

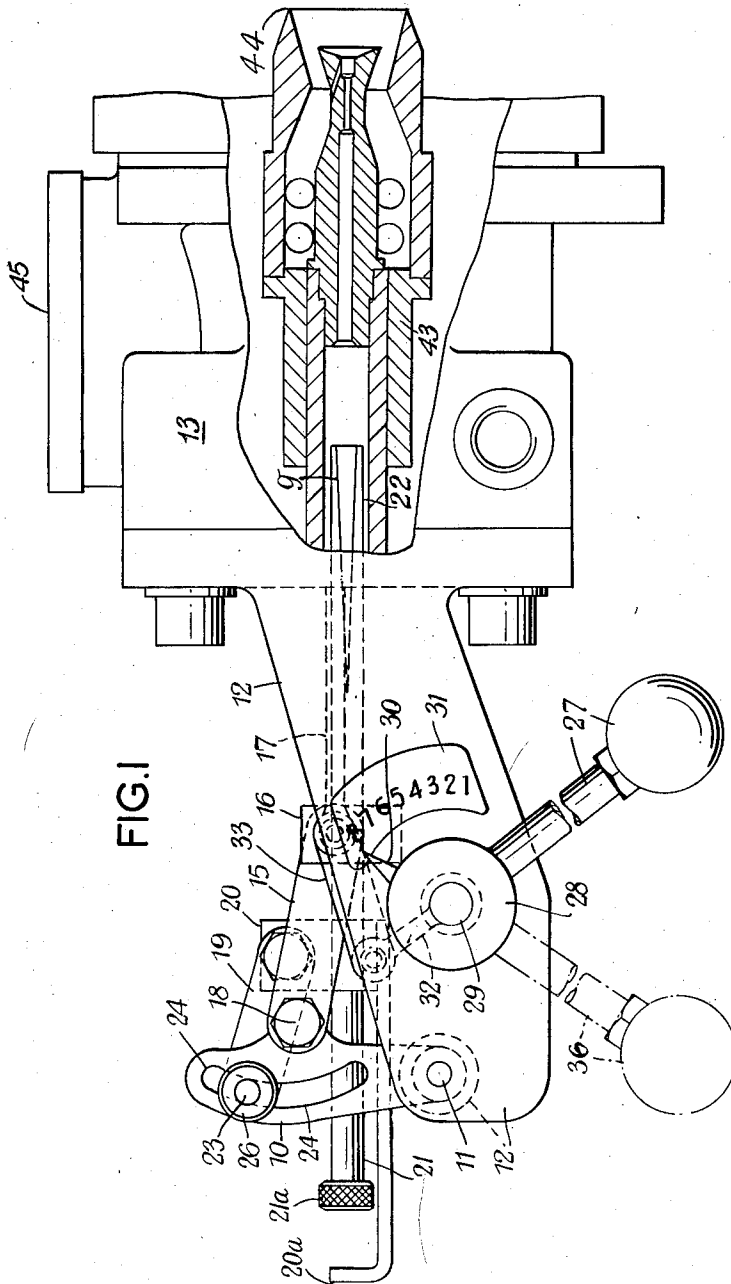
May 2, 1961

I. P. FROST
FUEL BURNER

2,982,349

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4 Sheets-Sheet 1



