Oct. 10, 1950 A. W. HERMANDORFER 2,524,795

FURNACE LIGHTER TUBE CONSTRUCTION

Filed May 10, 1946 2 Sheets-Sheet 1

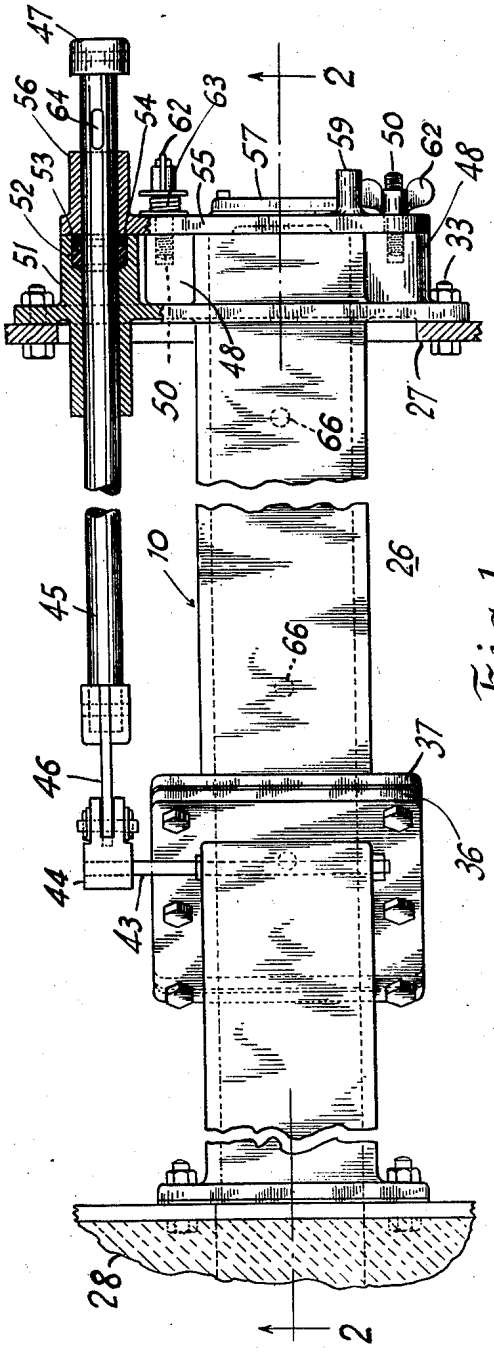

Fig. 1

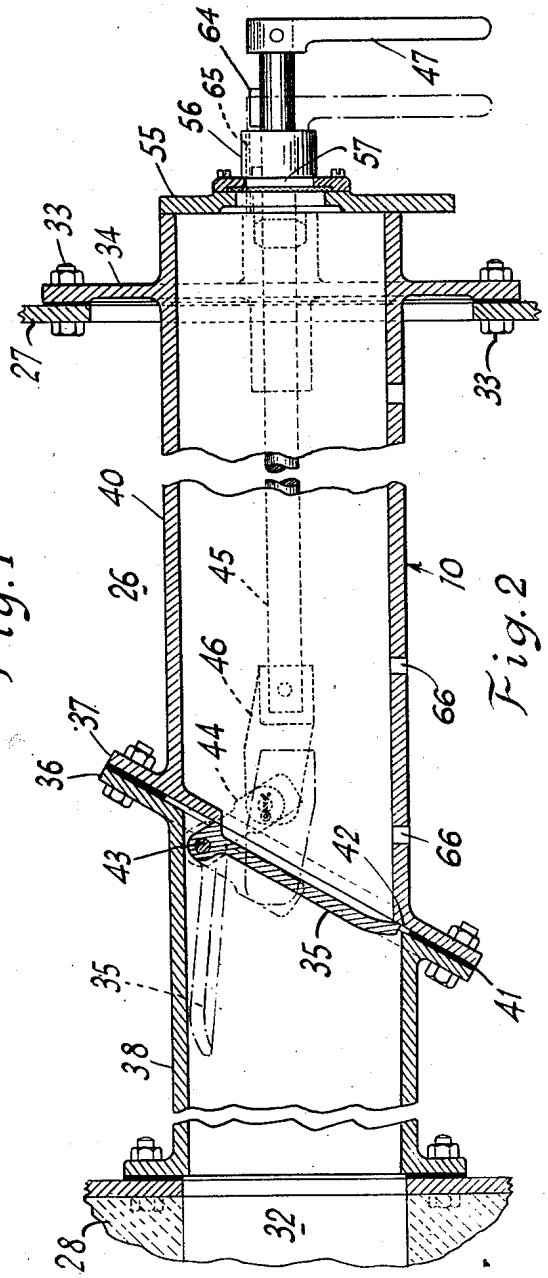

Fig. 2

INVENTOR
Arthur W. Hermandorfer
BY
J. P. Moran
ATTORNEY

Oct. 10, 1950 A. W. HERMANDORFER 2,524,795

FURNACE LIGHTER TUBE CONSTRUCTION

Filed May 10, 1946 2 Sheets-Sheet 2

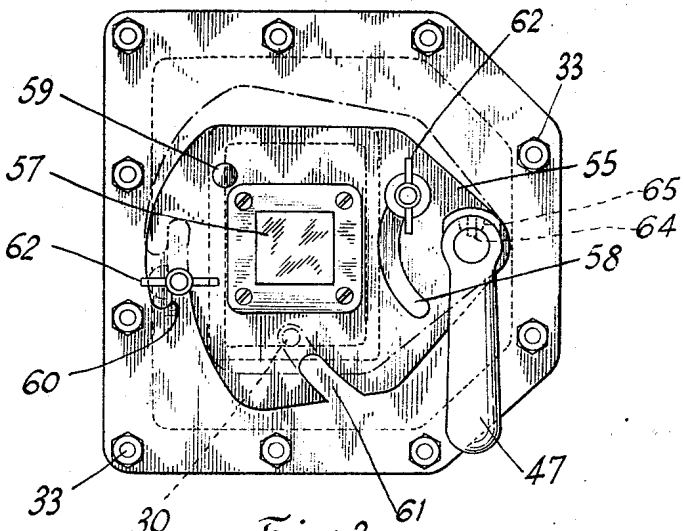

Fig. 3

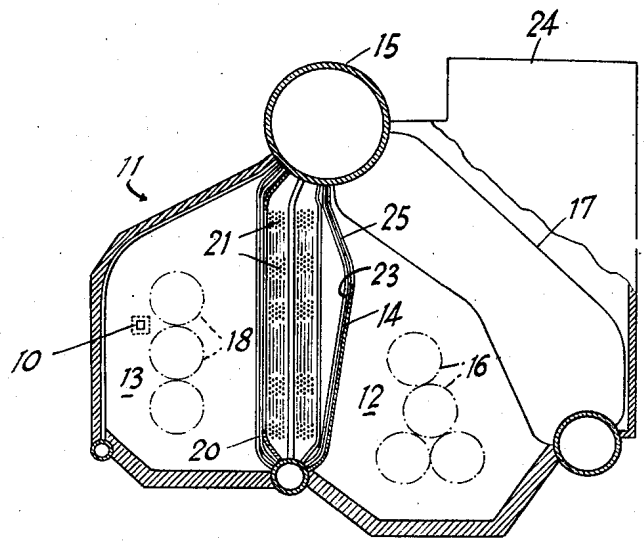

Fig. 4

INVENTOR
Arthur W. Hermandorfer
BY
ATTORNEY

Patented Oct. 10, 1950

2,524,795

UNITED STATES PATENT OFFICE

2,524,795

FURNACE LIGHTER TUBE CONSTRUCTION

Arthur W. Hermandorfer, Barberton, Ohio, assignor to The Babcock & Wilcox Company, Rockleigh, N. J., a corporation of New Jersey

Application May 10, 1946, Serial No. 668,939

5 Claims. (Cl. 110—1)

1

The present invention relates to improvements in furnace construction, and more particularly to the construction of lighter tubes used in the ignition of fluid fuel discharged by burners associated with furnaces operated at a positive pressure.

In some types of steam-generating equipment, for example, the furnace or furnaces associated therewith are maintained under a positive pressure to eliminate the necessity of having induced draft fans to maintain the desired gas flow across the convection heat exchange elements of the steam generating unit. Such furnace operation is usual in marine boilers having two communicating furnaces separated by a bank of steam generating and/or superheating tubes and having independently operable groups of burners. The separate groups of fuel burners are positioned so that the fuel discharged by one group of burners is not readily ignitable from the burning fuel discharged by the other group of burners. With both furnaces discharging to the same flue gas outlet connection, the operation of either group of burners will put the entire furnace under positive pressure. An open flame torch is usually used to ignite fluid fuel burners, but with a furnace operating under positive pressure, any attempt to insert a torch into that furnace through an open port to ignite a burner becomes hazardous to the operating personnel by reason of the flow of hot gases or flame through the wall port opening. Under such circumstances, lighter tubes of the well-known air-lock type are used to protect the operating personnel.

