July 17, 1956 C. J. STALEGO 2,754,541

METHOD AND APPARATUS FOR FORMING FIBERS

Filed July 5, 1951

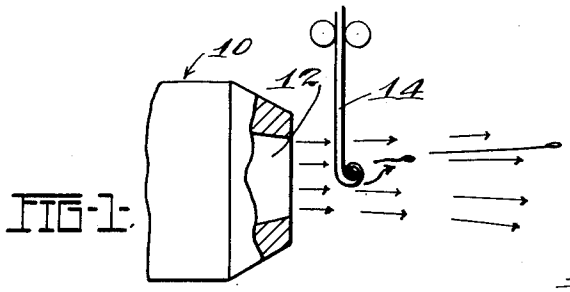


FIG-1-

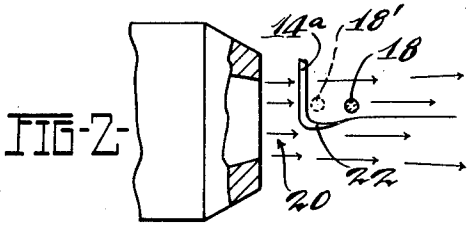


FIG-2-

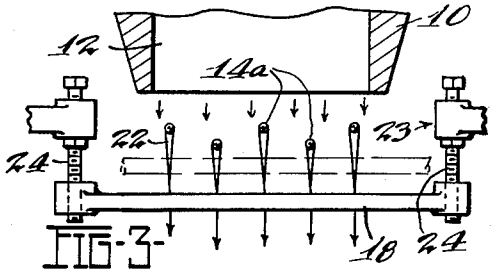


FIG-3-

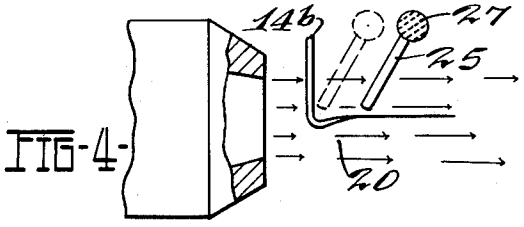


FIG-4-

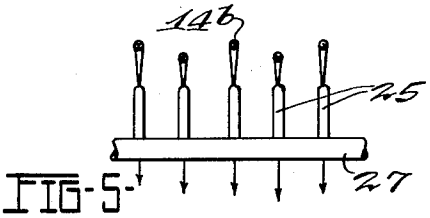


FIG-5-

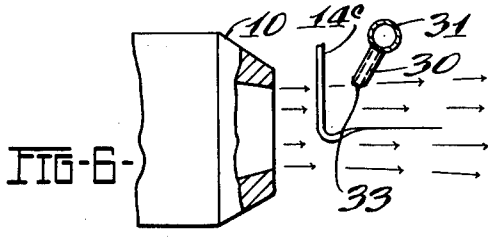


FIG-6-

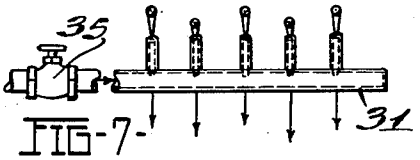


FIG-7-

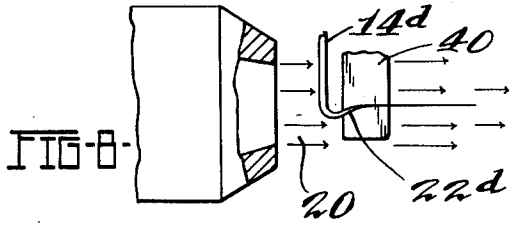


FIG-8-

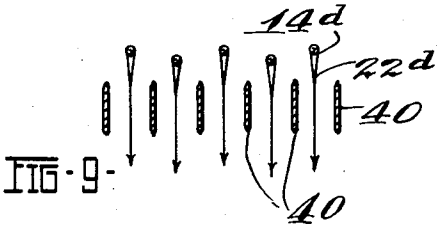


FIG-9-

Inventor:
CHARLES J. STALEGO.
By Stachin & Overman
Attorneys

United States Patent Office 2,754,541 Patented July 17, 1956

2,754,541

METHOD AND APPARATUS FOR FORMING FIBERS

Charles J. Stalego, Newark, Ohio, assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Application July 5, 1951, Serial No. 235,222

19 Claims. (Cl. 18—2.5)

This invention relates to method and apparatus for forming comparatively fine fibers from heat softenable material and more especially to the production of fine fibers attenuated from molten glass and the like.

