Sept. 29, 1953 G. SLAYTER 2,653,416

APPARATUS FOR FORMING GLASS FIBER MATS

Filed June 30, 1950 4 Sheets-Sheet 1

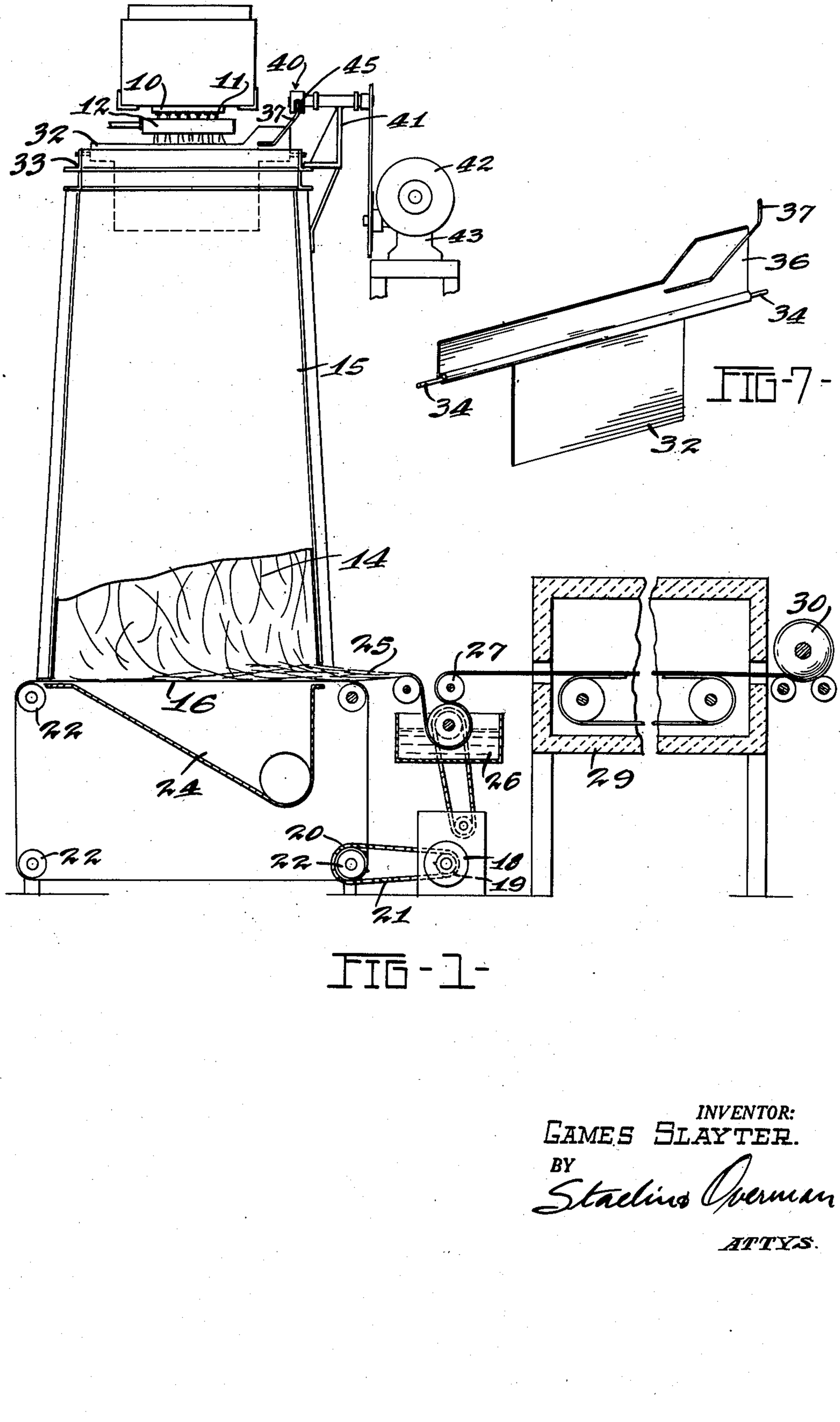

FIG-1-

FIG-7-

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APPARATUS FOR FORMING GLASS FIBER MATS