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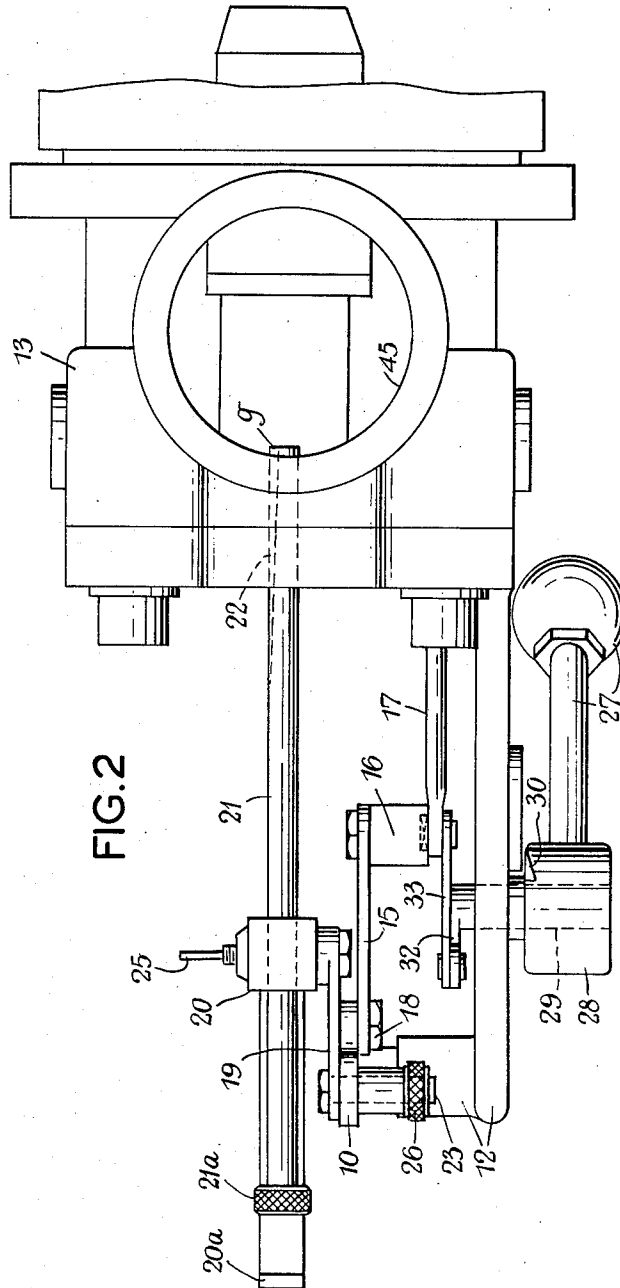
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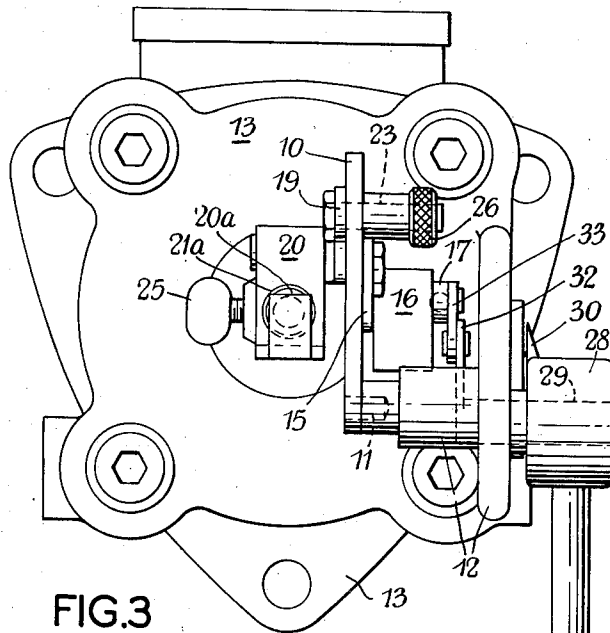


