

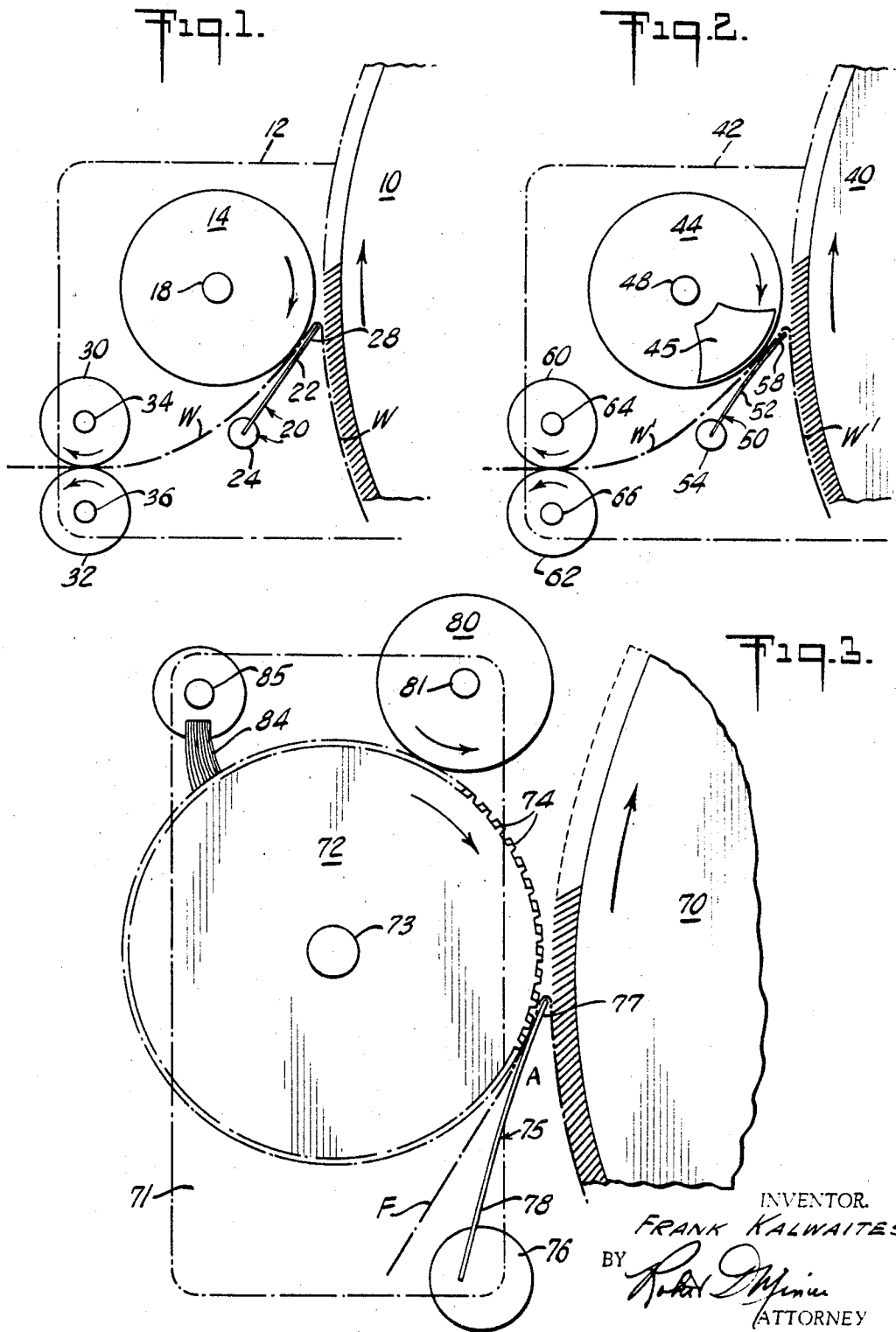
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APPARATUS FOR REMOVING A FIBROUS WEB FROM A ROTATABLE SURFACE

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APPARATUS FOR REMOVING A FIBROUS WEB FROM A ROTATABLE SURFACE

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ABSTRACT OF THE DISCLOSURE

An apparatus for removing a fibrous web from a rotatable surface comprising a rotatable roll adjacent the rotatable surface and a flexible nip blade in tangential contact with the rotatable roll and extending away from the roll on both sides of the point of tangency and magnetic means for pressing the blade against the rotatable roll at the point of tangency.

