Feb. 14, 1967 R. H. BALCH 3,303,982

FILAMENT FEEDING

Original Filed March 13, 1959 2 Sheets-Sheet 1

Fig. 1.

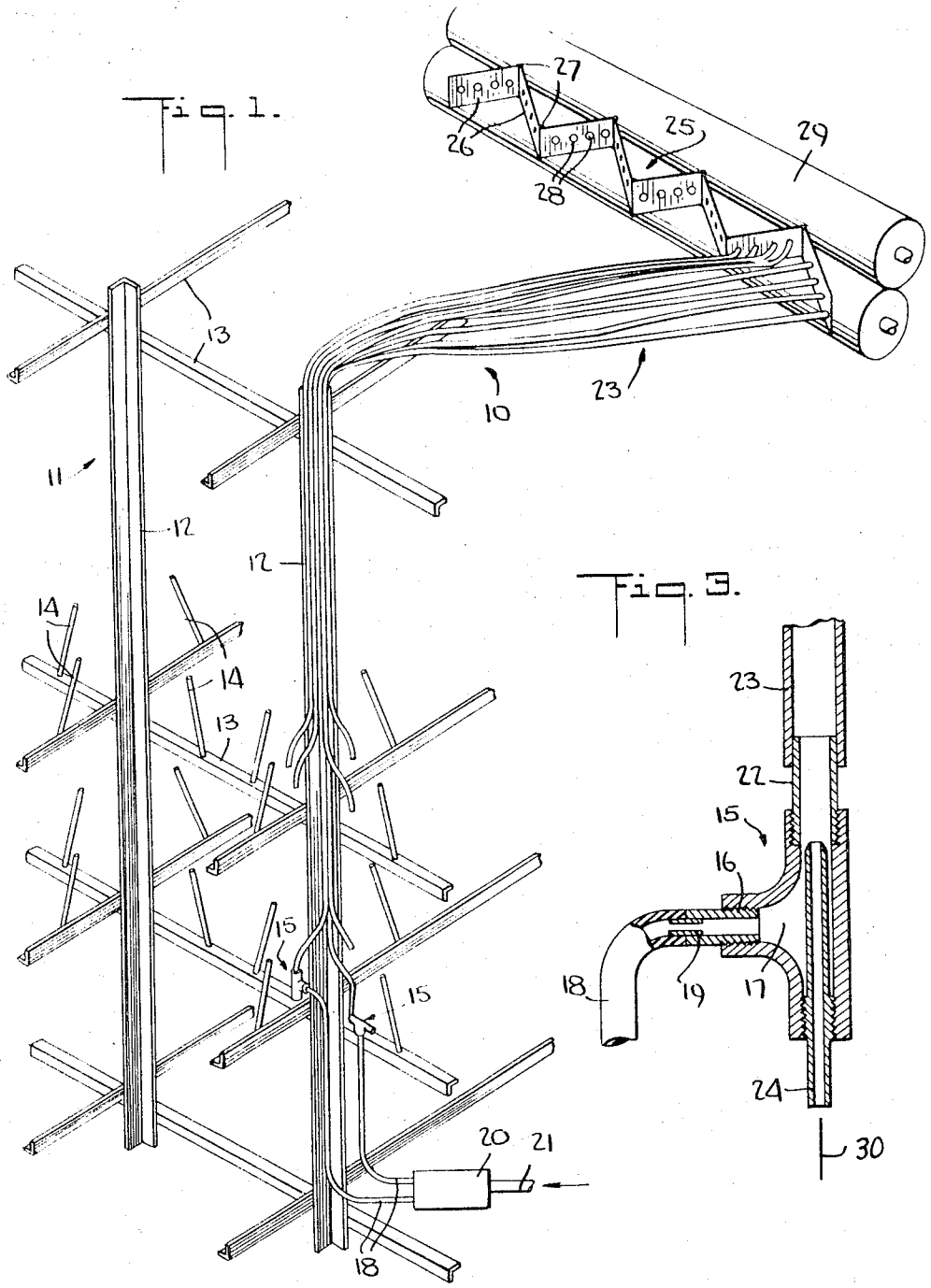

Fig. 3.