FIG. 3

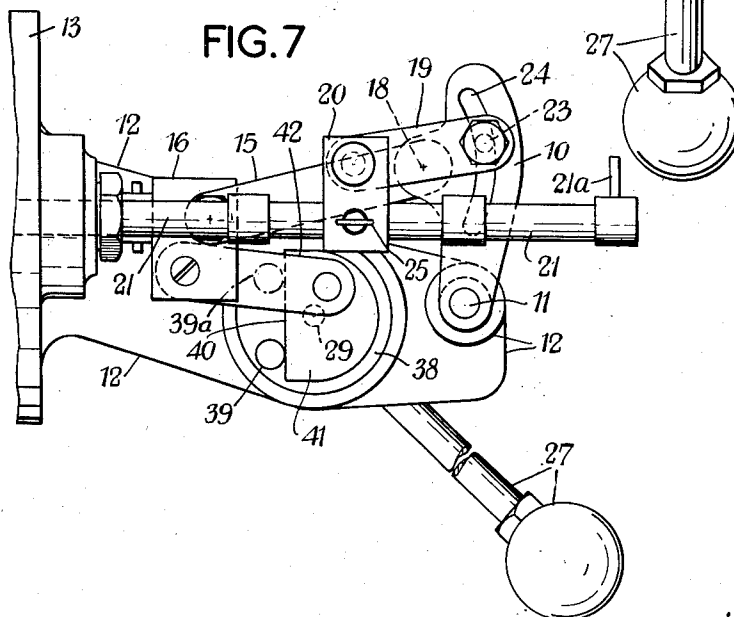


FIG. 7

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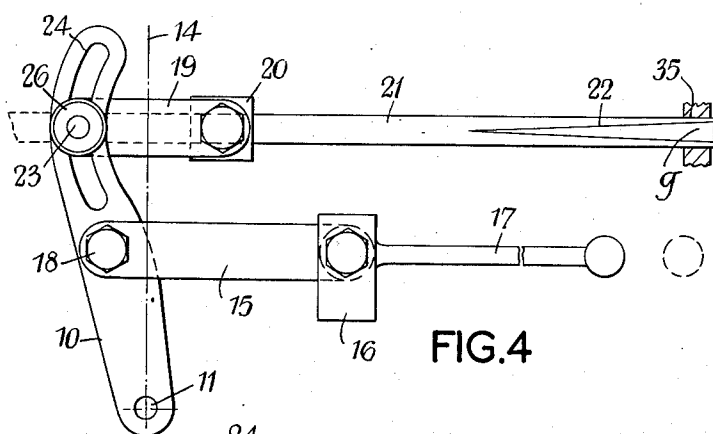


FIG. 4

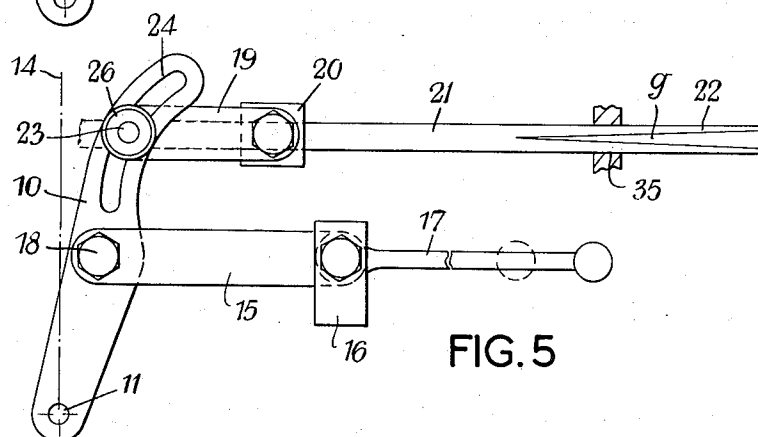


FIG. 5

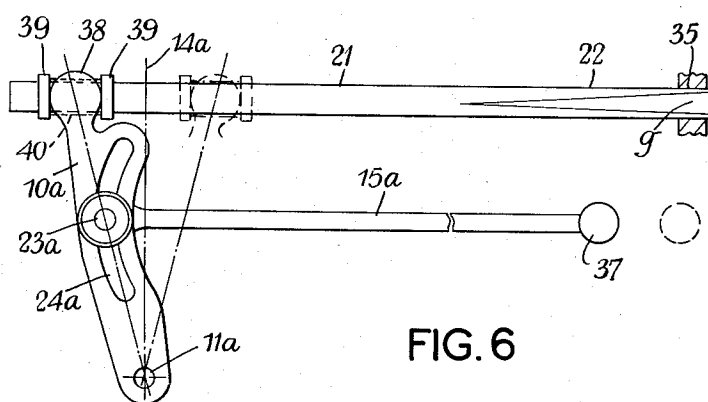


FIG. 6

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2,982,349

FUEL BURNER

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Claims priority, application Great Britain Mar. 29, 1957

7 Claims. (Cl. 158—76)

This invention relates to fuel burners and particularly but not exclusively to oil burners.

It has heretofore been proposed to provide a burner comprising a casing with a valve member movable to control the supply of air and a valve member movable to control the supply of fuel in which the two valve members are movable at the same time.