The main object of the present invention is to provide apparatus of the character described which is simple to construct and operate, and is so interlocked as to insure positive protection at all times to the operating personnel engaged in the operation of the burners. A further and more specific object is to provide a lighter tube of the air-lock type for the torch ignition of fuel discharged by a burner into a furnace wherein the spaced gates of the lighter tube are operable by separate means which are interlocked to prevent the opening of either gate when the other gate is open. A further specific object is to provide the furnace lighter tube which is so constructed as to prevent a leakage of furnace gases outwardly therethrough during periods of its non-use. In addition, another object is to provide means for cooling the apparatus during periods of its non-use so as to avoid deterioration of the apparatus due to its exposure to the heat of the furnace, and to further avoid extinguishing

2

the flame of the torch when that torch is inserted through the lighter tube into the furnace.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of my invention.

Of the drawings:

Fig. 1 is a plan view, partly in section, of a lighter tube constructed in accordance with the present invention;

Fig 2 is a side view, in section, of the apparatus taken along the line 2—2 in Fig. 1;

Fig. 3 is an outer end view of the apparatus; and

Fig. 4 is a somewhat diagrammatic elevation, partly in section, of a steam boiler of a type adapted to be equipped with the present invention.

In general the present invention includes an elongated tube provided with a spaced pair of gates operable by exterior means located adjacent one end of the tube. The operating mechanism for the gates is interlocked so that only one of the gates may be opened at any one time, although both gates may be in a closed position simultaneously. In the embodiment of the invention shown in the drawings the tube is arranged in co-operation with an opening through the wall of a furnace and positioned closely adjacent a fluid fuel burner to provide safe means for the insertion therethrough of an open flame torch for the ignition of the fuel discharged by the burner.

Referring to Fig. 4, the present invention is shown as a lighter tube 10 applied to a separately fired superheater furnace single uptake marine boiler 11, such as disclosed in U. S. Patent 2,332,534, wherein the fuel combustion space is divided between a main furnace 12 and an auxiliary furnace 13 separated by a bank of steam generating tubes 20 and superheater tubes 21, with a baffle 14 extending longitudinally of and projecting upwardly from the furnace bottom for part of the height of the tube bank. With this construction the main furnace 12 is provided with a group of oil burners 16 and a bank of saturated steam generating tubes 17, while the auxiliary furnace 13 is provided with a group of oil burners 18, saturated steam generating

tubes 20 and a superheater 21 which receives saturated steam from the upper steam and water drum 15 and delivers superheated steam to a point of use (not shown). The baffle 14 is water cooled and supported by a row of saturated steam generating tubes 23 which are connected into the steam and water circulatory system of the boiler.

The boiler 11 is of the single up-take type with a furnace outlet 24 upwardly adjacent the main furnace 12 so that the gases produced in the furnace 13 flow through a gas pass 25 located between the upper end of the baffle 14 and the drum 15 into the main furnace 12 on their way to the outlet 24. Thus, when it is necessary to operate only one portion of the furnace, such as the main furnace 12 during the initial starting of the boiler, both the main furnace 12 and the auxiliary furnace 13 will be maintained at substantially the same pressure due to their interconnection by the gas pass 25.

In boilers of the type illustrated, secondary air is usually supplied under pressure to the burners from a common air chamber, which may partially or completely enclose the walls of the furnace. As indicated in Figs. 1 and 2, such a chamber 26 is defined by a casing 27 spaced from and enclosing the front or burner wall 28 of the furnace and surrounding both groups of oil burners 16 and 18. The combustion air within the chamber 26 is maintained at a pressure greater than that of the gases within the furnaces 12 and 13 so as to overcome the pressure drop of the air in passing through the burners into the furnace as well as the flow resistance through the boiler. As an example, the furnace gas pressure may be from 20 to 60 inches, water gauge, while the corresponding combustion air pressure within the chamber 26 may be from 5 to 10 inches, water gauge, higher than that of the furnace to insure a proper supply of air for the combustion of the fuel. Such relatively high air pressures and superatmospheric furnace pressures avoid the necessity for induced draft fans in marine boiler installations, but any unrestricted opening between the interior of the furnace and the exterior of casing 26 will permit an outward flow of gases which is dangerous to the operating personnel.