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Original Filed March 13, 1959 2 Sheets-Sheet 2

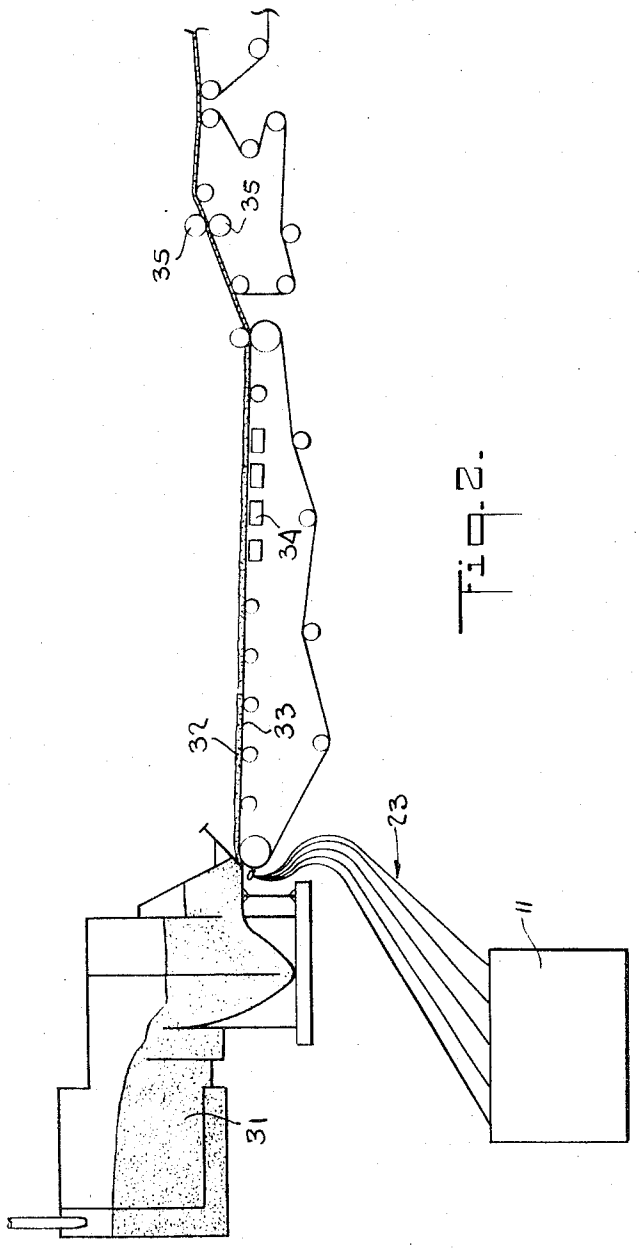

Fig. 2.

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3,303,982

FILAMENT FEEDING

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Original application May 13, 1959, Ser. No. 812,954, now Patent No. 3,151,021, dated Sept. 29, 1964. Divided and this application Apr. 29, 1964, Ser. No. 368,438
11 Claims. (Cl. 226—97)

This invention relates to filament feeding and positioning, more particularly to means for continuously providing a plurality of spaced filaments.

This application is a division of application Serial Number 812,954, filed May 13, 1959, now United States Patent 3,151,021.

In certain manufacturing procedures, such as the making of reinforced paper, it is necessary to supply continuously a plurality of spaced filaments, i.e. a warp. The job of starting up the equipment is time consuming in that all of the filaments must be manually threaded up. In addition, in the event of breakage or other interruption of the supply of any one of the filaments it is necessary to stop the equipment to permit reinsertion of the broken filament end or of a new filament. Additionally where a plurality of yarn ends are fed to continuous production process equipment, as required in the production of a desired reinforcing matrix, it is generally desirable to be able to vary the spacing between the matrix components, so as to permit different qualities and sizes of material to be made by the production equipment.

It is with the above problems in mind that the present means have been evolved, means implementing the continuous feeding of a plurality of spaced filaments from a supply of said filaments to a continuous production process. The novel feeding means minimizes the occurrence of breaks in the filament, eliminates the need for stopping the production process in order to re-insert an interrupted filament and also permits the selective adjustment of the spacing between the fed filaments. The term "filament" is here employed to designate any elongate material such as yarn, thread, fibers or the like, whether synthetic or natural, and whether twisted or not.

It is accordingly a primary object of this invention to provide improved filament feeding means.

