June 16, 1959 S. D. WILLIAMS 2,890,496

APPARATUS FOR MAKING FIBER MAT

Filed Oct. 8, 1956 4 Sheets-Sheet 1

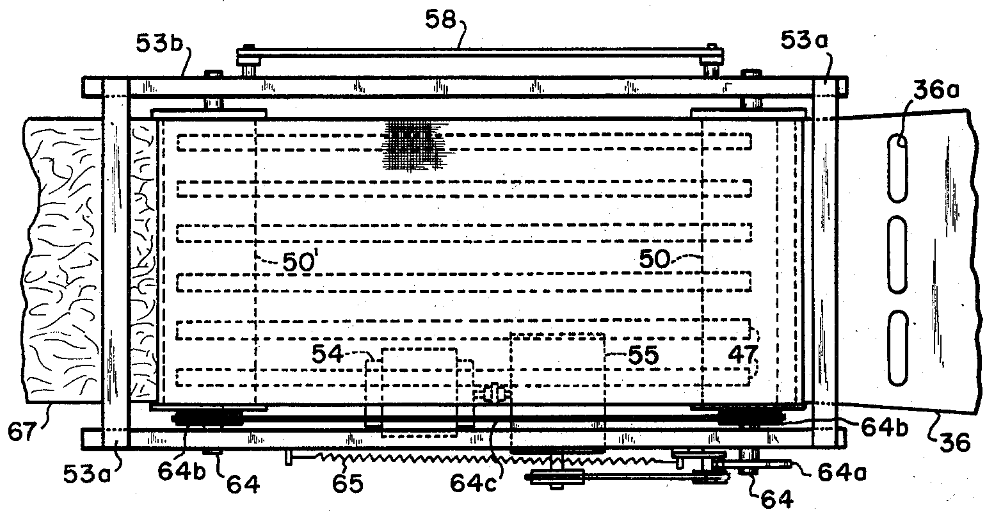

Fig. 1

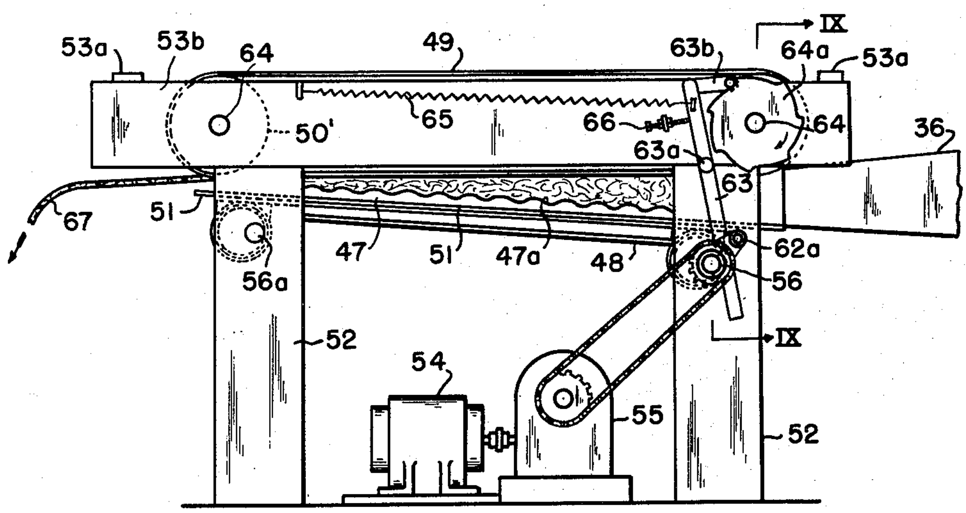

Fig. 2

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APPARATUS FOR MAKING FIBER MAT

