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APPARATUS FOR FIBERIZING FUSIBLE INORGANIC SUBSTANCES AND FORMING THE FIBERS INTO BATS

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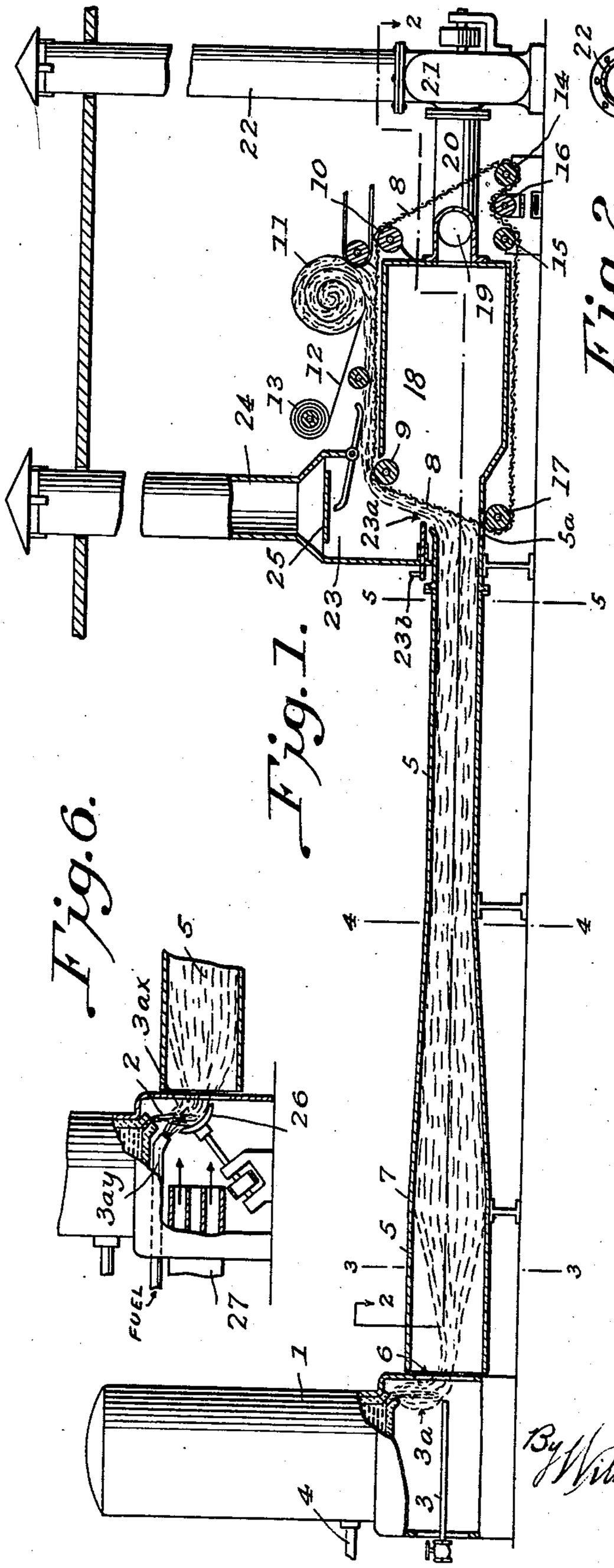

Fig. 1.

