May 19, 1970 H. H. LANGDON 3,512,218

MACHINE FOR FORMING RANDOM FIBER WEBS

Filed Jan. 19, 1968 5 Sheets-Sheet 1

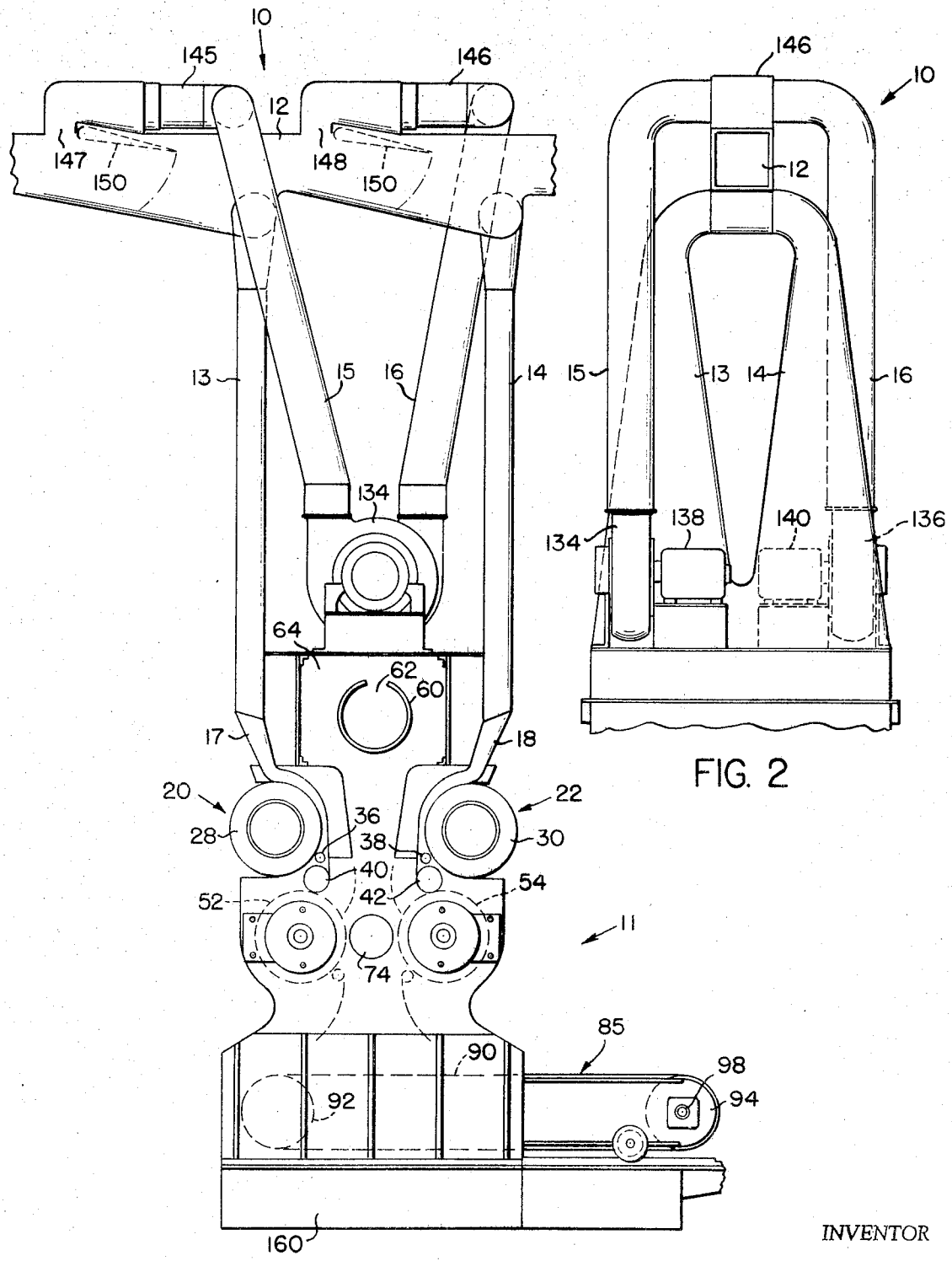

FIG. 1

FIG. 2