Another object of the invention is to provide filament feeding means serving to minimize the occurrence of filament breakage.

A further object of the invention is to provide an apparatus for making filament-reinforced paper continuously irrespective of discontinuities in the filaments.

An additional object of the invention is to provide feeding means for feeding a plurality of adjustably spaced filament ends.

It is also an object of the invention to provide an improved process and apparatus for introducing a filament to a continuous production process.

These and other objects of the invention which will become apparent in the following disclosure and claims are achieved by provision of novel filament maintaining means supporting a supply of filament packages in combination with a pneumatic conveyor such as an aspirator for picking up a filament end in a fluid such as air, and means guiding the air along with the filament end to a selectively adjustable delivery point. The filament supply maintaining means comprises a creel on which a plurality of pairs of filament package supports are mounted. Arranged on the creel are a plurality of aspirators, one for each pair of filament packages. Upon passage of air through an aspirator a filament end supplied to the aspirator will be sucked in and carried along with the air to means guiding the air stream to a selected delivery point, said guiding means comprising a flexible tube formed of

materials such as polyvinyl plastics, polyolefins such as polyethylene, polyamides, polyesters, or the like. The free ends of the tubes are preferably arranged to be supported by an expander comprising a plurality of hinged panels which permits selective adjustment of the spacing between the filaments fed by the tubes.

A primary feature of the invention resides in the arrangement of the air and filament guiding tube in combination with the creel, suction pick-up, and expander so that the passage of a filament from the creel to the desired delivery point is protected, minimizing filament breakage.

Another feature of the invention resides in the fact that the use of flexible tubes for guiding the filament to the point of delivery permits positioning of the creel at a distance remote from the delivery point providing for a flexibility of installation.

Another feature of the invention resides in the aforedescribed feed means in combination with a papermaking apparatus to permit continuous production of reinforced paper without interruption even where one or more of the reinforcing filaments temporarily runs out.

The specific structural details of a preferred embodiment of the invention, and their mode of functioning, will be made most manifest and particularly pointed out in clear, concise, and exact terms in conjunction with the accompanying drawing, wherein:

FIG. 1 represents a schematic perspective view with parts broken away of the novel filament feeding and positioning equipment;

FIG. 2 is a schematic perspective view of a machine for making paper reinforced with filament supplied thereto by the equipment of FIG. 1; and

FIG. 3 is a cross sectional view through the aspirator shown in FIG. 1 employed for introducing a filament from the filament packages supported on the creel to the guiding tubes.

Referring now more particularly to the drawing like numerals in the various figures will be taken to designate like parts.

As best seen in FIG. 1 the novel feeding and positioning means **10** comprise means maintaining a supply of the filaments to be fed, in the form of creel **11**. Creel **11** as illustrated comprises a plurality of spaced struts **12** between which a plurality of vertically spaced cross pieces **13** extend. Angle irons are found most suitable in the fabrication of these struts **12** and cross pieces **13**. A plurality of pairs of filament package supports in the form of pins **14** are arranged on the cross pieces **13** with one pin **14** of each pair preferably arranged on cross pieces **13** on opposite sides of strut **12**.

Supported on the creel in any suitable fashion by means of straps or the like are aspirators **15** one for each pair of pins **14** (only some being shown in FIG. 1). As best seen in FIG. 3, the aspirators **15** each comprise an air inlet nozzle **16** for directing a stream of compressed air to a chamber **17**. The air is conveyed to each nozzle **16** by an air supply hose **18** coupled to the nozzle **16** by means of hose nipple **19** or the like. All the hoses **18** are connected through a valving device **20** with a master supply hose **21** so that air can be supplied selectively to one or more of the aspirators **15**. If desired, however, a single hose **18** may be provided selectively to be attached to whichever aspirator **15** needs servicing.

Each aspirator **15** also includes an air outlet **22** coupled to a flexible guide tube **23** and a filament inlet tube **24** extending into chamber **17** and terminating adjacent air outlet **22**. Each tube **23**, one for each aspirator **15**, is trained along struts **12**, and suitably secured thereto by means of appropriate fastening devices such as straps or the like. The free end of each tube **23** is thereafter

secured to adjustable selective spacing means in the form of an expander **25**.

