May 14, 1963 D. LABINO 3,089,538

APPARATUS FOR GENERATING A HIGH VELOCITY HOT GASEOUS BLAST

Filed Aug. 26, 1958

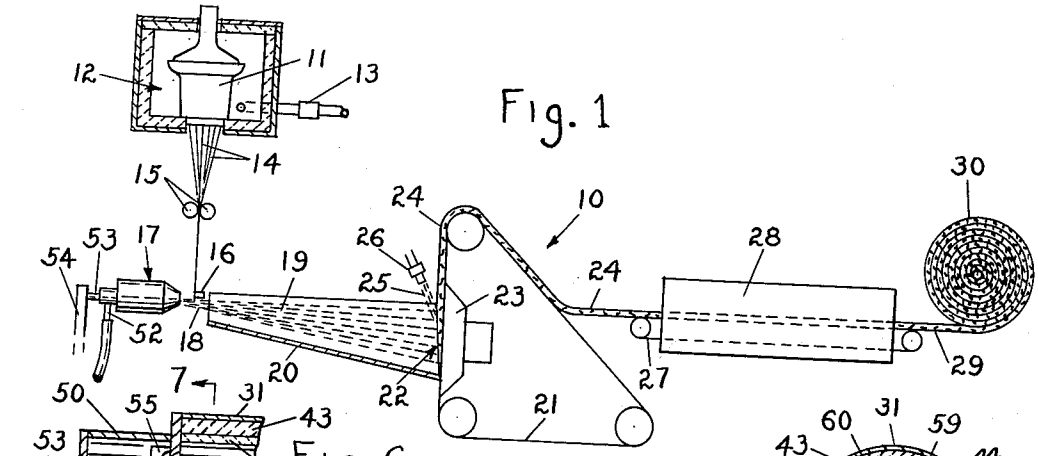

Fig. 1

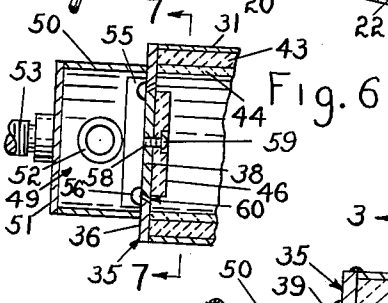

Fig. 6

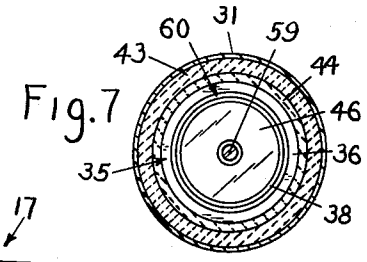

Fig. 7

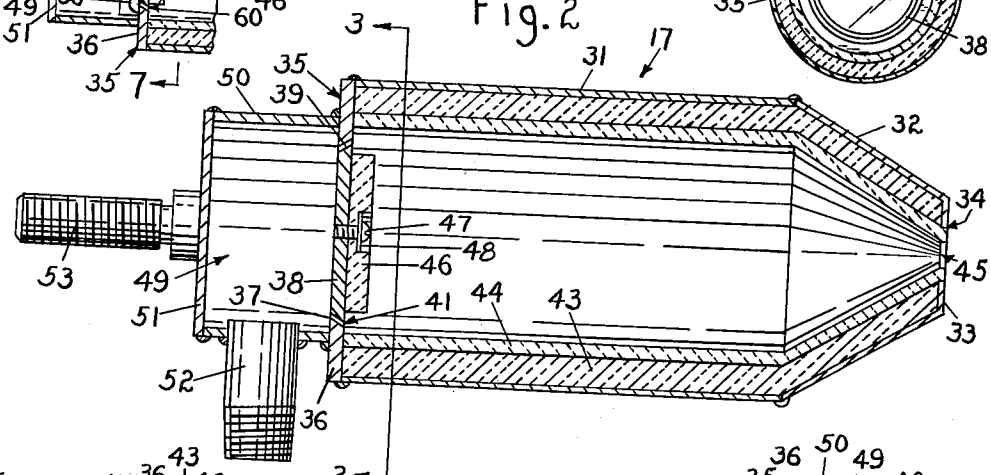

Fig. 2

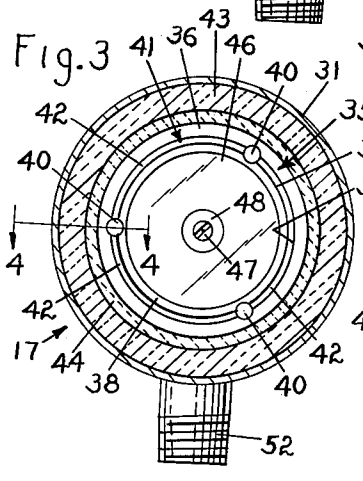

Fig. 3

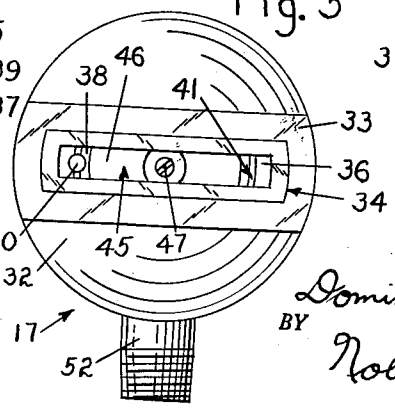

Fig. 5

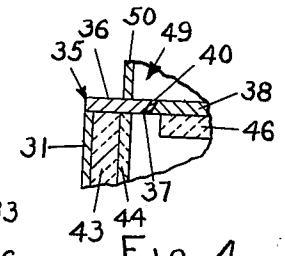

Fig. 4

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# APPARATUS FOR GENERATING A HIGH VELOCITY HOT GASEOUS BLAST

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This invention relates broadly to apparatus for generating a high velocity hot gaseous blast. More specifically, it relates to an internal combustion burner for generating a high temperature, high velocity gaseous blast sufficient to attenuate molten glass into fibers as fine as one micron or less in diameter.

The blast is produced by igniting a combustible gaseous mixture, usually gas and air in a combustion chamber formed within the burner and exhausting the products of combustion through a restricted opening in one wall thereof. The optimum characteristics of the burner are complete combustion of the mixture within the chamber to produce a very high velocity discharge blast at a temperature in excess of the attenuating temperature of glass. The accepted shape of the opening is a narrow rectangle, or modifications thereof, adapted to distribute the blast to impinge upon a multitude of filaments descending in parallel, spaced array. At the aforementioned high operating temperature, the combustible mixture ignites instantly upon entering the chamber, but if the components are not thoroughly mixed and properly distributed upon entrance to the chamber and during passage to the discharge, the combustion will be incomplete. In such instances the maximum heat is not extracted from the fuels and in extreme cases combustion may extend into the blast area outside the burner. Neither is desirable.

With the optimum results in mind, the problem is centered about the configuration of the combustion chamber and the orifice plate to secure complete combustion within the chamber to extract all the heat and blast force possible. These objectives are recognized by those in the art as essential to efficient operation.

It is therefore an object of this invention to provide a burner for a gaseous fuel mixture having a high efficiency.

It is another object of this invention to provide a tubular combustion chamber wherein a film of a combustible gaseous mixture is introduced around the circumference of the chamber.

It is still another object of this invention to provide a burner for a gaseous fuel mixture wherein the orifice plate is designed to preclude premature ignition of the mixture.

It is a further object of this invention to provide a burner for a gaseous fuel mixture wherein the length of the combustion chamber is sufficient to insure complete combustion of the fuel within the burner.

It is yet another object of this invention to provide a burner for a gaseous fuel mixture which will discharge incandescent gases at high velocity through an elongated port.

It is still another object of this invention to provide a combustion chamber lined with a refractory material which acquires and preserves, during the operation of the burner, a radiant temperature sufficient to propagate combustion.

Other objects and advantages of the invention will become more apparent during the course of the following description when taken in connection with the accompanying drawings.