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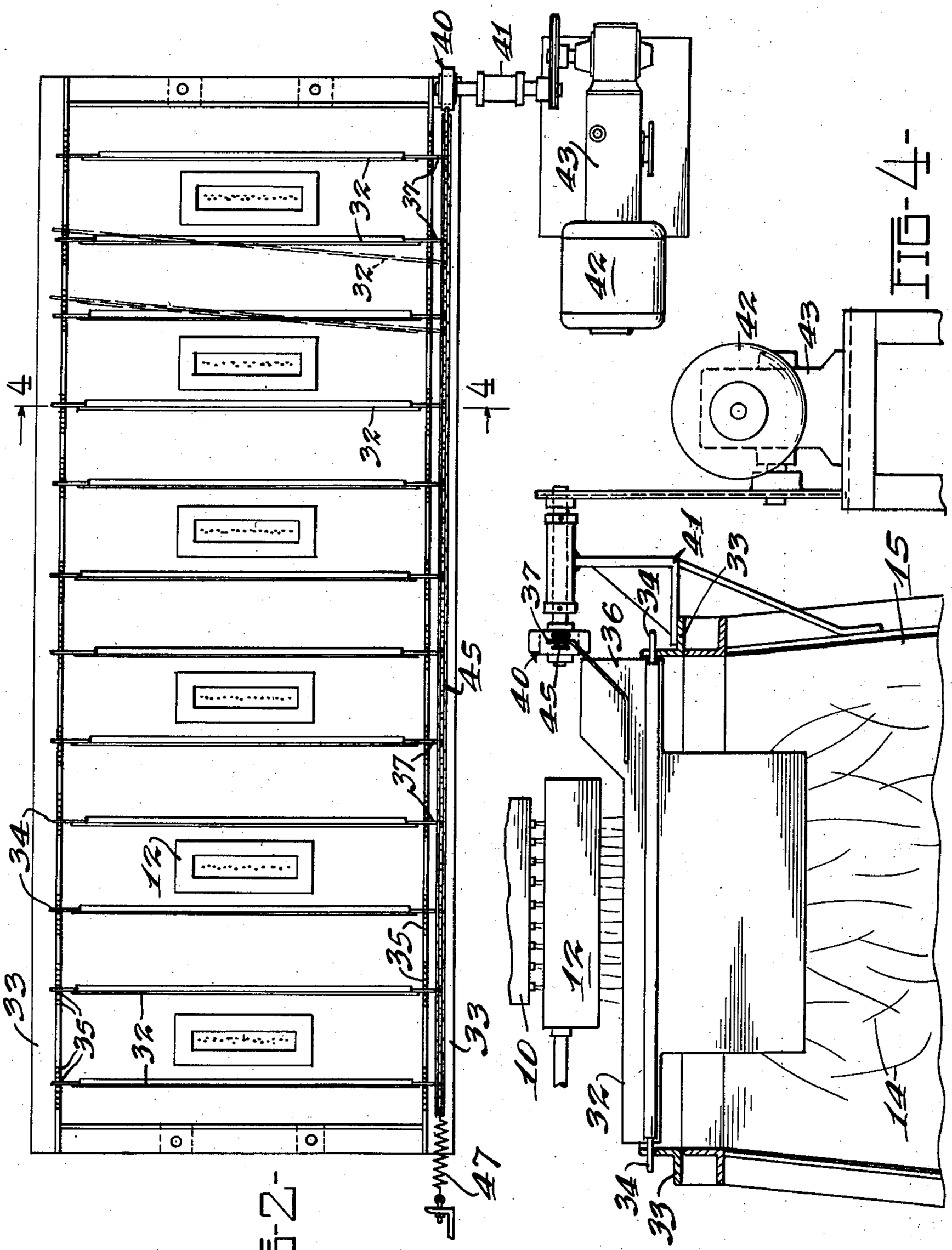

FIG-2-

FIG-4-

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APPARATUS FOR FORMING GLASS FIBER MATS

