United States Patent

[11] **3,570,653**

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[21] Appl. No. **777,445**
[22] Filed **Nov. 20, 1968**
[45] Patented **Mar. 16, 1971**
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Melbourne, Victoria, Australia
[32] Priority **Nov. 20, 1967**
[33] **Australia**
[31] **30,061/67**

[54] **FIBRE COLLECTION APPARATUS**
4 Claims, 8 Drawing Figs.

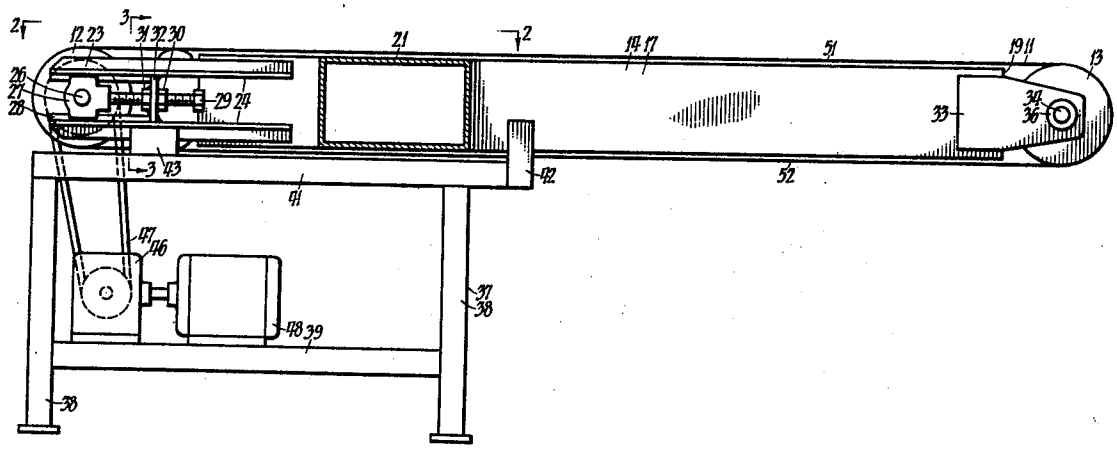
[52] **U.S. Cl.** **198/190**
[51] **Int. Cl.** **B65g 15/12**
[50] **Field of Search** 198/184, 187; 198/190; 271/74

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Primary Examiner—Richard E. Aegerter
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ABSTRACT: A fibre collection apparatus comprises wire, cable or the like supported in an endless configuration having a plurality of straight runs disposed side-by-side to serve as fibre collectors, drive means to drive the wire cable or the like through the endless configuration so that said runs travel in one general direction, and means to apply suction through the gaps between said runs.



