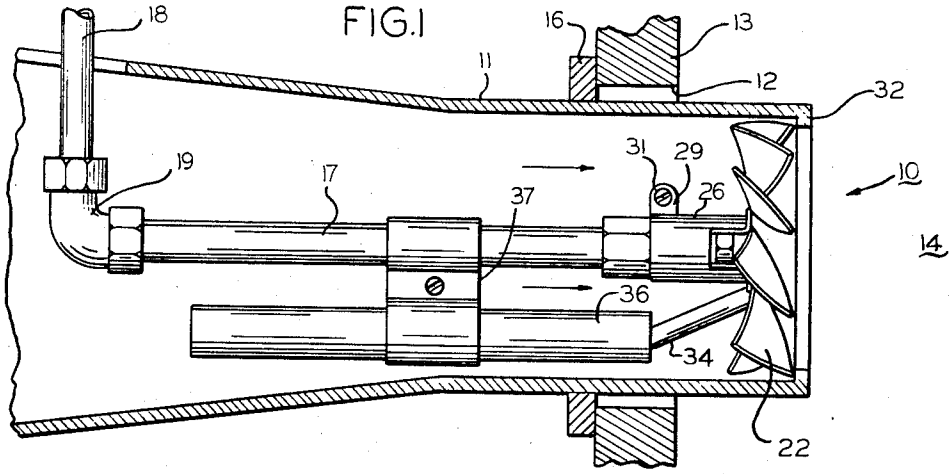
Nov. 5, 1968 E. L. OEHLERKING 3,409,231

SWIRLER FOR USE WITH BURNERS OF THE GUN TYPE

Filed Jan. 23, 1967

FIG.1



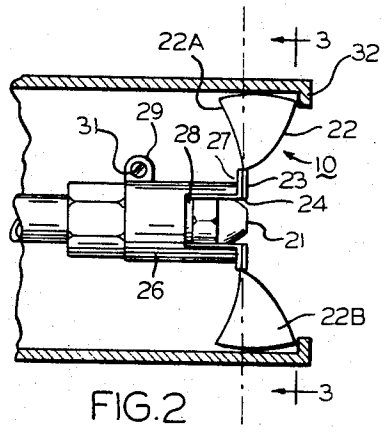


FIG.2

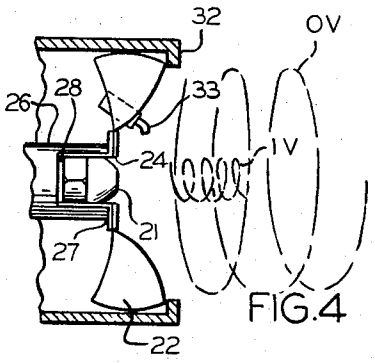


FIG.4

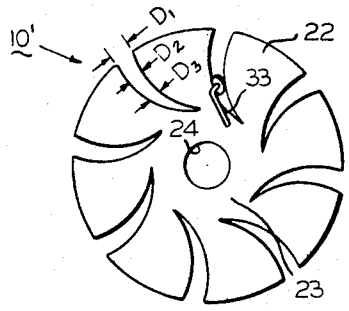


FIG.3

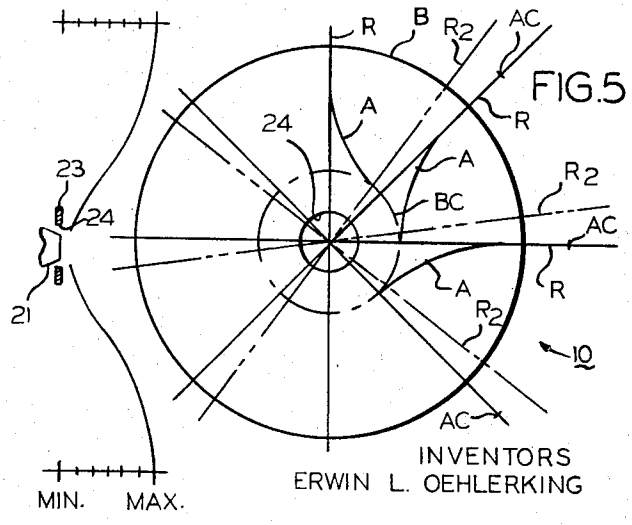


FIG.5

FIG.6

INVENTORS
ERWIN L. OEHLERKING

BY Richard C. Lindberg

ATTORNEY

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SWIRLER FOR USE WITH BURNERS OF THE GUN TYPE

Erwin L. Oehlerking, 9798 Oak, Des Plaines, Ill. 60016

Filed Jan. 23, 1967, Ser. No. 611,038
1 Claim. (Cl. 239—406)

