J. E. COPENHEFER

AUTOMATIC GLASS LOADER

Filed July 13, 1959

INVENTOR.

JOHN E. COPENHEFER

BY

ATTORNEY
This invention relates to apparatus for the spinning of condensed filamentous mats and particularly to an automatic loading device for reciprocating furnaces employed therein.

The spinning of condensed filamentous glass mats and the subsequent operations thereon in the formation of expanded glass fiber mat material are generally described in Jackson U.S. Patent No. 2,798,531. Briefly, the spinning of the condensed filamentous mat includes the traverse reciprocation of a glass furnace axially above a spinning drum which rotates a multiplicity of times during each reciprocation of the furnace and the feeding of a plurality of filamentous material, conveyed by the spinning drum, onto the furnace drum surface to build up a cylindrical condensed filamentous mat thereon during successive furnace traverses. Subsequent operations include removal of a condensed mat of desired thickness from the drum and elongation thereof to a predetermined length with a consequent decrease in width and increase in thickness thereof to form a web of expanded glass fiber mat material which may then be severed into a plurality of discrete units of predetermined dimension.

Product specifications require that the expanded mat contain a predetermined weight of glass that there be a relatively uniform distribution thereof throughout the expanded mat to provide a weight uniformity in the resultant several products within predetermined tolerances. These desired characteristics can only be attained by the fabrication of uniform character condensed mats and the uniform fabrication of such mats requires a maintenance of uniform furnace heat, the maintenance of a uniform rate of glass filament withdrawal from the furnace which in turn requires, inter alia, the maintenance of a uniform head of molten glass within the furnace, and the maintenance or control of the spinning rate.

Prior efforts in this field have included the suspension of the reciprocating furnace and its contents upon a balance weight scale to provide a readily observable and continual check upon the weight of the furnace and its contents and to enable the machine operator to closely control the spinning rate and the level of the molten glass contained within the furnace. However, in the operation of such apparatus the furnace must be periodically incrementally replenished with raw glass to replace that drawn therefrom as indicated by the balance weight scale.

In the operation of such apparatus, the closer the operator maintains the weight of the furnace and its contents to its tare weight value, the greater is the frequency of the required incremental raw glass replenishment operations. Since the furnaces are usually elevated above the rotating drum and the operator's attention is required both at the drum and at the furnace, the required incremental replenishment of the furnace in fabrication of mats by such method has required a division of the time of operation in operators although resulting in the fabrication of condensed mats of improved character.

This invention may be briefly described as an improved apparatus for effecting the controlled spinning of condensed filamentous mats and includes means for sensing predetermined departures in the weight of the furnace and its contents from its tare weight value and associated means for automatically effecting the replenishment of the glass in a reciprocating glass furnace in accordance with said predetermined departures in the weight of said furnace and its contents from its tare weight values during the spinning operation.

Among the advantages of the herein described invention is a permitted extremely fine control of the head of molten glass maintained in a reciprocating furnace, the ready maintenance of a close degree of constancy of operations in the spinning of condensed filamentous mats, the provision of simple control for determining the amount of glass contained in any given mat at any given time, the effective removal of one critical variable that is partially determinative of the character of the finished product from the machine operators who therefore can more efficiently devote their energies and skills to control of other variables in the fabrication process, and the provision of simple and inexpensive apparatus that materially contributes to the fabrication of an improved product.

The object of this invention is the provision of improved apparatus for effecting the controlled spinning of condensed filamentous mats.

Another object of this invention is the provision of an automatic glass loading device for reciprocating furnaces in the fabrication of condensed filamentous mats.

Other objects and advantages of the invention will be pointed out in the following disclosure and claims and will be illustrated in the accompanying drawings which disclose, by way of example, the principles of the invention and the essentials of presently preferred apparatus incorporating said principles.

Referring to the drawings:

FIGURE 1 is a schematic side elevational view of the essentials of suitable apparatus incorporating the principles of the invention.

FIGURE 2 is a schematic circuit diagram of the essentials of the electrical control system incorporating the principles of the invention.

By way of general introduction the herein described apparatus includes means for rendering the reciprocating glass furnace and its contents continually balance weighable during the spinning operation, means for rendering a supply of glass or other raw material continually balance weighable and associated means responsive to predetermined departures of the weight of the furnace and its contents from its tare weight value for effecting the selective introduction of raw material into said reciprocating furnace at a predetermined position in its path of reciprocation.

