Jan. 22, 1929.

1,699,623

C. G. NOVAK

LIQUID FUEL BURNER

Filed Oct. 20, 1927

3 Sheets-Sheet 1

Fig. 1.

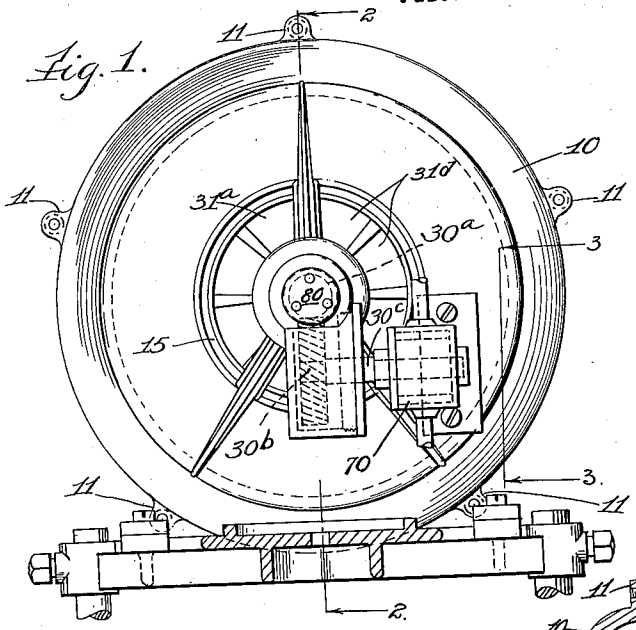


Fig. 3.

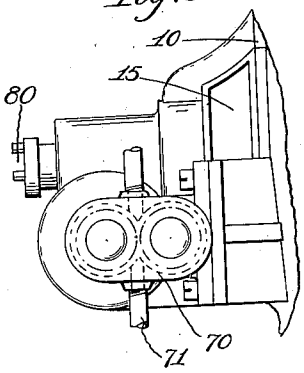
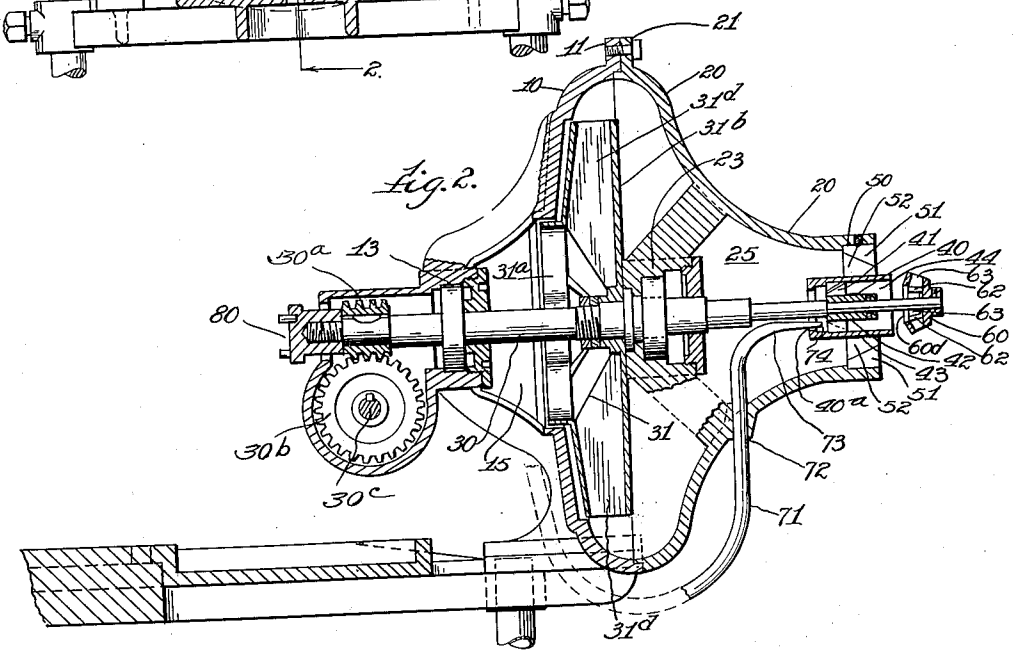


Fig. 2.