In the drawings wherein like numerals are employed to designate like parts throughout the same:



FIG. 1 is a schematic drawing of apparatus for making a bonded mat of glass fiber;

FIG. 2 is a section of the burner taken on the longitudinal centerline thereof;

FIG. 3 is a cross-section of the burner taken on the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary section of the burner taken on the line 4—4 of FIG. 3;

FIG. 5 is an exterior view of the burner taken from the right of FIG. 2;

FIG. 6 is a fragmentary sectional view showing a modified form of the burner; and

FIG. 7 is a cross-section taken on the line 7—7 of FIG. 6.

Referring to FIG. 1 of the drawings, the mat making apparatus is generally indicated by the numeral 10. The apparatus includes a crucible or bushing 11 for melting glass supported within an insulated chamber 12 and heated to render the glass fluid by a gaseous flame introduced into the chamber by a conduit 13.

The crucible 11 is provided with a plurality of openings in the bottom wall through which the molten glass flows in the form of primary filaments 14. The filaments are fed between a pair of power driven rolls 15 to attenuate and direct the descending filaments over the vertical face of a block 16.

A burner 17, to be described hereinafter, forcibly directs a hot, gaseous blast 18 in a direction normal to the vertical face of the block and below the lower edge of the face to melt and reduce the attenuated filaments to fine fibers 19. The force of the blast alters the vertical path of the filaments to a substantially horizontal path through a V-shaped trough 20. The trough 20 shields the fibers 19 from stray air currents prior to their deposition on an endless foraminous conveyor 21 which preferably is ascending vertically in the collection area 22. A suction box 23 is disposed behind the conveyor in the collection area and assists in laying up the mat 24. As shown in the drawings, a binder 25, which may be a phenolic resin, is sprayed upon the fibers 19 as they approach the collection area. The binder spray apparatus is indicated by the numeral 26.

The collection conveyor 21 discharges the resin impregnated mat 24 onto a second conveyor 27 which carries the mat through an oven 28 which cures the binder 25 to produce a bonded mat 29. The bonded mat is finally formed into a rolled package 30, as shown, or into any other convenient form.

The improved burner forming the subject matter of this invention, is illustrated in detail in FIGS. 2 through FIG. 5. The burner 17 has a tubular metal body 31 joined at one end to a metal reducer 32 gradually changing the cross-sectional contour to a substantially rectangular nose portion 33. The nose portion is turned inwardly in a direction normal to the extended axis of the body 31 to define a rectangular opening 34 that is centrally spaced with respect to the nose portion. The opposite end of the body 31 is closed by a two-piece metal orifice plate 35. The outer piece 36 of the orifice plate 35 is annular in shape with the outside diameter seam welded flush with the circumference of the body 31 and the inside diameter 37 bevelled to provide an included angle of approximately 60 degrees and with the larger diameter toward the interior of the body. The inner piece 38 of the orifice plate 35 is a disc the same thickness as the outer piece 36 having a diameter 39 slightly less than the inside diameter 37 of the outer piece 36 and bevelled at the same angles. The inner piece of the orifice plate is secured to the outer piece thereof at three places by spot welds 40 to provide an annular orifice 41 divided into three equal segments 42 by the spot welds. The bevelled diameters 37 and 39 form a throat extending

the thickness of the orifice plate **35** diverging in frusto-conical formation toward the interior of the body **31**.

A layer of high temperature insulation **43**, such as quartz fibers, lines the interior of the body **31** and the reducer **32** flush with the opening **34** in the nose portion **33**. An inner lining of a high temperature refractory material **44**, such as a metallic oxide, conforms to the cross-sectional contour of the body **31** and the reducer **32** and extends from the orifice plate **35** to the outer face of the nose **33**, at which latter point an exhaust or discharge opening **45** of substantially rectilinear shape extends horizontally to include within its effective blast area a multitude of filaments.

A disc **46** of high temperature refractory material, such as a metallic oxide, is fastened to the face of the orifice plate **35** within the combustion chamber by a screw **47** and a washer **48** and is centrally disposed within the orifice **41**.