As schematically shown in FIGURE 1 the rendering of the reciprocating glass furnace and its contents balance weighable is readily effected by mounting a balance weight scale on the drum traversing furnace carriage and suspending the glass furnace and the associated feeding funnel from the weight sensitive plate of the scale. A suitable arrangement includes a generally rectangular furnace carriage members 10 having wheels 13 mounted thereon adapted to run on a horizontally disposed track 14 and to be reciprocated in a predetermined path thereon by a drive mechanism (not shown) which preferably is of the type described in the above identified Jackson patent. The base portion 16 of a balance weight scale, generally designated 20, is mounted on the carriage member 10 and is reciprocable along the track 14 in conjunction therewith. The scale 20 includes the usual weight sensitive plate member 22 and an upwardly directed superstructure 24 for the balance weight arm 26. The furnace body 28 and its associated glass feeding funnel 30 are suspended from a supporting structure which includes a horizontally disposed supporting member 32 supported by the plate 22.
of the scale 20. By the above arrangement, the furnace 28 and its contents are rendered continuously balance weighable during the spinning operation.

The free end of the balance arm 26 of the scale 20 is utilized to operate an electrical switch member generally designated 34, whenever a predetermined departure in the weight of the furnace and its contents from its tare weight value occurs. The effect of such switch actuation will be described later in this specification. As shown in the drawings, the open mouth 36 of the furnace feeding funnel 30 is made of enlarged size in the direction of furnace reciprocation and has associated therewith an extending actuating arm 38.

The apparatus also includes a glass or raw material hopper 40 of a size to contain sufficient glass for a day's or more operations. The hopper 40 is suspended from the weight sensitive plate 42 of a balance weight scale 44 by suitable frame members 46. The scale 44 is mounted on a suitable supporting structure (not shown). The balance weight arm 48 of the hopper scale is preferably located on the spinning drum floor so as to be conveniently observable and settable by the machine operator and, as schematically shown in the drawings, the free end of the balance weight scale 44 is utilised to operate a switch member generally designated 50. The lower end of the hopper 40 is conventionally tapered as at 52 and terminates in a pan 54 having an air actuated vibrator assembly 56 associated therewith. The air actuated vibrator assembly 56 may suitably be a so-called Peterson Vibrator as manufactured by the Martin Engineering Co., of Kewanee, Ill. The essentials of such units are also disclosed in U.S. Patents 2,778,612 and 2,793,009. The vibrator actuated pan 54 feeds into a loading chute 58 having a gate 60 at the dependent end thereof. The gate 60 is pivotally mounted as at 62, biased in the closed position by a spring 64 and is provided with an upwardly extending actuating arm 66 adapted to be engaged and displaced, opening the gate, by the actuating arm 38 mounted on the reciprocating furnace assembly. The vibrator assembly 56 is conveniently operated by compressed air supplied through a line 68 having a solenoid operated valve 70 included therein.

As indicated earlier, the furnace assembly is horizontally reciprocated on the tracks 14 so as to traverse the surface of the spinning drum and for a predetermined portion of its traverse has the mouth 36 of the furnace feed funnel 30 disposed beneath the chute 58. Suitably positioned so as to be selectively actuated during the time period when said funnel 30 is disposed beneath the chute 58, as by engagement with one of the pressure assembly members, is an electrical location switch 72.

FIGURE 2 is a schematic circuit diagram of a suitable electrical switch arrangement to assure selective feeding of the reciprocating furnace only when the feeding funnel 30 is suitably positioned beneath the hopper chute 58. As there shown, the furnace assembly balance weight switch 34, the coil assembly 74 for the solenoid actuated air pressure valve 70 and the furnace assembly location switch 72 are connected in series across a suitable power source 76. Also connected across the power source 76 is the hopper balance weight switch 59 and a series connected attention arresting warning member, such as a buzzer or indicating lamp 78. The hopper balance weight switch is arranged so as to be closed when the balance weight arm 48 is disposed in its balance position and to be open when said balance weight arm 48 is displaced therefrom.

The above described apparatus is most conveniently described in conjunction with the serial steps of the operations necessary to effect the fabrication of a condensed filamentous glass mat.

