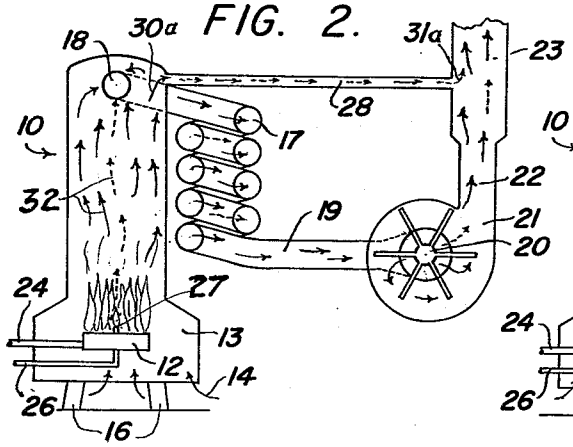
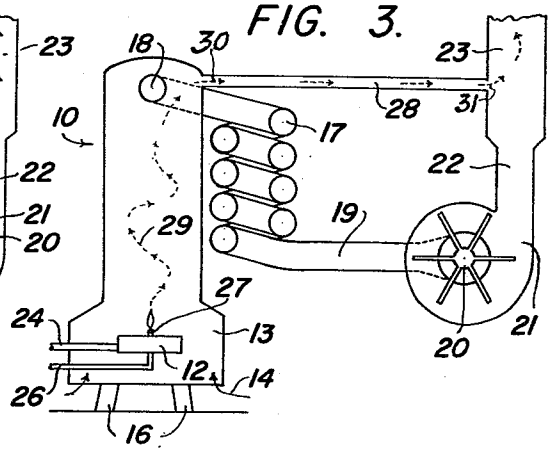


FIG. 3.



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REVERTIBLE DRAFT FLUID-FUEL-BURNING HEATER WITH SAFETY PILOT DRAFT

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2 Claims. (Cl. 158—1)

This invention relates to revertible draft fluid-fuel-burning heaters.

The principal objects of the invention are to provide safety, reliability, economy, automatic operation and simplicity of construction for down draft heaters using gas or other fluid fuel.

Additional objects appear hereinafter.

Heaters which burn fluid fuel, such as ordinary gas, have main burners for heating, and pilot burners for insuring ignition of the main burners. Pilot burners must have constant burning characteristics, while main burners function intermittently. A dependable pilot burner is in fact, a safety device for the main burner.

For efficiency, main burners are usually operated under forced draft. Pilot burners, on the contrary, usually operate under natural draft.

Gas heaters based on the principle of down draft or counterflow draft are known to be highly efficient, but heretofore have lacked simplicity in construction and operation when used with pilot burners.

A feature of the invention is to cause a revertible draft fluid-fuel-burning heater to be automatically switched from main burner forced draft to pilot burner natural draft, or vice versa, without the use of mechanical means such as dampers.

According to the invention, a forced draft circuitous conduit and a natural draft direct conduit extend independently of each other, from a combustion chamber to a waste flue in common. The amount of fluid which passes through the forced draft conduit in unit time is much greater than is the amount which passes through the natural draft conduit. The exact ratio between the two rates of flow depends upon individual conditions and is controlled.

Under forced draft operation the total fluid flow from burners may be caused to divide itself quantitatively as it leaves the combustion chamber, into two streams which are substantially in proportion to each other in accordance with the flow capacities of the respective conduits.

Cutting off the forced draft, automatically causes all of the pilot burner waste gases to pass out under natural draft. Restoring forced draft causes the waste gases from both burners to pass out under forced draft. All this is accomplished without the aid of mechanically operated devices.