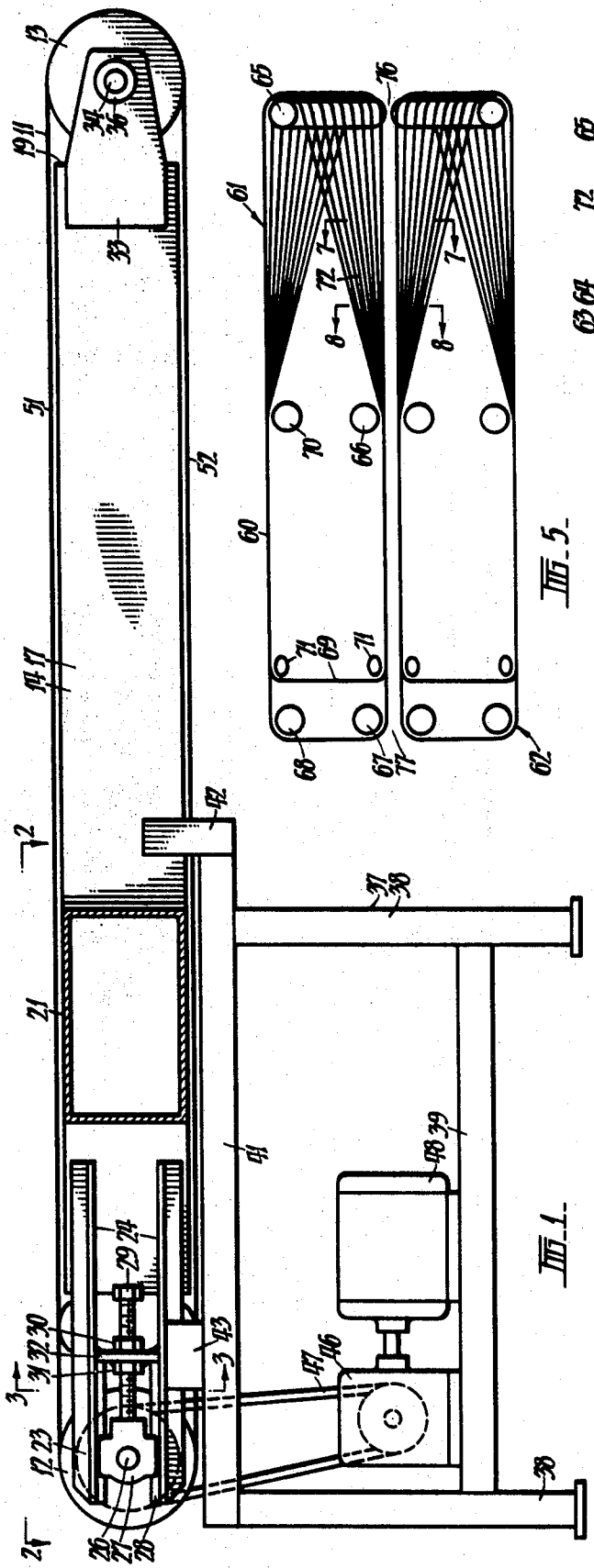


FIG. 1

FIG. 5

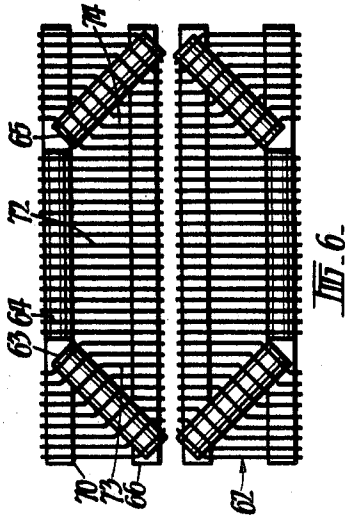


FIG. 6

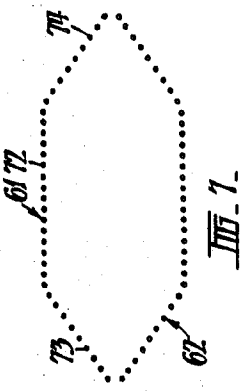


FIG. 7

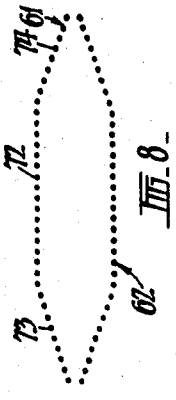


FIG. 8

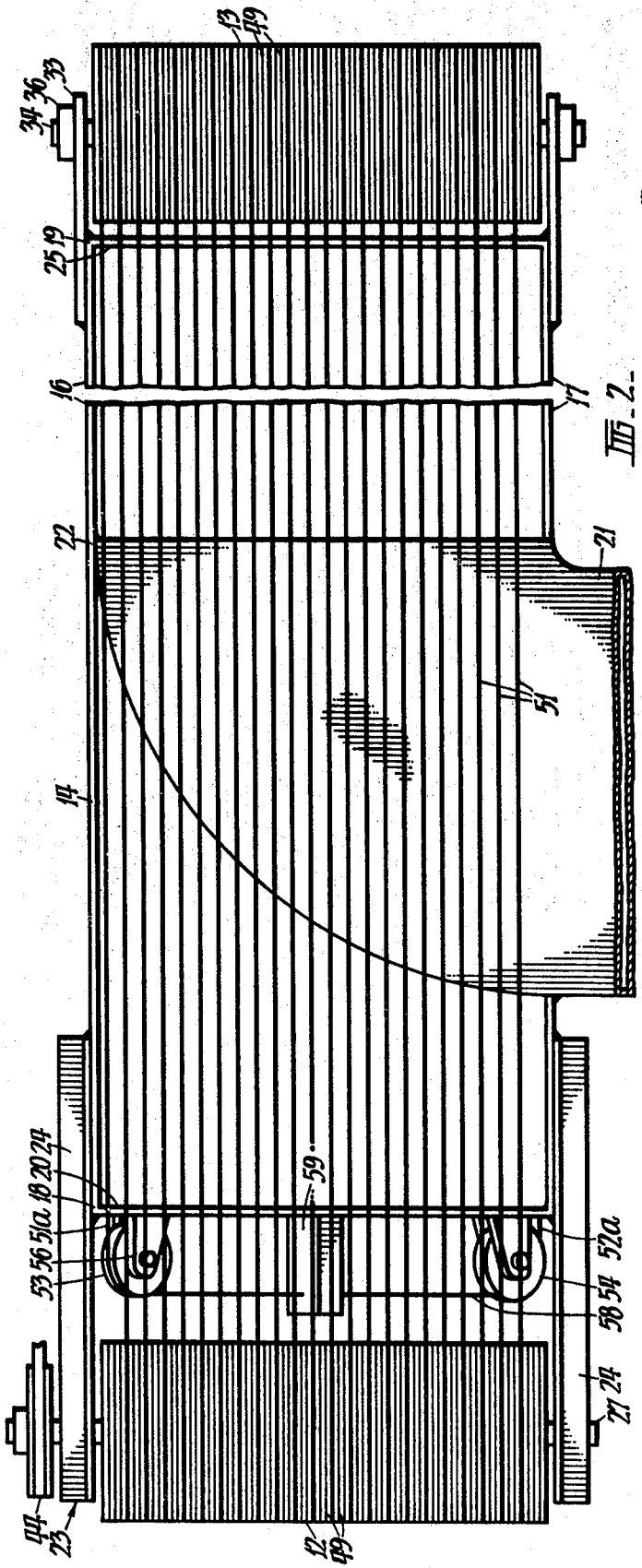


FIG. 2.

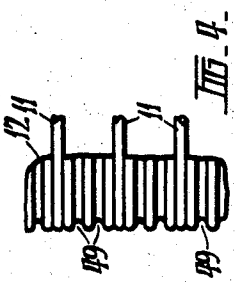


FIG. 4.

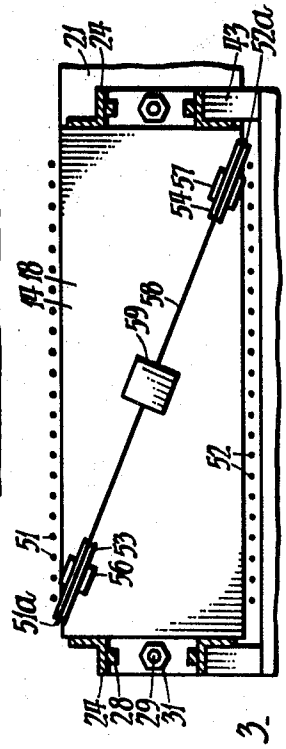


FIG. 3.

FIBRE COLLECTION APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the production of mats of mineral, glass or other fibers and is particularly concerned with apparatus for collecting the fibers as they are formed.

2. Description of Prior Art

In the manufacture of glass or mineral fibers mats, attenuated fibers are formed in a stream of hot gas. Molten raw material may be flung into the gas stream by centrifugal action of a spinner or primary filaments may be produced by direct extrusion from a furnace and then fed into the gas stream for attenuation. In either case, attenuated fibers are formed within the gas steam and must be collected so as to form a mat.

The most common manner of collecting the fibers is to direct the gas stream downwardly onto a horizontal belt conveyor the belt of which is in the form of an openwork wire mattress. Suction is applied through the mattress to draw the gas stream through it and cause the deposition of the fibers on the mattress so as to build up a mat which is carried forward by the conveyor. The fibers are sprayed with a resin binder, usually while they are still in suspension in the gas stream before reaching the wire mattress, so that they adhere together to form a bonded mat which is delivered as a coherent structure from the end of the conveyor. In another means of collecting the fibers, two wire mattress conveyors converge so as to form opposite walls of a convergent collection chamber, the other walls of the chamber being provided by a pair of generally triangular plates extending between the edges of the convergent conveyors. The whole chamber is disposed within a large suction box and the fibers bearing gas stream is directed into the open mouth of the chamber. The mattress conveyors are driven so that the portions forming walls of the chamber move from the mouth to the other end of the chamber and fibers collected thereon are thereby brought together to form a single continuous mat.