Initially, the hopper 40 is charged with sufficient raw material or glass to effect the fabrication of a plurality of mats. A suitable charge for apparatus presently employed has been found to be in the nature of 300 or more pounds of glass and should preferably be sufficient to at least one day's operation. As shown in the drawings, the furnace is provided with a scale 20. By the above arrangement, the furnace 28 and its contents are rendered continuously balance weighable during the spinning operation.

The balance weight arm 26 of the scale 20 is utilized to operate an electrical switch member generally designated 34, whenever a predetermined departure in the weight of the furnace and its contents from its tare weight value occurs. The effect of such switch actuation will be described later in this specification. As shown in the drawings, the open mouth 36 of the furnace feeding funnel 30 is made of enlarged size in the direction of furnace reciprocation and has associated therewith an extending actuating arm 38.

The apparatus also includes a glass or raw material hopper 40 of a size to contain sufficient glass for a day's or more operations. The hopper 40 is suspended from the weight sensitive plate 42 of a balance weight scale 44 by suitable frame members 46. The scale 44 is mounted on a suitable supporting structure (not shown). The balance weight arm 48 of the hopper scale is preferably located on the spinning drum floor so as to be conveniently observable and settable by the machine operator and, as schematically shown in the drawings, the free end of the balance weight scale 44 is utilised to operate a switch member generally designated 50. The lower end of the hopper 40 is conventionally tapered as at 52 and terminates in a pan 54 having an air actuated vibrator assembly 56 associated therewith. The air actuated vibrator assembly 56 may suitably be a so-called Peterson Vibrator as manufactured by the Martin Engineering Co., of Kewanee, Ill. The essentials of such units are also disclosed in U.S. Patents 2,778,612 and 2,793,009. The vibrator actuated pan 54 feeds into a loading chute 58 having a gate 60 at the dependent end thereof. The gate 60 is pivotally mounted as at 62, biased in the closed position by a spring 64 and is provided with an upwardly extending actuating arm 66 adapted to be engaged and displaced, opening the gate, by the actuating arm 38 mounted on the reciprocating furnace assembly. The vibrator assembly 56 is conveniently operated by compressed air supplied through a line 68 having a solenoid operated valve 70 included therein.

As indicated earlier, the furnace assembly is horizontally reciprocated on the tracks 14 so as to traverse the surface of the spinning drum and for a predetermined portion of its traverse has the mouth 36 of the furnace feed funnel 30 disposed beneath the chute 58. Suitably positioned so as to be selectively actuated during the time period when said funnel 30 is disposed beneath the chute 58, as by engagement with one of the pressure assembly members, is an electrical location switch 72.

FIGURE 2 is a schematic circuit diagram of a suitable electrical switch arrangement to assure selective feeding of the reciprocating furnace only when the feeding funnel 30 is suitably positioned beneath the hopper chute 58. As there shown, the furnace assembly balance weight switch 34, the coil assembly 74 for the solenoid actuated air pressure valve 70 and the furnace assembly location switch 72 are connected in series across a suitable power source 76. Also connected across the power source 76 is the hopper balance weight switch 59 and a series connected attention arresting warning member, such as a buzzer or indicating lamp 78. The hopper balance weight switch is arranged so as to be closed when the balance weight arm 48 is disposed in its balance position and to be open when said balance weight arm 48 is displaced therefrom.

The above described apparatus is most conveniently described in conjunction with the serial steps of the operations necessary to effect the fabrication of a condensed filamentous glass mat.

Initially, the hopper 40 is charged with sufficient raw material or glass to effect the fabrication of a plurality of mats. A suitable charge for apparatus presently employed has been found to be in the nature of 300 or more pounds of glass and should preferably be sufficient to at least one day's operation. As shown in the drawings, the furnace is provided with a scale 20. By the above arrangement, the furnace 28 and its contents are rendered continuously balance weighable during the spinning operation.

The balance weight arm 26 of the scale 20 is utilized to operate an electrical switch member generally designated 34, whenever a predetermined departure in the weight of the furnace and its contents from its tare weight value occurs. The effect of such switch actuation will be described later in this specification. As shown in the drawings, the open mouth 36 of the furnace feeding funnel 30 is made of enlarged size in the direction of furnace reciprocation and has associated therewith an extending actuating arm 38.