One of the preferred methods of forming or producing mineral fibers or fibers from heat softenable material such as glass is to subject filaments of heat softenable material to a heating medium usually in the form of a high velocity blast of intensely hot gasses projected from an internal combustion burner whereby the filaments are continuously advanced into the hot blast where they are attenuated or drawn into very fine fibers by the velocity of the hot gases emanating from the burner. Filaments of glass or other heat softenable material, usually referred to as primary filaments, especially usable for fiber formation are usually from ten to twenty thousandths of an inch in diameter and are advanced at a controlled rate into the hottest zone of exhaust or burned gases from the burner which softens the tips of the primary filaments, the velocity of the hot exhaust gases first drawing the softened tips to tapered configurations termed secondary filaments, the latter being attenuated to comparatively fine fibers, being in the nature of approximately two microns in diameter.

It has been found that while fiber attenuation by this method is successful under optimum conditions, the operating conditions are extremely critical. For example, the primary filaments must be advanced or fed into the flame of the burner at an accurately determined rate where the maximum volume of glass will be attenuated to secure the highest economy; and, if the filaments are advanced too rapidly or too slowly, then the attenuation of fibers is not carried on properly. The successful production of fibers by this method requires that several factors such as the temperature of the heating zone, the relative positioning of the primary filaments and the rate of feed of the filaments must be correlated and maintained in order to produce uniform fine fibers.

If the combustible mixture varies even in minor amounts in its constituent ratios, the temperature of the filament heat zone may also vary to an extent vitally affecting the attenuation of the glass or other heat softenable material into fibers. Furthermore, a minute variation in the diameters of the filaments or unit volume of glass being fed into the heating and attenuating zone may materially interfere with proper attenuation.

One of the difficulties encountered when the operating factors or conditions are not correlated or functioning in the proper manner is that the fibers may have minute pellets of glass attached thereto or the pellets may be unattached to fibers, such formation being conventionally referred to as "hot slugs." Thus if the primary filaments are fed into the flame at too slow a rate for the proper volume of glass to be attenuated or if the temperature is too high for the amount of glass fed into the heating zone, such slugs or pellets are formed, some being entailed on the fibers rendering the fiber forming process virtually inoperable. To restore normal operation, the

operator must make instant though minute correction of the factor or factors responsible for improper attenuation. Any temporary interruption of the normal rate of attenuation or deviation of the relation of the feed of the primary filaments into the blast or lack of correlation of other critical factors tends to produce the so-called "hot slugs." One of the factors which augments the tendency to slugging when optimum conditions are not present is the establishment of reduced or differential pressure on the "downstream" side of the primary fibers adjacent the lower ends of the filaments at their entrance to the attenuating zone. This differential pressure has the effect of causing the heat softened filament at the start of attenuation to be moved or biased upwardly and away from the hottest part of the attenuating blast, the net effect of which is to cause the fibers being formed to roll or coil up into pellets or slugs adjacent the softened end of the primary filaments in the zone of reduced pressure. This disrupts fiber formation and results in waste of glass.

The present invention embraces a method of minimizing the existence of unequal pressure or substantially equalizing the pressure adjacent the primary filaments so as to eliminate the tendency of the heat softened filament being attenuated to fibers to move out of the locus of the attenuating forces.

The invention contemplates a method and means of substantially equalizing the pressures in the attenuating zone of a fiber attenuating blast adjacent the fiber forming material entering the blast whereby attenuation of the fiber forming material may be continuously carried on in a manner securing satisfactorily attenuated fibers.

An object of the invention resides in the establishment of a pressure equalizing medium adjacent the entrance zone of a supply of heat softenable fiber forming material into an attenuating blast whereby disruption of fiber formation and attenuation is avoided.

An object of the invention resides in the provision of means disposed in a zone of normally reduced pressure adjacent the downstream side of a filament of heat softenable material being fed into a material softening and attenuating zone of an intensely hot, high velocity gaseous blast whereby the heat softened material forms secondary filaments which are maintained in the most efficient attenuating zone of the blast as the secondary filaments are drawn into fibers.

