June 10, 1930. E. O. ENGELS 1,763,349

TUBULAR BURNER JACKET

Filed Nov. 4, 1929

Fig. 1.

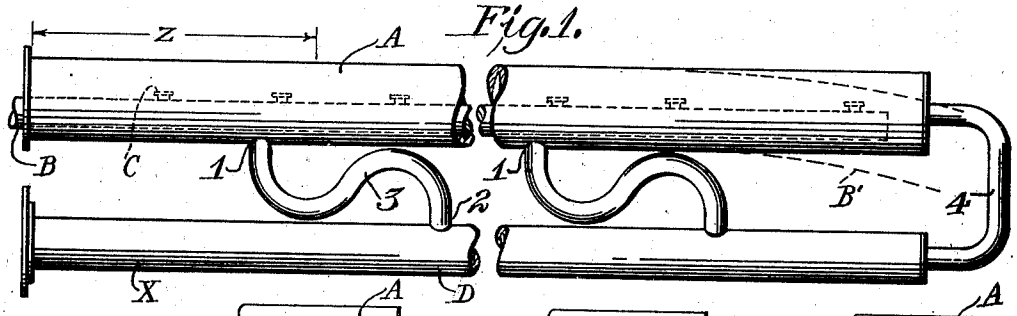


Fig. 6.

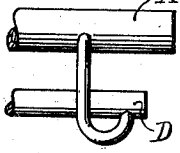


Fig. 7.

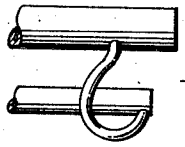
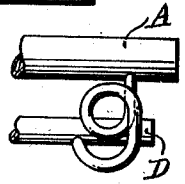


Fig. 8.



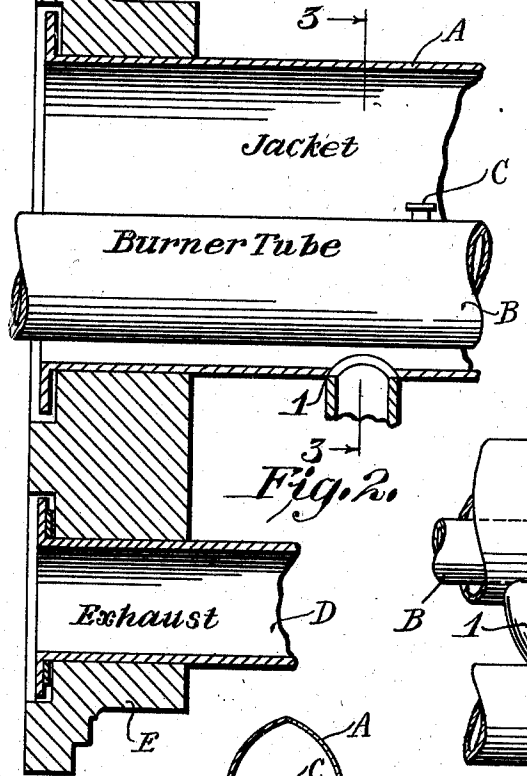


Fig. 2.

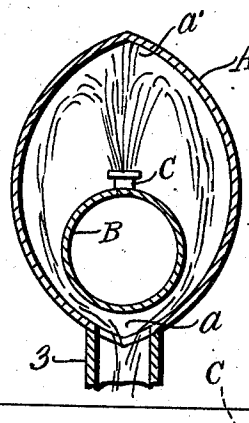


Fig. 3.

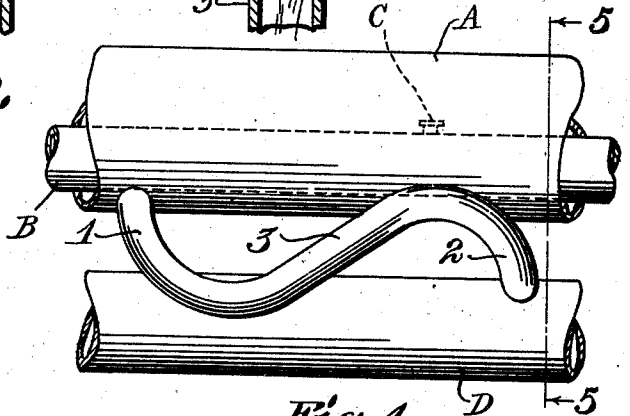


Fig. 4.

