Nov. 26, 1968 D. L. SMITH ET AL 3,412,942

NOZZLE HAVING INTERIOR GUIDE

Filed Sept. 28, 1966

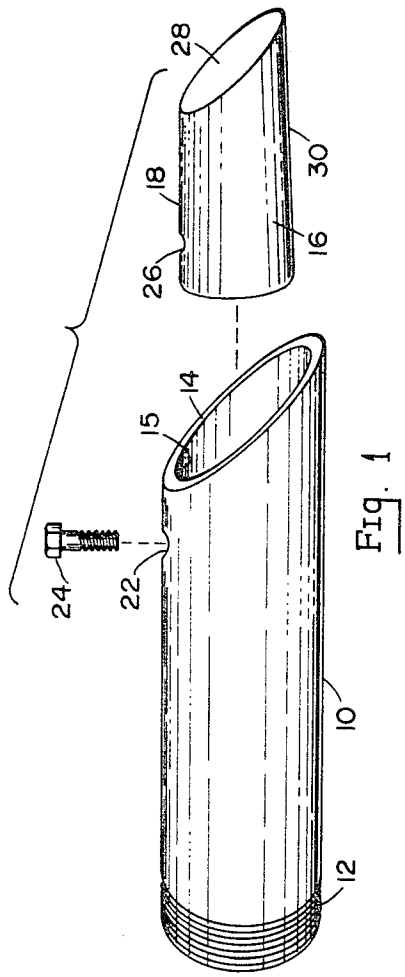


Fig. 1

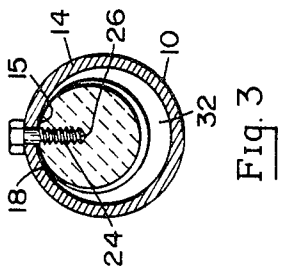


Fig. 3

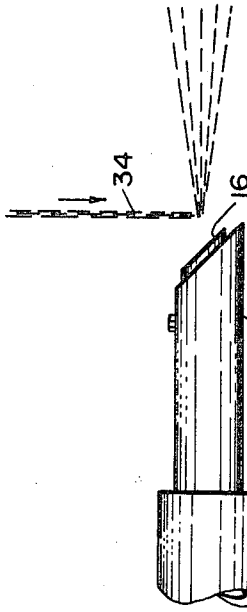


Fig. 4

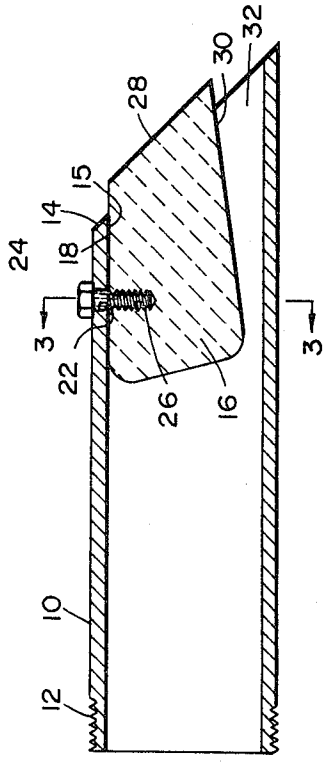


Fig. 2

INVENTORS

DONALD L. SMITH

PETER M. DOWNIE

K. W. Brownell

United States Patent Office 3,412,942
Patented Nov. 26, 1968

3,412,942

NOZZLE HAVING INTERIOR GUIDE

Donald L. Smith, Cattaraugus, and Peter M. Downie, Niagara Falls, N.Y., assignors to The Carborundum Company, Niagara Falls, N.Y., a corporation of Delaware

Filed Sept. 28, 1966, Ser. No. 582,596
6 Claims. (Cl. 239—590)

ABSTRACT OF THE DISCLOSURE

A nozzle for directing a high velocity blast of gas, such as steam or air, at substantially right angles against a stream of molten inorganic material to produce ceramic fibers. The nozzle is provided with a core or insert plug having a novel tapered configuration defining a diverging passageway that causes the gas to flow at a greater velocity to produce a finished product having a large percentage of fiber content.

This invention relates to apparatus used in the manufacture of inorganic fibrous material and, more particularly, to a new and improved nozzle employed in the production of blown inorganic fibrous material.