Filed Oct. 8, 1956 4 Sheets-Sheet 2

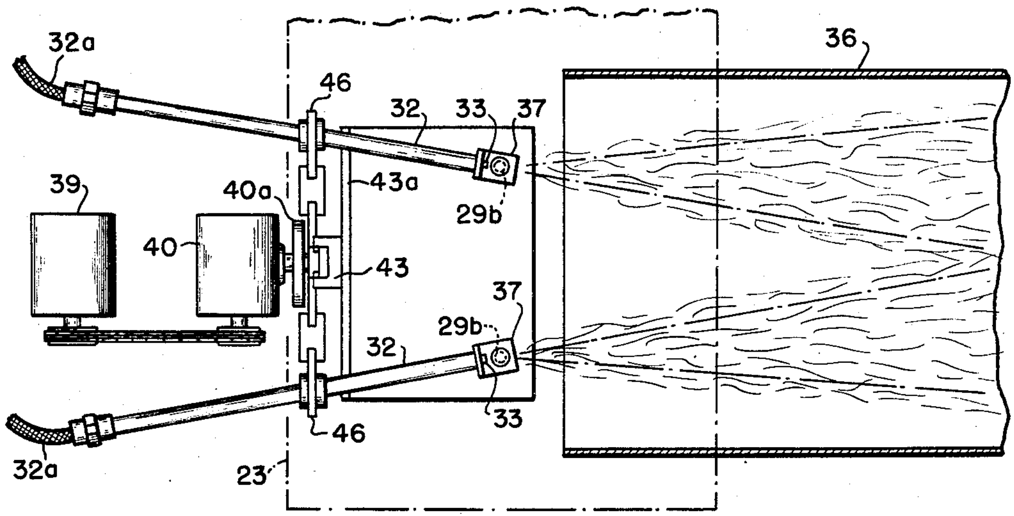

Fig. 3

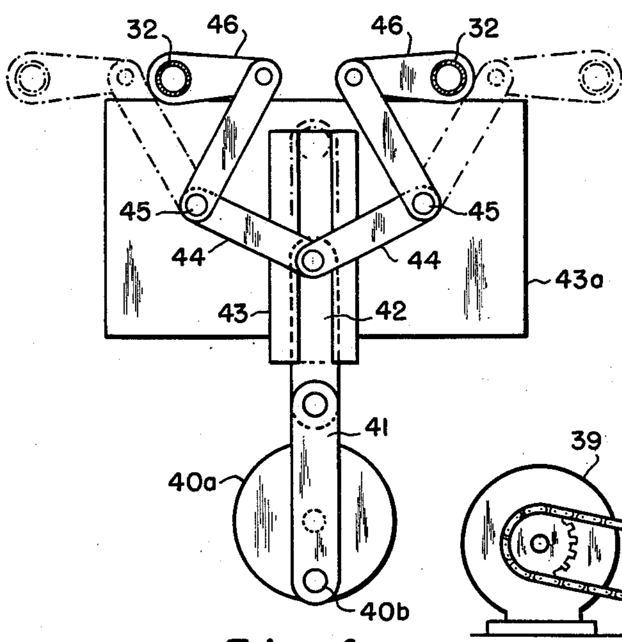

Fig. 4

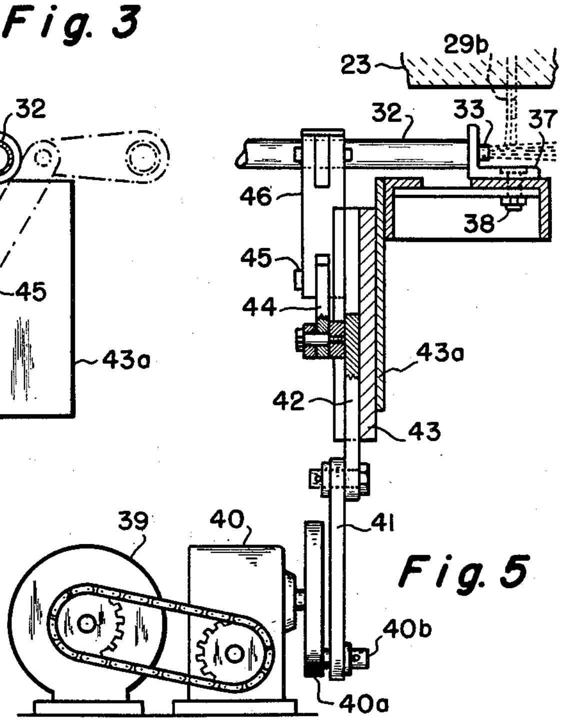

Fig. 5

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June 16, 1959 S. D. WILLIAMS 2,890,496