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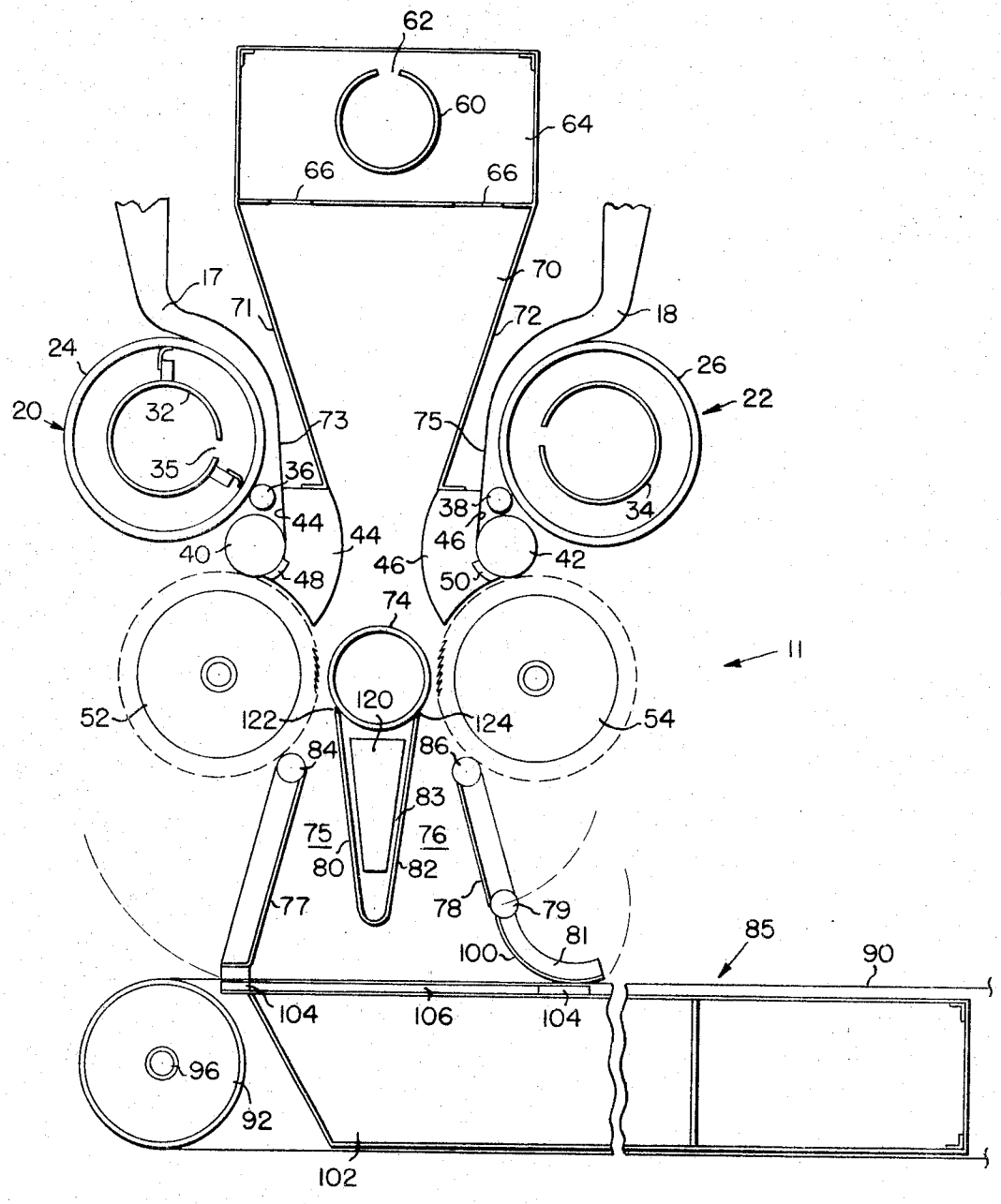

FIG. 3

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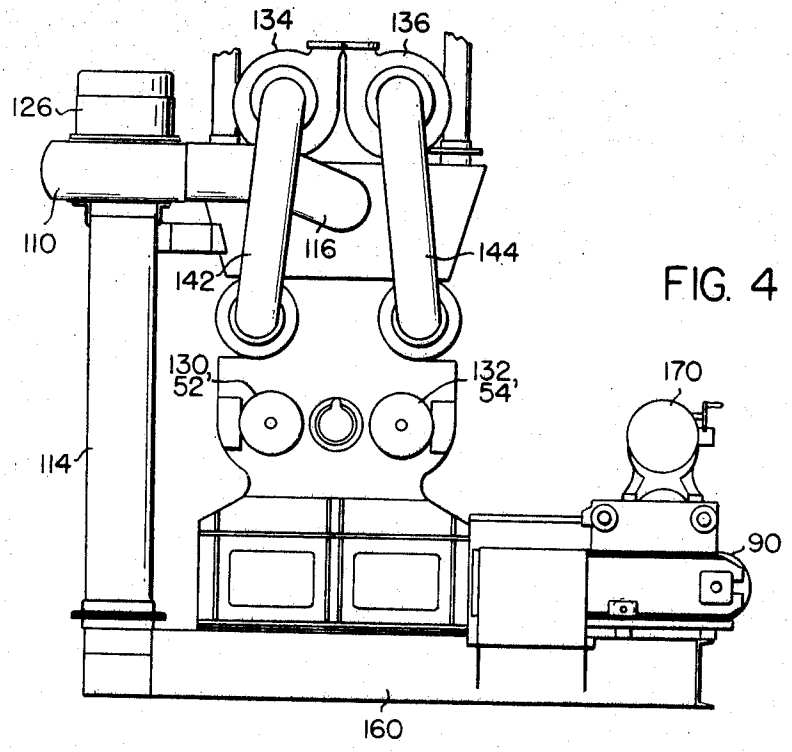

