Nov. 25, 1952 M. L. NATHAN 2,618,928

COMBUSTION APPARATUS WITH VANED FUEL INJECTOR MEANS

Filed May 19, 1945 2 SHEETS—SHEET 1

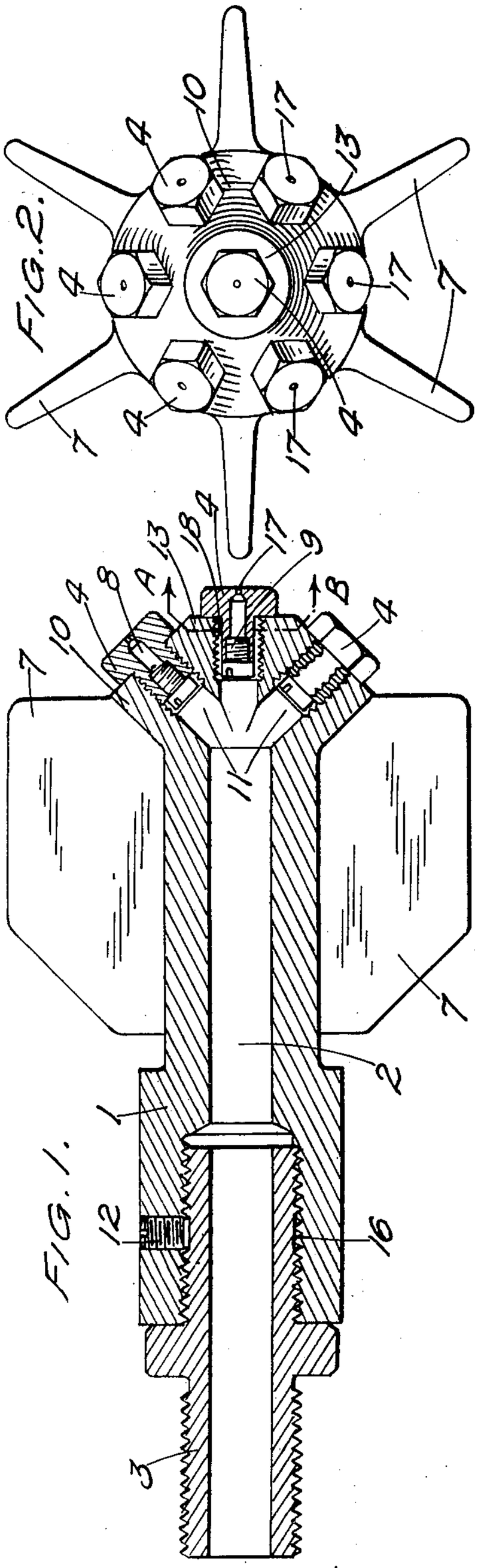


FIG. 2.

FIG. 1.

