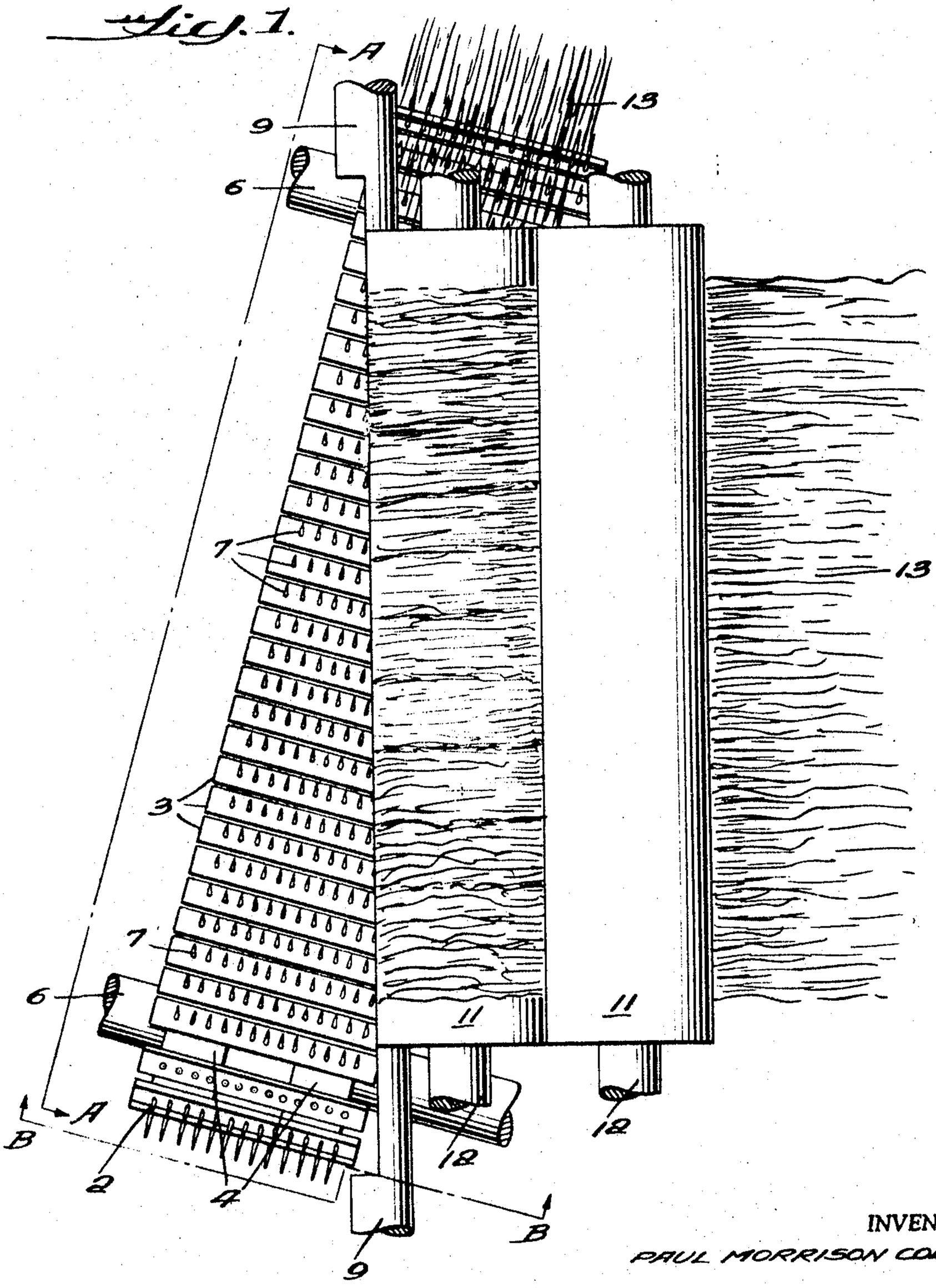
Aug. 19, 1969 P. M. COLE 3,461,508

ACUTE ANGLE TOW OPENER

Filed May 5, 1967 4 Sheets-Sheet 1

Fig. 1.