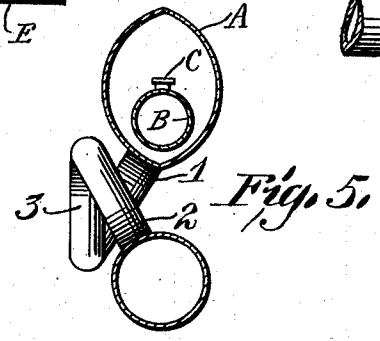


Fig. 5.

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UNITED STATES PATENT OFFICE

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TUBULAR BURNER JACKET

Application filed November 4, 1929. Serial No. 404,693.

This invention relates to heating units of the tubular gas burner type commonly used in bake ovens.

The invention is found in a new and useful construction and mode of operation of the heat-radiating jackets that surround and enclose the burner. The jacket is tubular and commonly has two legs, one containing the burner, the other conducting away the products of combustion to prevent their mixing with the oven atmosphere. When installed in an oven such a heating jacket projects through a side wall and across the baking chamber.

Serious inherent difficulties have attended the use of such heating units in bakers' ovens, wherein it is highly important to maintain dependable combustion at the burners under all conditions of use and to have complete control of heat intensity and distribution throughout the baking chamber.

The most serious difficulty was the danger of violent gas explosions in the jacket. If the jacket happened to be filled with explosive mixture at the time the ignition was turned on, explosion waves were set up at the intake end of the burner and, traveling the length of both legs of the jacket, attained a maximum explosive pressure near the exhaust end of the jacket, frequently rupturing the jacket there.

Another difficulty has been a persistent tendency of the flame to burn erratically, evidenced at times by a muffled popping sound caused by small explosions of gas in the tubular jacket. The cause has been found to be inherent in the design of the tubular jacket, as will be explained later.

A further difficulty was the tendency to unduly heat that part of the baking chamber space remote from the intake end of the burner. The cause of that uneven heating effect was also inherent in the design of the tubular jacket as heretofore constructed.

The object of my invention is to overcome the difficulties referred to by providing a jacket so constructed that major and minor explosions in the jacket can not occur and uniform heating of the baking chamber is attained.

With the foregoing and certain other objects in view, which will appear later in the specification, the invention comprises the devices described and claimed and the equivalents thereof.

In the drawings Fig. 1 is a plan view of a burner and tubular jacket equipped with the devices that constitute the invention.

Fig. 2 is a part sectional detail of the plate that holds the two ends of the tubular jacket in position.

Fig. 3 is a transverse section on the line 3—3 of Fig. 2.

Fig. 4 is a detail of a modified form of connection between the burner leg and the exhaust leg of the tubular jacket.

Fig. 5 is a sectional view on the line 5—5 of Fig. 4, showing the burner tube in place.

Figs. 6, 7 and 8 are details of modified arrangements of the connecting pipes.

As is clearly shown in the drawings, within one leg A of the tubular jacket is enclosed the usual tubular burner B equipped with gas orifices C, or a continuous burner slot, as the case may be. The intake and exhaust ends of the jacket legs A and D may be connected together in any suitable manner, as by a terminal plate E.

In my invention a number of small pipes 3 are connected to leg A of the tubular jacket, as at 1, suitably spacing them along its length. The other ends of tubes 3 are connected, as at 2, with the spent gas exhaust leg D, thus providing individual conduits to deliver hot gases that are generated at different places along the length of the burner B directly into the exhaust leg D of the jacket. Preferably the inlets 1 of tubes 3 are located in staggered relation with the outlets 2 as shown, in order that the pipes 3 may be made of ogee or other suitably curved form and sufficiently flexible to adapt themselves to unequal lengthwise expansion of the two legs A and D of the jacket; also to accommodate any displacement of the legs A and D sidewise with respect to each other without straining them. Better combustion results are attained when the tubular jacket leg A is substantially elliptical in cross section, as shown in Fig. 3, the burner tube B being located near

an end, *a*, of the major axis of the ellipse, projecting its flame along the major axis of the ellipse and against the opposite interior wall, *a'*, of the jacket.

Experience has demonstrated that burner tube B remains straight while in operation, but the jacket A expands most along its flame-impinged wall A'. Consequently jacket A becomes warped or bowed near its free end, as indicated in an exaggerated manner by the dotted lines at B' in Fig. 1. The result was that the gas flames near the end of the burner remote from the intake were often snuffed out by the close approach of the warping jacket wall.