The present invention relates to apparatus for removing fibrous webs from rotating surfaces and more particularly is concerned with apparatus for removing fibrous webs from the rotating doffing cylinder of a textile carding machine.

In the processing of textile-length fibers whereby they are converted from naturally-occurring or synthetically-prepared, intermatted fibrous masses into relatively uniform fibrous textile materials, such as slivers, rovings and webs which have a generally predominant fiber orientation in the long direction thereof, the individual fibers are initially separated and formed into a fibrous web by means of a textile carding machine. This fibrous web, in which the individual fibers are relatively aligned generally in the long direction of the web, is doffed or removed from the rotating doffing cylinder of the card usually by a rapidly reciprocating doffing comb for further processing or handling, as desired or required. This rapidly reciprocating doffing comb, having a periodic to-and-fro movement, is physically limited in its maximum speed and in the number of reciprocations it can make and in most cases is the limiting factor on the speed of the rotating doffing cylinder which, having a rotational movement, normally could have a greater surface linear speed, if it were not so limited by the doffing comb. Thus, the doffing comb limits the speed of the textile carding machine and is considered the limiting factor on its capacity or "throughput."

Additionally, it has been determined that the reciprocating action of the teeth of the doffing comb, as they rapidly pass to-and-fro through the fibrous web, strike, rub and brush against the individual fibers, change the predominant fiber orientation thereof, and perform their doffing function in a generally inefficient manner.

In my copending patent application, Ser. No. 478,027, filed Aug. 2, 1965, now Patent No. 3,283,366, there is disclosed apparatus capable of: (1) doffing or removing fibrous materials from a rotating surface such as the doffing cylinder of a textile carding machine without limiting its speed, capacity or "throughput"; and (2) performing such doffing or fiber-removing function in an efficient manner without materially changing the predominant fiber orientation of the fibrous web. This is accomplished by providing a first rotatable surface which is capable of carrying a fibrous web, positioning a rotatable roll also capable of carrying a fibrous web immediately adjacent to but spaced from said first-mentioned rotatable surface whereby a V-shaped throat having arcuate surfaces leading to a narrow opening is formed between the rotatable surface and the rotatable roll and then positioning a stationary but adjustable flexible nip blade in tangential pressing contact with the rotatable roll and extending away from that rotatable roll on both sides of the point of tangency

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therewith, with one relatively short free end of the nip blade extending up into the narrow V-shaped throat formed by the rotatable surface and the rotatable roll. As a result, the fibrous web which is carried by the first rotatable surface can be removed therefrom to be carried around the free end of the nip blade into contact with the rotatable roll to be pressed against such rotatable roll by the nip blade substantially only at the point of tangency and then to be carried forwardly by the rotatable roll and delivered for further processing and handling, as desired or required.

This apparatus is presently being used in many textile mills with considerable success. It is important in this apparatus that the flexible nip blade be in pressing contact with the rotatable roll along a line extending the length of the rotatable roll, i.e. substantially parallel to the axis of the rotatable roll. This pressing contact has generally been applied by some cantilever type of pressure-applying mechanism. Space limitations between rotatable surface and rotatable roll along with the fact that it is desirable to place the nip formed by the nip blade and rotatable roll as close as possible to the first rotatable surface make it difficult to apply direct pressure to the nip blade at the line where it contacts the rotatable roll.

In accordance with the present invention, I have discovered apparatus whereby direct pressure may be applied to the nip blade to press it against the rotatable roll, and furthermore, this apparatus is not limited by the space between the rotatable surface and rotatable roll.

In accordance with the present invention the rotatable roll and the nip blade are magnetized so that they attract each other and place pressure at their line of contact. The magnetic means may be mechanical or electrical or other suitable magnetic means, e.g. an electromagnet may be placed inside the rotatable roll which will attract the nip blade or either the nip blade or roll may be permanently magnetized in order to afford attraction of one for the other. By use of electrical means the amount of attraction and hence the pressure between the nip blade and roll may be controlled by the electrical impulses.