In both of the above-described conventional collection means, the wire mattresses rapidly become clogged with fiber and resin making it impossible to maintain constant conditions of suction to give a uniform mat and the cleaning of the mattresses is a major production problem. It is also found that less fibers are collected at the edges of the mattresses and the edges of the resultant mats must be trimmed off, giving substantial wastage. In the collection chamber type of apparatus, the stationary sidewalls also collect resin coated fibers and must be regularly cleaned. The present invention enables these and other disadvantages of the conventional kinds of fiber collection apparatus to be overcome.

SUMMARY

According to the invention there is provided fiber collection apparatus comprising wire or cable supported in an endless configuration having a plurality of straight runs disposed side-by-side to serve as fiber collectors, drive means operable to drive the wire or cable through the endless configuration so that said runs travel in one general direction, and means to apply suction through the gaps between said runs.

Said runs may be parallel and arranged in a flat general plane. For example, said runs may extend between a pair of horizontally spaced, horizontal support rollers to take the place of the openwork conveyor in a conveyor collection process. In this case the runs may be connected by return runs extending directly between the rollers in a general plane below the plane of parallel runs. The rollers may each be provided with circumferential grooves to engage the wire or cable and maintain desired spacing between the parallel runs and the drive means may be coupled to one of the rollers so as to be operable to rotate it and thus drive the wire or cable by friction.

However, as will be more fully explained hereinafter, the invention may also be employed to provide moving walls of a fiber collection chamber and in this case at least some of said runs may extend between mutually skewed rollers to define a twisted wall.

In order that the invention may be more fully explained, two specific embodiments thereof will now be described in detail with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevation of a flat conveyor-type fiber collection apparatus constructed in accordance with the invention;

FIG. 2 is a view generally on the line 2–2 in FIG. 1;

FIG. 3 is a cross section on the line 3–3 in FIG. 1;

FIG. 4 is an enlargement of the region 4 in FIG. 2;

FIG. 5 is a somewhat diagrammatic longitudinal cross section of a further form of fiber collection apparatus constructed in accordance with the invention;

FIG. 6 is an end elevation of the apparatus shown in FIG. 5;

FIG. 7 is a cross section on the line 7–7 in FIG. 5; and

FIG. 8 is a cross section on the line 8–8 in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the collection apparatus shown in FIGS. 1 to 4, the collection conveyor is defined by straight runs of a single wire 11 which is wrapped around a pair of horizontally spaced and parallel cylindrical rollers 12,13 between which a long open-topped boxlike structure 14 extends. Structure 14 is formed of an open-topped metal channel having sidewalls 16,17 and closed walls at its two ends 18,19 by end walls 20,25. Near the end 18 of structure 14, an opening is cut in the sidewall 17 to receive a rectangular duct 21 for connection to a source of suction, such as an air blower (not shown). One side of duct 21 extends across the structure 11 in a curve and is connected to the sidewall 16 at the location 22.

The roller 12 is mounted on a supporting frame 23 which is welded to structure 14 so as to extend from the end 18 thereof. Supporting frame 23 comprises four arms 24 of angle iron disposed in two pairs one to each side of structure 14 with the arms of each pair spaced vertically apart. FIG. 1 shows the manner in which one end of roller 12 is mounted on support frame 23 and the other end is mounted in identical fashion. As shown in FIG. 1, the mounting shaft 26 of roller 12 is journaled in an end bearing 27 which is slidable on track strips 28 carried by arms 24. An adjustment screw 29 is rotatably mounted at one end in bearing 27 and engages a nut 31 which is welded to a plate 32 extending between arms 24. Screw 29 extends through an aperture in plate 32 and carries a locknut 30. It will be appreciated that the position of roller 12 can be adjusted longitudinally of box structure 14 by appropriate operation of the adjusting screws at its two ends and its alignment transversely of the box structure can also be adjusted.

Roller 13 is disposed between a pair of wing plates 33 welded one to either side of structure 14 so as to project from the end 19 thereof and the shaft 34 of that roller is journaled in bearings 36 carried by the plates 33.

The assembly thus far described is supported on a support stand 37 having legs 38, a shelf 39, a table 41 and brackets 42,43 which project upwardly from table 41 and are connected respectively to box structure 14 and to the roller support frame 23.

One end of the shaft 26 of roller 12 carries a drive pulley 44 which is driven via a reduction gearbox 46 and V-belt 47 by an electric motor 48, the gearbox and the electric motor being mounted on the shelf 39 of support structure 37.