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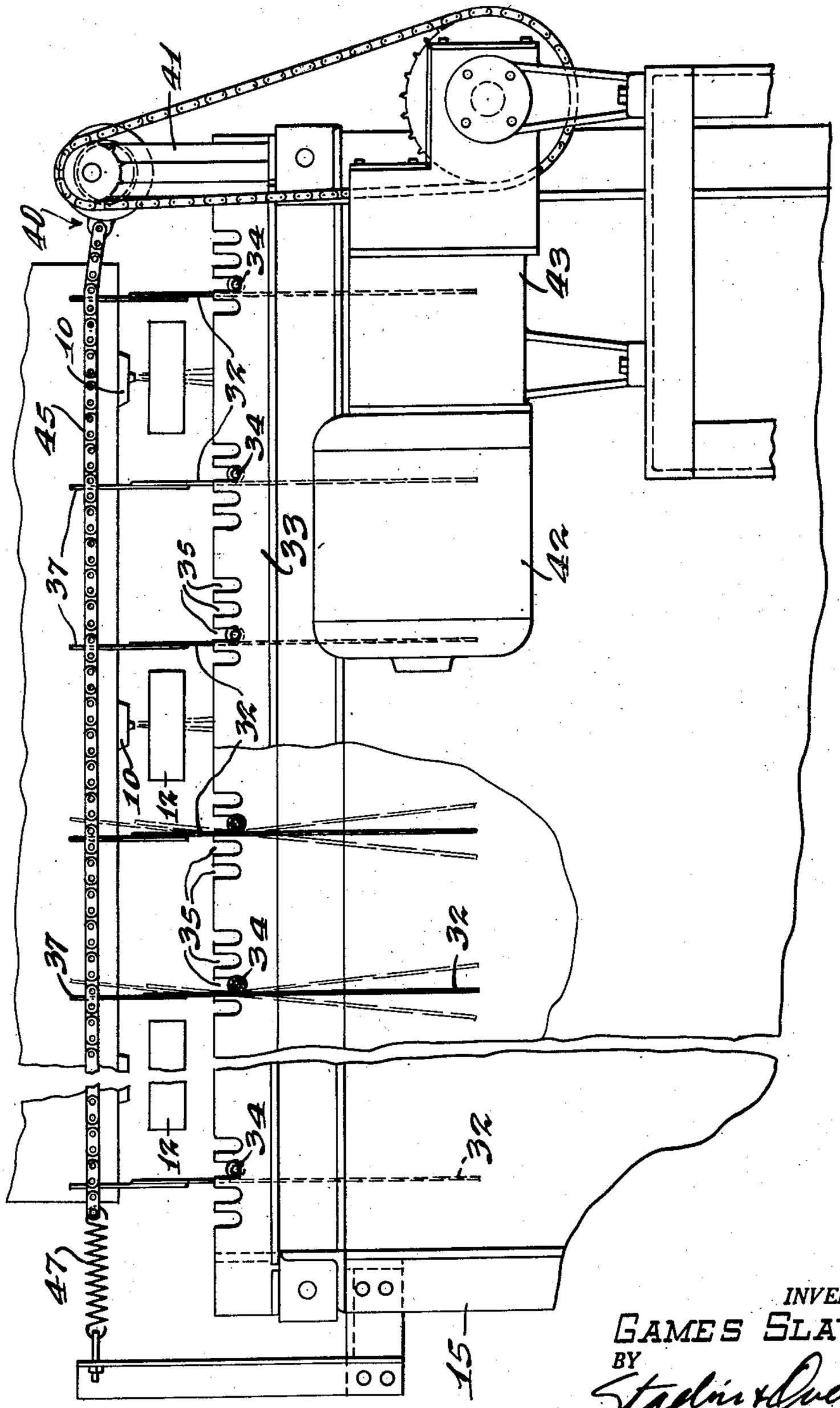

FIG-3-

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APPARATUS FOR FORMING GLASS FIBER MATS