Another object of the invention resides in a method and arrangement for attenuating fibers from thermofusible material wherein the various factors normally correlated to provide optimum operating conditions may deviate from normal without materially interfering with continuous satisfactory fiber attenuation.

Still another object is the provision of a method and arrangement of attenuating fibers from thermofusible fiber forming material by a blast of gas wherein a reduced pressure or partial vacuum existent at one side of the primary filament of fiber forming material is counteracted, offset or negated in a manner whereby the locus of movement of the fibers during the attenuation operations is substantially in the core of the gas stream of the blast.

Another object is the provision of an arrangement for attenuating fibers from glass utilizing a high velocity blast of hot gases wherein the formation of pellets or slugs is reduced to a minimum or substantially eliminated.

Still another object of the invention is the provision of a method of attenuating fibers from heat softenable material wherein the heat softened, fiber forming material is maintained in the most effective zone of the attenuating gas stream with a minimum of deviation therefrom so that a highly efficient and effective fiber attenuation is obtained and wherein the factors of rate of feed of fiber forming material, the temperature of the attenuating

flame and the like may vary within considerable limits without materially affecting the attenuation of fibers.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is an enlarged elevational view of the blast discharging end of an internal combustion burner showing a primary glass filament and the formation of pellets when the improper operating conditions for fiber attenuation are present;

Figure 2 is a view similar to Fgure 1 illustrating a method and apparatus of this invention for effecting an equalization of pressure adjacent the primary filaments;

Figure 3 is a top plan view of the arrangement shown in Figure 2;

Figure 4 is a view similar to Figure 2 illustrating another form of means for minimizing or eliminating the unequal pressures adjacent primary filaments at their entrance into an attenuating blast;

Figure 5 is a top plan view of the arrangement shown in Figure 4;

Figure 6 is a view similar to Figure 4 wherein a counterstream of gas is directed into a zone adjacent primary filaments for the purpose of attaining equalization of pressures adjacent the filaments;

Figure 7 is a top plan view of the arrangement shown in Figure 6;

Figure 8 is a view similar to Figure 6 showing a form of baffle means utilized for equalizing the pressure adjacent the primary filaments and the attenuating zone, and

Figure 9 is a top plan view illustrating the baffle arrangement shown in Figure 8.

While the invention is especially usable in attenuating extremely fine fibers from glass filaments, it is to be understood that the principles of the invention may be utilized to advantage in attenuating other heat softenable materials as, for example, fusible rock, slag and thermosoftenable resins.

One method of attenuating glass or other fiber forming materials to comparatively fine fibers involves feeding primary filaments, rods or elongated bodies of glass into an intensely hot, high velocity gaseous blast which functions to soften the advancing filaments and draw or attenuate them into fibers under the influence of the blast. An apparatus for accomplishing this purpose includes a burner **10**, the forward portion or outlet end of which is shown in Figure 1. The burner is of the internal combustion type shown and described in the U. S. Patent to C. J. Stalego, No. 2,489,243 granted November 22, 1949, having internal refractory lined walls capable of withstanding the high temperatures of combustion. A fuel and air mixture is delivered into the rear of the burner in proper proportions whereby substantially complete combustion takes place within a confined zone of the burner. The burner construction is provided with a restricted orifice or discharge outlet 12 preferably elongated laterally through which the exhaust or burned gases of combustion are projected at comparatively high velocities providing an intensely hot blast.

One or more primary filaments or rods **14** of glass are arranged to be continuously advanced or fed into the blast by feed rolls (not shown) in a manner whereby the advancing tips of the filaments are softened and drawn into fibers. It has been found in actual practice that several factors enter into the successful attenuation of fibers by the blast-burner method and that such factors are critical in nature so that in commercial practice difficulties may be encountered in correlating all of such factors to establish optimum fiber attenuating conditions. If the filaments are fed into the blast at too slow a rate for the proper volume of glass to be attenuated or if the temperature is too high for the amount of glass fed into the attenuating zone, then slugs or pellets of glass are formed on the fibers as illustrated in Figure 1, a condition which not only renders the fibers unsuitable for use but the pellets are waste material.