In the specification of the earlier British Patent No. 780,961 a construction is described in which the valve members controlling the supply of fuel and air, respectively, to the burner outlet, have a common actuating means so that they are movable together in an axial direction of the burner, are non-rotatable, and are so secured together that their relative connected positions are adjustable, whereby the ratio of fuel to air in the mixture supplied may be varied. A fuel burner embodying such a construction will be hereinafter referred to as "a fuel burner of the character specified."

According to the above-mentioned patent, the connection between the valves is a rigid connection comprising a yoke member connecting parallel valve stems, one of which has a screw-threaded portion slidable in the yoke member and adjustably secured thereto by coupling nuts. Adjustment of such a connecting means to alter the fuel/air ratio at a position of maximum opening of the valves effects an equal or proportional alteration of the fuel/air ratio at a position of minimum opening of the valves.

Alterations of the fuel/air ratio may be required, when, for example, conditions of pressure and viscosity of fuel oil have been changed. It has been found, however, that adjustment of the connecting means described above, to provide a correct mixture at a position of maximum opening of the valves, may result in the provision of an unsatisfactory mixture at a position of minimum opening of the valves. It is an object of the present invention to obviate this difficulty and to provide, in a fuel burner of the character specified, means for obtaining a correct mixture at both maximum and minimum opening positions.

According to the present invention, there is provided a fuel burner of the character specified, wherein the fuel valve member and the air valve member are so connected that adjustment of their relative positions at a position of maximum opening of such valves is effected independently of adjustment of their relative positions at a position of minimum opening of said valves, whereby the fuel/air ratios at said maximum and minimum positions can be varied independently of each other.

In one construction according to the invention, reciprocable stems of the valve members are connected by a linkage. Variation of the fuel/air ratio at maximum opening can then be effected by adjusting the connection of the linkage to the fuel valve stem longitudinally thereof, thereby moving the fuel valve member without moving the air valve member. Variation of the fuel/air ratio at minimum opening can then be effected by adjust-

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ing the relative positions of parts of the linkage so as to cause relative movement of the valve members, the linkage being so arranged that such adjustment has no effect on the relative positions of the valve members at maximum opening.

In another construction, reciprocable stems of the valve members are connected by a linkage and variation of the fuel/air ratio at maximum opening is effected by adjusting the connection of the linkage to the fuel valve stem longitudinally thereof, thereby moving the fuel valve member without moving the air valve member, variation of the fuel/air ratio at maximum opening being effected by adjusting the relative positions of parts of the linkage so as to cause relative movement of the valve members, and the linkage being so arranged that such adjustment has no effect on the relative positions of the valve members at minimum opening.

The valve members may be constructed and arranged in the burner casing in a similar manner to that described in the aforesaid specification No. 780,961. Thus the air valve may be a frusto-conical member adapted to engage a circular or annular seat in the casing and have a tubular stem slidably mounted on a tubular supply nozzle. The fuel valve stem may be coaxial with the fuel nozzle and with the air valve stem and project from a surrounding fuel supply passage through a seating ring into the rear end of the tubular fuel supply nozzle. The forward end of the fuel valve stem is suitably provided longitudinally with an elongated V-shaped and V-section groove so arranged that the valve opening decreases as the stem is pushed forwardly into the fuel supply nozzle. It will be understood, however, that the construction and arrangement of the valve members is immaterial so long as they are reciprocable axially of the burner.

The common actuating means of the valves may be of any convenient form. Suitably, use is made of one of the examples described in the aforesaid specification wherein an operating handle, pivotally mounted on the burner casing, is in operative connection with the tubular air valve stem through an eccentric or through linkage in such a manner that the valves, assuming uniform operation of the handle, are opened more rapidly in the final stage of opening than in the initial stage. In a modification, the linkage referred to may be of crank and connecting-rod type.

It will be understood that the terms maximum and minimum opening of the valves relate to the positions of the valves at any one setting of the adjustable connecting means and that these positions may be determined by the position of the operating handle which is the same for any maximum opening position of the fuel valve and is the same for any minimum opening position of the fuel valve, if in operative connection with the air valve stem, as described above.