If desired, the magnetic means may be the sole means for applying pressure between the blade and roll, or it may be combined with other pressure-applying means such as a spring, etc., to apply pressure along the line of contact between the nip blade and rotatable roll.

The fibrous web or layer which is processed to form the products of this invention may contain natural or synthetic, vegetable, animal or mineral fibers such as cotton, silk, wool, vicuna, mohair, alpaca, flax, ramie, jute, etc.; synthetic or man-made fibers such as the cellulosic fibers, notably cuprammonium, viscose or regenerated cellulose fibers; cross-linked cellulosic fibers such as "Corval" and "Topel"; cellulose ester fibers such as cellulose acetate ("Celanese") and cellulose tri-acetate ("Arnel"); the saponified cellulose ester fibers such as "Fortisan" and "Fortisan-36"; the polyamide fibers such as nylon 420, nylon 6 (polycaprolactam), nylon 66 (hexamethylene diamine-adipic acid), nylon 610 (hexamethylene diamine-sebacic acid), nylon 11 (11-amino undecanoic acid—"Rilsan"); protein fibers such as "Vicara"; halogenated hydrocarbon fibers such as "Teflon" (polytetrafluoroethylene); hydrocarbon fibers such as polyethylene, polypropylene, polybutadiene and polyisobutylene; polyester fibers such as "Kodel" and "Dacron"; vinyl fibers such as "Vinyon" and saran; dinitrile fibers such as "Darvan"; nitrile fibers such as "Zefran"; acrylic fibers such as "Dynel," "Verel," "Orion," "Acrlan," "Creslan," etc.; mineral fibers such as glass, metal; etc.

The average lengths of the fibers in the starting fibrous web are of textile length and may vary from about 3/8 inch or 1/2 inch up to about 2 1/2 inches or more in length,

depending upon the particular properties and characteristics required or desired in the resulting fibrous web.

If desired, the fibrous layer may have added thereto, by a subsequent processing step, from about 1 or 2 percent by weight up to about 100 percent by weight but preferably less than about 50 percent by weight, of fibers other than those of textile length. These other fibers may be of short papermaking length, which extend from about $\frac{3}{8}$ inch in length down to about $\frac{1}{16}$ of an inch or less in length, which shorter fibers normally are not used in conventional methods of producing fibrous webs.

Illustrative of these short papermaking fibers are the natural cellulose fibers such as woodpulp and wood fibers, cotton linters, cotton hull shavings fibers, mineral fibers such as asbestos, glass, rock wool, etc., or any of the hereinbefore-mentioned natural or synthetic fibers in lengths less than about $\frac{3}{8}$ inch and down to about $\frac{1}{16}$ of an inch or less.

The denier of the individual synthetic fibers referred to above is preferably in the range of the approximate thickness of the natural fibers mentioned and consequently deniers in the range of from about 1 to about 5 are preferred. Where greater opacity or greater covering power is desired, special fiber deniers of down to about $\frac{3}{4}$ or even about $\frac{1}{2}$ may be employed. Where desired, deniers of up to about 5.5, 6, 8, 10, 15, or higher, may be used. The minimum and maximum denier are naturally dictated by the desires or requirements for producing a particular fibrous web, by the machines and methods for producing the same, and so forth.

The weight of the fibrous web or layer of starting material on the doffing cylinder may be varied within relatively wide limits above a predetermined minimum value, depending upon the requirements of the intermediate or the final products. A single, thin web of fibers, such as produced by a card and as presented by the doffing cylinder, may have a weight of from about 30 to about 250 or more grains per square yard and may be used in the application of the principles of the present invention. Within the more commercial aspects of the present invention, however, web weights on the doffing cylinder of from about 50 grains per square yard to about 175 grains per square yard are contemplated.

The invention will be more fully understood from the description which follows taken in conjunction with the accompanying drawings in which there are illustrated preferred designs of machines and modes of operation embodying the invention. It is to be understood, however, that the invention is not to be considered limited to the constructions disclosed except as determined by the scope of the appended claims.