FIG. 4

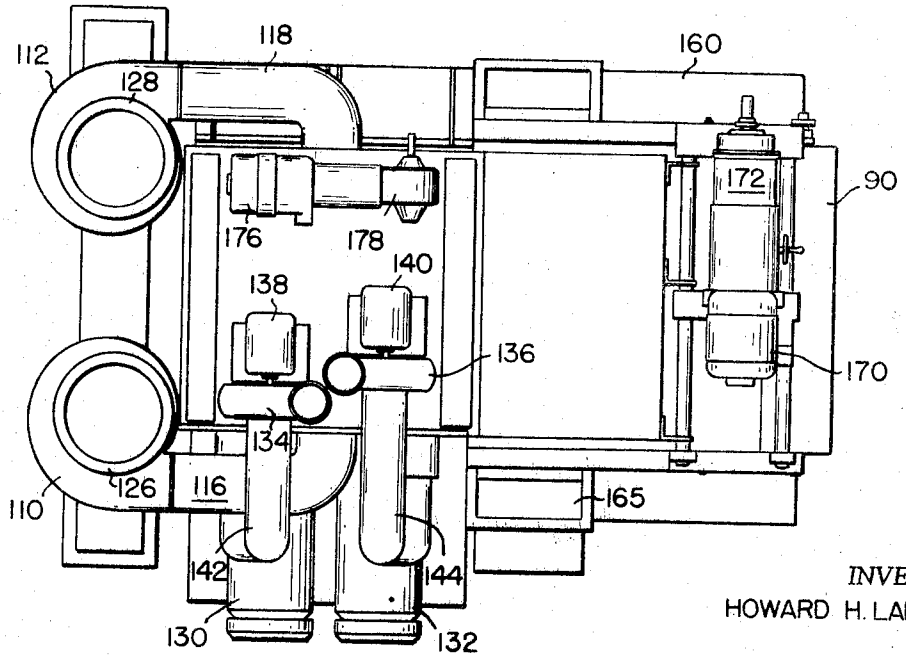

FIG. 5

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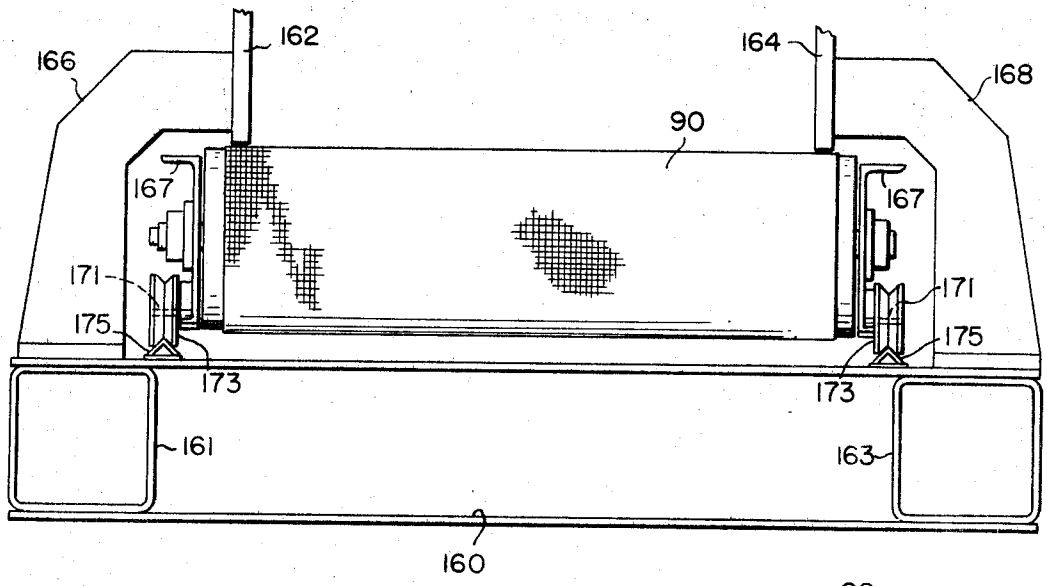
FIG. 6



