March 6, 1934. H. J. BLUM 1,950,219

SPUN GLASS METHOD AND APPARATUS

Filed Jan. 7, 1931 3 Sheets-Sheet 1

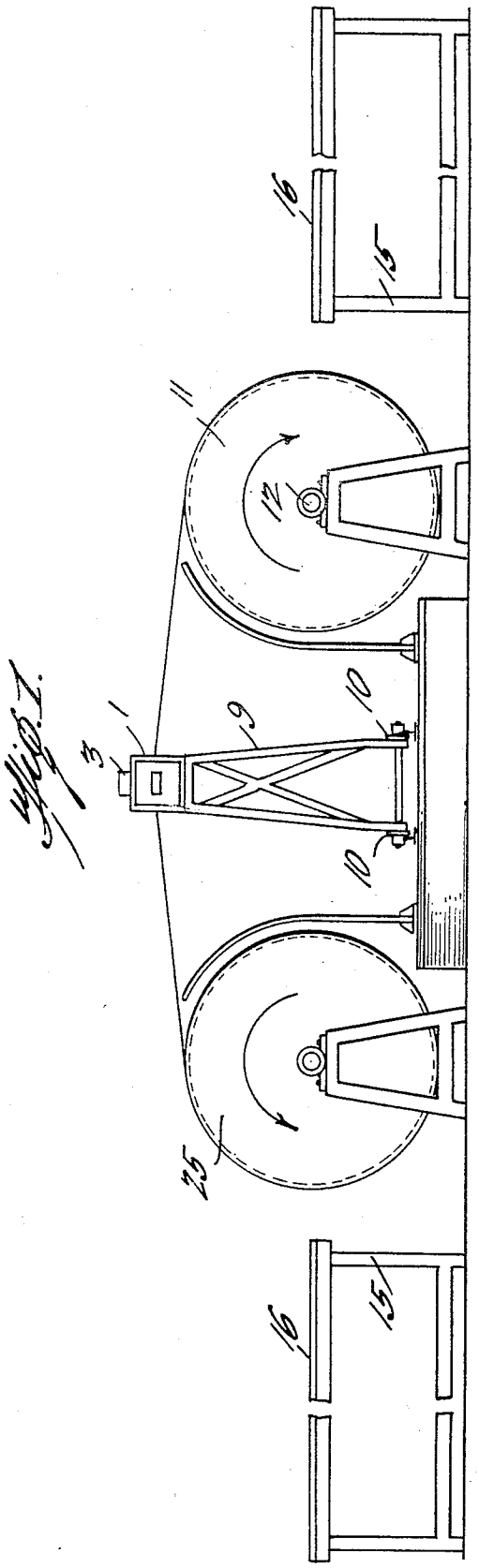


Fig. 1.

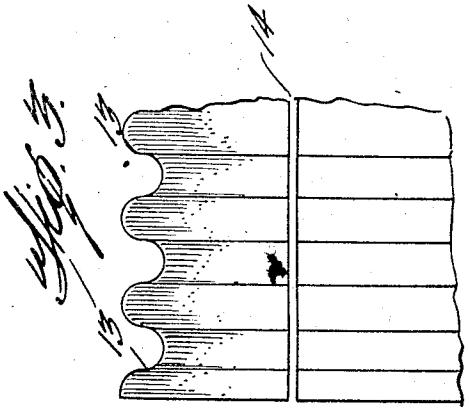


Fig. 3.

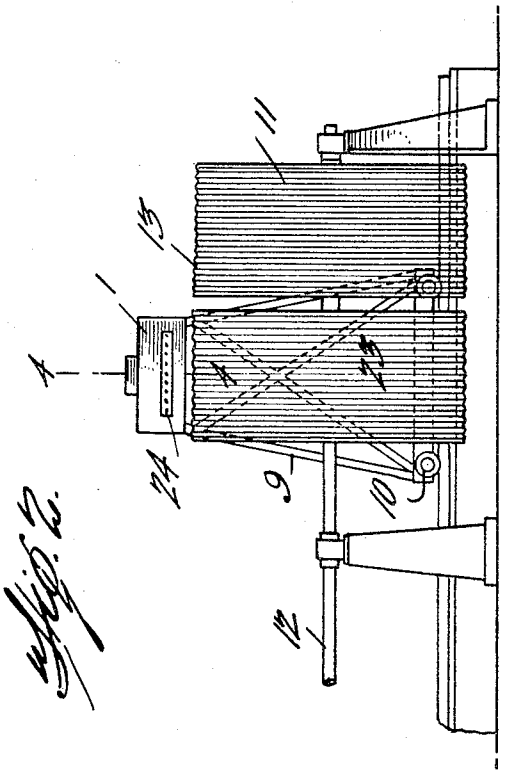


Fig. 2.