APPARATUS FOR MAKING FIBER MAT

Filed Oct. 8, 1956 4 Sheets-Sheet 3

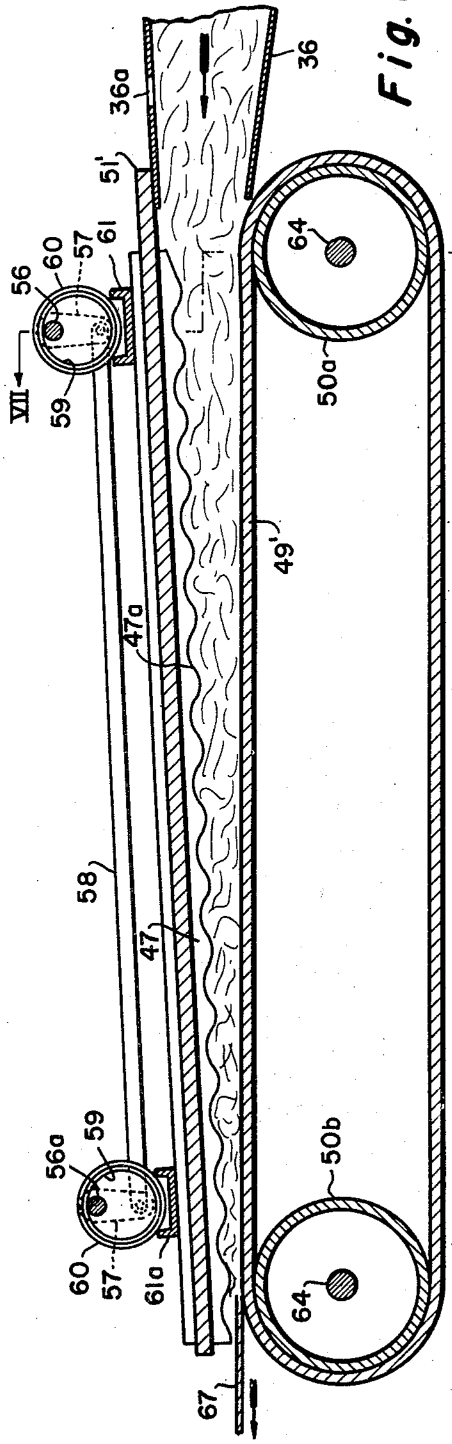

Fig. 6

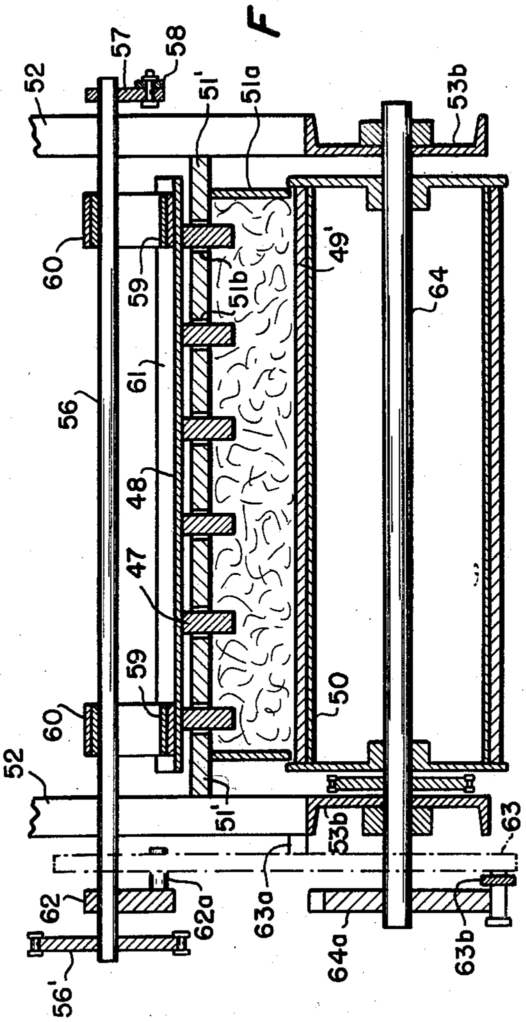

Fig. 7

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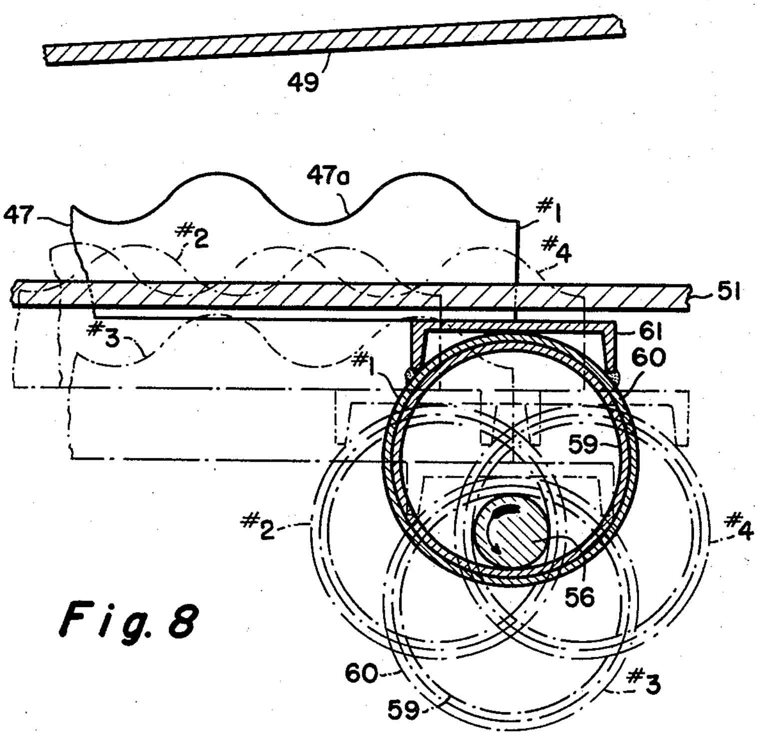

Fig. 8

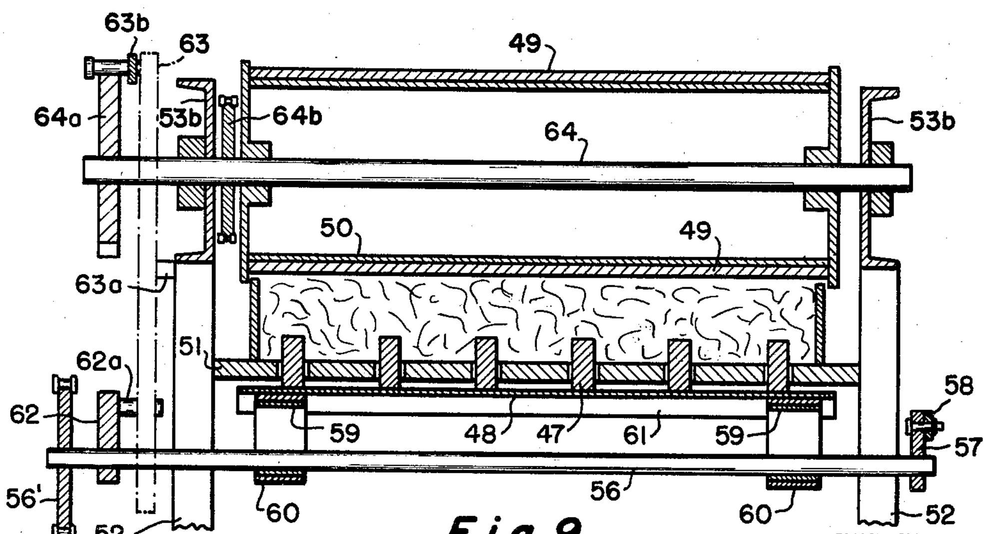

Fig. 9

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APPARATUS FOR MAKING FIBER MAT

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Application October 8, 1956, Serial No. 614,581

9 Claims. (Cl. 19—155)

This application is a continuation in part of the application Serial No. 531,948 filed September 1, 1955, and relating to Fiber Mat and Method of Making the Same. The invention here disclosed and defined relates to procedure and apparatus for forming glass fiber mat. An object of such invention is to produce fiber mat continuously and in the form of a flexible strip having substantial tensile strength both longitudinally and transversely of the strip.