Because of the forced draft, the current of gases passing through the waste flue may be used, if desired, to induce an aspiratory effect in the natural draft conduit for augmenting the effect of the natural draft. The extent of the aspiratory effect is controlled by properly shaping the outlet mouth or nozzle of the natural draft conduit where it enters the waste flue, in accordance with well known principles of nozzle design. An upward surge of the burning gases in the combustion chamber influences the pressure in the natural draft conduit. Finally, a restrictive pressure is asserted in that conduit, if desired, by modifying the aforesaid nozzle design.

In the accompanying drawing,

Fig. 1 represents an elevation, partially in vertical section, of a properly equipped revertible draft heater;

Fig. 2, a diagram indicating the normal flow of air and fuel through the heater, and the resulting normal discharge of the waste combustion products;

Fig. 3, a diagram similar to Fig. 2, but showing the gravity flow of waste gases from the pilot light only, as automatically switched directly into the waste flue, if and when there is interference with the normal artificial draft.

Referring to the drawing, the numeral **10** denotes a shell having a tightly walled dome **10***a* which encloses a combustion chamber **11**, the latter being located above a main burner **12** using combustible fluid. The main burner is located in a base compartment or firebox **13**, and is positioned below the combustion chamber **11**, so as to be in the path of the incoming air draft indicated by the arrows **14**. The base compartment or firebox **13** is preferably spaced upwardly of a floor surface **15** and is suitably supported, for example by legs **16**, so as to provide ample space for the passage of the incoming air.

In the present instance, a helically coiled pipe or conduit **17** extends from an outlet **18** in the upper part of the combustion chamber **11** downwardly on the outside of the combustion chamber wall, to an outlet branch **19**. The branch **19** is directly connected to the intake opening **20** of a suction fan **21**. The discharge **22** from the suction fan **21** flows into a waste flue **23**, which latter may lead into the atmosphere.

In the diagrams, Figs. 2 and 3, the revertible draft coil **17** is shown at one side of the combustion chamber **11**, instead of extending around the latter as set forth in Fig. 1. This is merely for the sake of clarity.

Gas, oil or other fuel is supplied to the main burner **12** through a supply pipe **24** which may be controlled by a usual valve **25**. A branch **26** leads from any suitable point in the supply pipe to a pilot burner **27**. The pilot burner **27** is located in close proximity to the main burner **12** so as to be ready to relight the fuel at the main burner whenever necessary.

Since a pilot burner is not utilized essentially for heating, it is desirable from the standpoint of economy, to allow it to consume only a necessary minimum of fuel. In other words it is desirable to limit the amount of heat necessary to maintain sufficient draft to keep the pilot flame alive, to an extent commensurate with the heat supplied by the pilot burner itself.

A further purpose in restricting the natural draft conduit is to prevent changing weather conditions from creating draft surges which otherwise would extinguish the pilot flame. Therefore it is also desirable to restrict to a minimum the flow capacity of the natural draft conduit leading from the pilot burner, so as not to dissipate unduly the relatively small amount of heat available to maintain circulation of fluid in that conduit. This is here accomplished by providing a natural draft conduit **28** of minimum size for the pilot burner **12**, and leading the conduit **28** as directly as possible into the waste flue **23**.

As an inventive feature, the natural draft conduit **28** is separate and distinct throughout its length, from the forced draft conduit **19**. The two conduits are widely spaced apart from each other structurally so any heat exchange between the two is impossible. It is further to be observed that the natural draft conduit **28** is fully open constantly, there being no obstruction at any time. This is possible without loss of efficiency by reason of the small size of the flow passage of conduit **28** relative to the sizes of the flow passages of revertible draft conduit **19** and natural draft waste flue **23**, respectively, and of the blocking action of the relatively higher pressure in waste flue **23** during normal operation, considering the forced draft

condition therein. Thus, efficiency is achieved without any need for mechanical dampers.

Assuming that the apparatus of the invention is functioning under natural draft, then the stream **29** of heated combustion products from the pilot burner **27** ascends and flows as at **30**, into the restricted conduit **28**. Subsequently, this stream at **31** enters the waste flue **23**.