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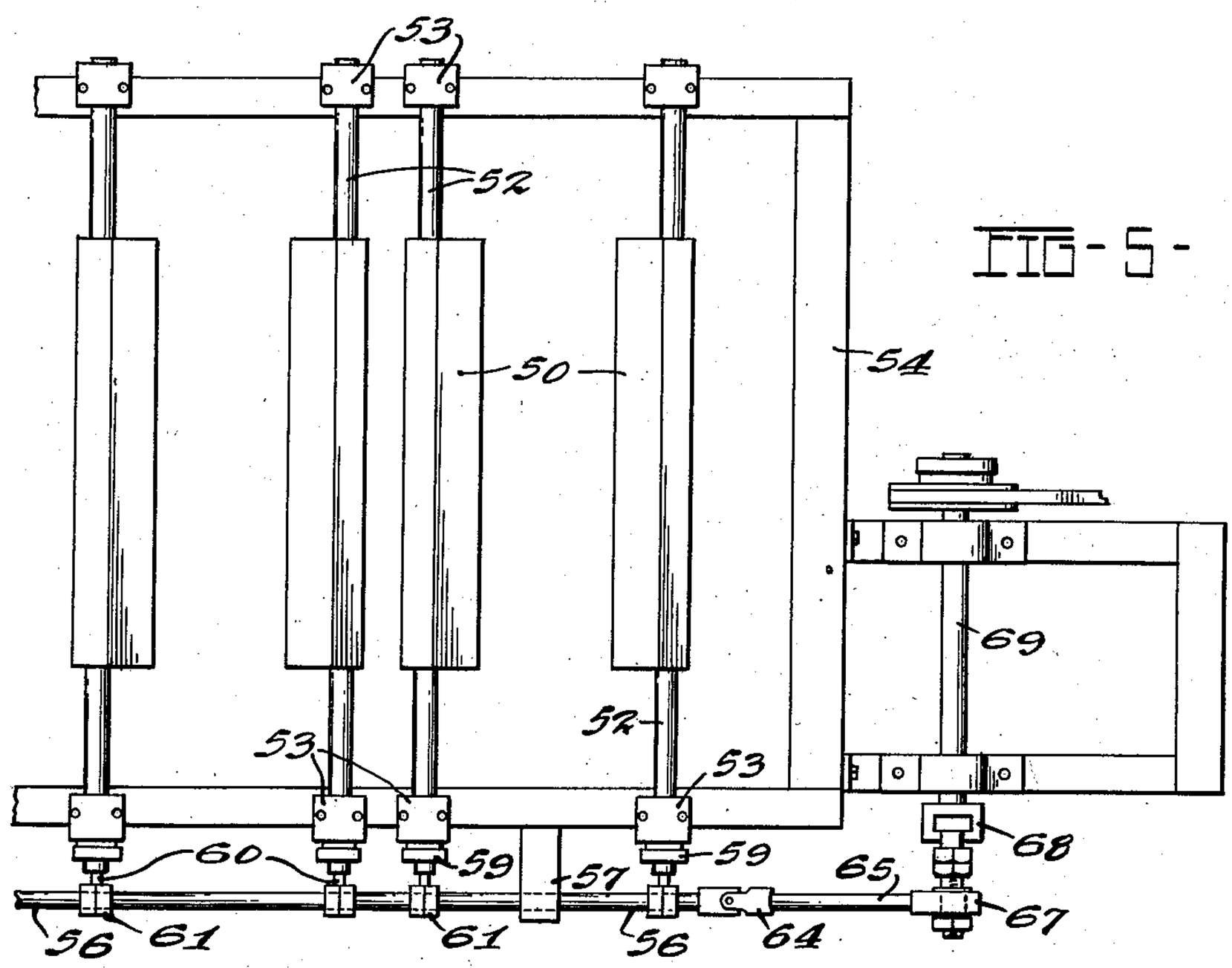