A further object is to produce procedure for forming a matted structure including in its make-up glass fibers of various lengths and extending at random in various directions but in which such fibers are interwoven and form a unitary structure of well defined shape which is flexible and in which substantially all the individual fibers included in the structure maintain their individual flexibility under normal conditions of use of the matted structure.

A further object is to produce effective and efficient apparatus for continuously producing a mat structure including in its make-up interwoven glass fibers of various lengths and extending haphazardly in various directions, but in which the mat constitutes a unitary structure of well defined shape and includes two opposed parallel substantially plane surfaces bounded by substantially straight edges which extend substantially parallel to each other.

In the apparatus illustrated and in the procedure defined for forming glass fiber mat, one or more suspended streams of molten glass are broken up into fibers of varying lengths while the glass of each such stream is in a molten state and the fibers so formed are substantially simultaneously formed into an approximately homogeneous mass in which the fibers extend at random in various directions and are to some extent interwoven so that different portions of the mass at least loosely adhere of each other. The mass so formed is gradually compressed into a substantially homogeneous structure of strip-like form in which the individual fibers contained therein extend at random in various directions and to a large extent retain their individual flexibility, but are interwoven and interconnected in such a way as to constitute the principal elements of a continuous strip or band of well defined shape having two opposed substantially plane surfaces located in parallel relationship and bounded by substantially straight edges extending parallel to each other.

In carrying forward the procedure of my invention, I preferably employ means for delivering two or more suspended streams of molten glass issuing from delivery orifices which are submerged by hot and highly molten glass. While the glass of each such stream is still in a highly molten state, it is broken up into numerous fine fibers of various and indiscriminate lengths which are simultaneously projected into a laterally confined passage so as to form therein a moving heterogeneous, but substantially homogeneous confined mass of fibers in which the fibers of the mass are located haphazardly and

extend in different directions and are interwoven just sufficiently to cause different portions of the mass to at least loosely adhere to each other. The fibers received into the mass are cooled to their solidification temperature and are of such dimensions that they are individually highly flexible.

The confined mass of fibers is gradually compressed as the mass is moved forward and is compressed under conditions such as to minimize fiber breakage and so that the mass is finally formed into a structure of interwoven and interconnected fibers extending at random in various directions and in which the matted structure is of strip-like form with opposed plane surfaces having straight bounding edges extending substantially parallel to each other. Prior to, during or after compressing the fibers into final matted form, the fibers are treated with a liquid which coats them and forms a temporary binder for the fibers within the mat structure and contributes to a more permanent bonding of such fibers in case a plastic material is applied to the mat structure. The binding liquid initially employed is such that it wets the fibers, coats them and assures a bond between the coated fibers and a plastic material where the mat structure is employed as a part of an end product which includes a plastic as a constituent thereof.

In the drawings accompanying and forming a part hereof—

Figure 1 is a fragmental plan view of a mat forming machine embodying one aspect of my invention and so formed and constructed that it is capable of carrying forward the procedure which forms the principal feature of my invention;

Figure 2 is a fragmental side elevation of the machine shown in Figure 1;

Figure 3 is a fragmental sectional view of a portion of the mat making machine illustrated in Figures 1 and 2, together with a plan view of a mechanism for forming fiber glass and delivering same to the mat making machine;

Figure 4 is a side elevation of a portion of the apparatus shown in Figure 3;

Figure 5 is a fragmental diagrammatic view of means employed in connection with mechanism shown in Figure 3 for delivering molten glass to such mechanism and shown in connection with the sectional view of the mechanism illustrated in Figure 4;

Figure 6 is a sectional view of apparatus such as is shown in Figure 2 in which portions thereof are shown inverted for convenience of operation;

Figure 7 is a sectional view along the line VII—VII of Figure 6;

Figure 8 is a fragmental sectional view of a portion of the operating apparatus; and

Figure 9 is an enlarged sectional view taken along the line IX—IX of Figure 2.

In Figure 3 I have shown in section a portion of a converging passage **36** into which the glass fibers are projected at a rate which substantially fills the delivery end of the passage with a mass of such fibers. The fibers are formed by means of apparatus illustrated in Figures 3, 4 and 5 of the drawings and which will be later described. The passage **36** is located and arranged to deliver the fibers received by it to a mat forming machine such as shown in Figures 1 and 2. The converging end of the passage **36** communicates with the receiving end of the mat forming machine and as noted, fibers are delivered to the passage **36** at a rate and under conditions such as to keep the delivery end of the passage filled with a mass of such fibers as the forward portion of the mass moves into the mat forming machine.

The mass of fibers initially formed in the receiving end of the passage **36** is loosely integrated. As the mass moves through the converging passage **36**, it becomes more consolidated and the operation of the mat forming machine is such that the mass is gradually formed into a closely integrated and continuously impelled strip such as previously described.

As illustrated in Figures 1 and 2 and also in Figures 6 and 7, the mat forming machine includes two movable members which converge from the receiving end of the machine to the delivery end thereof and which are so located as to receive the interwoven mass of fibers issuing from the passage **36**. The machine gradually and gently compresses the mass of fibers so received to final mat form.