Expander **25** comprises a plurality of panel members **26** connected by hinges **27** and formed with spaced aligned apertures **28** through each of which the free end of one tube **23** may extend. The hinging between panels **26** permits adjustment of the lateral spacing between the filaments exiting from the tubes **23**. One can readily see from an examination of the operation of expander **25** that as the angle between any two adjacent panel members **26** is decreased from 180 degrees that the lateral spacing between filaments is also decreased. Expander **25** is suitably mounted in any conventional mechanically expedient fashion for positioning adjacent the nip rolls **29** of the equipment to which the filaments are to be fed, as further shown in FIG. 2.

Operation

The aforedescribed structure is designed to facilitate positioning thereof in combination with a variety of production equipment to which filaments must be fed. This is implemented by the flexibility of guiding tubes **23**, and the fact that they can be made of any desired length. The creel **11** is suitably positioned in any available floor space adjacent the process equipment to be supplied with filaments. Thereafter expander **25** with its associated tubes **23** is arranged adjacent the nip rolls **29** of the process equipment. As is apparent, expander **25** is sufficiently close to nip rolls **29** so that any filaments emerging from tubes **23** will be caught up by the rolls **29**.

The creel is loaded with filament packages containing filaments of the type desired for introduction into the process. Upon each pair of pins **14** two appropriate filament supply packages, which for sake of clarity are not shown, such as bobbins, cones, cheeses, or the like are arranged. The beginning of the filament **30** on one package of each pair is held near filament inlet **24**, as is more clearly shown in FIGURE 3 of the drawing, and compressed air is selectively supplied to hose **18**. In passing around the inner end of tube **24** within chamber **17** and then out outlet **22** into and through tube **23**, the compressed air sucks the filament **30** into the tube **23**. The rolls **29** are not running and are temporarily separated so that the filament end falls over the lower roll in the space between the rolls. The compressed air is successively and selectively supplied to the other hoses **18**, and other filaments **30** are successively and selectively positioned adjacent each inlet **24** at each aspirator **15** until the full warp of filaments **30** lies over the lower nip roll. Nip rolls **29** are brought together and started rotating, supplying the reinforcing filaments **30** to the production equipment to which filaments are to be fed.

The end of the filament on one package of each pair is tied to the beginning of the filament on the other package so that upon exhaustion of one of the filament packages, the other may commence feeding. An operator who periodically services the creel will note the empty package and replace it with a full package, the beginning of which is tied to the end of the running package to provide a continuous filament supply.

In the event of a break or other discontinuity in one filament it is not necessary to stop the process to reinsert the broken end. Instead the broken end is brought near the filament inlet **24** of its respective aspirator **15**, compressed air is applied to the resective hose **18** and the broken filament is carried to, and then between, rolls **29** to restore the desired running conditions. As is apparent from the drawing, the displacement of the individual panel members **26** with respect to rolls **29** will determine the spacing between the filaments, the greater the angle between panel members **26** the greater the spacing between the filaments at their points of entry between rolls **29**.

The invention is hereinafter more particularly described in combination with paper-making apparatus but is not intended to be limited thereto. A paper-making slurry is fed to a large tank **31** which meters it in conventional

manner as a mat **32** onto a screen conveyor **33**. Excess water is removed from the mat **32** on the conveyor by suction boxes **34**. As shown schematically in FIGURE 2, the tubes **23** can discharge their filaments onto the conveyor **33** near where the slurry is deposited. The filaments can be either uppermost or lowermost depending upon whether they reach the conveyor after or before the slurry and in FIGURE 2 they are lowermost, i.e., between the slurry and conveyor. From the conveyor the mat **32** is calendered by rolls **35** and further processed in conventional manner. It will be seen that since the filaments are conveyed through flexible tubes to the point of incorporation, the tubes need not be perfectly parallel. This permits the creel **11** to be located at one side of the paper-making machine and some distance away from it, which is particularly advantageous in a paper mill. The tubes can be made as long as necessary, taking into consideration the amount of friction between the filaments and tubes and the strength of the filaments.