INVENTOR
PAUL MORRISON COLE,

BY

AGENT

Aug. 19, 1969 P. M. COLE 3,461,508

ACUTE ANGLE TOW OPENER

Filed May 5, 1967 4 Sheets-Sheet 2

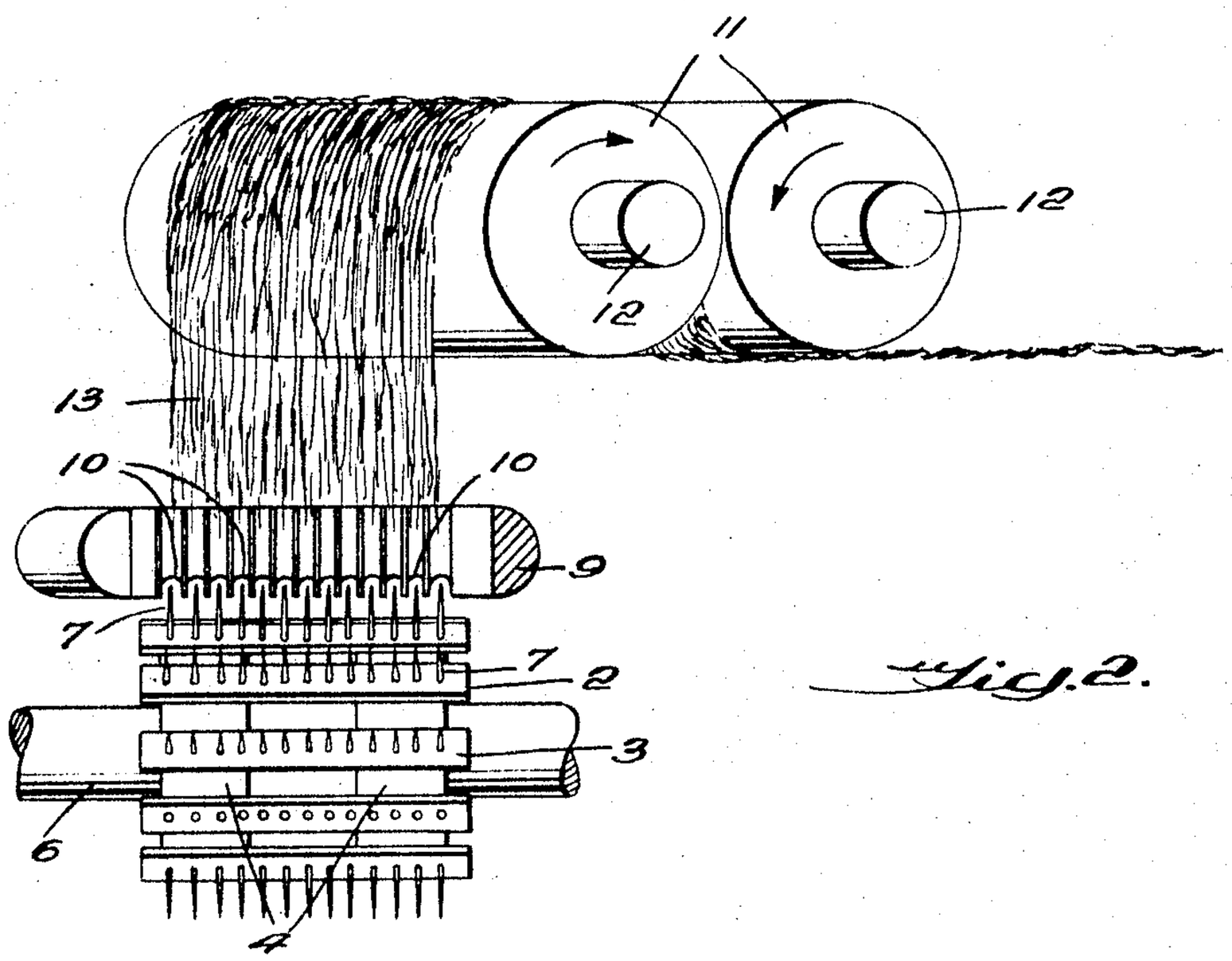


Fig. 2.