A swirler having a plurality of vane-like blades extending from a support ring and characterized by maximum air flow between the blades adjacent the periphery thereof and by minimum air flow at the support ring to supply minimum air flow at the support ring, so that minimum air is supplied at a fuel nozzle at the center of the support ring to prevent "dancing" of the flame pattern toward and away from the fuel nozzle.

Prior art swirler devices of the kinds as shown in Sanborn Patents Nos. 2,976,919 and 2,976,920 and Keyes et al. Patent No. 3,258,057 have all been directed to structures for supplying air at the burner nozzle to propagate the flame thereat, and to complete the burning by providing a swirling envelope of combustion air about the propagated flame to complete the combustion of the fuel.

Such prior art devices have been formed from a stamping requiring blanking and forming operations and special support arrangements to give particular direction of the air at the fuel nozzle for initial flame propagation.

The swirler according to the present invention is preferably formed in a single blanking and forming operation, and the fan-like blades extending from the support ring are each defined by identical arcs along which the blank is sheared during the blanking and forming operation, each fan-like blade being defined by these arcs and presenting a blade portion directed toward the air current in the burner tube and an integral blade portion extending in the direction of the air current. The configuration of the fan-like blades is such as to provide an area of flow between adjacent blades which decreases from a maximum at the periphery to a minimum near the support ring, so as to provide minimum air to the flame emerging at the fuel nozzle to prevent "dancing" of the flame pattern toward and away from the nozzle.

With the foregoing considerations in mind, it is a principal object to provide an improved swirler for a gun type burner for providing proper combustion air at the fuel nozzle for proper flame propagation and initial combustion thereat, and additional combustion air in a vortex at points spaced from the fuel nozzle to complete the combustion.

Another object is to provide a swirler which will supply a minimum quantity of air to give good preliminary burning and flame propagation at the fuel nozzle, so that there is no "dancing" of the flame toward and away from the nozzle, toward the end that there is no pulsation of the flame longitudinally of the axis of the burner gun.

In the drawing:

FIG. 1 is a longitudinal sectional view through the burner tube of a gun type burner, showing the improved swirler according to the present invention;

FIG. 2 is a view similar to FIG. 1 showing details of mounting the swirler on the fuel supply pipe;

FIG. 3 is a front view of the swirler looking in the direction of the arrows 3—3 of FIG. 2;

FIG. 4 shows the path of the air supplied at the fuel nozzle to give initial propagation of the flame at the fuel nozzle;

FIG. 5 shows the manner in which the swirler may be constructed from a flat sheet stock; and

FIG. 6 is a graph showing the gradient of the air volume supplied by the swirler as the air volume varies from the periphery thereof towards its center at the fuel nozzle.

The improved swirler according to the present invention is denoted by the reference numeral **10** and is shown in situ with respect to a burner tube **11**, the forward end of which extends a short distance through an opening **12** in a wall **13** of a combustion chamber **14**. A flange **16** secured to burner tube **11** abuts the wall **13** and limits the position of burner tube **11** in combustion chamber **14**.

A supply pipe **17** is supported within burner tube **11**, and is connected to a supply pipe **18** by an elbow coupling **19**. Fuel is supplied by the pipe **17** to a burner nozzle **21**, the precise form of which forms no part of the present invention, except to say it can supply either liquid fuel such as furnace oil, or gaseous fuel under pressure.

As seen in FIGS. 2 and 3, the swirler **10** has a series of fan-like blades **22** which extend radially from an inner flat support ring **23** having a central circular opening **24** through which the burner nozzle **21** extends. A split ferrule **26** for supporting the swirler **10** on the nozzle **21** has a base flange **27** which is welded or otherwise secured to the upstream face of the support ring **23**. Ferrule **26** is clamped about a barrel **28** of the nozzle **21**, and has a pair of spaced ears **29** struck out therefrom, the ears **29** being clamped by a through bolt **31** to hold ferrule **26** and swirler **10** in place on the barrel **28**.