Rollers 12,13 are of equal diameter, this diameter being slightly greater than the depth of box structure 14 so that each roller projects slightly above the plane of the top of the structure and slightly below the bottom of that structure. Each roller is provided with circumferential grooves 49 which are arranged at approximately one-fourth of an inch spacing and are of semicircular cross section to suit the diameter of wire 11. The wire is wrapped around the rollers to form a plurality of upper spans or runs 51 which define a collection conveyor

extending along the open top of structure 14 and return runs or spans 52 extending between the rollers and beneath the bottom of structure 14. The wire is wound in spirallike fashion to engage every third groove in each roller but its upper runs 51 extend in parallel relation in strict longitudinal alignment with structure 14 whereas the return runs 52 extend in parallel straight line paths at a slight angle to the upper runs, the spacing between the wire runs being maintained by the grooves 49. Because of the very small pitch between grooves 49, the slight angle between the upper runs 51 and the lower runs 52 does not show up in the drawings. It will be appreciated that if wire 11 were simple wound as described above it would leave two free ends one on either side of the apparatus. However, a pair of crossover sheaves 53,54 54 are disposed between roller 12 and structure 14 to enable the ends of the wire to be joined so that the wire has an endless configuration. Sheaves 53, 54 are mounted by means of brackets 56,57 on the end wall 18 of structure 14 one to each side of structure 14 and one to the top and one to the bottom of that structure, i.e. adjacent diagonal opposite corners of the end wall 18. The upper run 51A of wire at one edge of the conveyor does not extend to roller 12 but passes around the upper sheave 53 and then passes downwardly and across through a span 58 to sheave 54 around which it passes to extend into the return run 52A on the other side of the apparatus. Sheaves 53,54 are angled to align with the straight line span 58 between the upper run 51A and the lower run 52A which are thus connected.

The connecting span 58 of wire extends through a wire cleaning or stripping die 59 which is mounted on the end wall 18 of structure 14. Die 59 may be of any conventional construction and may simply consist of a block provided with a die aperture through which the wire extends.

When roller 12 is rotated by operation of motor 48, it drives wire 11 around its closed spirallike configuration. The upper spans 51 then all travel in one direction longitudinally of the structure 14 to serve as a flat conveyor travelling from right to left as seen in FIGS. 1 and 2 and the return runs 52 travel in the opposite direction. Suction is applied to duct 21 and a stream of gas and attenuated fibers is directed downwardly on to the upper wire spans 51 toward the right-hand end of the apparatus. The upper wire spans then serve as a fiber collection conveyor and the open-topped part of structure 14 to the right of duct 21 serves as a suction box into which gas is drawn downwardly through the gaps between the upper wire spans 51. The fibers collect on the upper wire spans to form a mat which is delivered as a coherent structure from the delivery end of the conveyor.

Since the single wire 11 moves through a closed configuration, all portions of the wire regularly traverse the same path and each part of the wire passes through the cleaning die 59 during one circuit of the enclosed configuration. Thus all runs of the wire are kept clean by the single cleaning die. However, it will be appreciated that in cases where clogging of the conveyor is particularly serious, several cleaning devices could be provided. For example, a number of the return runs 52 could be passed through stripping dies or steam cleaning devices. As another alternative, the wire may be diverted through a relatively large cleaning loop to pass through a cleaning bath and, if necessary, one or more stripping dies. In fact, the wire could be run out to a plurality of cleaning loops as it traverses one circuit. For example there could be a cleaning loop for every six upper runs.

Apart from its ease of cleaning, the continuous wire arrangement offers several other advantages over conventional wire mattress arrangements. The spacing of the wire runs can be adjusted to vary the width of the mat so as to cut trimming wastage or to vary the suction conditions. The adjustment may be carried out by "jumping" the wire runs between the circumferential grooves 14 of rollers 12,13 so that the spacing between the runs is varied. It is also possible by a similar adjustment to vary the spacing of the wire runs over the width of the conveyor to "tune" the conveyor to the fiberizing pattern of the process so as to produce a mat having even density over its full width. For example with a conventional mattress, less fibers are deposited on the edge portions of the mattress than on its central area due to changes in fiber distribution throughout the gas stream. With the present apparatus, it is possible to increase the spacing of the wires at the edges of the conveyor to give greater suction along the edges thereby to build up the fiber collection in those areas.