The filaments extending into the blast present impediments to the free flow of the gases of the blast, setting up unequal pressures on opposite sides of the filament in the direction of movement of the gases so that on the downstream or lee side of the filament a zone of reduced pressure or partial vacuum is existent while on the diametrically opposite or upstream side of the filament an elevated or increased pressure may be set up by reason of the impingement of the gases against the filaments. Thus the rate of feeding the filaments into the blast and the velocities and temperature of the blast must be properly correlated in attaining optimum conditions for attenuation.

If one or more of these factors deviate or vary from a regulated mode of operation, the reduced pressure or partial vacuum adjacent the downstream side of the filament usually results in the blast causing the softened filament to move upwardly in a hook-like formation and, as such portion is moved out of the most efficient zone of attenuation or core of the blast, the softened material tends to coil up and form small slugs or pellets. By increasing or equalizing the pressure adjacent the downstream side of the filaments, the tendency for the softened filaments or fibers formed therefrom to coil into pellets is eliminated or substantially minimized.

The invention provides a method and means for attaining substantial equalization of pressure in the attenuating zone adjacent the primary filament through the positioning of a medium at or adjacent the downstream side of the filament so as to eliminate to a substantial degree the existence of a partial vacuum in this zone. One form of means to eliminate or substantially reduce the partial vacuum is illustrated in Figures 2 and 3. One medium utilized for the purpose may be in the form of a baffle, rod or shaft **18** extending substantially horizontally of the blast and adjacent the downstream side of the filaments **14***a*. It has been found that the placement of the baffle may be advantageously employed at any position between the dotted and full line positions indicated respectively at **18'** and **18**. As the baffle **18** is actually in the path of the intensely hot gases, it is preferably formed of refractory material, heat resistant metal, ceramic or any suitable material capable of withstanding the high temperatures and velocities of the gases.

The hot gases of the blast moving in the path or locus indicated by the arrows at **20** function to soften the advancing tip portions of the primary filaments **14***a* which are drawn by the blast into tapered secondary filaments **22** usually referred to as secondaries which are drawn out or attenuated by the velocity of the blast to form fine fibers which are entrained in the blast and may be collected upon a continuously moving belt (not shown) or other suitable collecting means.

The baffle or member **18** extending transversely of the blast and adjacent the primary filaments **14***a* tends to streamline the flow of gases by introducing an impediment in the path of the gases between adjacent pairs of filaments on the downstream sides thereof which tends to equalize the pressure in the downstream zone above the softened secondary filament portions **22** and substantially eliminates the partial vacuum in this zone.

The baffle arrangement is disposed substantially centrally of the blast which tends to retard the speed of the gases at the core of the blast and eliminates upward movement and hook-like formation of the secondaries **22**. It has been found that the elimination of the hook-like formation avoids or substantially eliminates the formation of the pellets or fibers encumbered with the pellets.

The baffle arrangement **18** is preferably carried by a supporting means **23** adjacent the ends of the baffle such as threaded members **24** which may be manipulated so that the most effective and efficient fiber attenuating conditions may be secured by the proper positioning of the baffle means by regulating or controlling the ambient pressure at the zone of impingement of the blast upon the heat softenable material.

Figures 4 and 5 illustrate a modified arrangement of baffle means for accomplishing the hereinbefore mentioned purposes. In this form elongated baffles **25** of rod-like shape are respectively disposed in vertical planes passing through the several primary filaments **14***b* and at the downstream side of the primary filament. The rods or baffles **25** may be adjusted to a most efficient fiber attenuating relation as from full line to dotted line position or at any intermediate position. Furthermore the baffles **25** may be vertically positioned or may be angularly disposed up to an angle of about forty-five degrees with respect to the general direction of flow of the gaseous blast indicated by the arrows **20**, the angle of inclination of the baffles **25** with respect to the filaments **14***b* as illustrated in Figure 4 being about thirty degrees. The individual baffles **25** may be supported by a transversely extending member **27** and may be formed of refractory, ceramic or other material capable of withstanding the high temperatures of the blast. The baffles serve to minimize or prevent the existence of substantial vacuum on the downstream side of the filaments **14***b* and hence avoid the formation of pellets or slugs of the glass during fiber attenuation.