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Fig. 5.

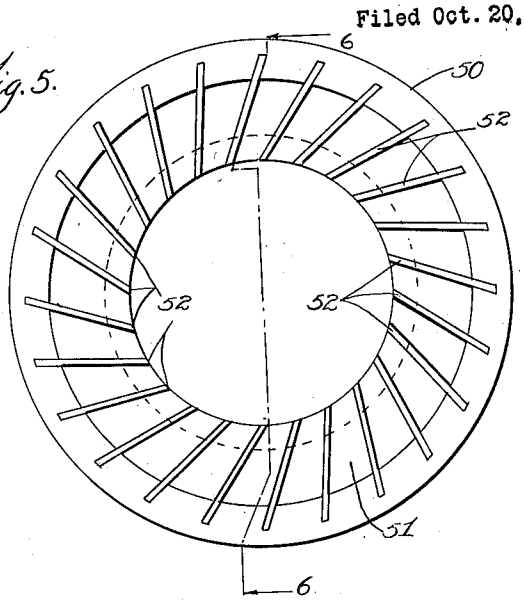


Fig 6

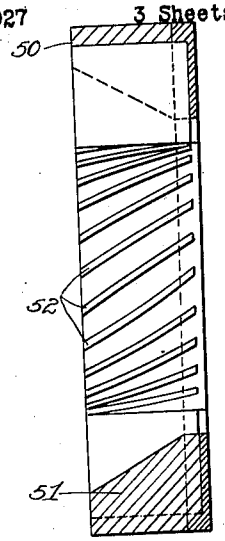


Fig. 8.

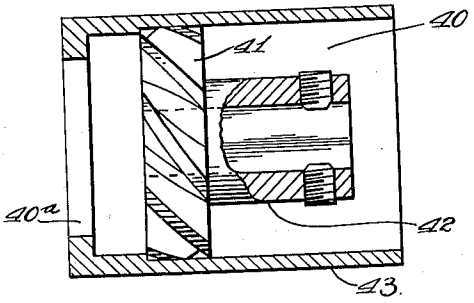


Fig. 7.

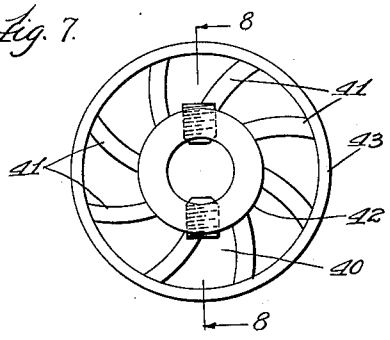


Fig. 9.

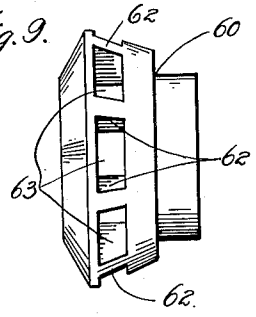


Fig. 10.

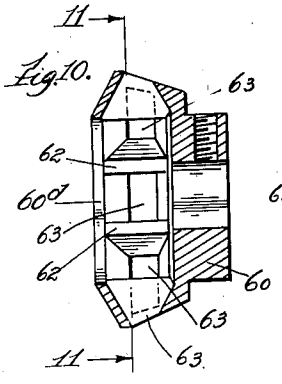
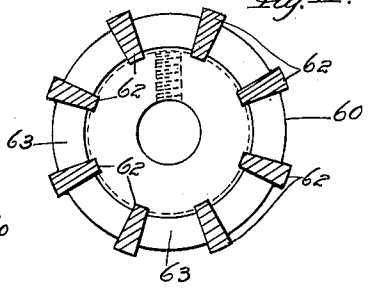


Fig. 11.