The apparatus also includes a glass or raw material hopper 40 of a size to contain sufficient glass for a day's or more operations. The hopper 40 is suspended from the weight sensitive plate 42 of a balance weight scale 44 by suitable frame members 46. The scale 44 is mounted on a suitable supporting structure (not shown). The balance weight arm 48 of the hopper scale is preferably located on the spinning drum floor so as to be conveniently observable and settable by the machine operator and, as schematically shown in the drawings, the free end of the balance weight scale 44 is utilised to operate a switch member generally designated 50. The lower end of the hopper 40 is conventionally tapered as at 52 and terminates in a pan 54 having an air actuated vibrator assembly 56 associated therewith. The air actuated vibrator assembly 56 may suitably be a so-called Peterson Vibrator as manufactured by the Martin Engineering Co., of Kewanee, Ill. The essentials of such units are also disclosed in U.S. Patents 2,778,612 and 2,793,009. The vibrator actuated pan 54 feeds into a loading chute 58 having a gate 60 at the dependent end thereof. The gate 60 is pivotally mounted as at 62, biased in the closed position by a spring 64 and is provided with an upwardly extending actuating arm 66 adapted to be engaged and displaced, opening the gate, by the actuating arm 38 mounted on the reciprocating furnace assembly. The vibrator assembly 56 is conveniently operated by compressed air supplied through a line 68 having a solenoid operated valve 70 included therein.

As indicated earlier, the furnace assembly is horizontally reciprocated on the tracks 14 so as to traverse the surface of the spinning drum and for a predetermined portion of its traverse has the mouth 36 of the furnace feed funnel 30 disposed beneath the chute 58. Suitably positioned so as to be selectively actuated during the time period when said funnel 30 is disposed beneath the chute 58, as by engagement with one of the pressure assembly members, is an electrical location switch 72.

FIGURE 2 is a schematic circuit diagram of a suitable electrical switch arrangement to assure selective feeding of the reciprocating furnace only when the feeding funnel 30 is suitably positioned beneath the hopper chute 58. As there shown, the furnace assembly balance weight switch 34, the coil assembly 74 for the solenoid actuated air pressure valve 70 and the furnace assembly location switch 72 are connected in series across a suitable power source 76. Also connected across the power source 76 is the hopper balance weight switch 59 and a series connected attention arresting warning member, such as a buzzer or indicating lamp 78. The hopper balance weight switch is arranged so as to be closed when the balance weight arm 48 is disposed in its balance position and to be open when said balance weight arm 48 is displaced therefrom.

The above described apparatus is most conveniently described in conjunction with the serial steps of the operations necessary to effect the fabrication of a condensed filamentous glass mat.

Initially, the hopper 40 is charged with sufficient raw material or glass to effect the fabrication of a plurality
In the illustrative example when 20 pounds of glass have been removed from the hopper 40, the balance arm 46 of the hopper balance weight scale will return to its balance position, thus closing electrical switch 50 and completing the circuit for the attention arresting alarm device 78. Actuation of the alarm device automatically informs the operator that the correct amount of glass has been spun on the drum and further indicates the necessity of shutting down the operation of the unit to effect the removal of the completed mat formed on said drum.

After removal of the finished mat from the drum, the operator again resets the balance arm 46 of the hopper balance weight scale to correspond to the weight of material to be included in the next mat to be fabricated, and the operation continues as described above in the fabrication of successive mats.

As will be apparent to those skilled in this art, the above described structure permits the maintenance of a practically constant head of molten glass in the furnace within very small limits; assures the inclusion of a predetermined weight of glass in each mat that is fabricated and thereby effectively removes from the operator one of the critical variables that controls the uniformity of the fabricated mats; contributes markedly to the controlled production of condensed mats of predetermined weight and uniform character, all of which contribute to marked reductions in the number of mats rejected for failure to meet specifications and to the concomitant realization of appreciable time and cost savings in the production of condensed mats.

As will also be apparent to those skilled in the art, the illustrated apparatus is essentially simple in nature and is of a character that can be installed in existing glass spinning machinery with a minimum of time and expense.

Having thus described my invention, I claim:

1. In apparatus for spinning condensed filamentous mats, a supply material hopper, a continuously reciprocating furnace periodically traversing a charge receiving location and from which filamentous material is continuously drawn, means for continuously weighing said furnace and its contents, first switching means selectively responsive to a predetermined decrease of the weight of said continuously moving furnace and its contents from its tare weight value, second switching means selectively responsive to the positional disposition of said continuously moving reciprocating furnace within said charge receiving location and means responsive to coincident actuation of said first and second switching means for selectively effecting the incremental transfer of supply material from said hopper to said moving furnace while the same is traversing said charge receiving location.