INVENTOR.
HANS J. BLUM
BY
ATTORNEY.

March 6, 1934. H. J. BLUM 1,950,219

SPUN GLASS METHOD AND APPARATUS

Filed Jan. 7, 1931 3 Sheets-Sheet 2

Fig. 4.

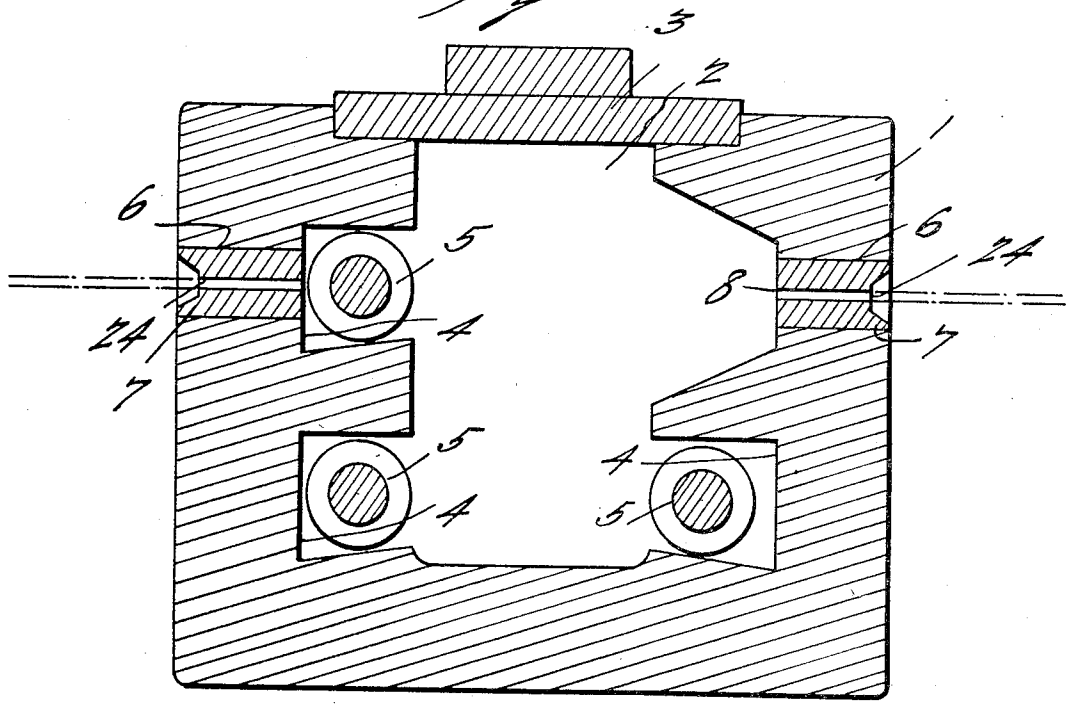


Fig. 5.

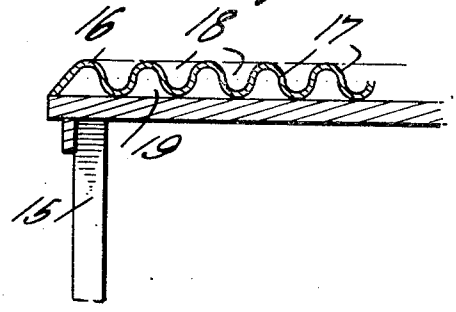
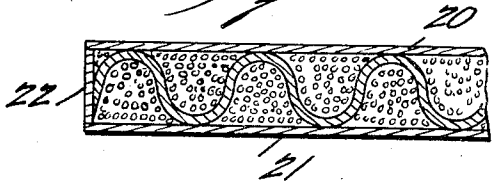


Fig. 6.



INVENTOR.
HANS J. BLUM
BY
ATTORNEY.

March 6, 1934. H. J. BLUM 1,950,219

SPUN GLASS METHOD AND APPARATUS

Filed Jan. 7, 1931 3 Sheets-Sheet 3

Fig. 7.