FIG-5-

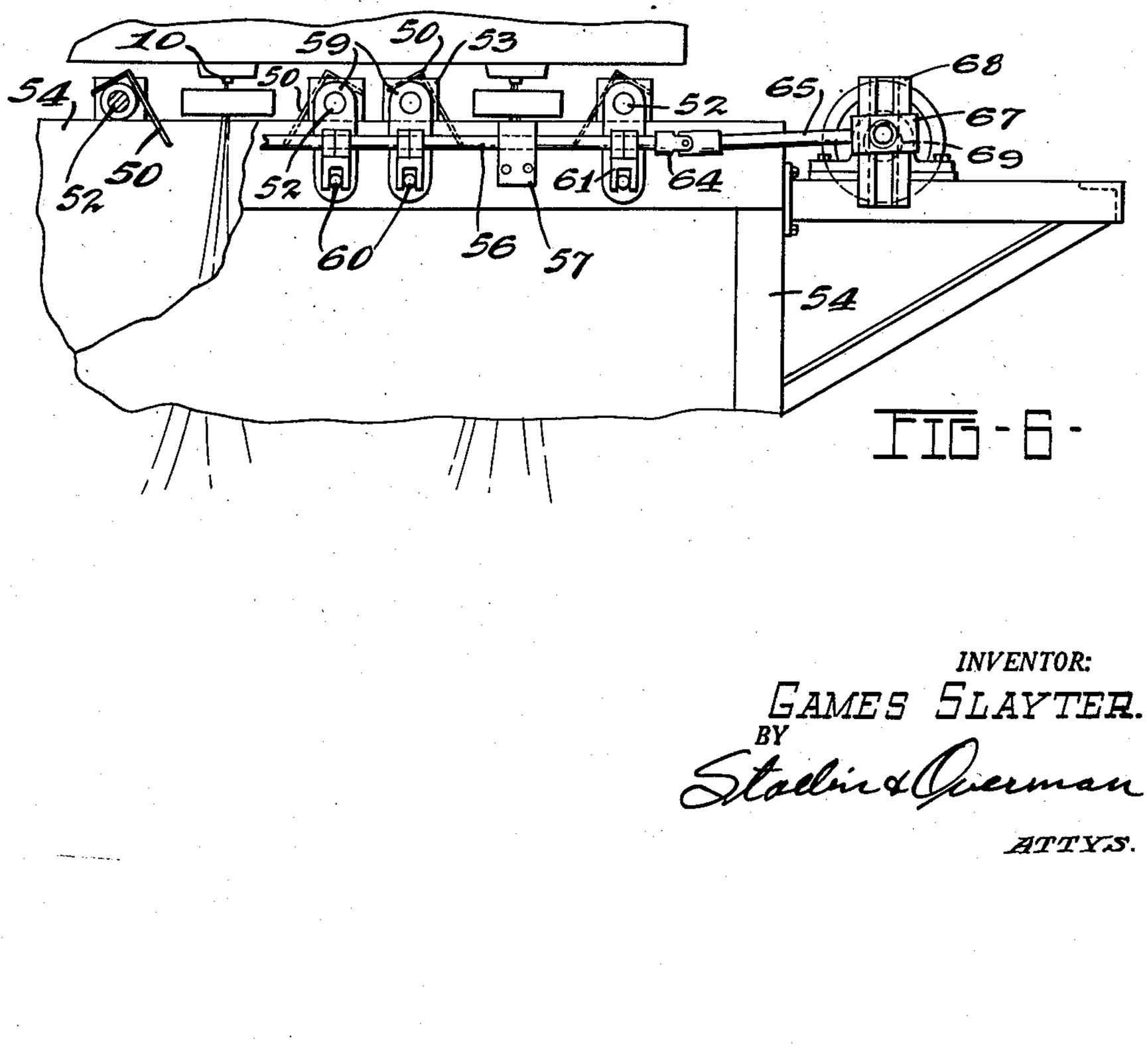

FIG-6-

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UNITED STATES PATENT OFFICE

2,653,416

APPARATUS FOR FORMING GLASS FIBER MATS

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Application June 30, 1950, Serial No. 171,445

11 Claims. (Cl. 49—1)

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The present invention relates to the production of mats of fibrous material and more particularly to improved apparatus for producing wide, thin mats of uniform thickness from mineral fibrous material, especially glass fibers.

Sheet or mat material of the present general character may be formed by various processes each having the common feature of engaging a flowing stream of molten glass with a gaseous blast. The blast disrupts or tears the stream into a multiplicity of fine fibers or filaments which are collected on a moving foraminous surface in haphazard arrangement in a mat. One form of apparatus for producing mats of glass fibers in this way is illustrated in Patent No. 2,306,347 to Games Slayter dated December 22, 1942. The present invention is particularly applicable to apparatus of this type.

Briefly, the apparatus comprises one or more feeders for the molten glass from which the glass is discharged in a plurality of streams. The molten streams are engaged by a blast of steam or other gas directed downwardly through a hood and drawn out into fibers, which collect as a mat or sheet on a moving perforated belt. A lubricant or binder may be applied to the fibers as they are formed and additional binder may be applied to the mat by drawing it through a bath of liquid binder material. The impregnated mat is then customarily passed continuously through a curing or drying oven to complete the mat-making process. Finally the finished mat is usually rolled to form a package suitable for shipment or for further processing operations. The thickness of the mat is controlled primarily by regulating the speed of the collecting conveyor.

The high velocity blasts of the blowers, especially when several are simultaneously employed, creates within the forming hood a substantial turbulence in the atmosphere in the hood. This is increased by the addition of air induced by the action of the blowers. The air flows into the hood around the blowers and substantially affects the distribution of the fibers as they collect on the moving belt. Under certain forming conditions which may be attributable to limitations in dimensions, atmospheric or other conditions within the hood, the fibers tend to collect in greater amount directly beneath the blowers and with the travel of the conveyor produce what amount to a series of longitudinal parallel ridges. A mat thus formed has alternate thick and thin areas extending along its length. This difference is more apparent in thin

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mats, but in thicker mats as well it impairs the quality of the mat and prevents use of the mat in many products normally made therefrom.