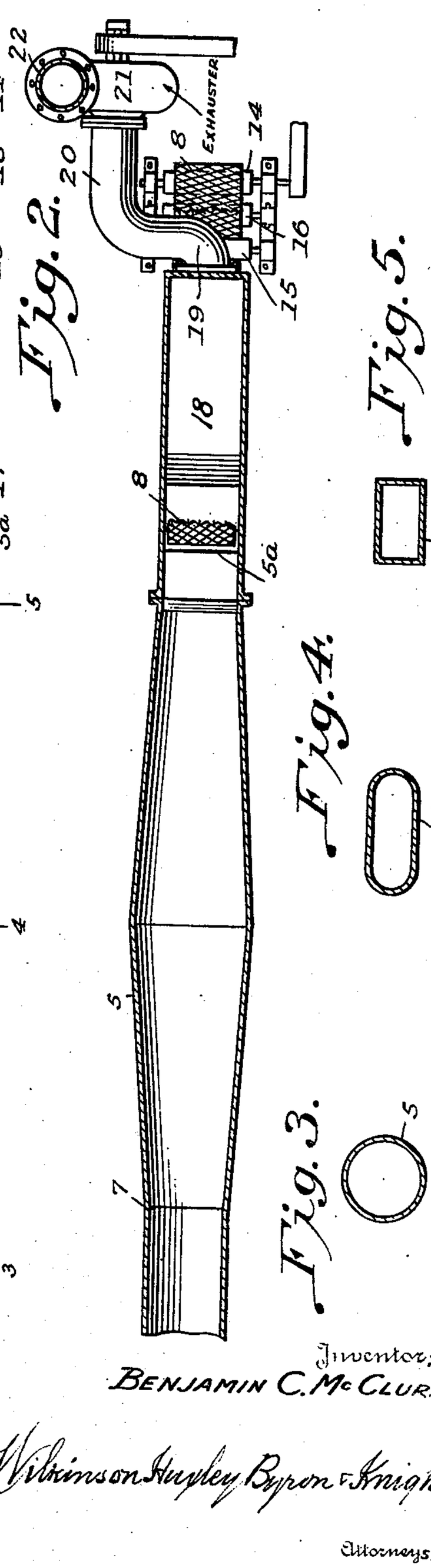

Fig. 2.

Fig. 4.

Fig. 5.

Fig. 3.

Fig. 7.

Fig. 6.

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APPARATUS FOR FIBERIZING FUSIBLE INORGANIC SUBSTANCES AND FORMING THE FIBERS INTO BATS

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4 Claims. (Cl. 154—27)

This invention relates to apparatus for fiberizing fusible inorganic substances and felting the resultant fibers into bats; the substances used being preferably those productive of the bats constituting the claimed subject matter of U. S. Letters Patent No. 1,913,242, of June 6, 1933; although the invention is applicable to, and will work a material improvement in producing bats from fusible inorganic substances of inferior qualities.

The present application constitutes a continuation-in-part of U. S. patent application, Serial No. 672,234, filed May 22nd, 1933, (now Patent No. 2,172,153) which was a continuation in part of said Letters Patent No. 1,913,242. Letters Patent No. 2,172,153, while relating to the production of bats of inorganic fibers obtained under the known principle of flowing a stream of the inorganic substance in molten state, into the path of a blast of steam, air or other gas, that shreds or subdivides the substance into particles that become attenuated into fibers, introduces an important innovation in the procedure by which the fibers are generated as well as in the manipulation and disposal of the fibers that result, and the manner of their disposal in felting them into the bat which they ultimately form. That is to say:

Prior to the present invention, the art of blasting furnace slags, natural silicious rock and the like, to produce fibers that might be by special treatment, assembled in so-called bats of mineral wool, taught disposal of the fibers that resulted from the blast upon the operative principle of discharging the fibers through an opening in the wall of a relatively large settling room, with or without a defined passageway leading from the blasting point through the said wall; and it collected the fibers in the form of a bat by permitting them to settle by gravity, superinduced by partial exhaustion of air upon a traveling foraminous belt constituting the bottom of the room. Any substantial structural integrity in the resultant accumulation of fibers, was obtained only by the use of adhesive substances so applied as to hold the fibers together at their points of intersecting contact.

The innovation described and claimed in Patent No. 2,172,153 resides in a method of procedure that causes the blasting medium and the shredded or subdivided substance produced by the blast and borne in suspension to enter immediately into a constricted shaping, directing and positively projecting and depositing barrel, in which it continues under propulsion (for instance of the conserved blasting force), as an effective vehicle to the felting point; accompanied by heat sufficient to insure continued attenuation and consequent lengthening of the fibers and refinement of their caliber within the barrel; effecting the tempering of the fibers by controlled cooling; causing a more intimate commingling of the fibers as they continue suspended in the travelling fiber-ladened beam; insuring the maintenance of the sectional area of the beam, as well as density of fiber content in predetermined relation to the dimensions of arresting and felting surface; causing deflection of the fiber-ladened beam, upon arrival at the transversely travelling foraminous collecting surface and consequent positioning of the fibers in parallelism with the plane of the bat, and to a material extent, lengthwise of the bat, thereby increasing structural integrity of the bat; production of a cleaner product with respect to discarding so-called "shot" at the bottom of the barrel where upward deflection of the beam occurs; and withal, insuring a product that is greatly superior to those obtainable with blasting and felting procedures heretofore known.