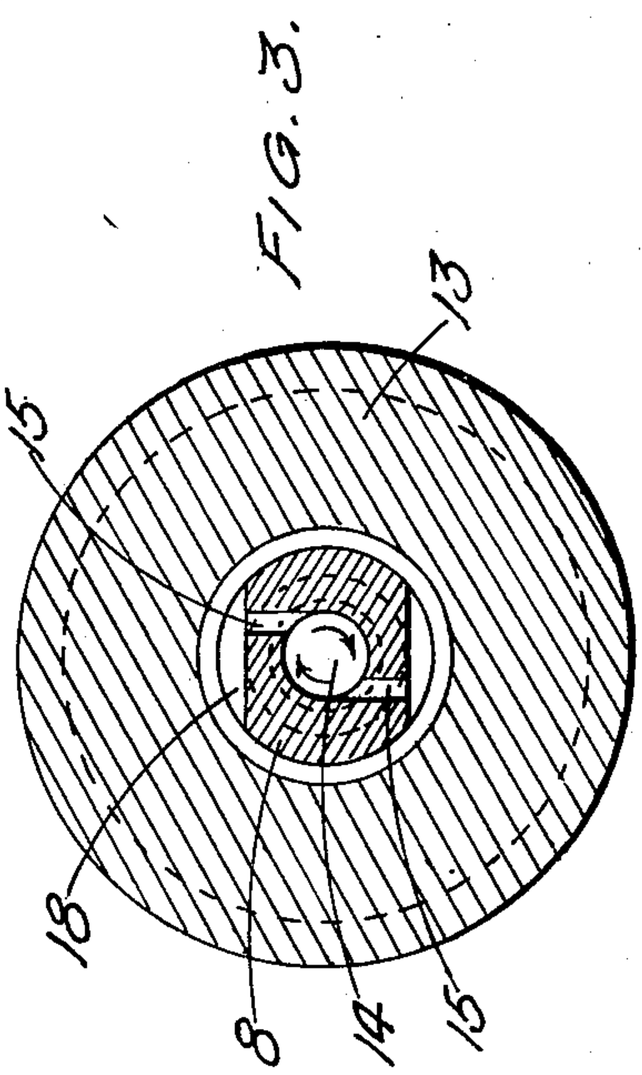


FIG. 3.

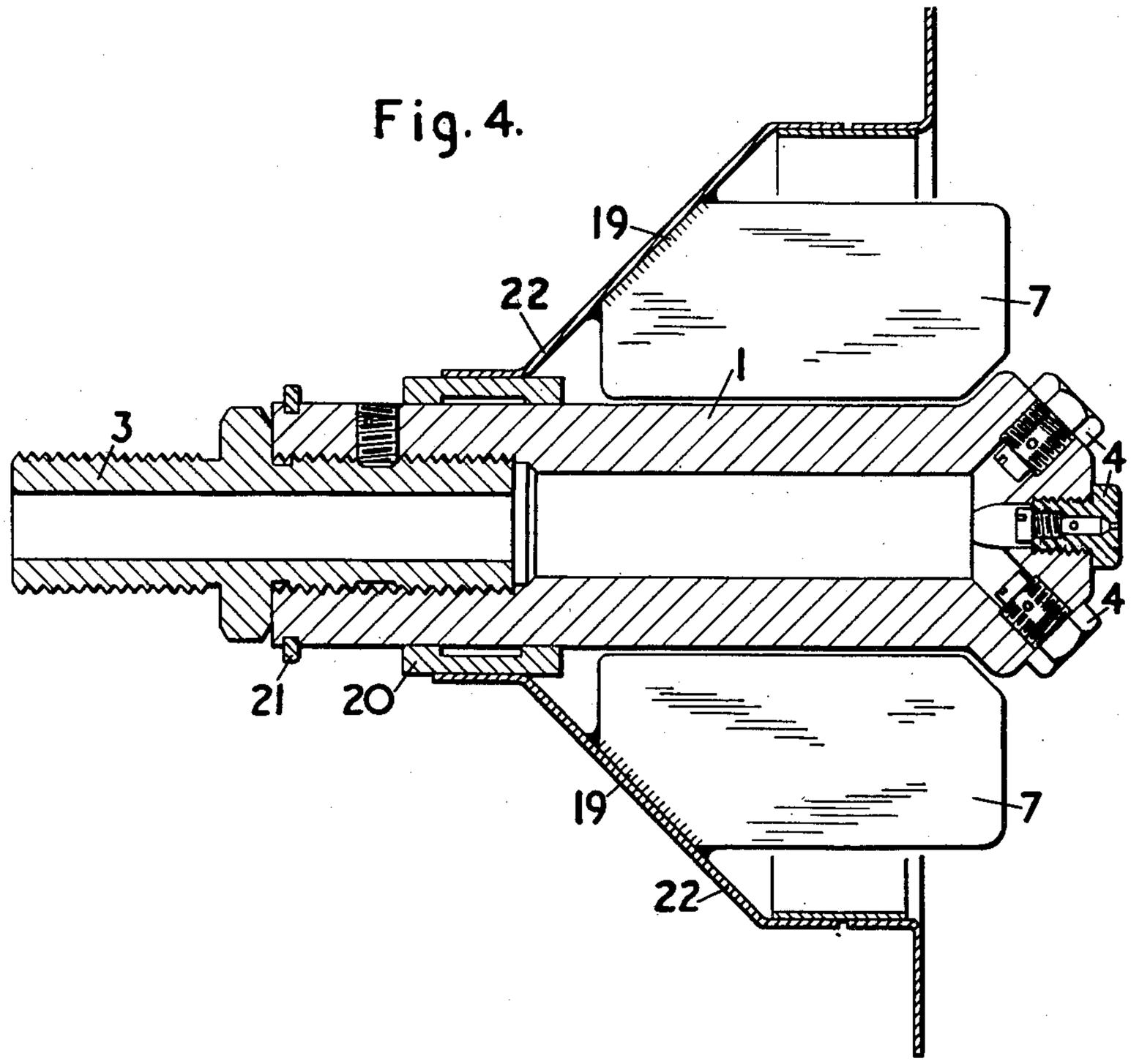
Inventor.
Matthew Lewis Nathan
By.
Loyd Hall Sutton
Attny.