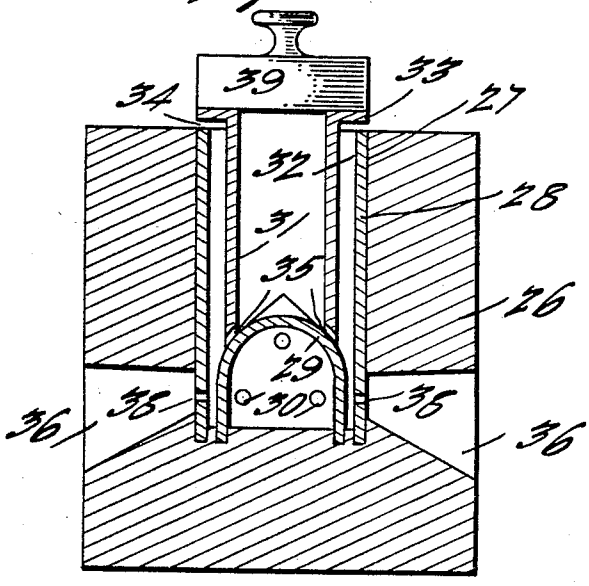
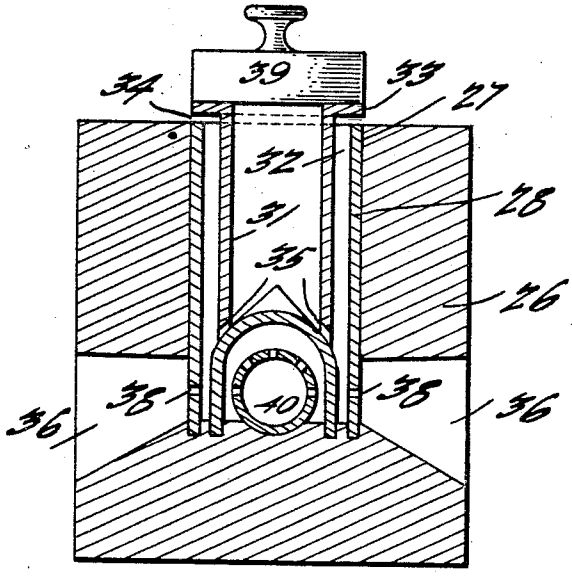


Fig. 8.



Inventor

HANS J. BLUM

By

Attorney

Patented Mar. 6, 1934

1,950,219

UNITED STATES PATENT OFFICE

1,950,219

SPUN GLASS METHOD AND APPARATUS

Hans J. Blum, New York, N. Y.

Application January 7, 1931, Serial No. 507,258

4 Claims. (Cl. 49—17)

This invention is directed to a method and means for producing insulating bodies of the type wherein a layer of spun glass or other similar type filaments held in place by sheet coverings constitute the form of the element.

It has been heretofore proposed to arrange an indiscriminate grouping of spun glass filaments between upper and lower sheet coverings to constitute an insulating element or body. It is recognized that the effective protective insulating effect of such bodies, particularly with regard to hot and cold insulation, is largely incident to the dead air spaces between adjacent filaments, and while it is comparatively simple to maintain an effective thickness of such grouping of spun glass filaments throughout the greater portion of the width of the body formed, it has proven practically impossible to maintain this effective thickness of filaments at the extreme side edges of the body owing to the lack of provision for holding the filaments in place in the effective thickness.

As a result of this heretofore conventional arrangement, the side edges of a particular insulating body are less effective for insulating purposes than the main width of the body, and thus if the body is used, for example, about a pipe or the like, the meeting ends of the body must be wrapped in order that the insulating effect at such meeting ends will be at least equal to that of the remaining portion of the body. This naturally requires a greater width of body than would be required if the effective insulation of the body were the same throughout its full width, and hence where wrapping is necessary, there is a loss of material, to say nothing of the time and labor required in so arranging the body.

The primary object of the present invention is a method of constructing insulating bodies involving spun glass filaments or other similar material of long fibres as the insulating element in which the thickness of the filaments at the extreme side edges of the body are equal to the thickness of the filaments at any portion of the body, so that the effective insulating properties of the particular body are the same throughout its full width and permitting the body, when used about a pipe for example, to be joined at the meeting edges by edge contact, avoiding the time, labor and wastage of material necessary in wrapping such edges, as is now conventionally required.