But while in Patent No. 2,172,153 the inventive ideas above alluded to are defined in terms of an art or process, the patent also shows and describes novel instrumentalities through which to facilitate the realization of the improvements in the art or process. The present application as a division of the application of the said patent, is directed to these novel instrumentalities.

In the accompanying drawing:

Figure 1 is an elevation largely in vertical longitudinal section, of a complete apparatus constructed in accordance with the present invention.

Figure 2 is a detail view in longitudinal section in a horizontal plane, of the complete apparatus minus the fusing and blasting elements of the system.

Figures 3, 4 and 5 are transverse sections taken, respectively, on the lines 3—3, 4—4 and 5—5 of Figure 1.

Figure 6 is a detail view showing modified means for acting upon the molten mass to prefiberize it and deliver it into the path of the vehicular blast; also a means for developing a flame or hot gas environment around the molten mass for conserving its heat until fiberizing fully takes place, instead of the means shown in Figure 1 which contemplate taking some of the flame from the fire used for fusing the mass of mineral material.

1 represents a furnace that may be of any desired appropriate construction in which to melt

a batch of mineral substances, producing a molten mass appropriate for use in practicing the present invention, said furnace being equipped with means for delivering a stream 2 of the batch in fused condition, and means being also provided for maintaining around this stream, and at least as far as the point of fiberization, a high temperature gaseous environment, for instance, flame from the furnace or from another adjacent source, having the capacity of retarding the cooling of the molten mass until fiberizing has taken place. 3 represents a nozzle through which may be delivered a fiberizing medium, such, for instance, as steam under a substantial pressure, into which, as it issues, may automatically be drawn air which will become highly heated and compensate condensation of the steam in maintaining volume of and building up the vehicular beam that suspends and conveys the fibers. 4 represents a liquid fuel supply for the furnace, and is typical of a means for maintaining a desired temperature in the furnace.

Constituencies or formulas for preferred batches appropriate for practicing the present invention, will be found described and claimed in Patent No. 1,913,242, from the application for which the present case is in part a division and in part a continuation. Such batches comprise generally, silica, an alkali metal and an alkali earth fused together in proportions that will produce fibers having length and fineness that cause them to automatically felt themselves into a body having mass integrity sufficient to enable the body to retain its shape during manipulation and while in position of use. But I may use other fusible materials, for instance those constituting the subject-matter of my Patent No. 2,143,022, of January 10, 1939, in which I have described and claimed a felted body of fiberized mineral compound consisting of a silica source and an amphoteric material, with or without a basic material.

5 represents a duct, passageway, tunnel, or the like, which, by reason of the effect which it produces upon the fiberized mass in the present invention, and notwithstanding it may be of any desired section or of several sections at different places in its length, I herein refer to as the barrel. Barrel 5 has an opening of determined capacity at its end 6 for the influx of air induced by the blast of the nozzle 3, and it is preferably of circular section at this point in order that the body of air taken in under the influence of the blast located at the center of the section, may be uniform throughout. This circular section will preferably continue for a material distance, for instance, to a point suggested by the transverse line 7 in Figure 2, where it will begin to change its section for the dual purpose of exercising a desirable influence upon the fibers that are being borne through the barrel and causing the area of delivery of the said fibers as they leave the remote end of the barrel to assume a definite form in relation to the wall or surface upon which the fibers are collected. And this change of form is preferably attained by first reducing the transverse dimension of the barrel 5 in one direction, for instance, vertically, to bring it to a section typified by that shown in Figure 4 and which is attained at a point suggested by the line 4—4 of Figure 2; and thereafter reducing it in a direction perpendicular to the direction of first reduction and, in this illustrative instance, horizontally, so that the barrel attains the form of section shown in Figure 5, by the time the discharge end is reached, as suggested by the line 5—5 in Figure 2. The section shown in Figure 5 may constitute a substantial diminution of capacity or sectional area as compared with either the section of Figure 3 or that of Figure 4; and this sectional reduction will have a beneficial effect upon the work in that it condenses the mass of fibers, brings about increased intermingling or interlocking of the fibers while they are still borne upon the gaseous vehicle which is propelling them, and causes the mass to issue from the barrel in better condition to encounter the arresting wall.