In the drawings:

FIGURE 1 is a simplified, fragmentary, schematic view in elevation showing one embodiment of the general principles of operation of the present invention;

FIGURE 2 is a simplified, fragmentary, schematic view in elevation showing another embodiment of the general principles of operation of the present invention; and

FIGURE 3 is a simplified, fragmentary, schematic view in elevation showing a further embodiment of the general principles of operation of the present invention.

In the embodiment of the invention illustrated in FIGURE 1 of the drawing, a conventional textile card is used and comprises a conventional rotatable main card cylinder (not shown) which is used to provide for the normal carding of the fibers fed thereto leading generally to a thin sheet of individualized fibers very sparsely spread over the main card cylinder surface in an amount weighing merely a few grains per square yard. These substantially individualized fibers are then presented to and transferred to a slower moving doffing cylinder 10 rotating on a shaft mounted in bearings secured to the card frame 12.

The doffing cylinder 10 is conventional and may be covered with conventional fillets which are continuous

strips of narrow card clothing, $1\frac{1}{2}$ or 2 inches wide, and long enough to helically wrap around and entirely cover the cylindrical surface of the doffing cylinder. The conventional bent wires penetrate the heavy fabric foundation of the fillet card clothing and protrude therefrom in the usual way whereby doffing and stripping functions are possible. If desired, however, the doffing cylinder may be covered with conventional metallic card clothing which consists of a steel band with teeth punched or otherwise formed in one side and usually a thick rib on the other side. This steel band is wound helically around the surface of the cylinder, on edge, so that each coil fits closely against the preceding coil, thus producing a cylindrical surface entirely covered with fine saw-tooth points whereby doffing and stripping functions are possible.

Immediately adjacent the doffing cylinder 10, and approximately at the position where the fibrous web W formed thereon is conventionally removed by the usual reciprocating doffing comb, there is located a cylindrical, rotatable doffing roll 14 rotating on a shaft 18 also mounted in the card frame 12. This doffing roll 14 has about the same length as the doffing cylinder 10 but has a much smaller diameter which is in the range of from about $1\frac{1}{4}$ inches to about 10 inches, or even larger, but preferably is in the range of from about 3 inches to about 6 inches. Under normal circumstances, it rotates with the same surface linear speed as that of the doffing cylinder 10.

The doffing roll 14 is so positioned with respect to the doffing cylinder 10 and is so spaced therefrom that a V-shaped throat is formed between two rotatable surfaces leading to a relatively narrow opening. This opening or clearance is sufficient to permit rotation of the doffing cylinder 10 without rubbing against the doffing roll 14. The clearance between the doffing cylinder 10 and the doffing roll 14 will depend upon many factors such as the type of fibers being processed, the weight of the web being handled, the relative speeds involved, etc. In most cases, this clearance is of the order of from about $\frac{1}{64}$ inch up to about $\frac{5}{32}$ inch, with a preferred range of from about $\frac{1}{32}$ inch up to about $\frac{1}{16}$ inch.

The doffing roll 14 is relatively smooth-faced, as compared to the doffing cylinder 10 which is covered with fillet or metallic card clothing. The doffing roll 14 is given a very slightly roughened or textured surface, preferably by means of flutes, fine knurling, engraving, etching, or sand-blasting. In many instances, a textured surface having very small cavities, such as prevails in the case of natural or synthetic rubber, leather or leather-like surfaces is suitable. In other instances flutes running along the axis of the rolls are preferred, for example from about 10 to 16 flutes per circumferential inch with the flutes having a depth of from about 0.02 to 0.05 inch have been found suitable. It is desired that the flutes be positioned on a slight spiral to the longitudinal axis of the roll to provide for smooth riding of the nip blade 20 and prevent chattering of the blade. The fluted rolls have been found very desirable when doffing cotton fibers as the seed and trash material normally found with cotton will ride in the flutes and still allow good contact between the roll surface and the nip blade. Doffing rolls which have smooth or slick surfaces are not generally suited for the application of the basic principles of the present invention.