The invention also has for its object the production of an apparatus for producing the spun glass or other similar material of long fibres in a manner to permit carrying out of the method employed for constructing the body, such apparatus involving means for automatically drawing the filaments from the furnace following the starting of the apparatus and the placement of these filaments in such relative relation as to facilitate the carrying out of the method.

The method consists in arranging the filaments within the body in a series of independent groupings, with the groupings so related that substantially the same number of filaments are included in any vertical section through the insulating body. Thus, no matter where the body may be divided longitudinally or transversely, the same vertical thickness of filaments are present at the edges of such division as at any other point in the body. Thus, the protective insulating depth of the body is the same throughout its length and breadth to and including its marginal edges, so that the marginal edges have the same protective influence as any other portion of the body.

In providing this type of body, the body is divided by a convolute partition, the convolutions of which may extend either longitudinally or transversely. The spun glass filaments are arranged in groups, one group to each convolution. Thus, on each side of the convolute partition there are a series of spaced groupings of spun glass filaments or other similar material of long fibres so that each group is separated from every other group, while substantially the same number of filaments is included in any vertical division of the body, whether this division is through one group alone or through the marginal edges of two groups.

The method of constructing the body also includes a means for drawing the glass filaments or other similar material of long fibres from the furnace in a series of independent groupings and transferring these groupings as independent groupings to a corrugated base, that is, to the spaces formed in one surface of such corrugated base. Following the completion of one side of the body by filling one side of the corrugations with the independent groupings of spun glass filaments or similar material of long fibres, a cover section is applied to hold these filaments in their convolute spaces, and the convolute base is reversed and the now open convolute spaces filled with a successive series of groups of the spun glass filaments or other similar material of long fibres and the surface section applied. The end sections may be extensions of the respective surface sections turned down at the end to secure that proportion of the filaments in the respective con-

volute spaces as may appear at the ends of the particular body partition. The article is thus complete and substantially the same number of spun glass filaments or other similar material of long fibres appear in any vertical line of the body, whether this line be at the central portion or immediately adjacent the side edges.

The apparatus employed in connection with the improved method is illustrated in the accompanying drawings, in which:—

Figure 1 represents diagrammatically a furnace, two opposed spinning wheels, and two tables to receive the spun filament groupings from the wheels.

Figure 2 is an elevation illustrating the adaptability of the furnace to be used with adjacent wheels to thereby permit a particular wheel to be used for spinning, while an adjacent previously operated wheel is being operated for the removal of the previously spun filaments.

Figure 3 is an enlarged transverse broken section of the filament-receiving surface of the spinning wheel.

Figure 4 is an enlarged vertical section of the furnace.

Figure 5 is an enlarged broken transverse section of the table showing one of the convolute partitions thereof.

Figure 6 is a sectional view of the complete article.

Figure 7 is a vertical sectional view of a modified form of furnace.

Figure 8 is a similar view of another form of furnace.

The furnace for use in connection with the present apparatus is more particularly illustrated in Figure 4. As here shown, it comprises a refractory body 1 of appropriate interior area having an opening 2 for the reception of the glass mass of particles to be melted, a cover 3 closing this opening when desired. The interior of the furnace is formed with off-set recesses 4 in which are arranged electric heating elements 5, preferably in the form of rod-like members and of an appropriate character to insure even heat distribution without liability of damage from the molten glass. For example, the heating elements may be constructed in the form of fused silica rods embedded in porcelain tubes to prevent mechanical damage. The heat afforded by these rods, which are, of course, electrically energized, must be that necessary to melt the glass pieces into a proper liquid form for spinning, that is, the glass should be in a molten form which will not of itself easily discharge through the discharge openings.

The glass furnace 1 is formed at an appropriate height and in preferably its front and rear walls with an opening 6 to receive an appropriate refractory filling 7 in which there are formed in longitudinal alignment a plurality of openings 8. As will later appear, the furnace is designed particularly for use in spinning glass from both the front and rear portions thereof, though it is quite obvious that if the intention is to utilize the furnace for permitting withdrawal of the heated glass in but one direction, then one wall of the furnace will be intact and the outlet openings 8 formed in the other wall. The furnace proper is mounted upon a frame 9 supported on a wheeled truck 10 so that it may be moved from place to place for a purpose which will later appear.