The flame or gaseous heat sustaining environment 3a will become mingled with or added to the air that enters the barrel, since this air must pass through or around the said environment in entering the barrel and the result will be a material elevation of temperature in the vehicle upon which the fiber is borne, which has the effect of slowing down the cooling of the fiber and greatly improving its physical properties. It is also to be noted that the barrel confines against expansion the gaseous vehicle upon which the fibers are borne to the point of deposit and thereby retards dissipation of heat from the fibers, besides maintaining the density of the vehicle and better enabling it to serve its purpose as well as promoting intermingling of the fibers as an initial step toward the felting which results from their deposit upon the arresting wall.

The wall by which the fibers are arrested will preferably consist of a foraminous or reticulated structure, such as woven wire or the like as shown at 8, and in order that this wall may be ever present at the point of fiber collection and at the same time given a travel which enables it to bear away the felted fibers as they accumulate to the desired thickness, the material of the wall is continued to produce an endless belt guided over rollers appropriately located to not only present it as a collecting wall at the discharge end of the barrel but to present the accumulating blanket in position for any desired convenient handling. For instance, the reticulated endless belt or wall 8 may be guided around rollers 9 and 10 to present the blanket in position for developing into a roll 11 with a spacing sheet 12 fed from roll 13, and the said collecting wall may pass thence around drive rolls 14, 15 with intervening tensioning roll 16 and guide roll 17, which, with the guide roll 9, defines the position of the portion of the wall upon which the blanket is developed.

18 represents an air trunk which is so related to the rear side of the collecting wall 8 as to receive all that portion of the gaseous vehicle that passes through the wall 8 and prevents chokage or back pressure which would adversely influence the flow of the vehicle. 19 and 20 represent a discharge passage from the trunk 18, suitably elbowed to avoid interference with the endless belt 8. 21 represents an exhaust fan, typical of any means for inducing discharge from the trunk 18, which means, however, could be the draft naturally induced in the stack 22 by the levity of the discharged vehicle, which, it will be understood still retains a substantial proportion of the temperature resulting from the molten stream, the flame that accompanied it, the fiberizing medium, or all of them.

The escape port 23a, maintained between the discharge end of barrel 5 or that portion of the developed blanket on the wall 8 which is leaving the area of the barrel, preferably delivers into a

hood 23 having discharge stack 24 for carrying off dust and waste particles, communication between hood 23 and stack 24 being regulated by a baffle 25. By this means a substantial proportion of the propelled vehicular gaseous beam reaching the end of the barrel 5 is deflected upwardly in parallelism with the bed of fiber being deposited, and has a beneficial influence upon the structural integrity of the bat as well as its degree of freedom from shot which naturally settle on the bottom of the barrel en route and to the extent that they may continue with the bat upward, will remain next to the wire wall 8 and not be trapped in the bat structure. By regulating the draft at the port 23*a*, the flow of the fibers borne upon the upper portion of the gaseous vehicle, which might otherwise be undesirably reduced by reason of the thickening dimension of the blanket at that point, will be kept up so as to assure continued accumulation of fibers until the blanket passes from the influence of the barrel. Moreover, this deflection of flow of some of the gaseous vehicle toward the port 23*a* has the effect of directing the ultimate position of fibers which has a beneficial influence on the resultant blanket structure. To determine the proportion of this positioning effect, the volume of gaseous vehicle escaping through the port 23*a* in proportion to that which passes through the accumulating blanket and reticulated wall 8, may be determined by proper adjustment of baffle 25 and pressure in the air trunk 18.