Figures 6 and 7 illustrate an arrangement similar to that shown in Figures 4 and 5 wherein tubular baffles or members **30** are employed and disposed on the downstream side of the primaries **14***c*. The members **30** are preferably hollow and may be supported by a manifold **31** adapted to be connected to a source of air or other gas under pressure for discharging jets of air or other gas from the outlets or mouths **33** of the tubes **30** to equalize the pressure in the zone rearwardly of the filaments **14***c* to eliminate the formation of slugs of glass and enhance the fiberization or attenuation of the filaments into fibers under the influence of the intense heat and high velocity of the gases of the blast.

The manifold **31** may be provided with a control means or valve **35** for regulating the rate of discharge of air or other gas from the tubes **30**. By this means the pressure established on the downstream sides of the primary filaments can be adjusted or controlled to secure conditions facilitating most efficient attenuation of the fibers thus minimizing the necessity for critical adjustments of blast temperature, rate of glass feed, etc. The relative position and angularity of the air discharge tubes **30** may be adjusted with respect to the primary filaments dependent upon the conditions of glass feed, blast temperature and velocity in order to secure the most efficient operation.

Figures 8 and 9 illustrate an arrangement of plate-like baffles or means for modifying the direction of flow of gases of the blast to tend toward equalization of pressure and the avoidance of the partial vacuum adjacent the primary filaments **14***d* on the downstream side. A plurality of baffles **40** is arranged with a baffle disposed in the gas stream intermediate each pair of primary filaments, the baffles preferably extending downwardly to approximately the lower boundary of the blast **20** and providing means for streamlining or channeling the flow of the gases to alleviate the partial vacuum otherwise existing in the downstream zone of the blast rearwardly of the filaments. The baffles present an impediment sufficient to divert the gases of the blast generally in the direction of the zones at the rear of the filaments to augment the pressure at said zones for the purpose of eliminating the formation of hot slugs or pellets of glass during attenuating operation. The plate-like baffles are preferably positioned directly between the secondaries **22***d* and serve to avoid interference between adjacent secondaries during fiber attenuating operations.

The foregoing structural forms are illustrative of means for carrying out the method of equalizing or tending to equalize the pressures on the downstream sides of primary filaments to facilitate fiber attenuation, and it is to be understood that baffles of different shapes and configurations may be employed without departing from the scope of the invention. For example, the impediment or abutment **18** may be of different cross-sectional configurations such as rectangular, square or oval and likewise the members **25** shown in Figure 4 may be of other than circular cross-section and accomplish the stated purposes of the invention.

The forms of apparatus for carrying out the method perform several important functions in improving the attenuating operations. The pressure equalizing means or baffles tend to streamline the gas flow from the blast between adjacent filaments and secondaries and eliminate or tend to greatly reduce the partial vacuum or zone of reduced pressure normally existent at the downstream sides of the primary filaments. The abutments, baffle means, or the discharge of air in the zone rearwardly of the primaries has the effect of slowing down the blast velocity in the center or core of the blast which substantially reduces the tendency of the fibers to be diverted or moved laterally of the center zone of the blast. The reduction in velocity at the central zone of the blast aids in directing or maintaining the secondaries of the filaments in the central and therefore the hottest zone of the blast in a manner to attain continuous attenuation of fibers without the formation of the glass pellets or hot slugs.

The retardation of the rate of travel of the central zone or core of the blast, which unimpeded in the zone of highest speed of the gases, eliminates the substantial differential in the velocity of gases at the central zone as compared with that of the gases bounding the central zone, a factor which otherwise influences or tends to divert the path of the secondaries into the zone of partial vacuum. By obtaining substantially uniform velocities of the gases throughout the cross-sectional area of the blast as is attained by the invention, the secondaries remain substantially at the central zone of the bast even though the rate of feed of the primary filaments may vary and the temperatures and velocity of the gases deviate from predetermined standards. Hence these factors, which have heretofore been extremely critical in obtaining optimum fiber attenuation conditions, may vary to a considerable extent without disrupting fiber attenuation and without resulting in the formation of slugs or pellets of unfiberized glass.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than is herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

What I claim is:

1. A method of forming fibers from elongated bodies of fiber forming material including establishing a heating zone of a moving stream of hot gases; of advancing a substantially solidified body of fiber forming material into the heating zone whereby the extremity of the body becomes softened and attenuated to fiber form by the heat and velocity of the moving gas stream, and of establishing a medium for increasing the pressure of the gases of the blast adjacent the side of the body in the direction of flow of the gases to modify the direction of movement of the softened material during attenuation thereof to fibers.

