

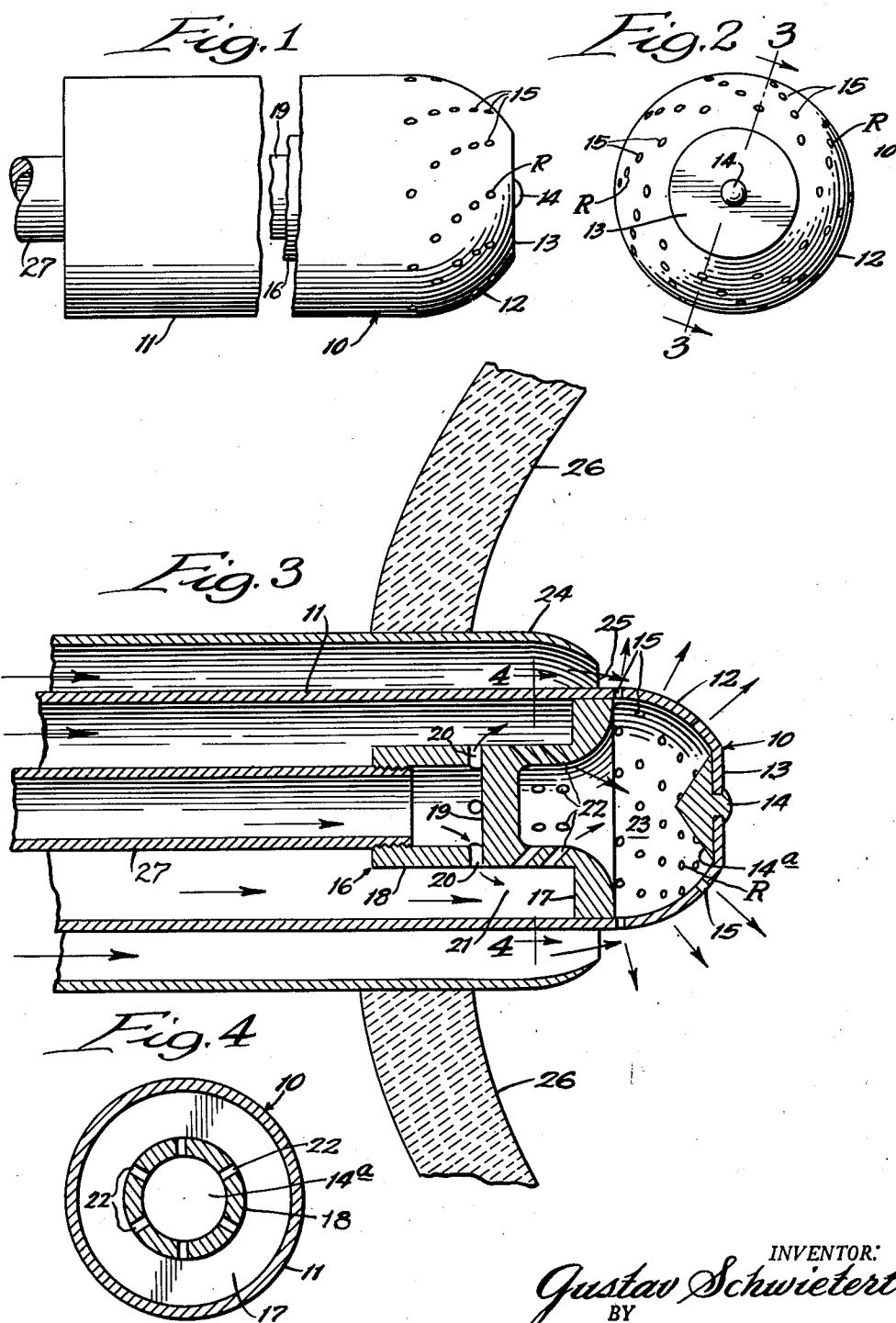
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OIL BURNER NOZZLE

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OIL BURNER NOZZLE

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My invention relates to an oil burner nozzle. More particularly my invention relates to a nozzle adapted for spraying a mixture of oil and air or other oxygen containing gas into a combustion chamber such as a boiler furnace.