The swirler **10** is held in position against a lip flange **32** on the burner tube **11**.

An ignition structure is provided for the burner nozzle **21**, and as seen in FIGS. 1 and 3, such structure comprises an ignition electrode **33** guided and supported in an insulating sleeve **34**. Ignition electrode **33** extends between adjacent fan-like blades **22** in spaced relationship to the flat support ring **23** and in close proximity to the burner nozzle **21**. As is conventional in such ignition devices, a potential exists between the insulated electrode **33** and ring **23** to strike an arc igniting the fuel discharged at the burner nozzle.

The insulating sleeve **34** is supported in a tubular housing **36** secured by a clamp **37** to supply pipe **17**. Alternately, the ignition structure consists of a pair of electrodes spaced angularly of each other and extending between the fan-like blades **22**. In such cases the potential exists across the two electrodes rather than between an electrode and the ring **23**.

The swirler **10** is formed in a unique manner so as to give the aforemetnioned characteristics, and the same is constructed as seen in FIG. 5, which shows a circular blank B having the central opening **24** therein. The fan-like blades **22** are laid out on the blank B by equiangularly spaced rays R. A base circle BC corresponding to the outer diameter of the support ring **23** is constructed on the blank B. An arc A is struck from each ray R with a center AC on ray R, each such arc A being tangent to the base circle BC substantially where it cuts the ray R.

A blanking and forming die, not shown, is adapted to shear the blank B along the arc A and to twist each fan-like blade **22** formed in the use of such die along a ray R_2 which intersects the arcs A substantially at their inner ends. It is known to those skilled in such operations that the swirler **10** may be formed thusly in a combined blanking and forming operation in a single die from a strip of flat stock.

The finished swirler seen in FIG. 3 thus provides areas of flow for a current of air in the burner tube **11** and through the swirler **10** which vary from a maximum at the periphery of the swirler to a minimum at the periphery of the inner support ring **23**. These varying areas of flow between the fan-like blades **22** are denoted by the letters D_1, D_2 and D_3. At the minimum area of flow where the blades **22** have their roots, only minimal air is supplied to the burner nozzle **21**. Such minimum supply of combustion air has the property of providing sufficient air for initial flame propagation, but not in such quantity

to cause "dancing" of the flame toward and away from the burner nozzle. Such minimal area of air can be described as having a vorticial configuration IV.

On the other hand, the combustion air supplied through the swirler **10** where the areas of flow are larger, can be described as moving in an outer vorticial path OV. This outer and larger supply of air completes the combustion of the fuel in the flame initially propagated within the inner vortex IV.

As seen in FIG. 6, air passing through the swirler **10** has a volume gradient from the maximum at the periphery to a minimum at the support ring **23**.

The configuration of the fan-like blades **22** as defined by the arcs A is such as to provide blade portions **22A** extending in a direction opposed to the direction of flow of air in burner tube **11**, and blade portions **22B** extending in a direction corresponding to such direction of flow.

In the blanking and forming operations the blades **22** have the same pitch, but the pitch may vary from 35° to 50°.

It may be noted that the swirler **10** can also be formed in a casting operation, rather than by stamping.

I claim:

1. A swirler for use with a burner of the gun type wherein air blows forwardly in a burner tube to a combustion chamber and past a fuel discharge nozzle, said swirler being adapted to be supported transversely in said burner tube adjacent said discharge nozzle, said swirler being circular in configuration and comprising an inner flat ring having a central opening therein for said discharge nozzle, a plurality of fan-like blades formed integrally with said inner flat ring and extending radially therefrom, each of said fan-like blades being defined by a pair of identical arcs having the center of each lying on a ray which is equiangularly spaced from an adjacent ray, each of said arcs extending from the periphery of said swirler to a point at its inner end substantially tangent to said inner flat ring, each of said fan-like blades being twisted along another ray passing substantially through the point defining said arc at its inner end, the area of air flow between adjacent blades decreasing from a maximum at the periphery to substantially zero area of flow at the periphery of the flat ring to supply minimum air to the flame emerging at the center of said flat ring to prevent "dancing" of the flame pattern toward and away from said nozzle.

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FREDERICK L. MATTESON, JR., *Primary Examiner.*

E. G. FAVORS, *Assistant Examiner.*