The spinning apparatus includes a spinning wheel 11 supported upon a shaft 12 and appropriately driven by any suitable mechanism. As the heating of the glass in the furnace is electrically controlled, it is contemplated that the spinning wheel will be electrically driven and that any appropriate form of mechanical control of the current will be provided whereby the desired current supplied to the furnace and to the means for operating the spinning wheel may be governed in accordance with the requirements in each particular instance. The peripheral surface of the spinning wheel is formed in a series of convolutions, indicated more particularly at 13 in Figure 3, these convolutions extending circumferentially of the wheel in regular order, and preferably being interrupted transversely of the wheel by a slot, indicated at 14 in Figure 3, which slot, of course, while including perforations, does not completely divide the rims of the wheels.

Arranged in advance of the wheel is a table 15 on which, for the purpose of carrying out the method, is to be positioned what is hereinafter termed a body partition 16 of appropriate material and formed with a series of convolutions 17 which present alternate openings 18 and 19 on the respective sides of the partition.

In carrying out the method, assuming the molten glass or similar material of long fibres in the furnace to be of the proper consistency, the operator will insert a glass rod in the openings 8 successively, the withdrawal of the rod following each introduction thereof drawing through the opening a thin filament of glass due to the adherence of the glass rod to the molten metal within the furnace. This filament, by means of the glass rod, is transferred to the appropriate convolution 13 on the spinning wheel in line with the particular opening from which the filament is withdrawn. As the molten glass at the end of the filament is hot, the end of the filament will adhere to the surface of the wheel. This operation is continued until a thin filament of glass or the initial terminal of such filament is connected to each of the convolutions 13 of the spinning wheel or as many of such convolutions as may be desired in the particular operation. It is, of course, understood that the respective filaments pass through respectively different openings 8 in the furnace.

Following the connection of the filaments to the desired number of wheel convolutions, the spinning wheel is started in slow rotation. The filaments are thus drawn through the openings 8 of the furnace and successively wound on the spinning wheel, each filament being confined, of course, to its own particular convolution of that wheel. The operation continues until the charged convolutions of the wheel are filled to the desired depth with the filament.

It is important that the filaments in the final insulating body be free of connection one with the other, and it is understood and demonstrated as a matter of actual practice that the glass filaments will be sufficiently cooled between the furnace and wheel to ordinarily prevent any adherence between the filament strands. It is contemplated, however, that artificial cooling means, such as a fine water spray or the like, may be directed onto the filaments, if desired, prior to their being laid in on the wheel to sufficiently cool the filaments to prevent any possibility of their adherence. This water spray may be arranged at the bottom of a wheel, though other artificial cooling means may be employed and appropriately located if desired.

If the molten glass is at the proper tempera-

ture, the filament can be continuously drawn out of the opening of the furnace without breaking, though if for any reason it should break, it can be replaced in proper position on the wheel by the use of the glass rod employed to initially withdraw the filament. When a sufficient quantity of filaments have been collected on the wheel, that particular wheel may be stopped and the endless rows of filaments divided by a knife drawn through the slot 14. One end of such grouping of filaments is lifted from the wheel and gradually drawn off the wheel by rotating the same and the filaments in their groupings laid in the openings, for example, 18 of the insulated corrugated partition 16 arranged on the table 15. A backing sheet 20 is then applied to the upper edges of the filled convolutions of the partition 16 and the thus partially completed body reversed upon the table to present the openings 19 of the corrugations of the partition uppermost. If but a single wheel is being used, the wheel is re-charged and when the desired number of filaments are in place thereon, the previous operation is repeated and such rows of filaments placed in the openings 19 of the partition 16 and the other backing or surface sheet 21 applied, following which the side edges are secured by edge strips 22 which may, if desired, be extensions of the backing sheet when the body is complete.

The invention contemplates, however, that while the spun glass filaments are being removed from one wheel, a second adjacent wheel is being charged in order that the operation may be a continuous one. Thus, as indicated in Figure 2, a second wheel 23 may be arranged adjacent the initial wheel 11, and following the filling of the latter, the furnace is moved on its truck 10 to a position to deliver to the second wheel 23. After the second wheel is filled, the table 15 with the reversed body is moved opposite the second wheel and the body completed, during which operation, of course, the furnace has been returned to a position in alignment with the wheel 11 and the latter is being charged.