Nov. 25, 1952 M. L. NATHAN 2,618,928

COMBUSTION APPARATUS WITH VANED FUEL INJECTOR MEANS

Filed May 19, 1945 2 SHEETS—SHEET 2

Fig. 4.



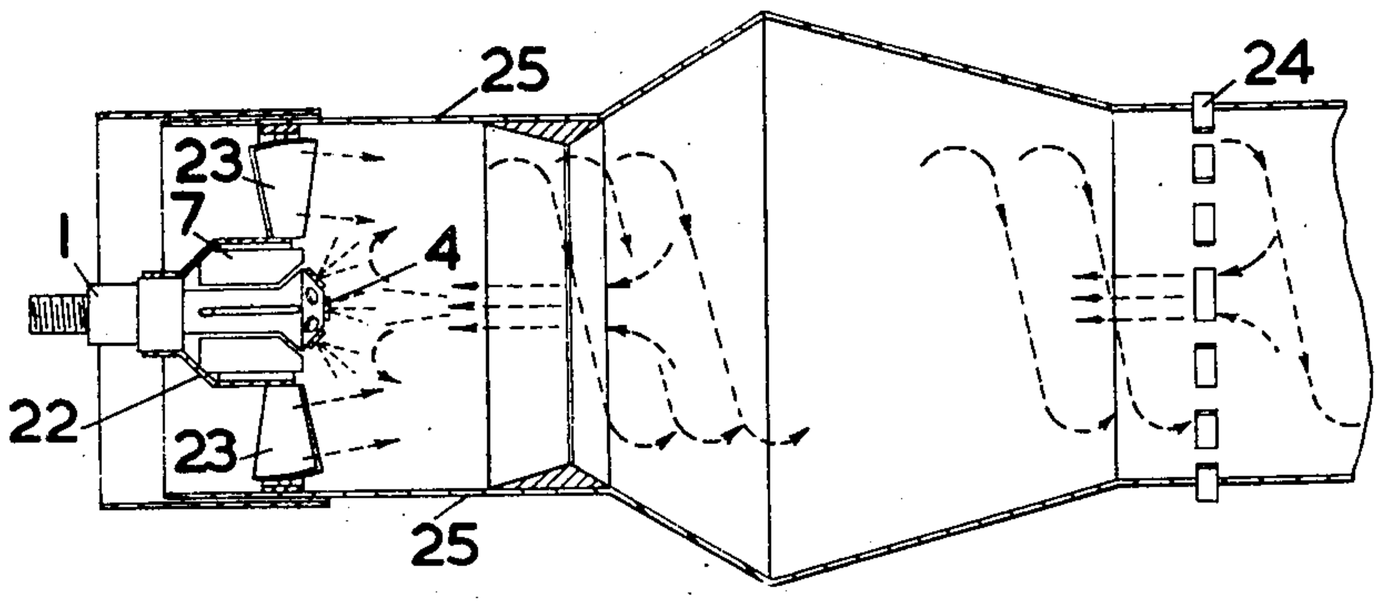


Fig. 5.