In accordance with the present invention a torch, such as for example flaming oily waste attached to the end of a metal rod 30, may be inserted through the lighter tube 10 in the wall 28 of the furnace to ignite the fuel discharged by the burners 18, without the risk of gases and/or flame blowing from the furnace through that opening. The tube is located so that the flame of the torch will be in the vicinity of the burners when inserted into the furnace. The lighter tube 10 is constructed so as to extend through the chamber 26 from the outside of the casing 27 to an opening 32 through the wall 28. In position, the tube is fastened at its outer end to the casing 27 by a series of bolts 33 so as to provide a substantially air tight joint between the casing and a flange 34 on the tube 10, and at its opposite end is attached in a gas tight manner to the wall 28 to match the opening 32.

Referring particularly to Figs. 1 and 2 the lighter tube 10 is shown as being rectangular in transverse cross-section and constructed in two pieces to facilitate the installation and operation of a flap type gate 35 which is located at a position intermediate the length of the lighter tube 10 and spaced from the furnace wall 28 to reduce its exposure to the radiant heat of the furnace. The two pieces of the tube are joined by bolting the matching flanges 36 and 37 attached respectively to the inner or furnace end portion 38 and the outer portion 40. The plane of the joint 41 formed by the flanges 36 and 37 is normal to the side walls of the tube 10, but is at an oblique angle with respect to the top and bottom walls. While the cross-sectional area of the portion 40 is generally equal throughout its length, the lower side of the portion 38 inclines downwardly and outwardly from its furnace end, where its area is substantially equal to that of the portion 40, to its opposite end adjoining the flange 36. Thus a shoulder 42 is formed at the bottom of the joint 41 by the adjoining end of the tube portion 40. This shoulder provides a stop or seat for the lower end of the gate 35 when that gate is in its closed position. In the embodiment of the invention shown, the gate 35 is supported by and pivoted about a horizontal shaft 43 which extends transversely across the upper part of the tube portion 38 closely adjacent the flange 36. The clearance between the side walls of the tube portion 38 and the sides of the gate 35 will be as small as possible consistent with freedom of gate movement so as to provide a restriction to the flow of gases therethrough when the gate is closed.

The holes in the side walls of the tube portion 38 accommodating the shaft 43 serve as bearings therefor and the shaft is extended outwardly on one side beyond the adjacent bearing to engage a clevis 44 to which it is secured. The clevis is pivotally connected with a push rod 45 by an arm 46 so that a linear movement of the rod will pivot the gate 35. The rod 45 is horizontally extended parallel to the longitudinal axis of the lighter tube 10 through the flange 34 to a handle 47 on the outside of the casing 27 so that lineal movement of the handle will position the gate 35. This construction permits axial movement of the rod 45 while restricting rotational movement thereof to an extent dictated by the mechanical "play" in the assembly of the rod 45 to the clevis 44.

The tube portion 40 is extended outwardly of the flange 34 and is provided with a pair of metallic pads 48 formed integrally with and on opposite sides of the tube extension to provide sufficient metal for drilling and tapping to receive a corresponding pair of stud bolts 50. In addition, a hub 51 is formed on the flange 34 at one side of the tube portion 40 and drilled for a sliding fit with the push rod 45. As shown particularly in Fig. 1 an annular recess 52 is countersunk in the outer end of the hub 51 for the insertion of packing material 53 and a packing ring 54 so as to avoid leakage of combustion air through the hub from the chamber 26. The outer ends of the tube portion 40, the pads 48 and the hub 51 are machined to lie in a plane normal to the axis of the tube 10 to provide a seat for a gate 55.

The gate 55 is provided with an outwardly projecting boss 56 which is drilled perpendicularly to the machined inner surface of the gate and arranged for pivotal mounting on the push rod 45. As shown particularly in Fig. 3, the gate 55 is provided with an observation window 57 arranged to cover an opening through the gate and located to correspond with the interior of the tube 10 when the gate is in its closed position. In addition the gate is provided with an arcuate

slotted opening 58 to accommodate the stud bolt 50 nearest the boss 56, and an arcuate notch 60 arranged to engage the stud bolt 50 on the opposite side of the lighter tube 10. A second arcuate notch 61 is cut in the bottom of the gate to accommodate the torch rod 30, as hereinafter described. An external projection 59 on the outside of the gate 55 is provided to facilitate pivotal opening thereof. The machined inner surface of the gate 55 and the machined outer end of the tube 10 cooperate to form a substantially gas tight seal under the influence of the tightened wing nuts 62 on the stud bolts 50. The wing nut 62 adjacent the rod 45 is supplied with a compression spring 63 bearing on the gate 55 so that when the other wing nut is loosened the gate 55 may be pivoted about its pivotal axis and still be maintained in proper alignment with ease of movement.