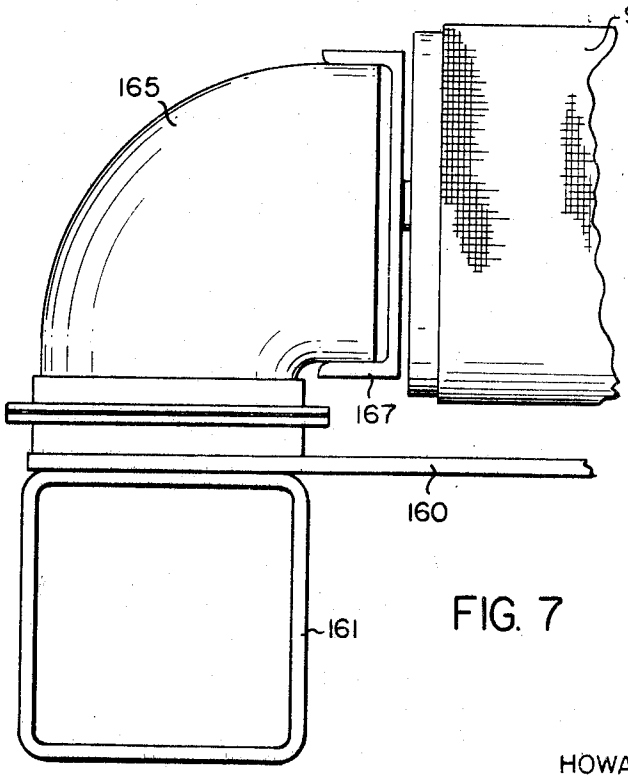


FIG. 7

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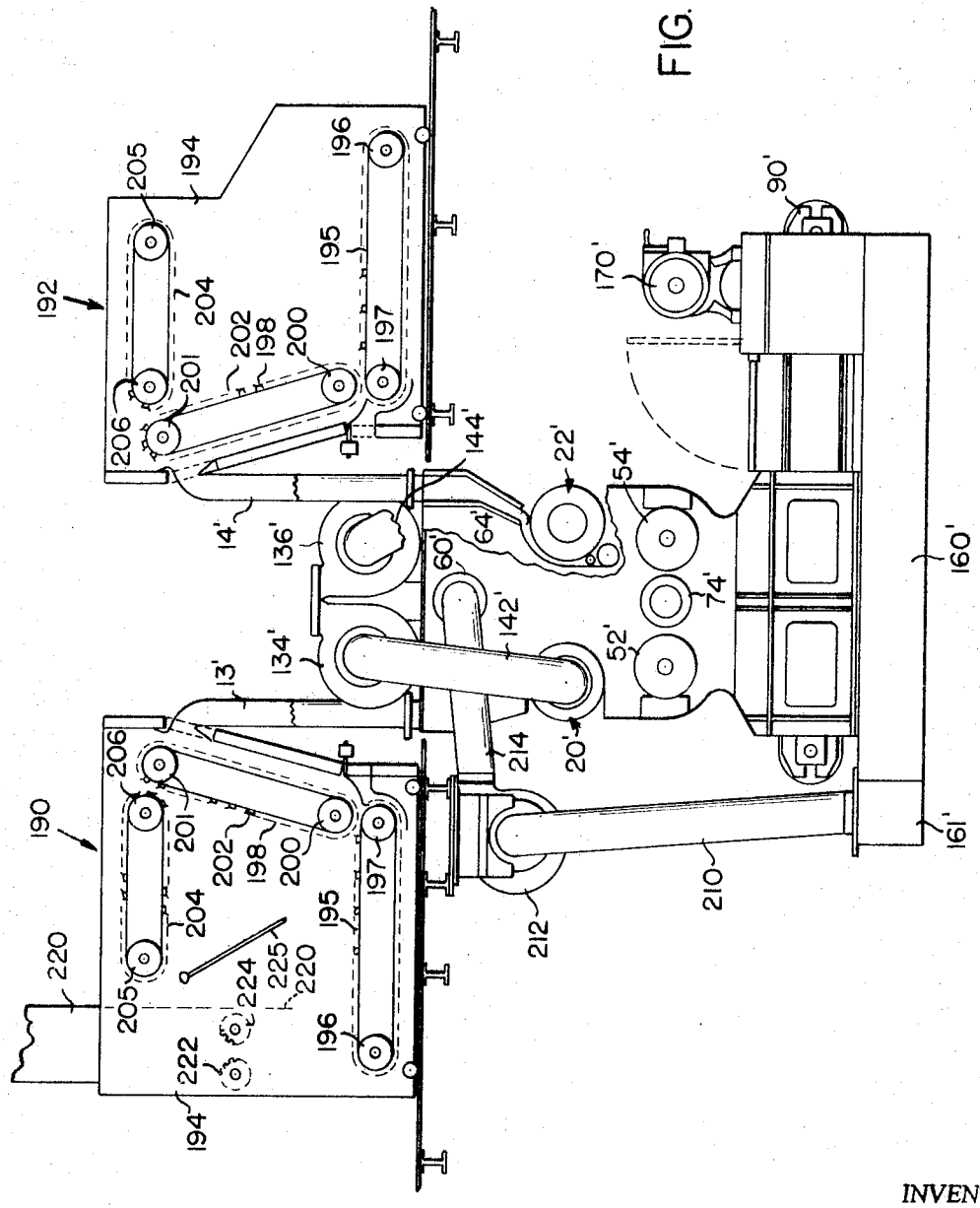
FIG. 8



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United States Patent Office 3,512,218 Patented May 19, 1970