In order to enable the invention to be readily understood, reference is directed to the accompanying drawings showing certain embodiments thereof by way of example. In these drawings:

Fig. 1 is an elevation of one embodiment showing part of the burner,

Fig. 2 a plan of Fig. 1,

Fig. 3 an elevation looking on the left-hand end of Fig. 1,

Figs. 4 and 5 are partly illustrative diagrams and partly depict a modification,

Fig. 6 a diagrammatic view illustrating a further embodiment, and

Fig. 7 an elevation of another embodiment.

In Figs. 1 to 3, the adjustable connecting means between the fuel and air valves has the form of a linkage

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including a lever 10 fulcrumed at 11 on a bracket 12 projecting from the rear end of the burner casing 13. The burner casing 13 includes an air inlet 45. Details of the burner itself are not shown as it is generally similar to construction described and illustrated in the aforesaid specification. As indicated diagrammatically by Figs. 4 and 5, the lever 10 is adapted to swing with relation to a plane 14 lying normal to the paths of the reciprocable valve stems and containing the pivotal axis of the lever. A link 15, pivotally connected at one end to a block 16 fixed on the rear end of a rod 17 extending from the rear end of the stem 43 of the air valve 44, is pivotally connected at the other end to an intermediate point 18 on the lever 10 (see also Figs. 1 to 3).

A second link 19, pivotally connected at one end to a block or sleeve 20 on the stem 21 of the fuel valve 22 is connected at the other end to a pivot 23 mounted for adjustment along an arcuate slot 24 in the outer portion of the lever 10. The block or sleeve 20 is slidably mounted on the fuel valve stem and adapted to be secured adjustably to such stem by a clamping screw 25. A knurled-head nut 26 secures the outer end of the link 19 at its adjusted positions in the arcuate slot 24.

The arcuate slotted lever 10 and the first and second links 15, 19 together with the block or sleeve 20 and its clamping screw 25, constitute one example of what has been above referred to as a linkage by which the reciprocable stems of the valve members are connected.

Referring to Figs. 1 to 3, the adjustments of the slotted lever 10 of said linkage with relation to the plane 14 are suitably effected by an operating handle 27 having a hub 28 carried on one end of a spindle 29 mounted revolvably in the bracket 12. The hub has a pointer 30 movable over a scale 31 on the bracket. On the other end of the spindle 29 is a crank arm 32 pivotally connected at its outer end to a link-form connecting rod 33 which in turn is pivotally connected with the rod 17 operative to reciprocate the air valve.

As indicated in Fig. 4, the arcuate slot 24 is so disposed in the lever 10, and its curvature is such, that when the lever is in the outer extreme position of its swing on its pivot 11 and the valve operating handle 27 is in the maximum valve opening position (Fig. 1), the centre of curvature of the slot is coincident with the pivotal axis of the link 19 on the adjustable block or sleeve 20. As a consequence, when the lever is in this position, the pivot 23 may be moved to any position in the slot 24 without moving the fuel valve 22.

The alteration of fuel/air ratios is effected in the following manner. When the valve operating handle 27 is turned to the maximum valve opening position (Figs. 1 and 4), the clamping screw 25 on the block or sleeve 20 is loosened, so that the fuel valve stem 21, with its V-shaped and V-section groove *g* may be taken by the knurled end 21a and slid within the block or sleeve which is held stationary by a hand-hold 20a. The fuel valve 22 is thus moved relatively to its seat (indicated diagrammatically at 35 in Fig. 4), without movement of the air valve which is connected by the linkage 15, 10, 19 to the stationary block or sleeve. Since the adjustable parts are outside the burner casing 13, the adjustment may be made whilst the burner is in operation, so that the correct mixture may be determined experimentally.

The adjustable connection having been set for the desired fuel/air ratio at maximum opening as stated and the clamping screw 25 on the block or sleeve 20 then tightened, the valve operating handle 27 is now turned to the minimum opening position indicated by the dot-and-dash lines at 36 in Fig. 1. The lever 10 has now been swung to its inner extreme position (cf. Fig. 5) in which the mean direction of the arcuate slot 24 is forward of its position at maximum opening of the valves. The nut 26 is now loosened and the pivot 23 is moved along the slot 24, the lever 10 and consequently the air valve being held stationary. Because of the displacement of the slot

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forwardly, the movement of the pivot 23 has a component in a direction parallel to the valve stems, and as a consequence the said second link 19, the block or sleeve 20 and the fuel valve stem 21 are also moved in that direction. As before, the position of the fuel valve 22 which gives the correct fuel/air ratio is determined, and the nut 26 is then tightened.