In the illustrated construction, roller 12 can be moved through its range of adjustment to vary the tension of the wire, to allow for thermal expansion of the wire or to take up and let out wire when the spacing between the wire runs is varied. It will be appreciated that the apparatus could be modified by spring loading one of the rollers 12,13 for this purpose or by providing a separate spring-loaded takeup roller.

Other modifications of the apparatus will be apparent to those skilled in the art. For example, rollers 12,13 could be ungrooved and the spacing of the upper wire spans 51 controlled by engagement with pins on a guide bar extending transversely across the conveyor adjacent one of those rollers. The guide bar could be arranged to pivot so as to vary the wire spacing. As a further alternative the rollers could be made up of a plurality of individual grooved discs separated by resilient spacers and could be provided with means to cramp them longitudinally so as to vary the wire spacing.

The invention is not limited to conveyor-type collection apparatus and FIGS. 5 to 8 show the manner in which it can be employed to provide moving walls for a fiber collection chamber. In this case, the chamber is formed by upper and lower wire circuits denoted generally as 61,62.

Circuit 61 is formed by a single continuous wire 60 wrapped around rollers 63,64,65 which are arranged in a splayed, inverted-U configuration and wide cylindrical rollers 66,67,68 and 70. All of the rollers are provided with circumferential, semicircular grooves arranged at equal spacing longitudinally of the rollers and the wire 60 is wrapped in successive loops in a spirallike manner from one side of the apparatus to the other to engage these grooves and its ends are joined by the provision of a connecting span 69 extending between crossover sheaves 71 in the same manner as the connecting span 58 and crossover sheaves 53,54 of the first embodiment. The runs of wire 72 extending between roller 64 and roller 66 define a planar wall portion whereas the runs 73,74 extending between rollers 63,65 and roller 66 define twisted wall portions which merge with the planar wall portion.

Wire circuit 62 is similar to circuit 61 except that it is inverted and the two circuits form a convergent collection chamber having wire walls which can be driven from its mouth 76 to its narrow outlet end 77.

In use, the apparatus constructed in accordance with FIGS. 5 to 8 is located within a conventional large suction box and a fiber supporting gas stream is directed into the open mouth 76 of the chamber. The gas is sucked through the moving walls of the chamber and the fibers are collected on those walls and are converged at the outlet 77 of the chamber to form a mat which is delivered from the apparatus at 78. The two continuous lengths of wire forming circuits, 61,62 can be readily cleaned by dies or steam cleaning devices in much the same manner as outlined above in the description of the first embodiment. Furthermore, the arrangement has done away with the stationary plate sidewalls which are usually associated with fiber collection chambers and all of the chamber wall area is effective to collect fibers and bring them into the mat. As in the first described apparatus, the spacing of the wire runs forming the chamber walls can be varied to alter the suction conditions and to "tune" these conditions to the fiber distribution in the gas stream so as to achieve a mat of uniform density.

I claim:

1. Fiber collection apparatus comprising a plurality of sheetlike arrays of wire runs defining walls of a fiber collection chamber having front and rear ends, the front end being open, rear wire support means supporting said arrays of wire runs at the rear end of the chamber such that the arrays are flat and

are in closely spaced parallel relationship at the rear end of the chamber, front wire support means supporting said arrays of wire runs at the front end of the chamber such that at said front end the arrays are of trough configuration and disposed in mouth-to-mouth relation to define the open front end of the chamber, said wire runs extending in straight lines in side-by-side relationship between the front and rear support means such that said arrays change from the trough configurations at the front end of the chamber to the flat configurations at the rear end of the chamber and are portions of endless wire circuits, means to drive the wire through the endless circuits such that all said runs travel from the front end to the rear end of the chamber, and means to apply suction through the gaps between the runs, whereby gas borne fibers directed into the chamber will be collected on said wire runs and brought together into a mat of fibers discharged from the chamber between the flat wire arrays at the rear end of the chamber.

2. Fiber collection apparatus as claimed in claim 1, wherein the front wire support means comprises two sets of rollers, each set comprising a plurality of rollers disposed end to end in trough formation so as to support one of the troughed wire arrays.

3. Fiber collection apparatus as claimed in claim 1, wherein the rear wire support means comprises a pair of elongate parallel rollers supporting the flat arrays at the rear end of the chamber.

4. Fiber collection apparatus as claimed in claim 1, wherein each array of wire runs is defined by a single endless wire circuit.