Inventor
Matthew Lewis Nathan
By
Stevens and Davis
His Attorneys

Patented Nov. 25, 1952

2,618,928

UNITED STATES PATENT OFFICE

2,618,928

COMBUSTION APPARATUS WITH VANED FUEL INJECTOR MEANS

Matthew Lewis Nathan, Godalming, England, assignor to Power Jets (Research & Development) Limited, London, England

Application May 19, 1945, Serial No. 595,297
In Great Britain May 19, 1944

2 Claims. (Cl. 60—39.72)

1

This invention relates to fuel burners and combustion arrangements and more particularly to arrangements in which a burner for the injection of fuel into a combustion space is so disposed that it may suffer adverse conditions, such as carbon deposition or formation, which are due to or related to the fact of the burner protruding into a region of reversed air flow or turbulence. Such a case exists, for example, in certain combustion arrangements of gas turbine engines, where a flame tube in which the general direction of flow is axial, has a burner extending into one end of it axially, and where in order (among other reasons) to hold the flame back into the burner at very low fuel flows, the air flow in the region of the burner is arranged (usually by means of swirlers) to have a core of reversed direction, i. e. towards the burner. The invention seeks to obviate adverse effects which may arise in such cases, and also to perfect burner and combustion devices in which the burner itself has a plurality of spraying jets arranged in "rose" fashion or similarly, which arrangement may be peculiarly susceptible to carbon deposition or formation.

For this purpose, the invention provides combustion apparatus comprising a fuel burner associated with means for opposing the production of gaseous vortex flow or large scale gaseous turbulence around said burner. Such means may comprise vanes or baffles which may be mounted on or form part of the burner body, in which case they may also have some effect as heat-exchanging fins, or they may be mounted as part of the surrounding combustion equipment, the former being preferred.

By way of example, two forms of embodiment of the invention will be hereinunder described with reference to the accompanying drawings in which:

Fig. 1 is a view in sectional elevation of one form of embodiment of the invention;

Fig.2 is a right hand end view of Fig. 1;

Fig. 3 is a section on the line AB of Fig. 1;

Fig. 4 is a view in sectional elevation of a second form of embodiment of the invention.

Fig. 5 is a view in longitudinal section of the embodiment of the invention shown in Fig. 1 as it appears in a typical installation in a flame tube.

Referring to the drawings and more particularly to Figs. 1 and 2, the burner body comprises a hollow cylindrical portion 1 having an axial bore 2 which can be supplied with fuel under pressure through a union 3 which is screw threaded to the cylinder 1 at its external or rear end. The union

2

3 is provided with a flat surface 16 against which can bear a grub screw 12 for the purposes of securing the union 3 rigidly to the body 1. At its inner or forward end the burner body comprises a frusto-conical portion 10 which together with a central portion 13 provide seven channels 11 of which six are arranged symmetrically around the axis of the burner body and the seventh is centrally located.

Each channel 11 is provided with a nozzle element 4 so that six of such nozzles 4 are arranged symmetrically around the axis of the cylinder 1 and protruding in divergent directions, while a seventh central nozzle element 4 is also provided which is directed axially.

The nozzle elements 4 are screw threaded into the walls of the channels 11 and a plug 9 is screw threaded into each nozzle element. Each nozzle 4 is provided with swirling means for producing a rapid swirling motion in the fuel before it is ejected through the orifice 17 of each nozzle 4. The construction of one form of such swirl means is shown in Fig. 3 wherein the swirling device 8 comprises a circular chamber 14 to which fuel is admitted from the space 18 by means of two tangentially directed channels 15 which are staggered so as not to be diametrically opposed so that fuel entering chamber 14 through these channels 15 is given a rapid swirling motion as indicated by the arrows. Each nozzle element 4 is provided with a flattened portion to form a communicating duct for the fuel between the channel 11 and the channels 15.

On the outside of the cylindrical portion 1 and lying substantially in axial-radial planes are provided a plurality of vanes 7 which are integral with or intimately attached to the body 1 and are preferably located as close as possible to the burner face. These vanes 7 are shaped at their margins to correspond with the internal shape of the combustion chamber in which the burner is operating so that they form, in effect, baffles intercepting the space between the burner body 1 and the end wall (and in some cases the side wall also) of the chamber (as shown in Fig. 4). It has been found satisfactory to provide the same number of vanes 7 as there are lateral nozzles 4, e. g. six in the example illustrated.