One of the two movable elements included in the machine is illustrated in Figure 2 as a rack which includes a plurality of bars **47** mounted on a plate **48**. The bars extend parallel to each other in the direction of the movement imparted to the fiber mass by the cooperation of the two movable members. The edge of each bar **47** which contacts the mass of fibers is shown as provided with a corrugated surface **47*a***, so formed that the peaks of the corrugations are well rounded and the valleys are shallow so that each bar presents an undulating surface to the mass of fibers entering and located within the mat forming machine. In addition, the corrugated surfaces of the rack bars are so formed and the bars so located on their mounting plate **48** that the peaks of the corrugations of adjacent bars are aligned transversely of the bars.

The other movable element of the mat forming machine is illustrated as an endless belt **49** located between and surrounding spaced pulleys **50—50′**. The pulleys are so positioned relatively to each other that the belt is held taut between them. As shown in Figure 2, the bars **47** project upwardly through parallel slots formed in a base plate **51** which in fact forms the bottom of a converging passage located between it and the lower reach of the belt **49**. The belt and the plate **51** are so positioned relatively to each other that the receiving end of the converging passage between them in effect forms a continuation of the converging top and bottom walls of the passage **36**. The rack bars **47** and the belt **49** are arranged to move in unison with each other so that as the bars move upwardly and forwardly (to the left in Figure 2), the lower reach of the belt also moves forwardly. As shown in Figures 1 and 2, the mat forming machine is supported on four uprights **52** which are arranged to provide corner supports for a frame which includes two end members **53*a*** and two side members **53*b***. The plate **51** is shown as located between and secured to the uprights **52** and extending lengthwise of the machine.

As disclosed in Figure 2, the rack bars and the rack plate are actuated by a motor **54** through the medium of a speed reducing mechanism **55** which is operatively coupled to a shaft **56** by a sprocket and chain connection. The shaft **56** constitutes the operating shaft of the mat producing machine and extends transversely of the plate **48** and the rack bars **47**. It is journaled in bearings which, in the machine illustrated, may be mounted on the two uprights **52** located at the receiving end of the machine. A shaft **56*a*** similar to the shaft **56** and extending parallel thereto is supported in suitable journals which, as shown, may be mounted on the uprights **52** located at the delivery end of the machine. A separate eccentric **57** is secured to each of the shafts **56** and **56*a***. These eccentrics are operatively connected by a connecting rod **58** so that the two shafts **56** and **56*a*** operate together and in phase with each other (see Figures 2 and 8).

It is noted that the now preferred embodiment of the machine is illustrated in Figures 6 and 7 of the drawings. As there shown, the rack bars **47** and their mounting plate **48** are located above the continuous belt **49**. The reason for this is that during the operation of the machine as shown in Figures 1 and 2, siftings tended to plug the slots in the base plate **51** through which the rack bars **47** project. With the inverted arrangement, the upper reach of the belt **49** forms a support for the mass of glass fibers moving through the machine and with this arrangement objectionable sifting is avoided. Reference is made to Figures 6 and 7 in the further description of the invention, since except for the reversal of the part noted, the structure is substantially the same as that disclosed in said application Serial No. 531,948.

As indicated in Figures 6 and 7, the shaft **56** is provided with two eccentric rings **59** which in the original disclosure are located between the supports **52**, one such ring being located adjacent one such support and the other adjacent the oppositely located support. The rings are secured to the shaft **56** so that they are located eccentrically thereof, and similar rings are located on and secured in corresponding positions to the shaft **56*a*** (Figure 6). A separate slip ring **60** surrounds and is journaled on the external surface of each of the rings **59**. The rings **60** are rigidly secured to a bar **61**, shown in Figure 7 as a channel member which extends transversely across the rack plate **48** and is secured thereto. A similar bar **61*a*** is rigidly secured to the slip rings **60′** carried by the eccentric rings **59** secured to the shaft **56*a*** (see Figure 6). The two bars **61** and **61*a*** extend in parallel relationship and each is operatively secured to the plate **48**. As a result, rotation of the shafts **56** and **56*a*** imparts reciprocating motion to the plate **48** and the rack bars **47**. This motion contributes to the compression of the relatively loose fiber mass delivered to the machine and contributes to the forward movement and the further compression of the fiber mass.

In Figure 8 I have diagrammatically illustrated the positions occupied by the eccentrics **59** and consequently by the slip rings **60** as the shaft **56** rotates. The four positions illustrated make it apparent that the attached bar **61** rises and falls during the rotation of the shaft and also moves forward and back as the eccentric actuated rings **60** complete a cycle. It is therefore apparent that the two shafts **56** and **56*a*** move together and through exactly similar cycles and that during each such cycle raise and then lower the rack plate **48** and consequently the rack bars **47** secured to the plate. Figure 8 also makes it apparent that as the plate **48** is moved upwardly it first moves rearwardly and then forwardly (to the left in Figure 8) and as the plate moves downwardly it continues its forward movement, but before reaching the bottom of its stroke moves rearwardly and is so moving at the bottom of the stroke.