3,512,218

MACHINE FOR FORMING RANDOM FIBER WEBS

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Filed Jan. 19, 1968, Ser. No. 699,213
Int. Cl. D01g 25/00
U.S. Cl. 19—156.3 8 Claims

ABSTRACT OF THE DISCLOSURE

In this machine fibers or tufts of fibers are fed to two rotating condensers on which the fibers are laid down by suction and from which the mats of fibers formed are doffed by doffing rolls, and fed over feed plates by feed rolls to two rotating lickerins which comb the fibers from the mats. The fibers are doffed from the lickerins by centrifugal force and by an air stream flowing through a balancing chamber disposed centrally between the two condensers and their feed plates. This stream is split by a saber, which is disposed between the two lickerins, so that it flows past the two lickerins. The split air stream (now two streams) delivers the fibers doffed from the lickerins onto an endless condenser belt on which the fibers are laid down in random fashion to form the random fiber web.

This invention relates to apparatus for producing random fiber webs, that is, for producing textile articles without spinning, weaving, or knitting operations. In a more specific aspect, the invention relates to organized machines of the general type disclosed in the patents of Buresh and Langdon Nos. 2,700,188, 2,744,294, 2,876,500 and of Langdon et al. 2,890,497.

One object of the present invention is to provide a machine capable of forming random fiber webs faster than prior such machines. To this end it is an object of the invention to provide apparatus for more efficiently producing random fiber webs, in which the product flow rate is increased.

Another object of the invention is to provide a machine of the character described suited to form random fiber webs with the best widthwise uniformity.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims, particularly when read in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is a fragmentary side elvational view, with parts broken away and shown in section, showing a random fiber web forming machine built according to one embodiment of this invention;

FIG. 2 is an elevational view, taken at right angles to FIG. 1 and partly broken away, showing fragmentarily the pneumatic feed system for supplying fibers to this machine;

FIG. 3 is an enlarged fragmentary sectional view showing, somewhat diagrammatically and on an enlarged scale, the structure of the lower part of the machine of FIG. 1;

FIG. 4 is a side elevation on a somewhat reduced scale of the machine;

FIG. 5 is a plan view of this machine;

FIG. 6 is a fragmentary view on an enlarged scale taken at the base of the machine and illustrating the mounting of the condenser screen on which the random fiber web is laid down;

FIG. 7 is a fragmentary sectional view on a still further enlarged scale showing the connection of the air exhaust duct to the condenser; and

FIG. 8 is a side elevation, with parts broken away, showing how hopper type feed mechanisms, instead of a pneumatic feed system, may be connected to the machine for feeding fibers to the machine.

Referring now to the drawings and first to FIGS. 1 to 7 inclusive, **10** denotes a pneumatic system for supplying fibers to the random fiber web forming machine, designated as a whole at **11**. This fiber supply system may be similar to that disclosed in applicant's pending application, Ser. No. 521,267, filed Jan. 18, 1966. It comprises a main line duct **12** which may be used to supply a line of machines, and which is connected by supply ducts **13** and **14** and by return ducts **15** and **16** to machine **11**. The main duct **12** may be fed from any suitable source as, for instance, a conventional opener.

The ducts **13** and **14** deliver the air-conveyed fibers to trumpets **17** and **18**, which form parts of the air bridge system conveying the fibers from the fiber supply source to rotary feed condensers **20** and **22**.

The condensers may be of conventional construction, and comprise rotary screens **24** and **26** (FIG. 3) carried by end plates **28** and **30**, respectively (FIG. 1) which revolve about fixed suction tubes **32** and **34**, respectively. Each tube is slotted, as indicated at **35** (FIG. 3) in the case of the tube **32**, along its length to suck the air through the screen **20** into the tube. The fibers are deposited on the screen.

Doffing rolls **36** and **38** are disposed in contiguity to the condenser screens to doff from the screens onto feed plates **44** and **46** (FIG. 3), the mats of fibers laid down on the screens. Feed plates **44** and **46** are extensions of the plates that bound one side of the trumpets **17** and **18**.

The mats are picked up by feed rolls **40** and **42**, which feed the mats over the feed plates **44** and **46**, and nose bars **48** and **50**, respectively, to the rotary lickerins **52** and **54**, respectively. These lickerins are of standard construction, as are the feed plates and the feed rolls.

The lickerins have peripheral teeth which comb fibers from the mats as the lickerins revolve. The lickerins are driven at high speed according to conventional practice; and the fibers are doffed from the teeth of the lickerins by centrifugal force and by air streams flowing over the teeth.

The air streams for doffing the fibers from the lickerins are supplied through an intake duct **60** (FIG. 3) which passes through each side wall of the machine and may be fed by a pressure fan or fans. A restrictive slot **62** is provided in this duct **60** to equalize the widthwise flow into the chamber **64** through which the duct **60** extends. This chamber is of generally rectangular cross-section, and has ports **66** in its bottom through which the air flows to a balancing chamber **70** that is bounded by the downwardly converging walls **71**, **72**, and the side walls of the machine.