Normally, in the manufacture of inorganic fibrous material, a stream of molten inorganic material is released and subjected to a fiberizing means. One such fiberizing means may be a high temperature, high velocity blast of gas, such as steam or air, directed at approximately right angles against the molten stream thereby forming many small globules and attenuating them into discrete bodies or fibers.

The production of inorganic fibrous material, particularly ceramic fibers, by the above process has resulted in a product having a relatively low fiber content or percentage of pure fiber obtained from the blown mass of material collected, the remainder of the material being "shot" or unfiberized material. Attempts have been made to solve this problem by inserting cores within the blast end of a nozzle and, although these improved nozzle designs have served the purposes for which they were designed, they have not been entirely satisfactory due to their inability to materially improve the quality of the fiber.

The apparatus of the present invention, as hereinafter described, substantially increases the fiber content or quality of the blown finished product by providing a nozzle having a new and improved core or insert plug incorporated therein. Utilization of the novel nozzle of the present invention has improved the fiber quality by as much as 50% over that produced by standard production nozzles.

Accordingly, it is an object of the present invention to provide a new and improved blast nozzle for use in the manufacture of blown fibers.

It is another object of the present invention to provide a new and improved blast nozzle having novel means incorporated therein for improving the quality of the blown fiber.

It is still another object of the present invention to produce an improved quality fiber having a smaller percentage of shot or unfiberized material therein.

These and other objects of the present invention will become more apparent upon consideration of the following detailed description thereof when taken in conjunction with the following drawings, in which:

FIG. 1 is an exploded perspective view illustrating the various parts of the blast nozzle constructed in accordance with the principles of this invention;

FIG. 2 is a longitudinal sectional view of the blast nozzle shown in FIG. 1;

FIG. 3 is a cross sectional view taken on the plane of line 3—3 of FIGURE 2; and

FIG. 4 is a schematic view illustrating the use of the blast nozzle of the present invention in the production of inorganic fibrous material.

Referring to the drawings it will be seen that a blast nozzle constructed in accordance with the principles of this invention comprises a hollow cylindrical conduit **10** provided with external threads **12** at one end thereof cooperable with an internally threaded high pressure gas line. The other end or outlet end of conduit **10** terminates in an inclined end portion **14** which is sloped forwardly and downwardly and preferably lies in a plane at an angle of approximately 45° relative to a horizontal plane taken through the axis of said conduit. It should be appreciated that the principles of this invention envisage the end portion **14** to be sloped at angles greater or less than 45° if desired. For purposes of this description, the front or forward end is taken to be the outlet end or the right-hand side of conduit **10** as viewed in FIG. 2.

Rigidly secured within conduit **10** adjacent the inner upper surface **15** thereof is a core or insert plug **16** of lesser cross sectional area than the inside of conduit **10**, said core having an upper arcuate surface portion **18** abutting the inner upper surface **15** of conduit **10**. An aperture **22** is provided in the upper wall of conduit **10** for receiving suitable securing means such as a bolt **24** having suitable threads thereon engageable with a threaded bore **26** of insert plug **16**.

As shown in FIG. 2, the forward portion of insert plug **16** preferably protrudes outwardly beyond the plane of the end portion **14** of conduit **10** and is provided with an end face **28** which slopes forwardly and downwardly at approximately the same angle as the plane of end portion **14**. However, if desired, face **28** may lie substantially in the plane of end portion **14** or rearwardly thereof within the purview of the present invention.

Insert plug **16** is substantially a truncated cone in shape with the upper peripheral arcuate surface portion **18** thereof milled to conform to the inner upper surface **15** of conduit **10** so that said portion **18** lies flush with the inner surface **15**. The remaining peripheral surface portion **30** of the plug converges toward the longitudinal axis thereof and is preferably tapered at an angle of approximately 2.5° as shown exaggerated in FIG. 2. Thus, it will be seen that the cross section of insert plug **16** is progressively reduced in cross section from the rear end thereof toward the front face **28** to form a divergent passageway **32** of a crescent shaped cross section. It should be realized that taper angles greater or less than 2.5° may be employed within the purview of the present invention.

In operation, the outlet end of the nozzle is so positioned that its axis lies in a substantially horizontal direction to release a high velocity blast of gas of crescent shaped cross section. A stream **34** of molten inorganic material is released so as to fall vertically just forwardly of the outlet end of the nozzle as illustrated in FIG. 4 into the trough-shaped formation or "pocket" of the gaseous blast. The molten material is turned 90° in a substantially horizontal direction and fragmented into numerous globules or droplets which are, in turn, attenuated into fibers.