In relatively large furnace installations, large quantities of fuel oil are commonly burned by mixing the fuel oil with air in a chamber exterior to the furnace, and then spraying or ejecting the vapor through an apertured nozzle into the combustion chamber. It is also common practice in such installations to provide an auxiliary supply of air to assist in burning the sprayed oil-air mixture. This can be done by providing a casing about the nozzle adapted to conduct the auxiliary air supply and to release it around the end of the nozzle.

Generally, the nozzles used for spraying fuel oil have consisted of a hollow tube providing a mixing chamber therein, and having a rounded or hemispherical end having a single circumferential row of apertures. With this type of nozzle a relatively large space is required to burn the fuel oil. For instance, burners using one-hundred gallons per hour of fuel oil are found to require a combustion chamber of at least from ten to twelve feet in length; and, if the furnace chamber is circular in cross section, it will need to be about eight feet in diameter. The required length of the combustion chamber is largely determined by the length of the flame projecting from the end of the nozzle, and heretofore no effective means has been known for shortening the length of this flame without sacrificing thoroughness of combustion. Thus oil burning furnaces have required relatively large and expensive combustion chambers.

Another problem has arisen with nozzles of the type described in that the exterior surface of the nozzle surrounding the spray apertures tends to become smoked and carbonized, which frequently progresses to the point of stopping up the apertures. The use of an auxiliary air supply sweeping around and over the apertured surface has proven to be only a partial answer to this problem. This auxiliary air tends to flow in channels or well-defined paths between the apertures and thereby is effective in removing the carbon from only a portion of the nozzle surface. Also, the auxiliary air is only effective in mixing with the oil around the outside of the flame, and fails to be mixed with the oil in the central portion of the flame with the result that combustion is less complete.

It is therefore an object of my invention to

provide an oil burner nozzle which allows a large amount of fuel oil to be burned in a relatively small space. It is a further object of my invention to develop an oil burner nozzle which shortens the length of the flame projected from the nozzle, and thereby allows the combustion chamber to be shortened. It is another object of my invention to provide an oil burner nozzle which causes the auxiliary air to sweep over the entire apertured surface in order to prevent any portion of this surface from becoming carbonized. It is a still further object of my invention to develop a nozzle which will cause the auxiliary air to be thoroughly mixed with all of the sprayed oil to achieve complete combustion of the oil. Further objects and advantages will appear as the specification proceeds. In one phase of my invention, I have discovered that the above objects can be substantially accomplished by forming the spray openings in the hemispherical end portion of an oil burner nozzle in a plurality of arcuate rows which are curved in the same direction and extend generally toward the end of the nozzle. The details of the apertured arrangement and the new results obtained will hereinafter be more fully developed.

My invention is shown in an illustrative embodiment in the accompanying drawing, in which—

Figure 1 is a broken side elevational view of my nozzle; Fig. 2, a top of plan view of the hemispherical spray portion of my nozzle; Fig. 3, a side cross-sectional view of my nozzle installed within the wall of a furnace and surrounded by the auxiliary air casing, the nozzle section being taken on line 3—3 of Fig. 2; Fig. 4 is a cross-sectional view of my nozzle taken in section through the annular partition member on line 4—4 of Fig. 3.

In the illustration given, 10 designates generally a nozzle adapted for spraying oil mixed with air into a combustion chamber. Nozzle 10 is composed of a hollow tubular extension 11, which has a conical or, more precisely, a hemispherical end portion 12. Although I prefer to have end portion 12 hemispherical, it will be apparent that it can be modified to approach a conical shape.

If desired, hemispherical end 12 can be provided with a flattened head portion 13, and a conical headed button or rivet 14 secured within head 13. As shown in Fig. 3, the conical head 14a of rivet 14 is located within hemispherical end 12. The function of conical head 14a will subsequently be described.