A reference to the diagram in Figure 8 discloses the relative position of the rack bars **47** as the eccentric rings move through four points of a complete cycle. In the diagram I have illustrated in full lines one of the eccentric rings **59** and its associated slip ring in the highest position, i.e., the position in which the rack plate **48** and the bars **47** are raised to their highest position. This position of the rings and the bars is designated in Figure 8 as the #1 position. The arrow associated with the sectional view of the shaft **56** designates the direction of rotation of the shaft and consequently indicates that the eccentric ring **59** moves to the left in Figure 8 in passing from the #1 to the #2 position. During this movement, the rack bars **47** continue their forward movement as they start their downward movement. As the eccentric rings move from the #2 position to the #3 position, the plate **48** and bars **47** are moved to their lowermost position and during this movement they also move rearwardly (to the right in Figure 8). This rearward motion of the plate **48** and bars **47** continues as the eccentric rings move from the #3 to the #4 position. During this portion of the cycle, the plate **48** and the rings **47** start their upward movement. In moving from #4 to #1 position, the eccentric rings move the plate **48** and rack bars **47** forward and to their highest position.

The diagram of figure 8 also discloses that during each cycle of the eccentric rings **59** the rack bars are first fully withdrawn from the space between the plate **51** and the lower reach of the belt **49**, but during the major portion of this withdrawal they are also moving forwardly. As the peaks of the corrugated surfaces of the bars **47** are moving out of the space between plate **51** and belt **49**, the bars are moving rearwardly. This rearward motion continues until the peaks of the corrugated surfaces project through slots in the plate **51**. However, the bars **47** are moving rearwardly throughout the major portion of their movement during the period that the corrugated surfaces are below the base plate **51**.

As a result of the movement of the rack bars positioned as shown in Figures 1, 2 and 8, it is apparent that these bars perform a double function in that they aid in propelling the mass of fibers forwardly and also gradually compress the mass into mat formation. That is to say, the fiber mass issuing from the passage **36** and entering the space between the upper reach of the belt **49** and the plate **51**, is propelled forwardly and at the same time is compressed into mat formation by reason of the fact that the rack bars converge toward the belt **49** and also because as the rack bars are raised to their highest position, their left hand ends (Figure 2) are located immediately adjacent the lower reach of the belt **49** and therefore exert the final mat forming pressure on the fiber mass as they and the lower reach of the belt move forwardly.

In the illustrated embodiment of the invention, the belt pulleys **50** and **51** are so driven that the belt moves periodically so that the lower reach thereof as shown in Figures 2 and 8, moves forwardly as the rack bars move forwardly. In order to accomplish this, I provide means actuated by the shaft **56** for advancing the lower reach of the belt in a step by step movement and so that each such movement takes place as the rack bars move upwardly and forwardly as shown in Figures 2 and 8. The shaft **56** is provided near one end with a crank **62** which carries a roller cam ***62a***. This cam engages and actuates a rocker bar **63** (Figure 2). The rocker bar **63** is fulcrumed on a pin ***63a*** carried by a side member ***53b*** of the frame of the machine and actuates a shaft **64** through the agency of a pawl ***63b*** and ratchet wheel ***64a***. The wheel ***64a*** is mounted on the shaft **64**. The pulley **50** is mounted on the shaft **64**. The pawl ***63b*** is pivotally connected to the upper end of the bar **63** and as shown in Figure 2 of the drawings is so located that it engages and actuates the wheel ***64a*** as the bar moves back and forth about its fulcrum pin ***63a*** in response to the operation of the roller cam ***62a***.

As shown in Figure 2, the movement of the bar **63** in one direction is limited by an adjustable stop **66** carried by a bracket mounted on one of the side members ***53b*** of the frame. The movement toward the stop **66** of the portion of the bar **63** above the fulcrum pin ***63a*** is impelled by a spring **65** which is shown in Figure 2 as acting between the upper end of the rocker bar and a pin carried by the side member ***53b***. The cam roller ***62a*** engages the lower end of the rocker bar during each rotation of the shaft **56** and turns the bar about its fulcrum pin in opposition to the pull of spring **65**. Thus, the cam roller moves the pawl to advance the ratchet wheel through a portion of a revolution during each revolution of the shaft **56**, consequently the pulley **50** moves through a portion of a revolution and the lower reach of the belt **49** a short distance during each such revolution.

The position of the crank arm **62** on the shaft **56** is such that the lower reach of belt **49** moves forwardly as the rack bars **47** move upwardly and forwardly. The position of the stop **66** is so adjusted that the pawl ***63b*** engages a ratchet of the wheel ***64a*** each time the bar **63** is actuated by the cam roller ***62a*** and, therefore, advances the lower reach of the belt **49** in a step by step movement, the arrangement being such that the belt and the rack bars **47** cooperate in imparting forward movement to the portion of the fiber mass located between the lower reach of the belt and the base plate **51**. In Figure 2 I have illustrated the completed mat in the form of a continuous strip which is designated by the numeral **67**.

From the foregoing it will be apparent that the procedure here defined involves the projection of fibers of indiscriminate length and form into a confining passage so as to form a loosely consolidated heterogeneous mass, but at the same time a substantially uniform mass of fibers which in moving or being moved through the confining passage are partially compressed and then delivered to a passageway located between two moving parts of the mat forming machine. As previously described, the moving parts involve a periodically moving belt and a cyclically moving rack plate **48** which is provided with a plurality of parallel rack bars **47**.

The operation of the machine is such that the fiber mass delivered to it is moved forwardly in a step by step movement and at the same time is gently compressed so as to combine the mass of fibers into a consolidated mass which is eventually delivered from the machine in the form of a continuous strip having opposed parallel plane faces which are bounded by spaced edges which extend substantially parallel to each other.