INVENTOR
PAUL MORRISON COLE,

BY

AGENT

Aug. 19, 1969 P. M. COLE 3,461,508

ACUTE ANGLE TOW OPENER

Filed May 5, 1967 4 Sheets-Sheet 3

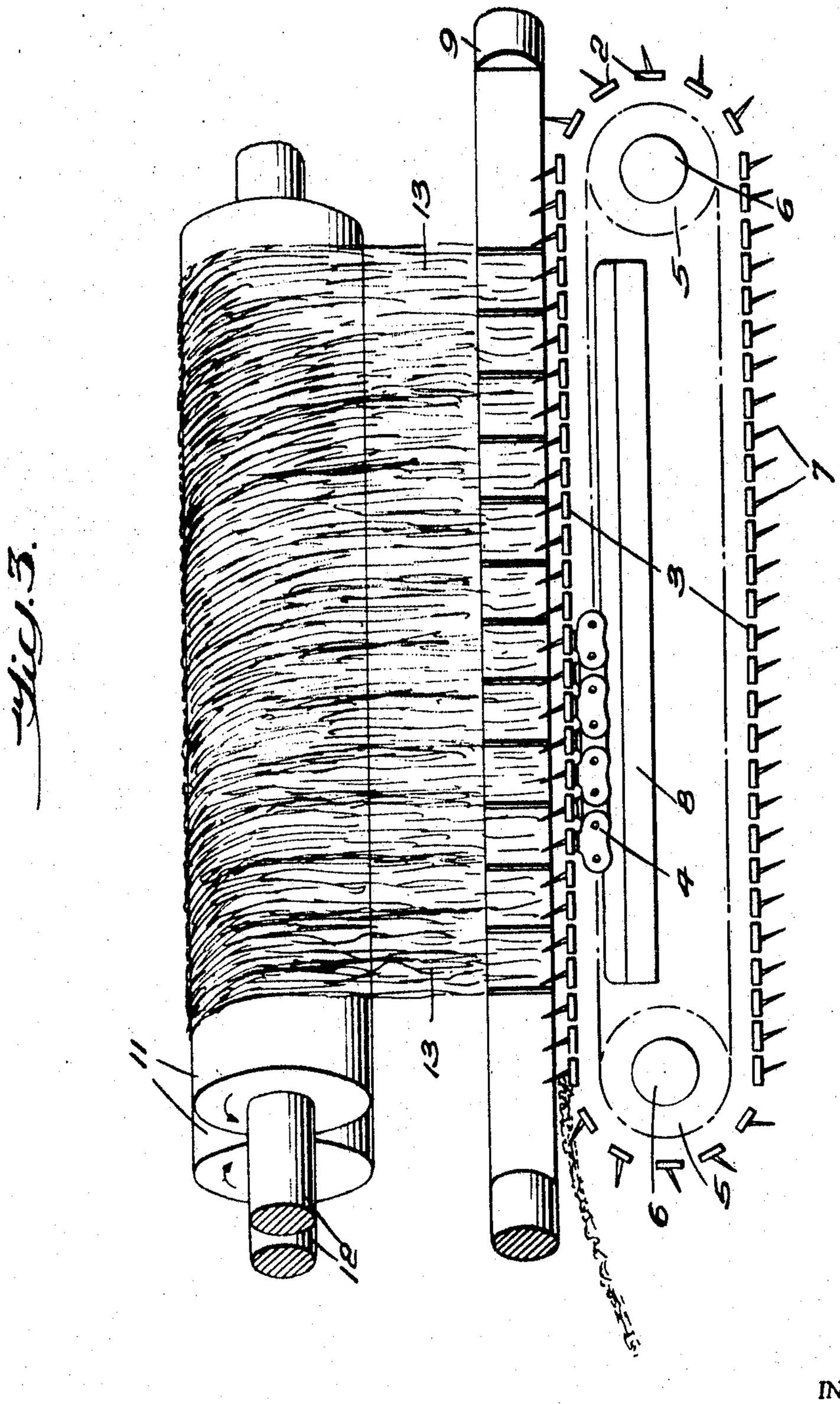


Fig. 3.

INVENTOR
PAUL MORRISON COLE,

BY

AGENT

Aug. 19, 1969 P. M. COLE 3,461,508

ACUTE ANGLE TOW OPENER

Filed May 5, 1967 4 Sheets-Sheet 4

Fig. 6.