I have discovered that the operation of nozzle

10 can be unexpectedly improved by greatly increasing the number of spray apertures or openings in the hemispherical end portion, and by arranging these openings in a definite geometrical pattern with respect to the surface of the hemispherical end portion. Basically, I have discovered that spray apertures 15 should be located in rows R around hemispherical end portion 12. I have also discovered that rows R should be curved or arcuate with respect to the surface of end portion 12, and extending generally toward the end of nozzle 10, but inclined away from a direct line to the end of nozzle 10. It is desirable for achieving best results to have rows R similarly curved, and all curved in the same direction. I have also found it desirable to drill apertures 15 perpendicular to the surface of end portion 12, as shown more clearly in Fig. 3.

It will be apparent that the number of holes in rows R as well as the number of rows R will necessarily be varied for nozzles of different diameters. In the illustration given, a nozzle of about two and one-half inches in diameter is represented. With a nozzle of this size, as shown, I have found that excellent results are obtained by using ten rows of holes having five holes in each row. It will be noted in the illustrated embodiment that a sufficient number of rows is provided so that the rows of holes tend to overlap. This is desirable, as will be described under the discussion of the nozzle's operation, to cause the auxiliary air to pass over the entire surface of end portion 12.

As shown more clearly in Fig. 3, the interior of tubular extension 11 is equipped with an annular partition member designated generally as 16. Partition member 16 has annular shoulders 17 at its forward end which are adapted to snugly engage the interior wall of tubular extension 11 beneath hemispherical portion 12. If desired, shoulders 17 can be secured to tubular extension 11 by means of spot welding or other suitable method such as providing interlocking threads. Partition member 16 has a reduced hollow tubular portion 18 which is divided by imperforate partition wall 19. The end of reduced tubular portion 18 is provided with threads for receiving correspondingly threaded fuel supply pipe 27. Adjacent to partition 19 tubular portion 18 is provided with openings 20 for admitting the fuel oil to the chamber or area 21 where it is to be mixed with the air, which is brought in through tubular extension 11 around fuel supply pipe 27 and partition member 16. It will be understood that additional openings 20 are located circumferentially beneath partition 19. On the other side of partition 19 tubular portion 18 is provided with a series of inclined passages or openings 22. In the illustration given, there are two circumferential rows of inclined passages 22 containing six openings each, as seen more clearly in Fig. 4. It will be readily understood that the number of such passages can be considerably varied. The inclination of passages 22 toward the end of nozzle 10 is desirable to impart a swirling motion to the oil and gas carried from area 21 to nozzle mixing chamber 23.

As shown in Fig. 3, the nozzle including the interior structure previously described is preferably located within a cylindrical casing 24 which provides an annular duct 25 around the base of end portion 12. The purpose of casing 24 is to supply auxiliary air to the flame projected from nozzle 10. Cylindrical casing 24 together with nozzle 10 is extended through refractory

wall 26 into the combustion chamber (not shown).

Operation

In using my nozzle for burning fuel oil, nozzle 10 is mounted in a refractory furnace wall such as wall 26, shown in Fig. 3. Also, I prefer to enclose tubular extension 11 of nozzle 10 within a casing 24 to supply auxiliary air to the flame.

Generally, partition member 16 is welded to tubular extension 11 and has its reduced portion 18 threaded, as shown in Fig. 3. A threaded fuel supply pipe 27 is then connected to tubular portion 18.

Fuel oil is supplied, preferably under considerable pressure, through pipe 27. The primary air is supplied through tubular extension 11 to combine or be mixed with the fuel oil ejected through openings 20 into area 21. It will be understood that oxygen or other oxygen containing gas can be used in place of air. Also, it will generally be preferable to supply the air to nozzle 10 under considerable pressure. The oil and air are partially mixed in space 21 and then forced through inclined passages 22 into the nozzle mixing chamber 23. The inclination of passages 22 causes the oil and air to have a swirling motion which assists in completing the mixing within chamber 23. Also, conical head 14a serves as a baffle member to turn the upwardly projected oil-air mixture downwardly, and thereby improving the dispersion of oil in the air.

The oil-air mixture is sprayed through apertures 15 into the combustion chamber, where it is ignited by any suitable means. Once ignited, the flame is continually fed by additional increments of the fuel mixture being continually sprayed from nozzle 10.