It is the primary object of the present invention to overcome the above difficulties by the provision of apparatus for eliminating non-uniformities in the mat.

Another object of the present invention is the provision of a novel apparatus for adjustably controlling the disposition of fibers as a mat is formed therefrom.

A further object of the invention is the provision of means for continuously redirecting the flow of glass fibers as they are formed to provide a mat of uniform thickness.

A still further object of the present invention is the provision of continuously oscillating means arranged adjacent the source of the fiber attenuating blast to vary the direction of flow of the blast.

Other objects and advantages of the invention will become apparent during the course of the following description when considered with the accompanying drawings in which:

Figure 1 is a side elevational view of an apparatus for forming fibrous glass mats and embodying a preferred form of the present invention;

Figure 2 is a plan view of the apparatus of the present invention;

Figure 3 is a sectional elevational view of the mechanism of the invention shown in operating relation with one form of fiber forming apparatus;

Figure 4 is a sectional view taken on line 4—4 of Figure 2;

Figure 5 is a partial plan view of a modified form of the invention;

Figure 6 is a sectional elevational view of the apparatus shown in Figure 5; and

Figure 7 is a perspective view of one element of the invention.

Referring now to Figure 1, a conventional type of apparatus for forming a mat or sheet of glass fibers is disclosed and includes one or more electrically heated feeders 10 from which a plurality of streams 11 of molten glass flow continuously. The streams of molten glass are engaged in the region adjacent their source by gaseous blasts of air or steam issuing from blowers 12 which direct the blast in the direction of flow of the streams and attenuate the streams into long fine filaments 14 or fibers. The feeders 10 and blowers 12 are arranged side by side in a row and are preferably mounted or sus-

pended by suitable structure over a vertically disposed forming hood 15 through which the attenuated fibers are conveyed by the blast.

The fibers 14 settle on a perforated collecting surface 16 which may be an endless belt and which forms the bottom wall of the forming hood 15. The belt is preferably driven continuously to carry the fibrous mass as it is formed from the forming hood in a direction transverse to the row of feeders. Driving means for the belt 16 includes a motor 18 connected by sprockets 19 and 20 and chain 21 to one of a series of rollers 22 about which the belt 16 is trained. A chamber 24 may be provided beneath the collecting surface and suction applied thereto by suitable means to assist in the collection of the falling fibers into a relatively compact mat or sheet 25.

The sheet of fibers is withdrawn from the belt 16 and passed through a bath of binder fluid 26 by means of pulling rolls 27 driven by the motor 18. The rolls 27 are driven at a speed somewhat in excess of the rate at which the mat is formed thus imparting a drafting action whereby the mat is stretched or thinned to effect a slight reorientation of the fibers. The binder impregnated sheet is then passed through a curing oven 29 in which the binder is dried or cured. As the mat issues from the oven 29 it may be wound into a roll 30 or cut into sheets depending upon the ultimate end use. Mats formed in the present manner find great utility as battery plate separators, battery retainer mat, pipe wrap, facing for acoustical insulation and other applications.

As previously pointed out difficulties sometimes arise in the production of relatively wide mats resulting in a non-uniform thickness across the width of the mat. This is especially true where a plurality of feeder units are arranged side by side in a single forming hood and are thus disposed in a row extending across the conveyor. It has been found that for unaccountable reasons the parallelly disposed blasts do not uniformly disperse the fibers so that the fibers collect in greater thickness directly beneath the blowers. This produces alternate thick and thin areas across the width of the mat. The present invention provides a relatively simple mechanical means for directing and controlling the blast from the blowers 12 and preventing the formation of non-uniform areas in the mat.

Referring again to Figure 1 of the drawings, the present invention comprises an assembly adapted to be mounted on the upper end of the forming hood 15 and supported by the structure thereof. The invention comprises a plurality of vanes 32 extending in a direction longitudinally of the collecting conveyor belt 16. The vanes are mounted in pairs adjacent each blower 12 and are supported at their ends on side rails 33 forming a part of the assembly supported by the hood structure. As illustrated particularly in Figures 4 and 7 the vanes are formed of sheet metal and have outwardly extending pintles 34 welded thereto. The pintles are received in notches 35 formed in the rails 33 so that the vanes may swing freely about the axis formed by the pintles. Several notches may be provided in each group to permit varying the spacing of the vanes with respect to the blower. One end of the vane is formed with an outwardly extending projection 36 and has secured thereto a vertically extending pin 37 which affords driving connection for oscillating the vanes.