Mounted at the bottom of the chamber **70** is a saber **74**, which is cylindrical in shape and is removable endwise.

The air flowing from duct **60** through chamber **70**, splits at the saber **74**, passes between the lickerins and the saber, and doffs the fibers from the lickerins. The air velocity is a maximum normal to the lickerins to aid in doffing of the fibers from the teeth of the lickerins. The fibers are then carried by the air streams through passages **75** and **76** formed between cover plates **77** and **78** and the side walls **80**, **82**, respectively, of a chamber **83**. The cover **77** may be relatively fixed but may be pivoted for cleaning about the axis of a doffing roll **84** that is contiguous to lickerin **52**. The cover **78** is made in two parts hingedly connected to one another. It pivots at one end about the axis of a doffing roll **86**; and it pivots intermediate at its ends on hinge **79**. It is adjustable by adjustment of its lower part **81** for thickness or weight of the web being formed. Both covers preferably have

"Plexiglas" or other transparent windows in them for observation purposes during operation, or may be made completely of "Plexiglas." The doffing rolls **84** and **86** aid in conventional manner the doffing of the fibers from the lickerins. They set up rotating swirls of air currents which materially aid the doffing of the fibers from the teeth of the lickerins.

The fibers doffed from the lickerins are deposited by the air stream on a condenser **85** which comprises an endless screen belt **90** that may be made of Fourdrinier screening and that travels over two pulleys **92** and **94** (FIG. 1) carried by rotary shafts **96** and **98**, respectively. The undersurface **100** of cover section **81** has sealing engagement on its bottom surface with the top of the web carried by screen **90**.

Mounted within the screen **90** is a suction box **102** which extends between the pulleys **92** and **94** (FIG. 1). It has sealing pads **104** on its upper surface which engage the inside of the screen as its upper reach moves over them, to insure optimum suction through the screen. It has a port **106** in its top into which the air streams flow by operation of a suction fan.

The rolls **92, 94**, over which the condenser screen **90** travels are journaled by their shafts in frame plates **167** (FIG. 6) which carry stub shafts **171** on which are journaled rollers **173** that ride on rails **175** which are secured on top of the base of the machine. Thus, the random fiber web condenser can be slid, as a unit, out of the machine for cleaning or replacement.

The drive motor **170** (FIGS. 4 and 5) for the condenser belt **90** is preferably a variable speed motor (FIG. 5) and may drive the belt through a belt and pulley, or chain and sprocket drive, or through gearing.

Fans mounted in housings **110** and **112** (FIGS. 4 and 5) create the high velocity air stream for doffing the fibers from the lickerins **52, 54** and for depositing the fibers in random fashion on the product condenser screen **90**. These fans are connected to opposite sides of the suction box **102** (FIG. 3) by ducts **114** (FIG. 4), and deliver the air by ducts **116** and **118**, respectively (FIG. 5) to opposite ends of the tube **60** (FIG. 3).

Through the side walls of the machine the air from these fans is also delivered through openings **120** (FIG. 3) in these side walls to the chamber **83**. Air flows from chamber **83** in the form of air jets through openings **122, 124** beneath the saber **74** at each side thereof.

The air box **83** serves to aid in streamlining the air-fiber flow from the saber to the condenser **90**. If this air box were not provided there could be a serious turbulence pocket below the saber, upsetting the product web quality. This air box, due to clearance at **122, 124** between the saber tube and the side plates **80** and **82** of the air box also performs an important function with respect to product web quality. The clearance between the plate end and the saber is adjustable on each side of the saber and ordinarily is from .016" to .062". The air jets using full air pressure from the fans act to spill this turbulence pocket, with marked improvement in total air flow as well as in web quality.

The fans are driven by direct connected motors **126, 128**.

Many of the parts used in the random fiber web machines illustrated in the Buresh and Langdon Pat. No. 2,876,500, granted Mar. 10, 1959, and in the Langdon et al. Pat. No. 2,890,497, granted June 16, 1959 may be used in the machine of the present application.

The lickerins **52, 54** are driven by separate direct-connected motors **130, 132** (FIG. 5). The variable-speed, feed roll drive motor unit **176, 178** (FIG. 5) is located on top of the air box **64** and is connected to the feed rolls **40, 42** (FIG. 3) through gearing (not shown).

The suction on the feed condensers, which assists in deposit of the fibers thereon from the trumpets **17** and **18** (FIG. 3), is generated by fans **134, 136**, respectively,

(FIG. 2) driven by motors **138** and **140**, respectively, which are mounted on top of the chamber **64**. The fans **134, 136** suck the air through each of the feed condensers **20, 22** to one end thereof, and then through the ducts **142, 144** (FIG. 4), respectively; and the exhaust air is delivered by the fans **134, 136** to ducts **15** and **16** (FIG. 1), respectively, which return the air through connecting ducts **145, 146**, respectively, to ports **147, 148**, respectively, which communicate with the main duct **12** at the top thereof. A vane or damper **150** (FIG. 1) pivotally mounted in the main duct **12** upstream of each supply duct **13, 14** determines whether fibers will be delivered to a particular supply duct, or carried on further to another machine in the line, as described with reference, for instance, to the machine of my application Ser. No. 521,267, above mentioned. By conducting the exhaust air into the main duct upstream of the associated supply duct, the returning air adds its pressure to the pressure of the main air flow in the duct **12** to prevent settling of fibers on the lower wall of the main duct. Further, this replaces the air withdrawn from the duct **12** by the ducts **13** and **14**, thereby to continue full circulating air in duct **12**.