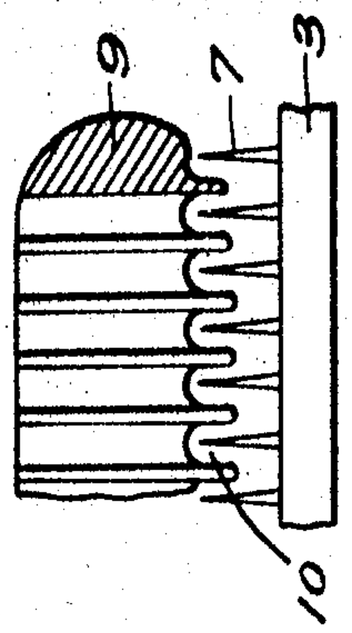


Fig. 7.

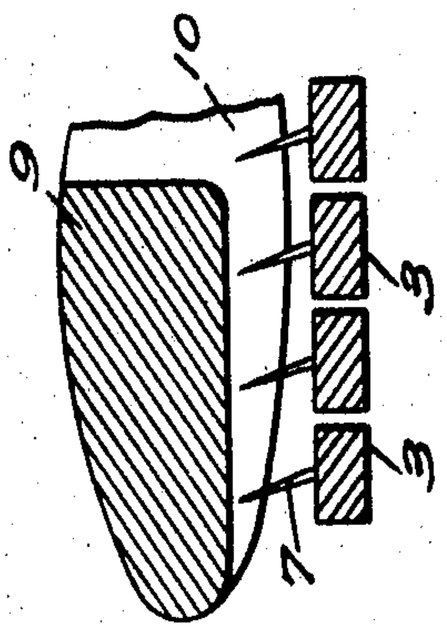


Fig. 4.

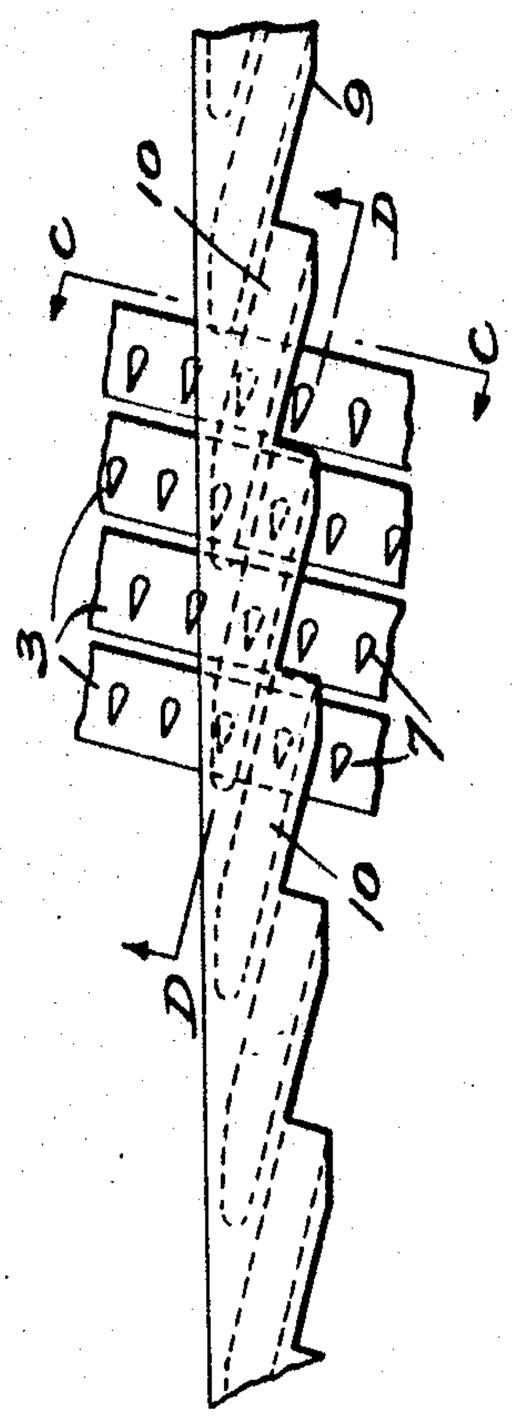
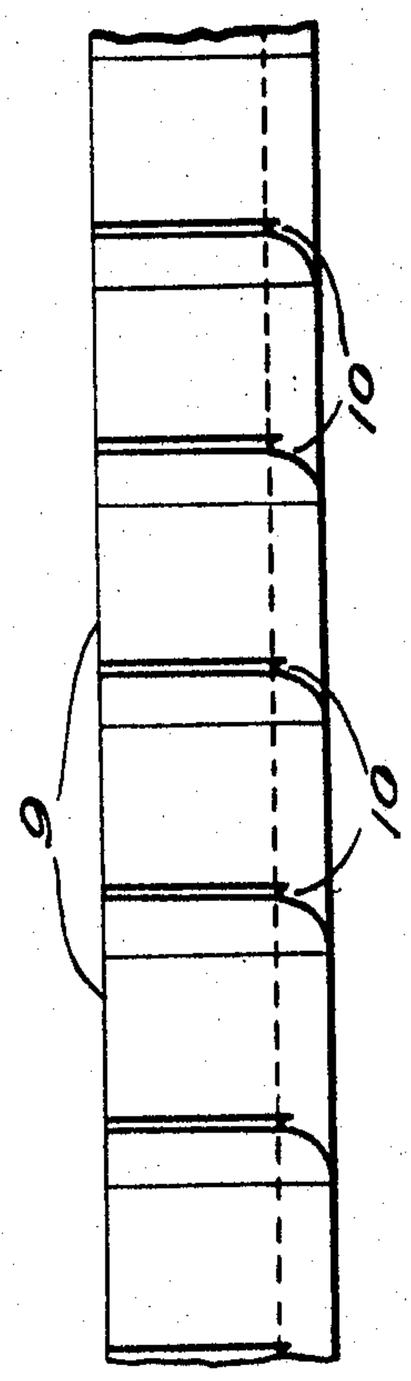