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Fig. 11

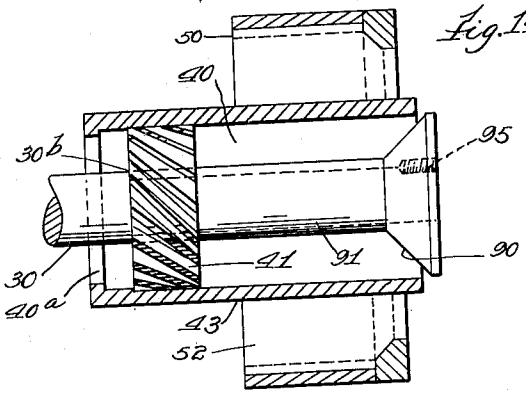


Fig. 13.

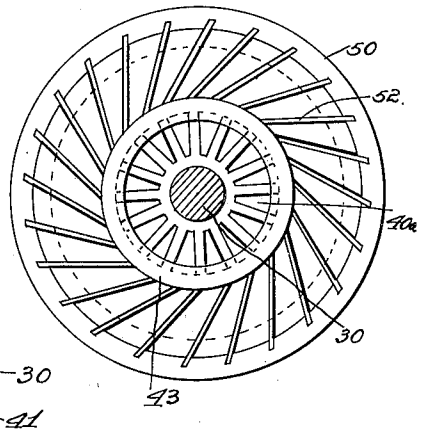


Fig. 12.

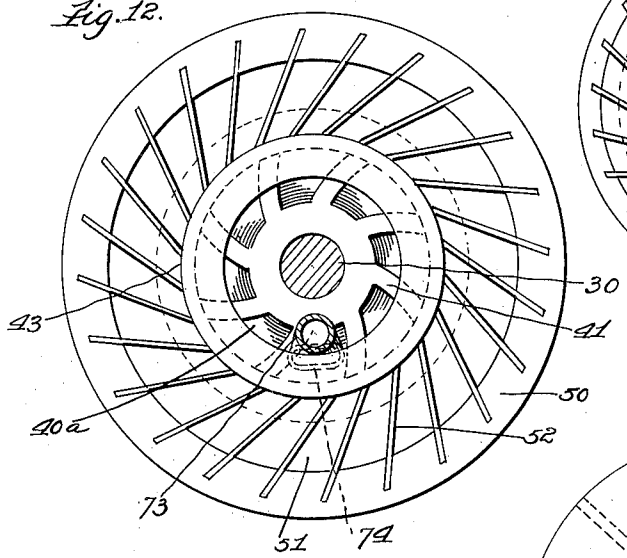
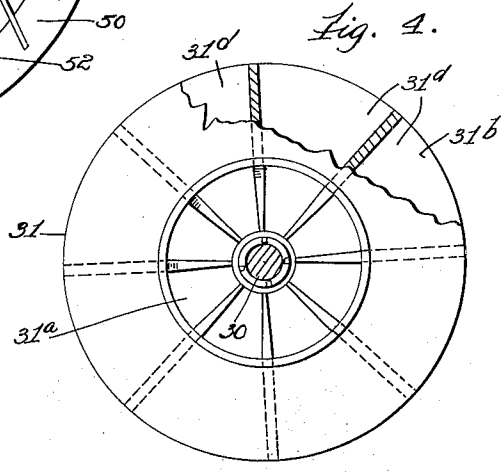


Fig. 4.



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Patented Jan. 22, 1929. 1,699,623

UNITED STATES PATENT OFFICE.

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LIQUID-FUEL BURNER.

Application filed October 20, 1927. Serial No. 227,371.

The purpose of this invention is to provide an improved construction of a fuel oil burner adapted particularly to produce a very thorough dispersion of the liquid fuel in an adequate quantity of air for complete combustion, in the process of driving the liquid fuel and the air through the burner apparatus to the point of ignition in the fire box or flame chamber of the furnace to which the burner is applied. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:—

Figure 1 is an outer end elevation of a burner embodying this invention.