2. A method of forming fibers from primary filaments of fiber forming material including establishing a heating zone of a moving stream of hot gases; of advancing a substantially rigid primary filament into the heating zone whereby the extremity of the filament becomes softened, and of establishing a medium increasing the pressure of

the gases at the side of the primary filament disposed in the direction of the downstream flow of the gases to direct the softened extremity of the filament into the gas stream during attenuation thereof to fibers under the influence of the velocity of the moving gases.

3. A method of forming fibers from primary filaments of fiber forming material including establishing a heating zone of a moving stream of hot gases; of advancing a substantially solidified primary filament into the heating zone whereby the extremity of the filament becomes softened and attenuated to fiber form by the moving gas stream, and of establishing a medium for substantially equalizing the pressure of gases surrounding and adjacent the softened extremity of the primary filament in the gas stream to substantially eliminate tendency of the softened material to be deflected away from the stream of moving gases.

4. A method of controlling the formation of fibers produced by attenuation from primary filaments including advancing a substantially solidified primary filament into a stream of hot gases in a manner whereby the advancing end is rendered soft and flowable; of attenuating the flowable portion to fiber formation by the velocity of the gas stream; and of establishing substantial fluid pressure adjacent the softened portion of the filament at the side thereof toward the downstream flow of the gas stream to bias the softened portion of the filament into the gas stream during attenuation of the softened material to fibers.

5. A method of eliminating the formation of slugs during the production of relatively fine fibers by attenuation including continuously feeding an elongated body of heat softenable material into a stream of hot gases moving at relatively high velocity whereby the material is attenuated into fibers; and of establishing an impediment in a zone in the gases of the blast at the side of the body of material that is downstream with respect to the direction of flow of the gases for reducing partial vacuum in said zone for controlling the direction of movement of fibers in the attenuating zone of the gas stream.

6. A method of eliminating the formation of slugs during the production of relatively fine fibers including continuously feeding an elongated substantially rigid body of heat softenable material into a stream of hot gases whereby the material is attenuated into fiber formation, and of directing an independent stream of fluid into a zone at the side of the body in the direction of downstream flow of the gases for establishing substantially uniform pressure at the attenuating zone of the gas stream.

7. A method of producing relatively fine fibers including continuously feeding a body of heat softenable material in a nonflowing state into a stream of hot gases whereby the material is softened and attenuated into fiber formation, and of establishing a pressure equalizing medium in a zone at the side of the portion of the material in the gas stream in the direction of flow of the gases for maintaining the material in the gas stream during attenuation.

8. A method of forming fibers from fiber forming materials including the steps of establishing a heating zone of moving gases; of advancing a supply of fiber forming material in nonflowing condition into the heating zone whereby the material is entrained in the moving gas stream to form fibers; and of establishing a medium for augmenting the gas pressure in a zone at the side of the advancing portion of material that is downstream with respect to the direction of flow of the gases and within the zone of the moving gases to retard the velocity of the moving gases in the central zone of the stream.

9. A method of attenuating fibers from heat softenable material including establishing a material heating zone provided by a moving stream of intensely hot exhaust gases; advancing a filament of heat softenable material into the gas stream in a direction substantially normal to the direction of movement of the gas stream; and of establishing a pressure equalizing medium at that side of the filament that is downstream with respect to the direction of flow of the gas stream to effect a retardation of velocity of the gases at the central zone of the gas stream to maintain the attenuation of fibers substantially in the central zone of the stream.

10. A method of attenuating fibers from heat softenable material including establishing a material heating zone provided by a moving stream of exhaust gases; advancing a filament of heat softenable material into the gas stream in a direction substantially normal to the direction of movement of the gas stream, and of establishing fluid pressure at the side of the filament that is downstream with respect to the direction of flow of the gases by directing an independent flow of gas angularly into the exhaust gas stream to effect a retardation of velocity of the gases at the central zone of the exhaust gas stream to maintain the attenuation of fibers substantially in the central zone of the stream.

11. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a combustion chamber adapted to burn combustible gases in a confined zone, said chamber having a restricted outlet for the extrusion of the hot gases of combustion; means for feeding a filament of fiber forming material into the exhaust gases in a direction normal to the flow of the gases and adjacent the outlet for attenuation of the filament into fibers, said filament interrupting the normal flow of gases of the blast adjacent the filament establishing unequal gas pressures adjacent the filament, and means for increasing the gas pressure at the side of the filament downstream of the blast for controlling the movement of the fiber forming material during attenuation.

12. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a combustion chamber adapted to burn combustible gases interiorly, said chamber having a restricted throat for the extrusion of the intensely hot exhaust gases of combustion, means for feeding filaments of fiber forming material into the exhaust gases adjacent the throat for attenuation of the filaments into fibers, said filaments impeding the normal flow of the gases at one side of the filament establishing unequal gas pressures at opposite sides of the filament, and means effective at the side of the filament downstream of the flow of the gases for establishing increased gas pressure adjacent the filament for controlling the path of movement of the fiber forming material during attenuation.

13. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot, high velocity blast; means for feeding an elongated body of heat softenable material into the blast adjacent the orifice, and baffle means disposed in the stream of gases forming the blast adjacent the body of material at its zone of entrance into the blast for retarding the velocity of the gases in the central zone of the blast.

14. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot, high velocity blast; means for feeding an elongated body of heat softenable material into the blast adjacent the orifice, and means including an impediment disposed in the path of flow of the gases adjacent the body of material at its zone of entrance into the blast for establishing a more uniform pressure of gases of the blast at said zone.

15. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot,

high velocity blast; means for feeding elongated bodies of heat softenable material into the blast adjacent the orifice, said bodies impeding the flow of gases of the blast establishing zones of unequal gas pressure adjacent the bodies and means including a plurality of baffles disposed adjacent the bodies of material in the path of the moving gases at the zone of entrance of the bodies into the blast for substantially equalizing the pressures of gases of the blast at said zone.

16. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot, high velocity blast; means for feeding an elongated substantially rigid body of heat softenable material into the blast adjacent the orifice, and a tubular member disposed adjacent the body of material and having an outlet, said tubular member being adapted to direct a gas under pressure through the outlet into the zone adjacent the body of material downstream of the blast for establishing substantially uniform gas pressure in said zone.

17. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot, high velocity blast; means for feeding an elongated substantially rigid body of heat softenable material into the blast in a direction normal to the blast and adjacent the orifice, and a tubular member disposed adjacent the body of material and having an outlet, said tubular member being adapted to direct a gas under pressure through the outlet into the zone at the side of the body of material downstream of the blast for increasing the gas pressure in said zone.

18. Apparatus for producing relatively fine fibers from heat softenable material including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot, high velocity blast; means for feeding an elongated body of heat softenable material into the blast adjacent the orifice whereby gases of the blast impinge upon the body at one side and set up a zone of reduced gas pressure at the opposite side of the body; means including an impediment disposed adjacent the side of the elongated body in the path of the moving gases effective to increase the pressure of the gases at the zone of reduced pressure, and means for adjusting the position of the impediment relative to the body for controlling the extent of increase in the gas pressure at said zone.

19. Apparatus for producing relatively fine fibers from glass including, in combination, a chamber adapted to burn a combustible mixture in a confined zone and having a restricted orifice through which the gases of combustion are projected as an intensely hot, high velocity blast; means for feeding filaments of glass into the blast adjacent the orifice whereby the filaments obstruct the normal flow of a portion of the gases of the blast and establish zones of reduced gas pressure adjacent the filaments; baffle means disposed adjacent the sides of the filaments in the zones of reduced pressure, and means for adjusting the relative position of the baffle means for controlling the gas pressures at the said zones.

References Cited in the file of this patent

UNITED STATES PATENTS

2,489,243	Stalego	Nov. 22, 1949
2,515,738	Slayter et al.	July 18, 1950
2,578,101	Stalego	Dec. 11, 1951