The crescent shaped gas stream provides the thickest gas stream at the bottom and a continually decreasing thickness up each recurving side. The bottom must have enough energy and thickness to prevent the melt from penetrating through it since the fragmentation process results from the initial exchange of energy between the two streams. The expansion and entrainment of ambient air around the upper portion of the gas stream provides an envelopment of the molten fragments in the fiberizing zone as opposed to non-recurving streams which simply

enlarge by entrainment and may push fragments out of the fiberizing zone entirely.

As a result of the present invention, a new and improved nozzle is provided for forming fibers from a molten inorganic material in an improved and more efficient manner. By the provision of a novel designed insert plug, a diverging passageway is formed in the nozzle which allows the gas to expand as it escapes from the nozzle. This expansion causes the gas to discharge at a greater velocity to more thoroughly disintegrate the melt stream and thereby produce a fiber product having a greater percentage of fiber than can be realized with conventional, known fiberizing nozzles.

A preferred embodiment of the principles of this invention having been hereinabove described and illustrated, it is to be realized that modifications thereof can be made without departing from the broad spirit and scope of this invention as defined by the appended claims.

We claim:

1. A nozzle comprising: a conduit having an inner surface and an outlet end through which a gas stream passes; an insert plug disposed within said conduit adjacent said outlet end and being of a lesser cross-sectional area than the cross-sectional area of the inside of said conduit; means for securing said insert plug within said conduit; said plug having a first peripheral portion abutting said inner surface of said conduit and a second peripheral portion converging toward the longitudinal axis of said plug and tapering toward said outlet end at an angle of about 2.5° relative to the longitudinal axis of said insert plug; said outlet end of said conduit having an end portion lying in a plane that is inclined relative to the longitudinal axis of said conduit; and said insert plug having a portion protruding outwardly beyond said outlet end and terminating in an end face that is inclined relative to the longitudinal axis of said plug.

2. A nozzle comprising: a conduit having an inner surface and an outlet end through which a gas stream passes; an insert plug disposed within said conduit adjacent said outlet end and being of a lesser cross-sectional area than the cross-sectional area of the inside of said conduit; said plug having a first peripheral portion abutting said inner surface of said conduit and a second peripheral portion converging toward the longitudinal axis of said plug and tapering toward said outlet end at an angle of about 2.5° relative to the longitudinal axis of said insert plug.

3. A nozzle comprising: a conduit having an inner surface and an outlet end through which a gas stream passes; an insert plug disposed within said conduit adjacent said outlet end and being of a lesser cross-sectional area than the cross-sectional area of the inside of said conduit; said plug having a first peripheral portion abutting said inner surface of said conduit and a second peripheral portion converging toward the longitudinal axis of said plug and tapering toward said outlet end at an angle of at least 2.5° relative to the longitudinal axis of said insert plug.

4. A nozzle comprising: a conduit having an inner surface and an outlet end through which a gas stream passes; an insert plug disposed within said conduit adjacent said outlet end and being of a lesser cross-sectional area than the cross-sectional area of the inside of said conduit; said plug having a first peripheral portion abutting said inner surface of said conduit and a second peripheral portion converging toward the longitudinal axis of said plug and tapering toward said outlet end at an angle of from 2 to 4° relative to the longitudinal axis of said insert plug.

5. A method of forming fibers comprising: releasing a stream of molten material; directing a high velocity blast of gas through a nozzle at substantially right angles to the stream of molten material; forming the blast of gas into a stream having a trough-shaped cross section with a deep pocket; directing the stream of molten material forwardly of the outlet end of the nozzle into the pocket of the trough-shaped blast of gas whereby the molten material is fragmented into numerous globules and attenuated into fibers.

6. A method as defined in claim **5** in which said molten material is an inorganic ceramic material.

References Cited

UNITED STATES PATENTS

2,743,136	4/1956	Aver	239—601
3,001,724	9/1961	Osborne	239—590 X
3,178,121	4/1965	Wallace	239—601 X

FOREIGN PATENTS

526,736	6/1956	Canada.

SAMUEL F. COLEMAN, *Primary Examiner.*