Fig. 5.



INVENTOR
PAUL MORRISON COLE,

BY

AGENT

United States Patent Office

3,461,508

Patented Aug. 19, 1969

3,461,508
ACUTE ANGLE TOW OPENER

Paul Morrison Cole, Wilmington, Del., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed May 5, 1967, Ser. No. 636,460
Int. Cl. D01d *5/00;* B65h *51/00*
U.S. Cl. 19—65 4 Claims

ABSTRACT OF THE DISCLOSURE

The apparatus spreads a continuous filamentary tow into a thin web and simultaneously deregisters the crimp to a desired degree. A stationary bar is positioned above a slatted conveyor and at an acute angle to the direction of conveyor travel. The slats have backwardly inclined pins mounted in longitudinal rows which pass through mating grooves in the stationary bar. Pull rolls mounted parallel to the stationary bar forward the spread tow after it is forced under the stationary bar by the slatted conveyor.

This invention relates to an apparatus for opening and spreading filamentary tows and more particularly to the separation of crimped filaments in a tow bundle into a thin web.

Several methods are known for either separating tightly spaced filaments in a tow bundle or spreading filaments in large diameter tow bundles into thin webs. In scaling up modern textile operations which employ large crimped tows, it has been difficult to spread such tows into very thin webs because the length of the machine required uses excessive space. Another difficulty, which has arisen when using conventional spreading means, is the tendency of the filaments to recombine laterally with the crimps in phase after having been spread.

Therefore, the invention embodied herein provides an apparatus for spreading continuous filamentary tow comprising a continuous flexible conveyor means capable of being driven and at least a portion thereof being a substantially flat surface with a plurality of spaced rows of projections mounted thereon. The rows of projections are positioned along the direction of travel of the conveyor means; the conveyor means is capable of receiving the continuous filamentary tow and carrying it along the conveying surface in the direction of travel of the conveyor means. The apparatus further comprises a rigid member mounted at an acute angle relative to the direction of travel of the conveyor means; the rigid member is additionally mounted across and substantially parallel to the conveying surface at a distance from the surface less than the height of the projections from the surface. The rigid member has a plurality of mating grooves to accommodate the plurality of spaced rows of projections. The apparatus further comprises forwarding means capable of being driven and having a take-up surface; the take-up surface is capable of receiving the tow after it passes between the conveyor surface and the rigid member. The direction of take-up of the tow by the forwarding means is at an angle relative to the rigid member greater than the acute angle at which the rigid member is mounted relative to the direction of travel of the conveyor means.