The gates 35 and 55 are mechanically interlocked to avoid the possibility of having both gates open at the same time with the resultant possibility of injury to the operating personnel and/or loss of flame from the torch due to an outward flow of gases from the furnace. This is accomplished by fixing a key 64 in the rod 45 so that the upper portion of the key projects above the surface of the rod. The key is located at a position closely adjacent the outer end of the boss 56 when the rod is in its outwardly extended position corresponding to a closed position of the flap gate 35.

The boss 56 is provided with a keyway 65 having dimensions sufficient to accommodate the key 64 when the gate 55 is closed and the rod 45 has been moved to its forward position, as when the gate 35 is open. This keyway is preferably of greater cross-sectional area than that of the key so that the rod 45 may be pushed forward, opening the gate 35 when the gate 55 has been raised a sufficient amount to permit the movement of the rod 30 in the notch 61. This latter position of gate 55 is shown in dotted lines in Fig. 3. Thus, if the gate 35 is in an open position it is impossible to open the gate 55 beyond a point substantially corresponding with the dotted position shown in Fig. 3.

Since the tube 10 and the gates 35 and 55 tend to get hot by reason of their proximity to the heat of the furnace, the tube is provided with a plurality of restricted holes 66 through the lower wall of the tube, between the gates. With this construction high pressure air from the chamber 26 will flow in limited amounts into the lighter tube and since the gate 35 is not air tight a small amount of air is permitted to escape through the end of the tube into the furnace, thereby tending to cool the tube and the gates at both ends thereof. In addition, the restricted flow of air into the lighter tube will advantageously provide a source of oxygen to sustain the combustion of the lighter torch during such periods of time that the torch is positioned in the tube with both gates in the closed position. Furthermore, when the gate 35 is opened and the torch moved into position for igniting the fuel in the furnace, a flow of air from the tube toward the furnace, as limited by the holes 66, will assist in providing oxygen to sustain the torch combustion. Likewise, the flow of high pressure air from the chamber into the tube and thence into the furnace will ordinarily tend to prevent the movement of combustion gases from the furnace into the lighter tube. It must be recognized, however, that under certain fuel ignition circumstances the gas pressure in the furnace may momentarily exceed that of the air pressure in the lighter tube and there may be puffs of flame and gases entering the lighter tube which will be prevented from passing therethrough by the gate 55. Such furnace conditions may occur during initial ignition of the fuel as caused by improper combustion conditions within the furnace.

In operation, when it is desired to ignite the fuel discharged from burners 18, the gate 55, which is substantially gas tight in its closed position, is opened by releasing the holding pressure of the wing nuts 62, inserting the lighter torch, and then closing the gate so that the torch rod 30 is embraced by the notch 61. It will be observed that due to the interlocking action of the key 64 on the push rod 45 and the keyway 65 in the boss 56 the gate 55 may not be opened unless the gate 35 is in a closed position with the rod 45 withdrawn so as to disengage the key and the keyway. With the torch in position between the closed gates 35 and 55 the air admitted through the holes 66 will provide sufficient oxygen to sustain the flame of the torch and the gases produced thereby will escape from the lighter tube past the gate 35 and through the portions of the notch 61 in communication with the tube 10 and not occupied by the rod 30.

During actual use of the lighter tube the torch will not be held between the closed gates 35 and 55 for any appreciable period of time, but conceivably the elapsed time in such a position would be sufficient to snuff out the torch flame if some provision were not provided for the admission of air thereto and the escape of gases therefrom as heretofore described.

When the torch is in the position described and the gate 55 has been closed to the operating position described, the key and keyway are in a relative position which will permit movement of the push rod 45 and the opening of the gate 35. With this gate open the torch may be pushed into position to ignite the fuel discharged from the burners. After the flame has been established in the furnace the torch may be withdrawn therefrom by reversing the operation of the gates of the lighter tube.

It will be noted that the present invention provides apparatus capable of effecting a torch ignition of fuel in a pressure furnace with safety to the operating personnel. While the apparatus is particularly adapted for operation in conjunction with a marine type steam boiler of the type described it is equally useful in conjunction with the ignition of any gaseous or liquid fuel within other types of furnaces even though such a furnace may not normally be operated at pressures above that of the surrounding atmosphere. The safety features of such a lighter tube are equally applicable in the ignition of fuel wherever a possibility of minor furnace "puffs" may create a momentary excessive pressure in a furnace whereby flame and hot combustion gases would tend to discharge through any unrestricted opening between that furnace and the position of the personnel "lighting off" the burners.