As illustrated in Figures 2 and 3 the apparatus may comprise a series of feeder units 10 and corresponding pairs of vanes 32. The vanes may be positioned as desired in any of the notches 35 to produce the desired formation of fibers in the mat. While the vanes are preferably employed in pairs it may at times be found that a single vane will produce an adequate result. Oscillation of the vanes is accomplished by means of an eccentric 40 mounted on a bracket 41 secured to one of the rails 33. The eccentric is rotated by means of a motor 42 and gearing 43. A link chain 45 is connected at one end to the rim of the eccentric 40 in alignment with the pins 37 carried by the vanes and at its other end by means of a coil spring 47 attached to a stationary member of the hood structure. The pins 37 are adapted to project through the links of the chain so that upon rotation of the eccentric 40 through the drive mechanism the chain is moved longitudinally against the tension of the spring 47 and thus the vanes are moved back and forth.

It will be noted by reference to Figure 3 that as the fibers are formed the oscillating vanes shift the blast from side to side so that the fibers fall over an area of substantial width and thus remove the tendency to form thickened portions in the mat as is sometimes encountered in operations where the vanes are not present.

Figure 2 illustrates in broken lines an alternate position of the vanes where shifting the blast in a different direction may be found necessary to provide for proper distribution of the fibers. Such arrangement may be employed, for instance, to overcome or reduce the possibility of forming a mat with thin edges. It is also within the spirit of the invention to individually position the vanes and vary their angularity with each other should operating conditions warrant such adjustment.

Figures 5 and 6 illustrate a modified form of the invention in which the vanes 50 may be in the form of angle irons welded to pivot rods 52 mounted in bearings 53 which in turn are secured to a frame structure 54. Oscillation of the vanes 50 is accomplished by means of a reciprocating rod 56 mounted on the outside of the frame 54 in bearing blocks 57. Connection between the rod 56 and the vane supporting rods 52 includes crank arms 59 secured at one end to the ends of the rods 52 and having an outwardly extending pin 60 secured to the opposite end of the crank arm. Clevis members 61 are secured to the rod 56 and engage within the forked end thereof the pins 60. The rod 56 may be connected through a universal joint 64 and link 65 to a block 67 pivotally mounted on a crosshead 68 carried by a rotatable shaft 69. The block 67 is adapted to be adjustably secured to the crosshead 68 to produce an eccentric motion as the shaft 69 is rotated by a suitable source of power. Thus it will be noted that reciprocation of the shaft 56 imparts oscillating motion to the vanes 50 in the manner described in connection with the preferred embodiment of the invention.

The vanes may be oscillated at any desired rate, for instance, 100 to 240 oscillations per minute depending upon the resulting arrangement of the fibers forming the mat.

Modifications may be resorted to within the spirit of the invention and the scope of the appended claims.

I claim:

1. Apparatus for forming wide thin glass fiber mats of uniform thickness comprising means for flowing streams of molten glass from a plurality

of sources disposed in side by side arrangement, blowers individual to said sources for impinging the molten streams with a gaseous blast to attenuate the streams to long fine fibers, pairs of depending vanes individual to said blowers, said vanes adapted for swinging movement about axes normal to the direction of flow of the blast and toward and away from the path of the blast, the vanes of each pair being pendantly supported adjacent to and on each side of the associated blower, means interconnecting said pairs of vanes, means for oscillating the vanes whereby said vanes continuously vary the air flow adjacent the blasts to change the direction of flow of said blasts and the fibers carried thereby, and a foraminous belt on which said fibers collect in a mat of uniform thickness.

2. Apparatus for forming glass fiber mats comprising means for flowing streams of molten glass from a plurality of sources disposed in side by side arrangement, blowers individual to said sources for impinging the molten streams with gaseous blasts to attenuate the streams to long fine fibers, pairs of depending vanes individual to said blowers disposed adjacent the blowers and normally out of the paths of the blasts, means interconnecting said pairs of vanes, a foraminous belt on which said fibers are deposited by said blast, and means for oscillating the vanes into the paths of the blasts to control the distribution of the fibers on said belt.