Figure 2 is an axial section at the plane indicated by the line 2—2 on Figure 1.

Figure 3 is a detail elevation as seen at the line 3—3 on Figure 1.

Figure 4 is an elevation of the fan element removed from the lower casing having a part of the fan casing broken away to disclose the interior.

Figure 5 is an end elevation on an enlarged scale of an annular element mounted in the blower casing for giving spiral movement to the air driven by the fan at an outer annular zone.

Figure 6 is an axial section of the annular element shown in Figure 5.

Figure 7 is an end elevation showing on the scale of Figure 6 an annular element mounted on the fan shaft for giving spiral movement and centrifugal discharge to the air driven in by the fan at a zone interior with respect to the zone of the annular element shown in Figure 5.

Figure 8 is a section at the line 8—8 on Figure 7 on the same enlarged scale.

Figure 9 is an edge elevation of a distributor which is rotated by the fan shaft at the discharge side of the burner.

Figure 10 is an axial section of the same.

Figure 11 is a section at the line 11—11 on Figure 10.

Figure 12 is a view on an enlarged scale, showing in end elevation two annular members which are shown respectively in Figures 5 and 7 in their relation to each other in the assembled structure.

Figure 13 is a view similar to Figure 12 showing a slight modification.

Figure 14 is an axial section of the parts shown in Figure 13.

The structure shown in the drawings comprises a blower casing comprising two mated members, 10 and 20, secured together by bolts through circumferentially distributed mated lugs, 11 and 21, on the two members respectively. Journal bearings, 13 and 23, for a fan shaft are mounted in the members, 10 and 20, at annular seats, 12 and 22, provided for such bearings on the two members respectively. 30 is a fan shaft journalled in the bearings, 13 and 23, and carrying a fan, 31, comprising an annular entrance plate, 31^a, whose central aperture admits the air, and a complete circular back plate, 31^b, with radial spacing ribs, 31^c, constituting fan blades and forming approximately radial discharge passages, 31^d. Mounted on the fan shaft, 30, for rotation therewith beyond the journal bearing, 23, there is an annular element, 40, formed with spiral ribs or flutings, 41, spanning the annular interval between an inner cylindrical wall, 42, and an outer cylindrical wall, 43, of said annular element, said spiral ribs being positioned and extending at a relatively short portion of the axial length of said annular element and terminating at the inner side midway in the length of said element, leaving in said element beyond the spiral ribs an unobstructed annular discharge passage, 44. Mounted fixedly on the blower casing member, 20, beyond the journal bearing, 23, and substantially at the zone of the passage, 44, of the annular element, 40, there is mounted a second annular element, 50, having exteriorly cylindrical and interiorly frusto-conical wall, 51, from which there are formed protruding inwardly spiral ribs, 52, which extend inward radially into close proximity with the outer surface of the outer cylindrical wall, 43, of the inner annular element, 40. Said annular element, 50, terminates at its inner end a short distance back of the inner or discharge end of the outer cylindrical wall, 43, of the element, 40. On the shaft, 30, inwardly beyond the element, 40, and spaced somewhat inwardly from the inner end of the outer wall, 43, of said element, there is mounted a distributor, 60, which is a chambered device having a relatively large central aperture at the side toward the fan leading into the chamber, and radial vanes, 62, partitioning the chamber forming radial discharge passages, 63, the annular margin bounding the central aperture at the side toward the fan being frusto-conical in form for deflecting outwardly the air current

delivered against it, while the portion of the air which is divergent in the passage, 44, and enters the central aperture is deflected and discharged radially through the passage, 60[a].

The oil for supplying the pressure is pumped from the source by a pump, 70, mounted on the blower casing member, 20, and driven by any suitable means as by a worm, 30[a], on the shaft, 30, meshing with the gear, 30[b], on the pump shaft, 30[c]. The discharge pipe, 71, from the pump is led in through the blower casing member, 20, as seen at 72, and terminates in the discharge nozzle, 73, which protrudes into the entrance aperture, 40[a], of the annular member, 40, anterior to the spiral ribs and passages of that member, as seen at 74 in Figure 2.