In Fig. 4 a second form of embodiment of the invention is shown in which the vanes 7 are attached to the inner surface of the end wall 22 of a combustion chamber in which the burner is operating. In this case also, the vanes 7 are symmetrically arranged as in Fig. 2, a central and axial gap being left between the vanes 7 for the

insertion of the burner. The vanes 7 may be secured to the wall 22 by any suitable means, for example by welding along the edge 19. A ring 20 is integral with the wall of the combustion chamber and serves to hold the burner firmly in position. A ring 21 is attached to the burner body 1 after the burner has been inserted to prevent excessive movement of the latter.

The function of the vanes 7 is to prevent vortex flow around the burner body 1 which flow may produce a core reversal near the burner with consequent carbon deposition on the burner face.

In Fig. 5 there is shown a burner according to Fig. 4 in a typical installation, in this case a flame tube of the type described in Lubbock et al. Patent No. 2,398,654. The flame tube 25 is provided with swirlers 23 and 24 which produce a vortex flow having a core of reversed direction towards the burner, i. e., from right to left as shown in the drawing. The burner 1 extends axially into the flame tube 25 and, as shown in Fig. 4, is provided with a coaxial annular wall 22 which partially blocks the flow of air through swirlers 23 in the end of the flame tube 25. Vanes 7 are attached to this wall, and as explained above, they prevent vortex flow occurring in the immediate vicinity of the burner 1.

As a secondary function, the vanes 7 help in pre-heating the fuel, the pre-heat at low fuel flows being considerable. This has the added advantage of decreasing the flow for a given pressure, thus increasing the range of the burner.

The burner described and constituting a feature of the invention, namely one with a plurality of divergent nozzles each with its own swirl chamber, is very simple and can be made to afford good atomisation over a wide range.

I claim:

1. Combustion apparatus comprising a flame tube through which a combustion-supporting gas flows in a generally axial direction, a fuel injector extending axially into one end of said tube, an injection nozzle at one end of said injector, entry means into said tube for the gas, swirler means to produce a vortex flow in said tube having a core of reversed direction axially toward said nozzle, wall means in supporting relationship with said injector and extending coaxially therewith to define a chamber, a plurality of axially extending vanes disposed in circumferentially spaced relation around said injector and extending radially for the major portion of the distance between said injector and said wall means to divide said chamber into pockets, and said wall means closing said pockets at their ends remote from said nozzle.

2. Combustion apparatus comprising a flame tube through which a combustion-supporting gas flows in a generally axial direction, a fuel injector extending axially into one end of said tube, a plurality of injection nozzles symmetrically disposed and each protruding in a different direction at one end of said injector, entry means into said tube for the gas, swirler means to produce a vortex flow in said tube having a core of reversed direction axially toward said nozzles, wall means in supporting relationship with said injector and extending coaxially therewith to define a chamber, a plurality of axially extending vanes disposed in circumferentially spaced relation around said injector and extending radially for the major portion of the distance between said injector and said wall means to divide said chamber into pockets, said wall means closing said pockets at their ends remote from said nozzles, and said vanes and nozzles being circumferentially alternated.

MATTHEW L. NATHAN.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,468,370	Morse	Sept. 18, 1923
1,529,531	Young	Mar. 10, 1925
1,603,032	Elze et al.	Oct. 12, 1926
1,855,187	Hvoslef	Apr. 26, 1932
1,862,673	Foster	June 14, 1932
2,097,255	Saha	Oct. 26, 1937
2,140,785	Cone	Dec. 20, 1938
2,284,906	Kerrick	June 2, 1942
2,289,625	Ofeldt	July 14, 1942
2,380,463	Poole	July 31, 1945
2,385,833	Nahigyan	Oct. 2, 1945
2,398,654	Lubbock et al.	Apr. 16, 1946
2,404,335	Whittle	July 16, 1946