What is claimed is:

1. In a lighter tube construction for a furnace, an elongated tube, a flap gate intermediate the ends of said tube, said gate pivotally mounted within the tube and on an axis transverse to the longitudinal axis of said tube, a push rod extending from a position adjacent said axis of said flap gate along said tube and ending out-

wardly of one of the ends of said tube, said push rod being slidable in a direction normal to the pivotal axis of said gate and linked therewith, a plate member pivoted about said push rod and arranged to cover the outer end of said tube and having a slotted opening therein to accommodate a torch rod, and a key on said push rod arranged to engage a corresponding keyway in said plate member when said flap gate is open and said tube is closed at its outer end by said plate member.

2. In a lighter tube construction for furnaces, a tubular member of rectangular cross-section adapted to communicate at its inner end with the combustion chamber of the furnace, a flap gate disposed intermediate the ends of said member and pivotally mounted within said member on an axis transversely related to the longitudinal axis of said member, a push rod operably connected to the flap gate and extending along the tubular member to a position adjacent the outer end of the latter, a closure member pivotally mounted on the outer end portion of the rod and arranged in one position to close off the outer end of the tubular member even when a burner lighter is disposed within said member, and means including the rod and its pivotal mounting of the closure member for so interlocking the gate and the closure member that either one of them must be in closing position before the other can be opened.

3. In a burner lighter tube construction for use across the combustion air chamber of a furnace and adjacent a burner, an elongated lighter tube adapted to extend through the air chamber adjacent the burner and adapted to communicate with the interior of the furnace, a substantially gas tight gate at the outer end of said tube, a second gate positioned intermediate the length of the tube and loosely fitted to its seat whereby a small leakage may be present, said construction having restricted openings between said gates to provide for a restricted air flow past said second gate and into the furnace even when both gates are closed, means for separately opening said gates, and interlocking means including said opening means and acting to prevent the opening of one of said gates when the other gate is opened.

4. In a burner lighter tube construction for use across an exterior air chamber of a furnace and adjacent burner, an elongated lighter tube adapted to extend through the exterior air chamber adjacent the burner and adapted to communicate with the interior of a furnace, a flap gate pivotally mounted in the tube about an axis transverse to the longitudinal axis of the tube and positioned adjacent the inner furnace end of the tube and operable from the outside of the tube by the linear movement of a push rod, a second gate pivotable about the push rod and positioned adjacent the outer end of said tube and having an arcuate notch therein arranged to permit the longitudinal movement of a torch rod within said tube, and means for interlocking said gates to restrict the flow of gases therethrough from said furnace, said last named means including a key in said push rod at a spaced position beyond the outer end of said second gate when said flap gate is in its closed position and arranged to project beyond the surface of said push rod, and a keyway in said second gate arranged to match said key when the pivoted gate is in its closed position.

5. In a burner lighter tube construction for use across the combustion air chamber of a furnace and adjacent a burner, an elongated lighter tube adapted to extend through an air chamber exterior to the furnace and adjacent the burner and adapted to communicate with the interior of the furnace, a flap gate movable about an axis transversely related to said tube and positioned adjacent the inner furnace end of the tube, means including a push rod for operating said gate from the outside of the tube, a pivotally mounted gate on the push rod and positioned adjacent the outer end of the tube and having an arcuate notch therein arranged to permit longitudinal movement of a torch rod within the tube, said tube being provided with restricted openings in walls thereof between said gates and adapted to communicate with said air chamber, and means for interlocking said gates to restrict flow of furnace gases therethrough including a key on said push rod at a spaced position beyond the outer end of said pivoted gate when said flap gate is in its closed position and arranged to project beyond the surface of said push rod, and a keyway in said pivoted gate arranged to match said key when the pivoted gate is in its closed position.

ARTHUR W. HERMANDORFER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
244,528	Beam	July 19, 1881
1,475,159	Masser	Nov. 20, 1923
1,951,379	Voorheis	Mar. 20, 1934
1,997,347	Schroeder et al.	Apr. 9, 1935
2,112,063	Blizard	Mar. 22, 1938
2,125,019	Haynes	July 26, 1938
2,186,474	Blizard	Jan. 9, 1940
2,402,803	Chandler	June 25, 1946