During the forward movement of the fiber mass it is wetted by a binder liquid of such form and consistency that it wets and adheres to the individual fibers of the mass and functions as a binding agent in holding the fibers in fixed positions relatively to each other. As previously noted, the binding liquid is such as to form a permanent bond between the individual fibers and a plastic material where such a material is employed in the formation of the mat structure.

Various means may be employed for forming the glass fibers going into the make-up of the mat structure and for projecting the fibers as formed into a confining passageway. As illustrated in Figures 3, 4 and 5, one or more streams of molten glass issue from orifices located in the bottom of a forehearth or other container which includes highly molten glass above the orifice. As indicated in Figure 3, the apparatus illustrated functions in connection with two such streams ***29b*** of molten glass in the formation of fibers of indiscriminate size and shape. As shown in Figure 3 and as described in the above mentioned parent application, each of the pipes **32** illustrated in the drawings communicates with a source of high pressure superheated steam through a flexible connection ***32a***. Each pipe **32** is so associated with one of the streams ***29b*** that it oscillates while delivering an expanding jet of steam to, and through the stream of molten glass and oscillates in such a way that the jet of steam issuing is always in contact with the stream of molten glass.

In Figure 5 the nozzle **33** forming a part of one of the pipes **32**, is shown projecting through an L-shaped bracket **37**, one leg of which is pivotally connected to a support by means of a pivot bolt **38**. The fulcrum point about which the bracket **37** pivots is in the axial line of flow of the associated stream of molten glass ***29b***. The oscillating means for each pipe **32** is such that the center of oscillation of each pipe is located in the axis of flow of one or the other of the streams ***29b***. The actuating mechanism for both pipes includes a motor **39** operatively coupled to a speed change gear **40** provided with a fly wheel or rotating disc ***40a***. The disc is provided with an eccentric pin ***40b*** which is operatively connected to a pitman rod **41**. The rod **41** is pivotally connected to a connecting rod **42** which reciprocates in a cross head guide **43** and functions as a cross head in that it actuates two bell cranks **44**. Each bell crank is pivotally mounted on a separate fulcrum pin **45** and its free arm is pivotally secured to a link **46**. Each link is in turn operatively coupled to one of the steam delivery pipes **32** so that during the rotation of the disc ***40a*** the two pipes **32** are moved in opposite directions, each pipe being moved away from and then toward the axis of the cross head guide 43 so that it oscillates about the axial flow line of the suspended glass stream with which the pipe is associated.

In this way each stream of molten glass is broken up into separate fibers and the fibers so formed are projected at a relatively high velocity and at a high temperature into the receiving end of the confining passageway 36.

As previously noted, the now preferred arrangement of the operating parts of the mat forming machine is shown in Figures 6 and 7. In Figure 6 the endless belt 49′ extends around the belt supporting pulleys 50*a* and 50*b*, each of which is mounted on one of the shafts 64. The so-called base plate 51 shown in Figure 2 is replaced by the upper reach of the belt 49′, and a plate 51′ is located above the belt and is so arranged with side panels 51*a* that it provides, with the belt, a converging passageway from the inlet end to the delivery end of the machine proper. The rack plate 48 is located above the plate 51′ and the rack bars 47 secured thereto, project through parallel apertures 51*b* formed in the plate 51′. With such an arrangement the actuating mechanism of the rack plate 48 is located above that plate and consists of the shafts 56 and 56*a* which are operatively connected together by means of crank arms 57 and a connecting rod 58 and each of which is provided with an eccentric ring 59. Each ring supports a slip ring 60 which is welded to or otherwise operatively secured to a channel bar located above and secured to the rack plate 48. One ring 60 is shown secured to the bar 61 and the other ring is shown secured to the bar 61*a*. The two channel bars 61 and 61*a* extend in spaced, parallel relation to each other and each is secured to the rack plate 48. The shaft 56 is driven by apparatus such as illustrated in Figure 2, i.e., by a motor 54, a reducing mechanism 55 and a chain and sprocket mechanism, the sprocket 56′ being mounted on the shaft 56.

The belt supporting pulleys 50*a* and 50*b* as shown in Figures 6 and 7 are so driven that the belt 49′ moves periodically in such a way that the upper reach thereof moves forwardly as the rack bars 47 move downwardly and forwardly. The operating mechanism for the shaft 64 on which the pulley 50*a* is mounted, is similar to that illustrated in Figures 2 and 9 of the drawings and includes a crank 62 which carries a roller cam 62*a*. The crank 62 is mounted on the shaft 56 and the cam 62*a* engages and actuates a rocker bar 63 fulcrumed on a pin 63*a*. The rocker bar is similar to the bar 63 of Figure 2 and actuates the shaft 64 on which the pulley 50*a* is mounted, through the agency of a pawl 63*b* and ratchet wheel 64*a*. The wheel 64*a* is mounted on the shaft 64 and the pawl 63*b* is pivotally connected to the upper end of the rocker bar 63 and is so located that it engages and actuates the ratchet wheel 64*a* as the bar moves back and forth about its fulcrum point in response to the operation of the roller cam 62*a*. In other words, while the operating parts shown in Figures 6 and 7 occupy relative positions the reverse of those shown in Figures 2 and 9, the operating devices therefor are in many respects the same as those illustrated in Figures 2 and 9 and are designated by the same reference characters.

While I have described but two embodiments of the invention, one of which is illustrated and described in the parent application, it will be apparent that changes, additions, omissions and modifications may be made in the apparatus illustrated without departing from the spirit and scope of my invention.