2. The apparatus as set forth in claim 1 wherein said weighing means includes a balance weight scale reciprocable in conjunction with said furnace.

3. The apparatus as set forth in claim 1 wherein said last mentioned means includes a solenoid actuated vibrator feed assembly.

4. The apparatus as set forth in claim 1 including means for weighing said hopper and its contents.

5. The apparatus as set forth in claim 4 including means responsive to removal of a predetermined amount of supply material from said hopper for providing an attention arresting indication thereof.

6. The apparatus as set forth in claim 1 including means responsive to coincident actuation of said first and second switching means for selectively effecting the incremental transfer of supply material from said hopper to said charge, and gate means on said charge for controlling the incremental admission of supply material to said continuously moving furnace.

7. The apparatus as set forth in claim 1 wherein said furnace is provided with an elongate feed tunnel adapted to receive material from said hopper over a substantial portion of the path of reciprocation of said furnace.

8. In apparatus for spinning condensed filamentous mats, a supply material hopper, a continuously reciprocating balance weight scale, a furnace mounted on said scale from which filamentous material is continually drawn and reciprocable in conjunction therewith to periodically traverse a charge receiving location, first switching means actuable by displacement of the balance arm of said scale for indicating a predetermined decrease of the weight of said continuously moving furnace and its contents from its tare weight value, second switching means actuable by the positional disposition of said continuously moving furnace within said charge receiving location and means responsive to coincident actuation of said first and second switching means for selectively effecting incremental transfer of supply material from said hopper into said continuously moving furnace while the same is traversing said charge receiving location.

9. The apparatus as set forth in claim 8 including means for continually weighing said hopper and its contents.

10. The apparatus as set forth in claim 9 including means responsive to removal of a predetermined amount of supply material from said hopper for providing an attention arresting indication thereof.

11. In apparatus for spinning condensed filamentous mats, a supply material hopper, a continuously moving balance weightible reciprocating furnace periodically traversing a charge receiving location and from which filamentous material is continually drawn, first switching means responsive to a predetermined decrease of the weight of said continuously moving furnace and its contents from its tare weight value, a loading chute positioned to receive material removed from said hopper, second switching means responsive to the positional disposition of said continuously moving furnace within said charge receiving location, means responsive to coincident actuation of said first and second switching means for selectively effecting transfer of supply material from said hopper to said chute, and gate means on said chute selectively displaceable in accordance with the positional disposition of said continuously moving furnace relative to said chute for effecting transfer of material disposed in said chute into said furnace while the same is traversing said charge receiving location.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>615,493</td>
<td>Richards</td>
<td>Dec. 6, 1898</td>
</tr>
<tr>
<td>1,646,705</td>
<td>Peller</td>
<td>Oct. 25, 1927</td>
</tr>
<tr>
<td>1,769,639</td>
<td>Gustafson</td>
<td>July 1, 1930</td>
</tr>
<tr>
<td>1,796,480</td>
<td>Schellengerger</td>
<td>Mar. 17, 1931</td>
</tr>
<tr>
<td>2,135,072</td>
<td>Forster</td>
<td>Nov. 1, 1938</td>
</tr>
<tr>
<td>2,330,857</td>
<td>Alcott</td>
<td>Oct. 5, 1943</td>
</tr>
<tr>
<td>2,373,838</td>
<td>Lindholm</td>
<td>Apr. 17, 1945</td>
</tr>
<tr>
<td>2,453,864</td>
<td>Schlehr</td>
<td>Nov. 16, 1948</td>
</tr>
<tr>
<td>2,546,230</td>
<td>Modigliani</td>
<td>Mar. 27, 1951</td>
</tr>
<tr>
<td>2,798,531</td>
<td>Jackson</td>
<td>July 9, 1957</td>
</tr>
<tr>
<td>2,814,657</td>
<td>Labino</td>
<td>Nov. 26, 1957</td>
</tr>
<tr>
<td>2,927,763</td>
<td>Overman</td>
<td>Mar. 8, 1960</td>
</tr>
</tbody>
</table>