The invention also contemplates, as previously stated, the use in connection with the furnace of outlet openings 24 directly opposite the openings 8, in which event the wheel 11 which is charged from the openings 8 of the furnace will be duplicated by wheel 25 mounted on the opposite side of the furnace so that the furnace may be serving the wheels 11 and 25 simultaneously. Of course, in this use it is also contemplated that the wheels 11 and 23 which are mounted in spaced relation on the same shaft will be duplicated with respect to the wheels on the opposite sides of the furnace so that when the furnace is employed for serving opposite wheels at the same time, this function may be permitted to continue when the furnace is transferred to adjacent wheels. In fact, if desired, the invention may contemplate a battery of wheels arranged in adjacent pairs, either at one side or both sides of the furnace and the furnaces provided one for each pair of wheels for, as a matter of fact, the operation of charging the wheels is a comparatively slow one due to the finenesss of the filament and the number of turns required to fill the wheel and, therefore, a single operator can well take care of a battery of wheels and a plurality of furnaces without unusual exertion.

The invention so far described is concerned particularly with spinning glass filaments for the charging of an insulating body of a particular form. The invention, however, extends beyond this particular result and is concerned with the spinning of the glass in fine filaments without regard to any particular relation of the filaments on the wheel. In this event, the wheel will be of unbroken periphery except for the dividing slot and the application of the initial end of the filament withdrawn through the use of the glass rod, as described, will be applied to the surface of the cylinder in line with the opening in the furnace. Thus, on the revolution of the cylinder, the filaments will be withdrawn from the furnace without particular division between them but in more or less regularity of alignment until the surface of the cylinder contains a requisite thickness of filaments. After the requisite thickness of filaments have been accumulated on a particular wheel, the filaments may be divided, as previously stated, and the mass of filaments withdrawn and arranged in any desired insulating receptacle and, if desired, they may be intertwisted or braided to prevent entanglement or connected together in other forms to insure their proper relation within the margins of the insulating body.

Therefore, the invention contemplates the method of spinning glass filaments consisting in providing a furnace in which glass particles are melted to a proper consistency, the initial withdrawal from the furnace of a plurality of filament ends, and the attachment of these filament ends to the surface of a wheel, followed by the continuous rotation of the wheel to draw a glass filament from each of the openings of the furnace utilized, and to continue the rotation of the wheel until the filaments have accumulated thereon to the depth desired for that use of the filament contemplated. The special use in dividing the filaments in spaced groups as initially described is of importance in creating the particular type of insulating body desired, though it is to be understood that while this is a desirable characteristic of the present invention, such invention either in method of apparatus is not limited to the provision on the surface of the wheel of any means for dividing the filaments, nor to the use of such filaments when separated from the wheel in connection with a body of a particular type.

Thus the invention contemplates broadly a method of spinning glass in continuous filament form, as well as a more specific method of dividing the spun filaments in group relation for a particular purpose.

A modified form of electrically heated furnace is shown in Figures 7, wherein 26 represents a refractory body of appropriate size formed with a vertical opening 27 in which there is arranged a refractory lining 28. The opening 27 does not extend entirely through the body 26, and on the bottom or base of such opening and rising above the same is arranged a wall 29, the side portions of which are in spaced relation to the lining 28, and the upper portion of which presents rounded or downwardly divergent areas in both directions from the vertical median line of the opening 27. The wall 29 constitutes or defines in the space enclosed within said wall the heater or furnace, there being in the particular figure referred to a plurality of electric heating elements 30 of the resistance type.

A material receiving chamber is formed within the opening 27 and above the furnace by a cylindrical body 31 having a diameter less than that of the refractory lining 28. This material receiving chamber is supported at its lower end directly on the furnace wall 29, and by reason

of its inferior diameter provides an annular space 32 between it and the refractory lining 28. The upper end of the material receiving chamber 31 extends slightly above the upper end of the body 1 and has an outstanding flange 33 which overlies the upper end of the refractory lining 28 to provide an atmospheric opening 34 to the space 32.

The lower edge of the body 31, that is, the edge resting upon the furnace wall 29, is formed with a series of openings 35 to establish communication between the interior of the material receiving body 31 and the space 32. Of course, the molten material flows through these openings 35 and they may be formed as a series of openings ranging successively throughout the lower edge of the material receiving body 31 or such lower edge of the body may be formed with an elongated slot extending substantially throughout the whole length of the body, with end portions resting on the furnace wall to maintain the slot in open relation at all times.