What I claim is:

1. A machine for compressing a mass of fibers into mat formation, including in combination an elongated base plate; an elongated top member located above and extending along said plate and located in converging relationship therewith; a rack plate located below said base plate and movable toward and from said base plate; rack bars mounted on said rack plate, each extending in the direction of said base plate and each movable through a separate elongated slot formed in said base plate and into and out of the space between said base plate and said top member; and means for periodically moving said rack plate toward and away from said base plate and said bars into and out of the space between said base plate and said top member.

2. In a machine for compressing a mass of glass fibers into mat formation, an elongated top member; an elongated base plate located below said member extending longitudinaly therealong and converging toward said member; a rack plate located below and movable toward and away from said base plate; parallel rack bars mounted on said rack plate each extending longitudinally thereof and each movable through a separate elongated slot formed in said base plate and into and out of the space between said base plate and said member; and means for periodically moving said rack plate toward and away from said base plate and simultaneously in first one direction and then the other longitudinally of said base plate.

3. A machine for compressing a mass of glass fibers into strip formation, comprising in combination a longitudinally extending top member; an elongated base plate located beneath and extending longitudinally of, and in converging relationship to said member; a rack plate movable toward and away from said base plate and forward and back longitudinally thereof; a plurality of rack bars mounted in parallel relationship on said rack plate, each such bar movable into and out of the space between said member and said base plate through an elongated slot formed in said base plate and extending longitudinally thereof; means for periodically moving said rack plate toward and away from and forward and back longitudinally thereof to thereby cause said bars to move into and out of the space between said member and said base plate and to simultaneously move first in one direction and then in the other longitudinally of said base plate; means for moving said member longitudinally of said base plate as said bars move within the space between said member and said base plate; and means for delivering a mass of glass fibers into the space between said base plate and said member.

4. In a machine for compressing a mass of fibers into strip formation including a longitudinally extending top member and a longitudinally extending base plate located beneath said member and extending along said member in converging relationship thereto; means for delivering a mass of fibers into the larger end of the converging passage between said member and said plate; means including a plurality of parallel rack bars for compressing the mass of fibers within such passage and for moving such mass toward and through the converging end of such passage; means for moving said rack bars toward and away from said member and simultaneously first in one direction and then the other longitudinally of said plate and said member; and means for periodically moving said member longitudinally and toward the converging end of said passage.

5. A machine for compressing a mass of fibrous material into mat formation, including an elongated stationary plate; an elongated movable member extending along said plate and located in converging relationship thereto and forming therewith a converging open-ended passage; a rack plate extending along and located adjacent to said stationary plate on the side thereof remote from said passage; rack bars mounted on said rack plate and extending in parallel relationship longitudinally thereof and each movable into and out of said passage through a separate longitudinally extending slot formed in said stationary plate; and means for periodically moving said rack plate toward and away from said stationary plate and said bars into and out of said passage.

6. A machine for compressing a mass of fibrous material into mat formation, including an elongated member;

an elongated stationary plate extending longitudinally of and converging toward said member and forming therewith an open-ended, converging passage; a rack plate extending along and located adjacent to said stationary plate on the side thereof remote from said passage; parallel rack bars mounted on said rack plate each extending longitudinally thereof and each movable into and out of said passage through a separate elongated slot formed in said stationary plate; means for periodically moving said rack plate toward and away from said base plate and simultaneously in one direction and then the other longitudinally of said base plate; and means for moving said member longitudinally of said stationary plate and toward the small end of said converging passage.

7. A machine as defined in claim 6 in which the free, longitudinal edge of each of said bars is corrugated.

8. A machine for compressing a mass of glass fiber into strip formation including an elongated stationary plate; a movable member extending longitudinally of said plate and in converging relationship thereto and forming therewith an open-ended converging passage; a rack plate adjacent said stationary plate on the side thereof remote from said passage and movable toward and from said stationary plate and simultaneously forward and back longitudinally thereof; a plurality of parallel, spaced rack bars mounted on said rack plate, each movable into and out of said passage through a separate elongated slot formed in said stationary plate and extending longitudinally thereof; means for periodically moving said rack plate toward and away from and simultaneously forward and back longitudinally of said stationary plate to thereby move said bars into and out of said passage; means for moving said member longitudinally of said stationary plate and toward the small end of said passage as said bars

move into said passage; and means for delivering glass fibers into the large end of said passage.

9. A machine for compressing a mass of fibrous material into strip formation, comprising in combination an elongated, longitudinally extending, movable member; a stationary plate spaced from and extending longitudinally of said member in converging relationship thereto and forming therewith a converging, open-ended passage; a rack plate adjacent said stationary plate on the side thereof remote from said passage; spaced, parallel rack bars mounted side by side on, and extending longitudinally of said rack plate and each movable into and out of said passage through a separate elongated slot formed in said stationary plate; means for periodically moving said rack plate toward and away from said stationary plate and simultaneously longitudinally thereof to cause said bars to move into and out of said passage and in one direction and then the other relatively to said stationary plate; means for moving said member longitudinally of said stationary plate and in a direction toward the small open end of said converging passage; and means for delivering fibrous material into the large open end of said passage.

References Cited in the file of this patent

UNITED STATES PATENTS

1,638,981	Columbro	Aug. 16, 1927
1,834,309	Harney	Dec. 1, 1931
2,113,514	Molins	Apr. 5, 1938
2,155,875	Stemper	Apr. 25, 1939
2,281,860	Renault	May 5, 1942
2,571,334	Browne	Oct. 16, 1951
2,635,301	Schubert et al.	Apr. 21, 1953