The operation of this burner may be understood from the foregoing description. The fan being driven by any suitable power means connected to the shaft as indicated at 80, the air entering at the annular air intake, 15, of the casing member, 10, enters the central aperture, 31[a], of the fan, 31, and is discharged centrifugally into the chamber of the casing in which it is converged in the member, 20, to the discharge neck, 25, thereof, wherein part of the air current is forced and drawn through the rotating annular member, 40, in which it picks up the oil discharged from the nozzle, 73, and atomizes it while it is carried in the spiral passages of that element and discharged from them with a whirling movement into the annular discharge portion, 44, from whose discharge end the fuel mixture is discharged with a whirling motion tending to cause it to disperse centrifugally. A portion, however, enters the distributor, 60, partly under the impulse of the discharge from the passages, 44, and partly by the fan action of the distributor tending to drive the fluid out centrifugally in the radial passages, thereby causing lower pressure at the center which operates for drawing in the fuel mixture discharged from the passages, 44, as mentioned. The remainder of the fuel mixture is discharged centrifugally past the frusto-conical margin of the distributor between the same and the end of the tubular part, 43, where it encounters transversely the portion of the air which is converged in the neck of the blower casing as mentioned, which was not driven and drawn, as described, through the rotating annular member, 40, but which passed out around that element through the spiral passages of the outer annular element, 50. This portion of the air it will be observed will have derived a spiral movement in the direction determined by the direction of obliquity of the spiral ribs of the element, 50, which is opposite to that of the rotated annular and spirally vaned element, 40; so that the air currents derived respectively from the rotating member, 40, and the fixed member, 50, are not only relatively transverse to each other, one being in general radial, and the other in general axial, but in addition they have opposite spirality. The result is to very greatly intensify the effect of their impact upon each other for breaking up the fuel element already carried in suspension by the current which has passed through the rotating spirally vaned member, and produces fuel mixture discharged with a tendency to expand and stretch out at its emergence from the burner into the flame chamber; so that at the advance from the discharge end of the burner at which ignition occurs, the resulting flame is as wide spread as the form of the flame chamber will permit.

Figures 13 and 14 show a slight modification consisting in dispensing with the distributor shown in Figures 9, 10 and 11, and substituting a conical deflector, 90, formed integrally with the spirally partitioned element, 40, to which it is joined by a sleeve, 91, which fits on the fan shaft, 30, which is reduced in diameter at the end portions which receive said sleeve and thereby provided with a shoulder, 30[b], by which the integral member comprising the part, 41, and the deflector, 90, is stopped on the shaft, said integral member being secured and keyed on the shaft by a threaded key, 95, for which a threaded key seat is formed at the end of the shaft and of the said member having each of said parts, as seen in Figure 14. The operation of this modification is not very materially different from that of the form shown in the other figures. For it will be understood that the fuel mixture discharged and deflected by the conical member, 90, encounters the air current discharged outside the member, 40, in a direction in general transverse to the discharge current and with a spiral movement opposite to that which characterizes the latter current for the purpose and with the effect of thoroughly breaking up the fuel carried in suspense in the current which emerges past the conical member, 90.

I claim:

1. A liquid fuel burner comprising in combination with a blower casing and rotary fan member therein, open ended spirally ribbed annular elements at the discharge side of the blower casing, one of said annular elements being mounted for rotation with the rotary fan member and the other being fixed in the casing, the spiral ribs of said annular elements respectively having opposite pitch, and a fuel nozzle mounted for discharge of fuel in the zone of the rotating annulus from behind the same against the spiral ribs thereof.