The adjustment thus made at minimum valve opening does not affect the previous adjustment made at maximum valve opening, since, as aforementioned, movement of the pivot 23 in the slot 24 does not affect the position of the fuel valve 22 when the valves are at maximum opening, and the fuel valve will return from its new minimum opening position to the new maximum opening position.

It will be understood that, in the embodiment shown in Figs. 1 and 3, the stroke of the fuel valve member 22 between maximum and minimum opening positions is somewhat longer than that of the air valve member when the pivot 23 is at a higher level than the point 18 and somewhat shorter when the pivot is below that point. Adjustment of the fuel/air ratios is effected by altering the maximum and minimum opening positions of the fuel valve member and the length of its stroke. The air valve member is unaffected by either of the adjustments.

It should be mentioned that the swinging movements of the slotted lever 10 are somewhat exaggerated in Figs. 4 and 5 as compared with Figs. 1 to 3 because Figs. 4 and 5 are partly illustrative diagrams as above stated. It is believed, however, that these Figs. 4 and 5 are of assistance in understanding the operation of the linkage described.

The modification depicted in Figs. 4 and 5 resides in the showing of the connection of the link 15 with the slotted lever 10 at a point 18 located below the curved slot 24. The pivot 23, therefore, can never be at a level below the point 18 and consequently, in this case, the stroke of the fuel valve member 22 between maximum and minimum opening positions will always be somewhat longer than that of the air valve member.

In the embodiment of the invention shown in Fig. 6, the slotted lever 10a which would be pivoted at 11a on the bracket 12 of the burner casing 13 as aforesaid, is again adapted to swing with relation to a plane (14a) lying normal to the paths of the reciprocable valve stems and containing the pivotal axis of the lever. In this instance, the arcuate slot 24a occupies an intermediate position in the length of the lever 10a, and the pivot 23a, adjustable therein, is connected to a link 15a, the other end of which is pivotally connected at 37 to the air valve stem. The disposition and curvature of the slot 24a is such that, at the maximum valve opening position, its centre of curvature is coincident with the pivotal connection of the link 15a to the air valve stem at 37.

The lever 10a terminates outwardly from its fulcrum 11a in a disc-like portion 38, the rounded periphery of which is adapted to engage opposed transverse faces of abutments, such as flanges 39, on opposite ends of a sleeve 40 adjustably secured on the fuel valve stem 21, whereby the lever and valve stem are connected in such a way as to accommodate movement of the lever end 38 during the swinging movement of the lever from one extreme position to the other. The sleeve may be secured to the valve stem by a clamping screw, as before, and the lever may be forked so as to provide a disc-like portion 38 on each side of the sleeve 40 as will be understood.

Adjustments are made in a manner similar to that employed in the first embodiment. In the position of maximum valve opening shown, the fuel valve stem 21 is adjusted slidably within the sleeve 40, whilst the latter, the lever 10a and the air valve stem are held stationary. In the position of minimum valve opening (indicated in dotted lines) and with the fuel valve member 22 held

stationary, the pivot 23a may be adjusted in the slot 24a, thus moving the air valve member without affecting the position of the air valve member at maximum opening position. It will be appreciated, however, that if the air valve member is under greater constraint than the fuel valve member 22, the latter would be moved by adjustment of the pivot 23a in the slot 24a.

In this construction the stroke of the fuel valve member 22 is also longer than that of the air valve member. Adjustment of the fuel/air ratios is effected by altering the maximum and minimum opening positions of the fuel valve member.