3. Apparatus for forming wide, thin, glass fiber mats of uniform thickness comprising means for flowing streams of molten glass, blowers for impinging the molten streams with gaseous blasts to attenuate the streams to fibers, a pair of vanes supported adjacent each of said blowers for oscillatory movement about axes normal to the direction of flow of the blast, the vanes of each pair being pendantly supported adjacent to and on each side of the associated blower, means for oscillating the pairs of vanes whereby said vanes continuously change the direction of flow of said blast and the fibers carried thereby, and a foraminous belt on which said fibers collect in a mat of uniform thickness.

4. In a fiber-forming apparatus of the character described, in combination, a feeder for flowing a plurality of streams of molten glass, a blower arranged to discharge a gaseous blast into engagement with the streams of molten glass, said blast moving in the general direction of flow of the streams for attenuating the streams to fibers, a pair of vanes supported adjacent the discharge side of said blower and normally out of the path of movement of the blast, a fiber-collecting surface, and means for oscillating said vanes about axes normal to the direction of flow of the gaseous blast into the path of the blast to modify the direction of flow of the fibers entrained in the blast to effect a uniform distribution of the fibers deposited upon the collecting surface.

5. In a fiber-forming apparatus of the character described, the combination of a blower arranged to discharge a gaseous blast into engagement with streams of molten glass for attenuating the streams to fibers, a vane pivotally supported at each side of the blower but normally out of the path of the blast, means for concomitantly oscillating the vanes into the path of the blast to change the direction of movement of the induced air stream adjacent the blast to establish an undulating path for the gases of the blast and the fibers conveyed by the blast, and means for collecting the fibers entrained in the blast in a mat formation.

6. In a fiber-forming apparatus of the character described, in combination with a blower for attenuating streams of molten glass to fibers, a pair of vanes, pivotal supports for said vanes, said vanes being respectively disposed adjacent the discharge side of the blower and on opposite sides of the blower, means for adjusting the position of the pivotal supports of the vanes relative to the path of travel of the blast issuing from the blower, and means for oscillating said vanes about their pivotal supports to vary the path of the air stream induced by movement of the blast to control the direction of the path of movement of the fibers entrained in the blast.

7. Apparatus for forming fibers including, in combination, a blower for discharging a gaseous blast into engagement with streams of molten glass for attenuating the streams to fibers, a vane pivotally supported adjacent the blower and out of the path of the blast, means for adjusting the position of the pivotal axis of the vane in relation to the path of travel of the blast issuing from the blower, and means for moving the vane to control the direction of the air stream induced by the gaseous blast to alter the direction of flow of the blast.

8. In a fiber forming apparatus of the character described, the combination of a blower for attenuating streams of molten glass to fibers with a pair of vanes disposed at the discharge side of said blower for movement about axes normal to the blast issuing from the blower, a pair of rails supporting the respective ends of said vanes and provided with notches for pivotally retaining the vanes, means for oscillating said vanes to direct the flow of fibers discharged by said blower, and means for collecting the fibers in a mat of uniform thickness.

9. In a fiber forming apparatus of the character described, the combination of a blower for attenuating streams of molten glass to fibers with a pair of vanes disposed at the discharge side of said blower for movement about axes normal to the blast issuing from the blower, pintles formed on said vanes, a pair of rails supporting the respective ends of said vanes and provided with notches for pivotally receiving said pintles, means for oscillating said vanes to direct the flow of fibers discharged by said blower, and means for collecting the fibers in a mat of uniform thickness.

10. In a fiber forming apparatus of the character described, the combination of a blower for attenuating streams of molten glass to fibers with a pair of vanes disposed at the discharge side of said blower, pintles formed on said vanes, a pair of rails supporting the respective ends of said vanes and provided with notches for pivotally receiving said pintles, means for oscillating said vanes to direct the flow of fibers discharged by said blower, said means including a linear member interconnecting said vanes, tension means at one end of said linear member, a rotatable eccentric element connected to the opposite end of said linear member, and means for rotating said eccentric element to impart reciprocating motion to said linear member against the retracting force of said tension means.

11. In a fiber forming apparatus of the character described, the combination of a blower for attenuating streams of molten glass to fibers with a pair of vanes disposed at the discharge side of said blower, pintles formed on said vanes, a pair

of rails supporting the respective ends of said vanes and provided with notches for pivotally receiving said pintles, means for oscillating said vanes to direct the flow of fibers discharged by said blower, said means including a linear member interconnecting said vanes, tension means at one end of said linear member, a rotatable eccentric element connected to the opposite end of said linear member, means for rotating said eccentric element to impart reciprocating motion to said linear member against the retracting force of said tension means, and means for collecting the fibers in a mat of uniform thickness.

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