This invention will be more readily understood by reference to the subsequent description and the attached drawings wherein:

FIGURE 1 is a schematic plan view of the principal working parts of the apparatus;

FIGURE 2 is elevation view B—B of FIGURE 1;

FIGURE 3 is elevation view A—A of FIGURE 1;

FIGURE 4 illustrates a plan view of a preferred design of the arrangement of the slats in a typical conveyor and

the positioning of pins on said slats with respect to openings in a slotted bar;

FIGURE 5 shows a front elevation of the arrangement in FIGURE 4, without the slats shown;

FIGURE 6 shows in cross-section a view of the pins positioned in the slotted bar taken along section C—C taken in FIGURE 4; and

FIGURE 7 shows in cross-section a view of section D—D taken in FIGURE 4, showing the backward inclination of the pins opposing the direction of tow travel.

A preferred embodiment of the invention will hereafter be described for spreading a tow of crimped synthetic filaments. The apparatus described has the capacity to handle a tow of 50,000 denier. Referring concurrently to FIGURES 1, 2 and 3 the slatted conveyor **2** is made by mounting commercial pin plates **3** on two commercial roller chains **4** having standard attachments on each link. The commercial pin plates each have mounted thereon a row of pins **7**. Each link in the continuous roller chain is not fully illustrated in FIGURE 3 for simplicity, but it should be understood that the chain is a continuous roller chain comprising interconnecting links. Each chain is tensioned and driven by a pair of sprockets **5**, two parallel shafts **6** accommodating the sprockets. A rail **8** under each chain supplies support for the rollers and precludes sagging in the operating zone. A continuous belt conveyor having metal pins mounted on its conveying surface may be substituted for the slatted conveyor with substantially no change in performance. Such a conveyor would be driven in the same manner as the slatted conveyor except that rollers would be substituted for the sprockets.

A discharging bar or rod **9** is rigidly mounted over the flat surface of the slats. The mounting angle relative to the direction of tow travel depends upon the degree of tow spread desired. The bar **9** is mounted at a distance from the flat conveying surface formed by the pin plates less than the vertical distance to the points of the pins **7** from the slats. So that the pins can clear the bar, the discharging bar **9** has been provided with grooves **10** corresponding to the path of pin travel. The interaction of the pins and the grooves in the bar restrain tow motion along the horizontal axis of the bar as the tow is being discharged across the bar.

After the tow **13** has been fed under the discharge bar by the action of the conveyor, the spread tow is forwarded or taken up from the discharging bar by the action of forwarding rolls **11**. The forwarding rolls are driven by external driving means (not shown) through shafts **12**. These rolls can withdraw the spread tow at a rate equal to the linear speed at which the tow is being fed to the discharging bar. If deregistering of the crimped filamentary tow is a desired result, the take-up rolls should be driven at a linear speed greater than the feed rate. Preferable roll speeds for deregistering the crimp exceed the feed rates by a factor of 5 to 70 percent, although the speed may be less or greater than these limits. Deregistering a crimped tow is a process by which the crimps in a plurality of filaments comprising the tow are moved out of phase relative to each other. The take-up surface of the rolls **11** preferably is mounted parallel to the discharging bar. Although the embodiment shown in FIGURE 1 utilizes a set of take-up rolls **11**, any equivalent thereof may be substituted for them, e.g., a conveyor.

FIGURES 4–7 are detailed illustrations showing the grooves **10** in the discharging bar **9** and the interrelation among the grooves **10** and the pins **7** mounted on pin plates **3**. FIGURE 4 shows a portion of a discharging bar illustrating in plan view the path of pins **7** through the grooves **10** on the bottom of the bar. FIGURE 5 is a front elevation of the discharging bar **9**, omitting the pins and pin plates. Cross-sections across section lines C—C and

D—D are shown in FIGURES 6 and 7, respectively. Note, as one observes the FIGURES 4 and 7, that the pin plates when moving would travel from left to right.