2. A liquid fuel burner comprising in combination with a blower casing and rotary fan member therein, open ended spirally ribbed annular elements at the discharge side of the blower casing, one of said annular elements being mounted for rotation with the rotary

fan member and the other being fixed in the casing, the spiral ribs of said annular elements respectively having opposite pitch, and a fuel nozzle mounted for discharge of fuel in the zone of the rotating annulus from behind the same, and means for discharging the liquid fuel under pressure from said nozzle against the rotating element at the zone of its spiral ribs.

3. In the construction defined in claim 1, the rotating annulus comprising inner and outer cylindrical members between which the spiral ribs extend, the outer of said members being extended back toward the fan beyond the spiral ribs of said element and flanged inwardly for trapping the air which may be reflected upon striking the spiral ribs of said annulus.

4. In the construction defined in claim 2, the rotating annulus comprising inner and outer concentric cylindrical elements between which at an intermediate part only of the length of said elements the spiral ribs extend; whereby there is formed in said annulus at the discharge side of the spiral ribs an annular discharge passage for the air-and-fuel mixture, the fixed annulus being positioned encompassing said annular discharge passage of the rotating annulus and having its discharge approximately in the transverse plane of the discharge of said annular passage.

5. In the construction defined in claim 1, the rotating annulus comprising inner and outer concentric cylindrical elements between which at an intermediate part only of their length the spiral ribs extend; whereby there is formed at the discharge side of said spiral ribs an annular discharge passage for the air and fuel mixture, in combination with the fixed and rotating annular elements a distributor mounted for rotation with the fan shaft at the discharge side of the rotating annulus, said distributor comprising an annular frusto-conical flange facing said rotary annulus at the outer circumferential part thereof and spaced slightly away axially therefrom, a second annulus spaced axially from the frusto-conical annulus having its central aperture dimensioned for mounting the distributor on the fan shaft for rotation therewith, and a multiplicity of radial ribs joining said frusto-conical annulus and said shaft-fitting annulus spaced apart circumferentially to form a multiplicity of fuel mixture discharges; whereby the fuel mixture delivered through the rotating annulus is distributed by substantially radial discharge crosswise of the air discharged through and deflected spirally by the fixed spirally ribbed annulus.

6. A construction for the purpose indicated comprising a blower comprising a rotary fan member and having a casing formed for converging air blast for discharge about the center; an open ended annulus mounted in the casing at the discharge side thereof having spirally formed ribs occupying an outer zone thereof; a second annulus mounted co-axially with the first mentioned annulus having spirally formed ribs occupying an annular zone, said second annulus being mounted on the fan shaft for rotation thereby, the spiral ribs of the two annular elements being of opposite pitch, and a fuel duct led in through the wall of the blower casing beyond the rotating fan thereof terminating for discharge in the zone of the revolving annulus from behind said zone; whereby the liquid fuel is discharged from said revolving annulus dispersed in the air discharged through the latter in the oblique direction of spirality of the ribs of said rotating annulus and counter to the air discharged through the fixed annulus having ribs of opposite spirality.

7. A construction for the purpose indicated comprising a blower casing; a rotary fan member therein; open ended spirally ribbed annular elements at the discharge side of the blower casing, one of said elements being mounted for rotation with the rotary fan member and the other being fixed in the casing, the spiral ribs of said annular elements respectively having opposite pitch; a fuel nozzle mounted for discharge of fuel in the zone of the rotating annulus from behind the same; a distributor positioned at the discharge side of the rotating annulus, and means for rotating it in the same direction as the latter, said distributor comprising frusto-conical members facing each other spaced apart to form between them an annular chamber tapered narrowing from inner to outer circumference and having a multiplicity of partitions distributed circumferentially in said tapering space for delivering a multiplicity of centrifugally discharging jets of air-and-fuel mixture outwardly across the air blast delivered through the fixed spirally ribbed annulus.

8. In the construction defined in claim 7, the distributor being closed at the farther side whereby the entire air-and-fuel current entering at the opposite side is discharged centrifugally at the periphery of said distributor.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 18th day of October, 1927.

CHARLES G. NOVAK.