The positioning of apertures 15 in a series of rows R which are curved or arcuate with respect to hemispherical end portion 12 causes the fuel-air mixture to be sprayed in fan-like lines of jets. The curving of rows R causes the flame produced by the fan-like jets to be given a substantially rotary or twisting motion in which layers of the flame fed by the fan-like rows of jets combine to produce a turbulent ball of fire.

As shown in Fig. 3, I prefer to supply auxiliary air to the flame issuing from nozzle 11 by means of annular duct 25. The inward curvature of casing 24 about duct 25 causes the auxiliary air to pass over the surface of hemispherical end portion 12. The auxiliary air is then enveloped by the twisting fan-like jets of flame, and thereby brought within and disbursed throughout the turbulent flame. This accomplishes a more effective utilization of the auxiliary air and results in better combustion than heretofore obtained.

The curved inclination of rows R deprives the auxiliary air of a low resistance path or channel, and causes it to sweep over the entire surface of the hemispherical end portion. Thus, carbonization on the hemispherical surfaces or about the apertures is completely prevented, since the air is effective in burning off the carbon. This effect is still more perfectly obtained if the rows of openings are spaced sufficiently close together to somewhat overlap.

In the actual use of oil burner nozzles having my new aperture configuration, I have found that the space required to burn oil in excess of one-hundred gallons or more per hour can be about one-eighth that required when using nozzles such as have been hitherto provided. This is accomplished by producing a turbulent spheri-

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cal shaped flame which envelopes and distributes the auxiliary air. It will therefore be apparent that my improved oil burner nozzle will lend itself to virtually every size of industrial heating unit.

Actual operation of my improved oil burner nozzle has demonstrated that substantially complete combustion can be obtained for widely varying amounts of fuel oil supplied to the nozzle. This means that over a considerable range the differing load requirements of a furnace can be met by controlling the amount of fuel oil and air supplied to the nozzle while still obtaining nearly perfect combustion at all settings within the control range. This is a marked advantage over previously known types of nozzles which had a rather narrow operating range within which the quantity of fuel oil supplied could be varied while still obtaining good combustion.

While in the foregoing specification I have described my oil burner nozzle in relation to a specific embodiment for purpose of illustration, it will be apparent that many of the details set forth can be varied without departing from the spirit of my invention.

I claim:

1. An improved oil burner nozzle, comprising a hollow tubular member terminating in a generally hemispherical end portion having apertures therethrough for spraying a mixture of oil and air into a combustion chamber, a partition member secured within said tubular member adapted to provide mixing zones for oil and air, said partition member having a reduced hollow portion adapted to receive a fuel supply pipe, and a casing surrounding said tubular portion providing a duct opening around the base of said hemispherical portion arranged to direct auxiliary air over the surface of said hemispherical portion, said openings in the hemispherical end portion being arranged in a plurality of rows curved in the same direction and each of said rows having a plurality of openings, said rows extending generally towards the end of said nozzle but being inclined away from the most direct line to the central point on the end of said nozzle.

2. The oil burner nozzle of claim 1 in which said rows are sufficiently numerous to cause the opposite ends of said rows to overlap and in which said openings are perpendicular to the surface of said hemispherical portion.

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3. An improved oil burner nozzle, comprising a hollow tubular member terminating in a generally hemispherical end portion having apertures therethrough for spraying a mixture of oil and air into a combustion chamber, and a casing surrounding said tubular portion providing a duct opening around the base of said hemispherical portion arranged to direct auxiliary air over the surface of said hemispherical portion, said openings in the hemispherical end portion being arranged in a plurality of rows curved in the same direction and each of said rows having a plurality of openings, said rows extending generally towards the end of said nozzle but being inclined away from the most direct line to the central point on the end of said nozzle.

4. An improved oil burner nozzle, comprising a hollow tubular member terminating in a generally hemispherical end portion having apertures therethrough for spraying a mixture of oil and air into a combustion chamber, and a casing surrounding said tubular portion providing a duct opening around the base of said hemispherical portion arranged to direct auxiliary air over the surface of said hemispherical portion, said openings in the hemispherical end portion being arranged in a plurality of arcuate rows around said hemispherical portion, said rows being similarly curved and extending generally towards the end of said nozzle and each row containing a plurality of apertures.

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