In the embodiment of the invention shown in Fig. 7, parts which are similar to those illustrated in Figs. 1 to 3 are indicated by similar reference numerals. One difference lies in the means adopted for transmitting the movements of the operating handle 27 to the block 16 carried by the rod 17 (not shown but see Figs. 1 to 3). The handle turns a disc 38 carrying a pin 39 bearing against the flat face 40 of a crank-disc section 41 revolvable on the spindle 29 of the handle and coupled by a link-form connecting rod 42 to the block 16. Another difference is that the curved slot 24 in the slotted lever 10 is centred on the adjustable block or sleeve 20 in the minimum position of opening of the valves, instead of in the maximum opening position of Figs. 1 to 3. Thus, the reverse operation will now take place namely, the fuel valve will not be moved by moving the pin 23 in the slot 24 in the minimum opening position of the handle 27 as shown. If, as might be, the arrangement were modified by situating the pin 39 on the disc 38 at the dot-and-dash line position 39a, the reverse procedure of setting the oil valve would be possible, that is to say, by the turning of the handle 27 to maximum position, the fulcrum of the link 19 on the block or sleeve 20 will no longer be the centre for the curved slot 24, thus enabling adjustment of the fuel valve to be made by moving the pivot 23 in the curved slot. It will be realised that Fig. 7 is a view taken from the opposite side of the apparatus as compared with Fig. 1.

I claim:

1. A fuel burner for heating purposes, comprising a fuel valve and an air valve, means including a fuel valve operating rod and an air valve operating rod disposed parallel to each other and movable longitudinally respectively to operate said fuel valve and said air valve of the burner, a linkage connecting said rods, and settable means operative on said linkage to cause it to move such rods longitudinally to limit open positions corresponding as regards one limit open position to maximum opening of said valves and as regards another limit open position to minimum opening of said valves, said linkage embodying means operative to adjust the relative positions of said rods in one of said limit open positions while maintaining intact the relative adjustment between such rods in the other limit open position and while maintaining connection between said rods by said linkage.

2. A fuel burner according to claim 1, wherein the settable means comprises a manually operable handle

pivottally mounted on the burner and a second linkage of crank-and-connecting rod type connected between said handle and the linkage of claim 1.

3. A fuel burner according to claim 1, wherein the linkage connecting the fuel valve operating rod and the air valve operating rod comprises a slotted lever and a pair of links namely a first link pivottally connected at one end to a member fixed on said air valve operating rod and pivottally connected at the other end to an intermediate point on said slotted lever, and a second link pivottally connected at one end to a second member slidably adjustable on said fuel valve operating rod and connected at the other end to a pivot mounted for adjustment along the slot in said slotted lever.

4. A fuel burner according to claim 1 wherein the linkage connecting the fuel valve operating rod and the air valve operating rod comprises a slotted lever and a link connected at one end to a pivot mounted for adjustment along the slot in said lever and pivottally connected at the other end to said air valve operating rod, the end of said slotted lever outwardly from its fulcrum being engaged between abutments at opposite ends of a sleeve adjustably secured on said fuel valve operating rod.

5. A fuel burner according to claim 3, wherein the slot in the slotted lever is a part-circular slot which is concentric with the pivotal axis of the second link on the second member in the limit open position corresponding to maximum opening of the fuel and air valves.

6. A fuel burner according to claim 3, wherein the slot in the slotted lever is a part-circular slot which is concentric with the pivotal axis of the second link on the second member in the limit open position corresponding to minimum opening of the fuel and air valves.

7. A fuel burner for heating purposes, comprising a fuel valve and an air valve, means including a fuel valve operating rod and an air valve operating rod disposed parallel to each other and movable longitudinally respectively to operate said fuel valve and said air valve of the burner, a linkage connecting said rods, and settable means operative on said linkage to cause it to move such rods longitudinally to limit open positions corresponding as regards one limit open position to maximum opening of said valves and as regards another limit open position to minimum opening of said valves, said linkage comprising a slotted lever, a link connected pivottally at one end to one of said operating rods and at the other end to a pivot adjustable along the slot in said slotted lever, and a connection between said slotted lever and the other of said operating rods, said connection on the one hand being pivoted at a point on the solid part of said slotted lever and on the other hand pivoted at a point on said other operating rod.

References Cited in the file of this patent

UNITED STATES PATENTS

712,879	Wilgus	Nov. 4, 1902
1,874,238	Callahan	Aug. 30, 1932