The novel structure may be employed in a variety of situations requiring a plurality of spaced filaments. Thus the structure may be utilized in conjunction with, in addition to the fabrication of paper laminates as above-described, the fabrication of plastic laminates, and in the production of non-woven fabrics. As illustrated the novel structure has particular applicability in conjunction with the provision of reinforcing yarns such as high tenacity regenerated cellulose in the production of laminated kraft paper. While the space available to feed filaments into the forming zone of conventional kraft paper making equipment may be limited, use of the novel filament feeding apparatus here disclosed permits creel **11** to be arranged at any convenient point either on the side or to the rear of the paper machine. Positioning of the expander permits the ready feeding of the filaments to the kraft paper making machine. The spacing between the filaments may be adjusted by varying the angles between the panel members **26** and the filaments fed are protected in transit by guide tubes **23**.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention what I desire to secure by Letters Patent is:

1. Means implementing the continuous feeding of a plurality of spaced filaments, said means comprising filament supply means, filament end pick-up means adjacent said supply means, filament guiding means coupled to said pick-up means, and adjustable spacing means supporting the delivery end of said guiding means to permit the selective spacing of the delivered filaments.

2. Means as in claim **1** in which said filament guiding means includes a flexible tube through which each filament is guided, whereby the discharge of said guiding means may be adjustably positioned with respect to said supply means.

3. Means for feeding elongate material, said means comprising means maintaining a supply of the material, pneumatic conveying means adjacent the supply of material, means for supplying compressed air to said conveyor means for transport of the material, guiding means coupled to said conveying means for carrying the air stream along with the end of the material to a discharge at a selected delivery point and adjustable spacing means supporting the discharge end of said guiding means to permit the selective spacing of the delivered elongate material.

4. Means for providing a warp of spaced filaments, said means comprising means maintaining a plurality of filament packages, aspirator means adjacent said packages and at least equal in number to the number of filaments to be provided, means for supplying compressed air to said aspirator means selectively thereby to draw an end of each of the filaments to be provided into the respective

aspirator means, guiding means coupled to each of said aspirator means respectively for carrying each air stream along with its respective filament end to a discharge at a selected delivery point adjacent the delivery points of the other air streams and their respective filaments and adjustable spacing means supporting the delivery end of the guiding means whereby the filaments are laterally spaced with respect to one another.

5. Means as in claim **4** in which said means for supplying compressed air to said aspirator means selectively includes an air hose for each aspirator means, a master air supply hose, and valving means for selectively connecting said master air supply hose with any one or more of said air hoses.

6. Means for providing a warp of spaced filaments, comprising a plurality of pairs of supports for filament packages, an aspirator for each pair of supports, means for supplying compressed air to said aspirators thereby to draw an end of a filament into the respective aspirator, a plurality of guides respectively coupled to said aspirators for carrying each air stream along with its respective filament end, and expander means adjustably supporting said guides to permit variation of the relative disposition of the filaments issuing from said guides.

7. Apparatus as in claim **6** in which said expander comprises a plurality of panel members having apertures through which said guides may pass, and hinges connecting said members to permit adjustment of the angle therebetween and thus of the lateral distances between filaments.

8. Means for providing a warp of spaced filaments, said means comprising means maintaining a plurality of filament packages, aspirator means adjacent said packages and at least equal in number to the number of filaments to be provided, an air hose for each aspirator means, a master air supply hose, valving means for selectively connecting said master air supply hose with at least one of said air hoses, guiding means coupled to each of said aspirator means respectively for carrying each filament and its respective air stream to a predetermined discharge point, and adjustable spacing means operatively associated with said guide means whereby the lateral spacing between the filaments in the warp of spaced filaments is determined.

9. Method of supplying a plurality of filaments in a predetermined spaced relationship from a supply means at a distance remote from their delivery point comprising:

(a) forwarding said filaments to a selectively adjustable delivery point at which point the filaments are in a fixed spaced relationship; and

(b) forwarding said filaments from said delivery point into the nip formed by a pair of rolls whereby the lateral spacing between the filaments is changed.

10. Means according to claim **8** wherein the guide means are flexible plastic tubes and the spacing means comprises a plurality of panels having apertures therein in each of which is located a guiding tube, said panels being interconnected by hinges whereby the panels are selectively adjustable with respect to one another and the spacing between the filaments is thereby determined.

11. Expander for selective adjustment of spacing between a plurality of filaments comprising a plurality of panel members hingedly connected together, each of said panel members having therein a plurality of spaced aligned apertures through which said filaments pass, the spacing between the filaments being adjusted by varying the angles between the panel members.

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