In the machine shown in FIG. 3, the feed plates **48** and **50** are of so substantial depth and are disposed to constitute extensions of trumpets **17** and **18**, respectively, and of side walls **71** and **72**, respectively, of balancing chamber **70**. They form stabilizing members between the side plates **71** and **72** of the balancing chamber **70** and the opposed walls **73** and **75**, respectively, of the trumpets **17** and **18**, respectively.

The base section **160** of the machine has a box section framework with cover plates top and bottom; and the longitudinal box sections are used as suction air ducts from the condenser unit to the inlets of the webber fans **110** and **112**.

The mounting of the heavy side plates **162, 164** (FIG. 6) of the machine to the base section **160** by brackets **166, 168** along with the heavy section of the feed plates **44** and **46** (FIG. 3) provides structural stability.

The return air stream may be humidified with spray jets to eliminate static electricity so far as possible in the fiber flow, similar to the arrangement disclosed in the Buresh and Langdon Pat. No. 2,700,188, granted Jan. 25, 1955.

FIG. 8 discloses alternate methods for feeding the random fiber web machine. Here two different hopper feeders **190, 192** are shown to illustrate the scope of possible use of the machine. Each hopper feeder is similar, in general, to the feed mechanism disclosed in the Langdon et al. Pat. No. 2,890,497, granted June 16, 1959. Each feed mechanism comprises a hopper **194**, an endless floor apron or conveyor belt **195**, traveling over pulleys **196** and **197**. This conveyor belt carries the stock material in the hopper to an elevating apron or conveyor **198** which is mounted to travel over pulleys **200, 201**, and which may be made of a plurality of slats in which there are embedded pins **202**. A stripping apron **204**, which travels over pulleys **205** and **206**, and which is also provided with slats that carry pins, is mounted in cooperative relation to the elevator to strip fibers from the elevator apron.

The principal difference between feeders **190** and **192** is that feeder **190** incorporates feed rolls **222** and **224** and an oscillating gate **225**, which is pivotally mounted in the side walls of this feeder, which is actuated by pressure of stock in the feeder to effect closure of a clutch to drive the feed rolls **222, 224** to cause these rolls to feed stock from the reserve box **220** into the hopper **194** in a manner similar to the feed rolls **46** of the Auten and Langdon Pat. No. 3,326,609, granted June 20, 1967.

The fibers are stripped from the elevating aprons **198** by an air stream traveling over the pins **202** by the suction in the ducts **13', 14'** which deliver the fibers to the condensers **20', 22'**.

Parts of the machine shown in FIG. 8, which are similar to the parts of the machine previously described are designated by the same reference numerals but primed. Here, however, the air is drawn by suction from the base **160'** of the machine through ducts **210** to the pressure fans **212**, which are connected by ducts **214** to the two ends of the air duct **60'** in the balancing chamber **64'**. The ducts **142'** and **144'** connect to motor driven fans **134'**, **136'**, respectively; but these merely exhaust to atmosphere. As before, a humidifier may be put in the box **161'**. The stock material may be dumped into feeder **192**. It may be fed to feeder **190** pneumatically through the reserve box **220**.

With the machine described, for a given thickness of web, the product flow rate can be doubled as compared with prior machines through use of two feed systems, two rotary condensers, two lickerins, a single air stream split to doff fibers from the two lickerins, and a single product web.

With the present machine, moreover, the web weight is readily adjustable by adjustment of the position of cover section **81** (FIG. 3) with reference to the product condenser screen **90**.

With the machine illustrated in FIG. 8 the feed condensers **24**, **26** are part of the web-forming unit instead of, as previously, being part of feeder mechanism, such as shown at **190**, **192**. This change makes it possible to form the feed mats close to the feed rolls. The air bridges function to strip the fiber tufts from the elevator aprons as needed, and these tufts drop vertically by combined gravity and air flow to the trumpets **17**, **18**. This insures widthwise uniformity in the product. This arrangement contrasts with prior constructions in which the feed condenser and associated parts are disposed at the air bridge and the feed mat has then to be transferred by conveying means to the feed roll for the lickerin. The separation of the air bridge and trumpet as shown in FIG. 8 makes it possible to form a very uniform feed mat, and hence a very uniform product web.