The operative embodiment employed ½ inch (1.27 cm.) pitch roller chain with standard attachments on all links. The brass slats or plates were 3¾ inches long by 7/16 inch wide by ⅛ inch thick (9.52 x 1.11 x 0.32 cm.) and had thirteen tapered pins at ¼ inch (0.635 cm.) spacing. The pins were in either a single or double row arrangement that formed precise longitudinal alignment of the corresponding pins of all the slats. Pins having a base diameter of 0.031 and 0.056 inches (0.079 and 0.142 cm.) and tapering to a point worked well, the larger being preferred for strength. The projection of the pins above the slats was ⅜ inch (0.95 cm.). The backward inclination of the pins was preferably from 20° to 40° from the vertical, although lesser and greater inclinations are operable.

The discharging bar was rigidly mounted 3/16 inch (0.48 cm.) above the surface of the slats and angled 15° to the direction of tow travel. Grooves 3/16 inch (0.48 cm.) wide by ¼ inch (0.635 cm.) deep were machined into the bar to accommodate each of the rows of pins on the slats. A pair of 2¾ inch (6.99 cm.) diameter pull rolls was mounted above the discharging bar with their axes parallel to the discharging bar and in a horizontal plane 4¼ inch (10.8 cm.) above the points of the pins. In operation, the tow is fed to the slatted conveyor surface, which is running at speeds from 50 to 130 feet per minute (1520 to 3960 cm. per minute). Since deregistering of the crimp is usually desired, the pull rolls are operated at a linear withdrawal speed exceeding the conveyor speed by 5% to 70%. The tow is fed under the discharging bar and forwarded by the take-up rolls. The tow is uniformly spread to a web having a width approximately four times the original width. The filament crimps are substantially deregistered.

The process and apparatus of this invention is particularly useful to separate light- or heavy-denier tows into thin webs. The invention is especially suitable for opening or separating heavy-denier crimped tows of either natural or synthetic fibers to produce webs of separated filaments, and even produces some degree of deregistration of the crimp. The crimp in the tows being processed may be either a mechanical crimp, such as the conventional zigzag crimp, or it may be three-dimensional in nature, such as the known helical crimp, random crimp, and the like. The invention is also advantageous for separating tows into thin webs of filaments for subsequent textile processing, such as treating the thin webs of separated filaments with liquids, resins, or by dipping the webs in a solution dispersion or emulsion of resinous or elastomeric binders, or by spraying the webs with a similar solution or emulsion.

Although a unitary preferred embodiment of the subject invention has been illustrated and described in the foregoing portion of the specification, it is manifest that

diverse alterations may be effected without deviating from the spirit of the invention or the scope of the annexed claims.

What is claimed is:

1. An apparatus for spreading continuous, filamentary tow comprising:

a continuous flexible conveyor means capable of being driven and at least a portion thereof being a substantially flat conveying surface having a plurality of spaced rows of projections mounted thereon, the said rows of projections being positioned along the direction of travel of a conveyor means, said conveyor means capable of receiving said continuous filamentary tow and carrying said tow on said conveying surface in the direction of travel of said conveyor means,

a rigid member mounted at an acute angle relative to the direction of travel of said conveyor means, said rigid member additionally mounted across and substantially parallel to the plane of said conveying surface at a distance from said surface less than the height of said projections from said surface, said rigid member having a plurality of mating grooves to accommodate said plurality of spaced rows of projections,

forwarding means having a take-up surface and capable of being driven, said take-up surface capable of receiving said tow after it passes between said conveying surface and said rigid member, the direction of take-up of said tow by said forwarding means being at an angle relative to said rigid member greater than the said acute angle at which said rigid member is mounted relative to the direction of travel of said conveyor means.

2. The apparatus of claim **1** wherein said conveyor means comprises at least one continuous chain member supported by sprockets mounted on at least two shafts, one of said shafts capable of driving said chain member, a plurality of slats attached to said chain member, the axes of said plurality of slats mounted parallel to the axes of said shafts.

3. The apparatus of claim **1** wherein the said projections are pins mounted on said conveyor means inclined in a direction opposite to the direction of travel of said conveyor means.

4. The apparatus of claim **1** wherein the said forwarding means consists of take-up rolls having their axes mounted substantially parallel to said rigid member.

References Cited

UNITED STATES PATENTS

2,822,582	2/1958	Hayward et al.	19—65
3,329,543	7/1967	Arthur et al.	19—66 XR
3,369,276	2/1968	Kalwaites	19—65

DORSEY NEWTON, Primary Examiner