A chamber **49** to distribute the gaseous combustible mixture for passage therefrom through the orifice **41** is comprised of a short metal pipe section **50** with one end welded to the outer face of the orifice plate **35** in concentric surrounding relation to the orifice **41**, and the other end is closed by a plate **51** seam welded thereto. An inlet conduit **52** for the combustible mixture penetrates the wall of the pipe **50** and is connected to a source which admits the fuel mixture under pressure into the chamber **49**. A threaded post **53** is welded or otherwise secured to the exposed face of the end plate **51**, projecting in a direction normal to said face, and serves to support the burner **17** on a framing member **54**, as shown in FIG. 1.

The fuel mixture is fed under pressure from the source through the conduit **52**, expands within the distribution chamber **49**, and passes through the frusto-conical orifice **41** in a direction to impinge upon the interior wall of the combustion chamber closely adjacent the orifice plate and at an angle which advances the mixture within the combustion chamber.

In the modified burner construction illustrated in FIGS. 6 and 7, the fuel inlet orifice is continuous. In the description thereof all parts identical with the embodiment previously disclosed will bear the same numbers.

The burner disclosed in FIGS. 6 and 7 is identical in all respects to the burner disclosed in FIGS. 2 through 5 inclusive, with the exception that one or more yokes **55** are welded to the inlet face of the outer portion **36** and the inner portion **38** of the orifice plate **35** to support the inner portion **38** and the refractory disc **46** without resorting to the spot welds **40**, which divide the orifice **41** into segments **42**.

The yokes **55** are provided with notches **56** which span the orifice **60** to permit unobstructed entrance of the fuel mixture into the orifice. A threaded hole **58** extends through the inner portion **38** of the orifice plate **35** on the axis of the burner and is adapted to receive a screw **59** passing centrally through the center piece **38** of the orifice plate **35** and the refractory disc **46**. The inside diameter of the outer annular disc **36** and the outside diameter of the inner disc **38** define a continuous frusto-conical orifice **60** with the small diameter forming the exit for the fuel from the distribution chamber **49**.

After initial ignition of the mixture within the chamber the ignition of the incoming mixture takes place closely adjacent the intersection of the orifice plate and the body and because of the film-like conical distribution of the mixture in that area the combustion of the mixture is substantially complete. Upon ignition, the fuel mixture expands rapidly in volume within the combustion chamber and the hot products of combustion exhaust with great force from the restricted discharge opening **45** where they impinge upon the filaments at the bottom edge of the block **16**.



In use, it has been proven that the burner structures disclosed herein produced a blast of high temperature and with sufficient force to produce fibers having a diameter of one micron or less with a minimum of fuel consumption.

It is to be understood that the forms of the invention herewith shown and described are to be taken as illustrative embodiments only of the same, and that various changes in the shape, size and arrangement of parts, as well as various procedural changes, may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. Burner apparatus, comprising in combination:
   (*a*) a refractory wall defining a combustion chamber,
   (*b*) said combustion chamber having an inlet and a restricted outlet;
   (*c*) a plenum combustible fuel chamber adjacent said inlet;
   (*d*) a metallic wall disposed between said combustion chamber and said fuel chamber,
   (*e*) said metallic wall defining a substantially annular port,
   (*f*) the portion of said combustion chamber immediately adjacent to said metallic wall being cylindrical in cross-section and having a diameter greater than said annular port and defining an arrangement wherein the refractory of the cylindrical portion is spaced laterally from said port and the axis of said cylindrical portion is substantially perpendicular to said metallic wall, and
   (*g*) said port extending outwardly through said metallic wall at an angle toward said refractory wall to direct the fuel into initial contact with said refractory wall at an acute angle therewith.

2. The burner apparatus as defined in claim 1, wherein the metallic wall comprises an outer portion having a circular opening therein and a circular inner portion spaced radially and inwardly from said outer portion, the surface of said inner portion facing the combustion chamber having a larger area than the surface of said inner portion facing the plenum chamber.

3. Burner apparatus as defined in claim 2, wherein the outer portion is supported adjacent its periphery by the plenum chamber, and further comprising means carried by said outer portion supporting the inner portion, said inner and outer portions defining a substantially continuous annular port therebetween.

4. Burner apparatus as defined in claim 1 wherein said port when said burner is in operating position has its outlet opening out of vertical alignment with any superposed refractory of said combustion chamber and being spaced from said refractory wall to deter entry of spalling refractory into said port.

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