While the invention has been described in connection with different embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. A machine for forming a random fiber web comprising:

two spaced feed condensers mounted to rotate about spaced, parallel axes,

separate means for conducting tufts of fibers in air streams to said two feed condensers, to deposit fibers in mats thereon,

a feed plate disposed adjacent each condenser,

means for doffing the mat from each condenser onto the associated feed plate,

two rotary lickerins rotatable about axes parallel to the axes of rotation of said feed condensers,

means for feeding the mats from said feed plates to the two lickerins so that the lickerins in their rotation comb fibers from the mats,

a chamber,

means for conducting an air stream into said chamber,

means for splitting said air stream into two separate air streams and directing the two streams past said two lickerins so that fibers are doffed from the two lickerins by said air streams and by centrifugal force,

a movable product condenser disposed downstream of said lickerins, and

means for conducting said two separate air streams with the fibers doffed from the two lickerins to said product condenser to deposit the fibers in random fashion on said product condenser to form thereon a single random fiber web.

2. A machine for forming a random fiber web comprising:

two spaced feed condensers,

separate means for delivering tufts of fibers to said two feed condensers, to deposit fibers in mats thereon,

a feed plate disposed adjacent each condenser,

means for doffing the mat from each condenser onto the associated feed plate,

two rotary lickerins,

means for feeding the mats from said feed plates to the two lickerins so that the lickerins in their rotation comb fibers from the mats,

means for directing an air stream past said two lickerins so that fibers are doffed from the two lickerins by said air stream and by centrifugal force,

a movable product condenser disposed downstream of said lickerins on which the fibers doffed from the two lickerins are deposited in random fashion to form thereon a single random fiber web,

said air stream directing means comprising

a chamber disposed between said condensers and into which air is flowed and opening at its bottom between said lickerins, and

a saber disposed at the bottom of said chamber to split the air stream flowing from said chamber into two streams flowing, respectively, past the two lickerins.

3. A machine as claimed in claim **2**, wherein:

a second chamber is disposed beneath said saber,

means is provided for delivering a separate air stream to said second chamber, and

ports are provided in said second chamber adjacent opposite sides of said saber to direct jets of air at spaced points against said saber.

4. In combination,

a mainline duct for carrying air and fibers,

a random fiber web forming machine comprising

two feed condensers rotatable about spaced, parallel axes,

two feed ducts connected separately to said mainline duct for conducting fibers and air to said condensers to lay down fibers on said condensers to form mats of fibers thereon,

a trumpet associated with each feed duct and constituting a prolongation thereof,

a feed plate associated with each trumpet and constituting a prolongation of one wall of the trumpet,

a fan for sucking air through each condenser from the associated feed duct and trumpet,

a duct connecting each fan to said mainline duct to return the air thereto,

a doffing roll associated with each feed condenser for doffing the mat of fibers therefrom,

a pair of lickerins rotatable on spaced parallel axes disposed below said two feed condensers, respectively,

a feed roll associated with each feed plate for feeding a mat therefrom to the associated lickerin so that the lickerin in its rotation will comb fibers from the mat,

a chamber disposed between said feed condensers, said chamber being open at its lower end,

means for directing a stream of air into said chamber that flows out its lower end,

a saber disposed at the open lower end of said chamber between said lickerins to divide the air stream issuing from the chamber and pass it by the two lickerins,

a product condenser disposed downstream of the lickerins,

walls bounding the space between the lickerins and

said product condenser to conduct the divided air-stream to said product condenser, and

means for sucking the air in the divided air stream through said product condenser and returning it to said chamber.

5. The combination claimed in claim 4, wherein:

opposite walls bounding said chamber converge downwardly, and

a portion, at least, of one of the walls bounding the space between said lickerin and said product condenser is adjustable relative to said product condenser to control the thickness of the web laid down on said product condenser.

6. The combination claimed in claim 4, wherein means is provided for projecting spaced jets of air at the under surface of said saber in the vicinities of said lickerins.

7. The combination with a machine for forming random fiber webs and:

comprising two feed condensers rotatable on parallel axes,

a feed plate associated with each feed condenser,

a duct for delivering air-borne fibers to each condenser,

a hopper associated with each duct for holding a supply of fibers,

means for delivering fibers from a hopper to the associated duct,

means for sucking air through each duct and its associated feed condenser to cause a mat of fibers to be laid down on each condenser,

two lickerins rotatable on parallel axes disposed below said feed condensers, respectively,

a rotary feed roll associated with each feed plate to feed the mat of fibers from the associated feed condenser over said feed plate to the associated lickerin to comb fibers from the mat,

a saber disposed between the lickerins,

a chamber disposed between the feed condensers,

a product condenser disposed below said lickerins,

and means for sucking air serially through said chamber, past said saber, through said product condenser, and returning it back into said chamber,

said saber operating to divide the air sucked by said means into two air streams flowing past the two lickerins to doff fibers therefrom.

8. The combination claimed in claim 7, wherein adjustable means is provided for controlling the thickness of the webs laid down on said product condenser.

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DORSEY NEWTON, Primary Examiner

U.S. Cl. X.R.

19—205