As shown schematically in Figure 6, the stream 2, which may issue from the same source as in Figure 1, may be kept up to fiberizing temperature by a flame environment 3*ax* issuing from an independent adjacent burner 3*ay* instead of from the furnace as in Figure 1; and in lieu of the steam or air jet as a means of fiberizing, as shown in Figure 1, the stream 2 may drop upon a rapidly rotating receiver 26 of concave or other form, which will throw it off in fibrous form in the path of a gaseous blast 27 of annular or other form which will deliver the fibers in suspension into the barrel 5 as in Figure 1.

In the preferred embodiment of the apparatus, the gas collecting trunk 18 will be coextensive with the discharge end of the barrel 5 in the horizontal direction, but will extend vertically beyond the discharge end of the barrel at least a distance sufficient to induce suction over that portion of the foraminous member 8 which receives the upwardly deflected portion of the fiber-laden gaseous vehicle and which is enclosed in the housing 23, the suction of which causes said deflection. As in my Patent No. 1,913,242, the discharge end of barrel 5 may be spaced from the felting member as shown at 5*a* herein, in order to facilitate escape of shot at the place of upward deflection. The fiber concerned with the deflection will be held to the foraminous member by suction of the trunk 18, that is maintained in excess of the suction that induces the deflection. The volume of the deflected fibers may be influenced by opening 23*a* that is regulated by valve 23*b*.

From the foregoing it will be seen that the present invention simulates a gun in its action in that the barrel 5 confines the propelling gaseous beam; constricts its volume; conserves its heat and delivers the beam and its suspended fibers immediately against the felting member or accumulating bed of fibers thereon with an improved felting effect.

I claim:

1. Apparatus for fusing and fiberizing inorganic material and recovering the fibers as felt, said apparatus comprising a suitably mounted reticulated felting wall, means for delivering a stream of molten material, means delivering an auxiliary heating medium to and maintaining a hot environment around the path of the issued molten material and blasting means having connections through which it receives and delivers a propelled beam of vehicular gaseous material; said blasting means delivering said beam against the portion of the molten material that is within the hot environment and being directed toward the felting wall.

2. Apparatus for fusing and fiberizing inorganic material and recovering its fibers as felt, said apparatus comprising means for delivering a constricted stream of inorganic material in molten state, means supplying an auxiliary heating medium to and maintaining a hot environment around said stream, means fiberizing the molten material of said stream, means driving into and mingling with the heating medium of said environment during fiberization, means for delivering a propelled beam of vehicular gas, a confining and directing barrel having a receiving end located to receive said propelled beam of gas, and a fiber condensing member against which said barrel discharges.

3. Apparatus for fusing and fiberizing inorganic material and recovering its fibers as felt, said apparatus comprising a reticulated felting wall, means delivering a stream of molten material, means acting upon said stream of molten material to fiberize it, means supplying an auxiliary heating medium to and maintaining a hot environment around the molten material during fiberization, means driving into and mingling with the heating medium of said environment and the fibers being formed thereat, means for delivering a vehicular beam of gas that absorbs heat from the environment and takes the fibers into suspension, and a barrel having an intake end presented to receive said beam and a discharge end positioned to deliver against said felting wall.

4. Apparatus for fusing and fiberizing inorganic material and recovering the fibers in the form of felt, said apparatus comprising means for supplying a stream of molten material, means delivering and forcibly driving against said stream a vehicular beam of gas, a fiber condensing member, and a confining and directing barrel receiving said beam of gas and delivering it to said condensing member; said barrel having a predetermined configuration adjacent the material supply and varying in cross-sectional configuration longitudinally therefrom by an increase in cross-sectional configuration in the direction of the intermediate portion of said barrel to increase the dimension thereof in one direction and to reduce the dimension thereof in a direction substantially normal thereto, the said barrel having its cross-sectional configuration further changed from said intermediate portion toward said fiber condensing member to decrease the dimension in said one direction while substantially maintaining the dimension substantially normal thereto, thereby varying the form of the fiber laden beam to produce a uniform deposit of said fibers on said fiber condensing member.

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