The adjacent flames having been extinguished, the burner jacket wall cooled somewhat and returned to its normal position. Gas escaping from the extinguished burner orifices would then reignite from the other tips and the operation automatically repeated itself with the result that the recurrent small explosions previously mentioned caused erratic operation that interfered with all attempts of the operator to closely control heat distribution in the oven. That zone of the tubular jacket remote from the intake was always over-heated because through it the accumulated heat of all the preceding burner tips had to pass.

In the present invention the connecting pipes 3 prevent localized over-heating.

A pipe 4 smaller than the legs A and D may be employed to connect their ends, as shown in Fig. 1, to prevent severe expansion and contraction strains from being transmitted from one leg of the tubular jacket to the other. Pipe 4 also serves to reduce the normal rate of flow of hot gas through leg A, insuring that each of the connecting tubes 3 shall handle its proportion of the total flow. It may be dispensed with, however, without departing from the invention as set forth in certain of the claims, and in its stead the connections shown in Figs. 6, 7 or 8 may be used, near the free end of legs A and D.

Pipes 3 preferably communicate with the burner leg of the tubular jacket at that part of its wall remote from the burner flame, as shown in Fig. 3, causing the hot gases of combustion to flow around the entire area of the inner wall of the jacket A, thereby increasing the heat transference to the baking chamber. Pipes 3 may lead out from the side wall of the burner jacket as shown in Fig. 1, or they may communicate with it in a slightly upward direction as shown in Figs. 4 and 5. They may also be variously curved to provide for necessary contraction and expansion, as shown.

In operation, burner B is supplied with combustible gas and lighted, burning in the usual manner. The hot products of combustion pass from those burner orifices nearest the inlet end through the nearest pipe 3 into the exhaust leg D of the tubular jacket, thence to exhaust. Similarly, each pipe 3 serves a certain length or combustion zone Z of the burner tube B, removing hot gases from the adjacent jacket space and conveying them by shortest route to exhaust.

If explosive gas mixture is present in the jacket legs A, D, when ignition occurs, the conduits 3 relieve the initial pressures which, as known, are attendant upon explosive wave propagation in tubes. Propagation being thereby checked in its initial stage, and also all along tube A, the force of explosion is reduced to a negligible amount, and rupture of tubular leg D, heretofore frequently occurring at X, is entirely avoided.

Warping the tubular jacket, as indicated at the dotted lines at B', is avoided and the small recurrent explosions are eliminated, because excessive heat at any part of its length is effectually prevented, and no burner tips are extinguished and re-ignited by displacement of the jacket.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In combination, a jacket including tubular intake and exhaust legs, a tubular burner within said intake leg, and gas conduits situated at intervals along the length of the intake leg and connecting said leg with the exhause leg, for the purposes set forth.

2. In combination, a jacket including tubular intake and exhaust legs, a tubular burner within the intake leg, and expansionally yieldable gas conduits extending lengthwise thereof, connecting said intake leg and the exhaust leg at intervals along their length, for the purposes set forth.

3. In combination, a tubuar jacket including an intake leg and an exhaust leg, a tubular burner within said intake leg, conduits connecting the intake and exhaust legs at intervals along their length comprising flexible pipes, for the purposes set forth.

4. In combination, a tubular jacket having an intake leg and an exhaust leg, a tubular burner enclosed within the intake leg of said jacket, extending lengthwise thereof and having burner orifices, conduits connecting the legs of the jacket at spaced intervals along their length and comprising flexible pipes, a U-formed conduit of smaller cross-sectional area than the said legs, connecting the ends of said legs, for the purposes set forth.

5. In combination, a tubular jacket having an intake leg and an exhaust leg, a tubular burner enclosed within the intake leg of said jacket, extending lengthwise thereof and having burner orifices, conduits connecting the legs of the jacket at spaced intervals along their length and comprising flexible pipes, a U-formed conduit connecting the ends of said legs, for the purposes set forth.

6. A structure as set forth in claim 5 where-

in the leg containing the burner is of elliptical cross-sectional shape, the tubular burner located at one side thereof and having its burner orifices directed along the major axis of the ellipse, for the purposes set forth.

7. A structure as set forth in claim 5 wherein the said gas conduits are made of flexible pipes bent to curvilinear form, for the purposes set forth.

8. In combination, a jacket comprising tubular intake and exhaust legs arranged side by side and spaced apart, a burner within said intake leg, and gas conduits connecting said legs and situated at intervals along the length thereof, for the purposes set forth.

In testimony whereof I affix my signature.

EUGENE OSCAR ENGELS.