The refractory body 1 laterally of the furnace wall 29 and beyond the refractory lining 28 is formed with outlet openings 36, the lower wall of which is downwardly convergent, as at 37, and in the refractory lining 28 about centrally of the vertical dimension of the inner end of the opening 36 there are formed a series of minute openings 38 extending in longitudinal succession and providing access to the molten metal space 32 for the initial withdrawal of the spun glass or other type of filament, as described in connection with the previously noted type of furnace. The lateral flange 33 of the material receiving body 31 is designed to receive a capstone 39 which closes the upper end of the material receiving body.

Of course, if the furnace is designed for single use, there will be provided but a single opening 36 on one side wall. If the furnace is intended for double use, this opening 36 will be duplicated on opposite sides, as indicated in Figure 7.

Figure 8 is identical with the construction shown in Figure 7, except that the heating element, here indicated at 40, is shown as a burner for use with gas, oil or other fuel. In this respect, the furnace shown in Figure 8 differs from that shown in Figure 7, the details being otherwise the same and indicated by the same reference characters. Through these modified forms of furnace it is, of course, understood that electric power or fuel heat may be utilized in melting the material to be spun into filaments.

It is understood that the raw material is delivered into the material receiving body 31 and brought to a proper molten condition by the heat of the furnace, either electrically or fuel heated, the molten material flowing through the openings or slots 35 into the molten material space 32, thus providing a supply of material adjacent the openings 38 for withdrawing, as described in connection with the previously indicated furnace.

It is to be understood that while the present apparatus is described as designed more particularly for use with glass, any known or other material which may, under the action of heat, be brought to a condition permitting it to be drawn out into filament form may readily be used in place of glass. In the use of glass, however, the material ordinarily used is waste material made up of broken glass bottles and other glass parts, for which waste there is little demand and which naturally exists in large volumes. Of course, the invention contemplates any grade of material, though, as stated, is particularly adapted for the handling of the waste broken material referred to.

I claim:—

1. An apparatus for the production of spun glass filaments or similar material of long fibres including a plurality of rotating elements, means for independently rotating said elements, a furnace to receive the glass to be melted, means in the furnace for melting the glass, said furnace being formed in one wall with filament openings, the initial filaments being withdrawn through said openings manually and connected to one of the rotating elements for subsequent continuation of filament withdrawal and the collection of filaments on the element as the latter is rotated, the furnace being adapted for bodily movement to be arranged for successive cooperation with the respective rotating elements.

2. A method of simultaneously producing a plurality of completely segregated, rope-like masses of spun glass filaments, consisting in providing a molten mass of material, withdrawing a plurality of filaments from said mass, accumulating a series of wholly segregated masses of filaments, each made up from a single filament from the molten mass and in the form of an endless body, and dividing said bodies simultaneously to present wholly segregated, independent, rope-like bodies, each made up of a plurality of glass filaments.

3. An apparatus for the production of spun glass filaments, including a furnace in which the material has been melted, filament openings formed in the furnace, each of the openings being formed to permit the passage therethrough of a filament from the melted material, a single rotating element in advance of the furnace formed to present endless spaced channels rotating in a plane in alignment with the filament openings, said channels serving to withdraw a plurality of filaments simultaneously from the furnace and arrange the filament in an endless mass of increasing thickness during the rotation of the element, said channels further maintaining complete segregation of each mass of filaments, whereby to draw from a single furnace a plurality of endless, completely segregated bodies, each made up of a single filament.

4. An apparatus for the production of spun glass filaments, including a furnace in which the material has been melted, filament openings formed in the furnace, each of the openings being formed to permit the passage therethrough of a filament from the melted material, a single rotating element in advance of the furnace formed to present endless spaced channels rotating in a plane in alignment with the filament openings, said channels serving to withdraw a plurality of filaments simultaneously from the furnace and arrange the filaments in an endless mass of increasing thickness during the rotation of the element, said channels further maintaining complete segregation of each mass of filaments, whereby to draw from a single furnace a plurality of endless, completely segregated bodies, each made up of a single filament, said rotating element being formed with a groove transverse and opening through all of the channels to permit of the simultaneous separation of all masses of filaments in the channels and to permit withdrawal of said masses from the rotating element, the channels in the element serving to maintain complete segregation of the filament bodies during such withdrawal.

HANS J. BLUM. [L. S.]