A relatively flat flexible nip blade 20 is adjustably positioned on a pivot 24 and is placed in pressing tangential contact with the doffing roll 14. The roll 14 is permanently magnetized and the nip blade is made of material which is attracted to the magnetized roll to cause the nip blade 20 to exert the desired pressure on the doffing roll 14. As shown in FIGURE 1, both sides of the nip blade 20 extend tangentially away from the surface of the doffing roll 14, with the relatively short free end 28 extending forwardly up into the V-shaped throat formed by the doffing cylinder 10 and doffing roll 14. The point of tangency of the nip blade 20 and the doffing roll 14 is

so located that the free end 28 of the nip blade 20 is of relatively short length, and is only about $\frac{1}{8}$ of an inch up to about $\frac{3}{8}$ of an inch in length. As a result of this extension of the free end 28, a relatively short entrance opening is formed between the short free end 28 and the surface of the doffing roll 14. The purpose of this small opening will be discussed hereinafter.

The other end or the base portion 22 of the nip blade 20 also extends tangentially away from the surface of the doffing roll 14 and provides an exit opening of rapidly increasing size. The purpose of this exit opening of rapidly increasing size will also be discussed hereinafter.

Consideration of FIGURE 1 will reveal that the fibrous web W is carried forwardly on the surface of the doffing cylinder 10 and is directed around the extending free end 28 of the nip blade 20 into the small opening or entrance formed by the free end 28 and the doffing roll 14. The fibrous web W is then pressed by the nip blade 20 against the doffing roll 14 for a very short length located substantially at the point of tangency. Then, due to the exit opening of rapidly increasing size, the pressure on the fibrous web W is quickly released whereby it does not build up to accumulate or drag on the doffing roll 14 but is rapidly carried forwardly by any advancing means, such as a pair of rotatably driven nip rolls 30 and 32 mounted on shafts 34 and 36 rotatably mounted in bearings in the card frame. The fibrous web W is then advanced for further process or handling, as desired or required.

As shown in FIGURE 1, the relatively short area of pressing contact is to be noted particularly whereby the possibility of frictional drag on the fibrous web is drastically reduced, thus decreasing the possibility of jamming and fiber accumulation on the doffing roll 14. If the area of pressing contact becomes too large or too long, fiber accumulation and machine stoppages will occur.

In FIGURE 2 there is illustrated another embodiment of the present invention wherein corresponding parts are given reference numerals 30 higher than their counterparts in FIGURE 1. One difference in the two embodiments is the use of a curved or arcuate nip blade 50 in this embodiment, as compared to the relatively planar or flat nip blade used in the embodiment of FIGURE 1. The use of such a curved nip blade 50 which is convexly shaped with respect to the rotating surface of the doffing roll 44 permits a wider entrance opening with a shorter free end 58 as well as an exit opening with an even more rapid increase in size for the same length of the base portion 52 of the nip blade 50. Naturally, the length of the area of tangency is also decreased which is highly desirable. Another difference in the two embodiments is that in this embodiment the pressure-applying means is electro-magnetical. The roll 44 is hollow and contains an electro-magnet 45 positioned in the area where the nip blade contacts the roll. Suitable electrical connections are made to the magnet through the shaft 48. These connections are made through rotatable couplings as are well known in the art to permit free rotation of the roll 44. The pressure between the nip blade and roll is controlled by the electrical impulses fed to the electro-magnet.

In FIGURE 3 there is illustrated another embodiment of the present invention. A conventional doffing cylinder 70 covered with conventional clothing either fillet or metallic is provided and rotates in the direction of the arrow shown. Mounted on a frame 71 immediately adjacent the doffing cylinder is the doffing roll 72. The doffing roll is mounted for rotation on the shaft 73 mounted in the frame and rotates in the direction of the arrow shown. The doffing roll has flutes 74 on its outer surface. There are approximately 16 flutes per circumferential inch of the roll and the flutes have a depth of about 0.035 inch. The flutes run in the longitudinal direction of the roll on a slight spiral of about $1\frac{5}{16}$ inches.