Now, assuming that the functioning is under forced draft, then the gases from both the pilot burner and the main burner mix, indicated by the ascending stream arrows **32** in Fig. 2. The mixed stream divides, the greater portion passing out at **18** to follow through the forced draft conduit **19**. Still under forced draft, a much smaller portion of the mixed stream passes at **30***a* into restricted conduit **28**, and at **31***a*, enters the waste flue **23**.

As shown in Fig. 1, the upper part of combustion chamber **11**, the natural draft conduit **28** and the waste flue 23, preferably form a self-contained, air-tight assembly, which simplifies construction and reduces manufacturing costs.

Obviously, this heater is adaptable to requirements of different kinds, such for example, as hot air furnaces, steam boilers and so on. In the drawing only the bare heater is illustrated.

Satisfactory Pitot tube tests have been conducted with heaters of the invention, which show no loss in efficiency by reason of using the conduit **28**, open, instead of closing the same during forced draft operation. This proves there is no need for dampers or other mechanical regulating devices.

Briefly, the purpose of the invention is to provide forced revertible draft means adapted to normally carry off the major portion of mixed combustion gases from a main burner and a pilot burner. Further, to provide natural up-draft conduit means which is perpetually open throughout, from the two burners to the atmosphere, and normally is restricted to carry off the minor portion of the combustion gases from the pilot burner. And finally, to provide revertible draft conduit means which is operatively associated with forced draft means, so as at one time to be effective to draw combustion gases through only the revertible draft conduit means, and at another time, to cause the combustion gases from the pilot burner to be drawn wholly into and through the natural up draft conduit means.

It is to be noted that stoppage of the forced draft means blocks the passage of any pilot burner waste gases through the revertible draft system, and causes the automatic switching of these gases into the up draft conduit, whose natural up draft is now completely free to function in the normal manner, unhampered by the blocking effect of abnormally high pressure in the waste flue.

What is claimed is:

1. A revertible draft, fluid-fuel-burning heater with safety pilot draft, comprising a main burner; a pilot burner in co-operative conjunction with the main burner; combustion chamber means enclosing the two said burners and having a closed dome; forced revertible draft means having an intake below the dome for combustion gases; a waste flue leading from the revertible draft means remote from said dome; and an independent by-pass conduit having an intake below said dome and an outlet in the waste flue, the passage through the by-pass conduit being small with respect to the passage through the revertible draft means and the passage through the waste flue, and the intake of the by-pass conduit being spaced apart from the intake of the forced revertible draft means.

2. A revertible draft, fluid-fuel-burning heater with safety pilot draft, comprising wall means defining a combustion chamber; a main burner within said chamber; a pilot burner within said chamber in igniting relation with said main burner; a natural up draft waste flue remote from said chamber; forced revertible draft conduit means leading from said chamber into said waste flue, said revertible draft conduit means and said waste flue having flow capacity adapted to carry off, under forced draft conditions, combustion gases from both said burners; forced draft means connected to said revertible draft conduit means for the purpose of normally forcing combustion gases downwardly therethrough and up said waste flue; and natural draft conduit means independent of the said revertible draft conduit means and leading from said chamber and into said waste flue on the outlet side of said forced draft means, said natural draft conduit means being constantly open and unobstructed and restricted in flow capacity approximately to that required to carry off combustion gases from the pilot burner, the flow cross-section of said natural draft conduit being small relative to the flow cross-sections of said waste flue and said revertible draft conduit, respectively.

References Cited in the file of this patent

UNITED STATES PATENTS

1,224,700	Atherton	May 1, 1917
1,674,213	McDowell	June 19, 1928
1,943,053	Boisset	Jan. 9, 1934
2,022,835	Whiteley	Dec. 3, 1935
2,376,171	Mueller	May 15, 1945
2,504,315	Feuerfile	Arp. 18, 1950

FOREIGN PATENTS

63,057	Switzerland	Jan. 14, 1913