A flexible nip blade 75 is adjustably positioned on pivot 76 mounted from the frame 71 and is capable of being

placed in pressing tangential contact with the doffing roll. The nip blade is bent slightly at A to insure a line contact on the doffing roll and removes the blade from interfering with the fibrous web as it leaves the doffing roll. The roll 72 is permanently magnetized and the nip blade is made of a material which is magnetically attracted to insure pressure at the line of contact between the roll and the blade at A. Both sides of the nip blade 75 extend tangentially away from the surface of the doffing roll 72 with the free end 77 extending forwardly up into the V-shaped throat formed by the doffing cylinder and doffing roll. The other end or base portion 78 extends tangentially away to the bend A. The base portion with the bend provides an exit opening of rapidly increasing size.

The fibrous web F is carried forwardly on the surface of the doffing cylinder and is directed around the extending free end of the nip blade. The web is pressed by the nip blade against the doffing roll for a very short length located substantially at the point of tangency. Then due to the rapidly increasing exit opening, the pressure on the web is released and the web drops from the fluted roll to be carried forwardly by any suitable advancing means.

Mounted adjacent the doffing roll in light surface contact is a cleaner roll 80. The cleaner roll is mounted for rotation on shaft 81 mounted in the frame. The cleaner roll rotates in the direction of the arrow shown. The cleaner roll is preferably felt-covered and is used to remove any fibers which may become wrapped about the doffing roll.

Mounted behind the cleaner roll in light contact with the doffing roll is the brush 84. The brush is mounted on a stationary shaft 85 mounted in the frame. The brush is used to keep the doffing roll clean, that is, free of loose fibers.

In the drawings, no driving means such as motors, pulleys, belts, gears, sprockets, and the like have been illustrated for the doffing cylinder, the doffing roll, or the pair of nip rolls. It must be understood that this has been done because such driving means are conventional and well known in the art. Additionally, their omission from the drawings makes the individual figures thereof less complicated and easier to read and to understand.

Having now described the invention in specific detail and exemplified the manner in which it may be carried into practice, it will be readily apparent to those skilled in the art that suitable changes, modifications and variations may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for removing a fibrous web from a rotatable surface carrying the same which comprises: a rotatable surface capable of carrying a fibrous web; a rotatable roll capable of carrying a fibrous web and located immediately adjacent said first-mentioned rotatable surface whereby a V-shaped throat is formed between the rotatable surface and the rotatable roll; a stationary flexible nip blade in tangential contact with said rotatable roll and immediately extending away from said rotatable roll on both sides of the point of tangency therewith, one free end of said nip blade extending into the throat formed by the rotatable surface and the rotatable roll, whereby the fibrous web carried by the first rotatable surface is removed therefrom, carried around the free end of said nip blade into contact with the rotatable roll; and magnetic means pressing said nip blade against said rotatable roll at said point of tangency whereby the fibrous web is pressed against said rotatable roll by the nip blade at the point of tangency and carried forwardly by the rotatable roll.

2. Apparatus defined in claim 1 wherein the stationary nip blade is arcuate and convex with respect to the rotatable roll.

3. Apparatus defined in claim 1 wherein the magnetic means is an electro-magnet.

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4. Apparatus defined in claim 1 wherein the rotatable roll is fluted.

5. Apparatus for removing a fibrous web from a rotatable surface carrying the same which comprises: a rotatable surface capable of carrying a fibrous web; a rotatable roll having flutes disposed longitudinally along the surface of the roll and on a slight spiral capable of carrying a fibrous web and said rotatable roll located immediately adjacent said first-mentioned rotatable surface whereby a V-shaped throat is formed between the rotatable surface and the rotatable roll; a stationary flexible nip blade in tangential contact with said rotatable roll and immediately extending away from said rotatable roll on both sides of the point of tangency therewith, one free end of said nip blade extending into the throat formed by the rotatable surface and the rotatable roll, whereby the fi-

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brous web carried by the rotatable surface is removed therefrom, carried around the free end of said nip blade into contact with the rotatable roll; and magnetic means pressing said nip blade against said rotatable roll at said point of tangency whereby the fibrous web is pressed against said rotatable roll by the nip blade at the point of tangency and carried forwardly by the rotatable roll.

References Cited

UNITED STATES PATENTS

3,304,582 2/1967 O'Neal et al ----- 19—106

MERVIN STEIN, *Primary Examiner*.

DORSEY NEWTON, *Assistant Examiner*.