United States Patent

[11] 3,604,475

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[21] Appl. No. 130,648
[22] Filed Apr. 2, 1971
[23] Division of Ser. No. 869,300, Oct. 24, 1969, abandoned, which is a continuation-in-part of Ser. No. 793,715, Jan. 24, 1969, which is a continuation-in-part Ser. No. 729,068, May 14, 1969, abandoned
[45] Patented Sept. 14, 1971

[54] METHOD OF APPLYING CARD CLOTHING AND THE LIKE TO A CONCAVE

12 Claims, 10 Drawing Figs.

[52] U.S. Cl. 140/97
[51] Int. Cl. B21f 45/10
[50] Field of Search 140/97, 100

[56] References Cited

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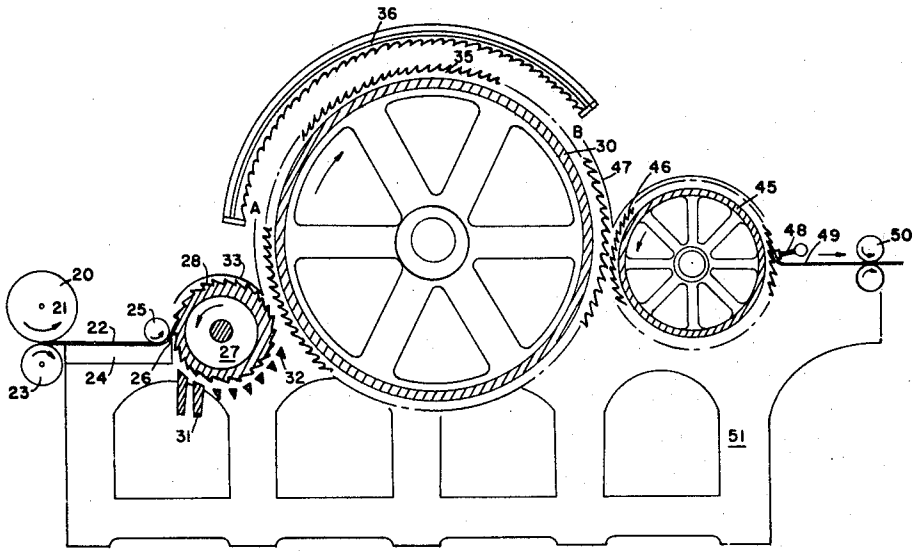
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Primary Examiner—Lowell A. Larson
Attorneys—Ralph Bailey and Julian W. Dority

ABSTRACT: A concave metallic surface suitable for carding and the like is applied to a concave support by placing a predetermined concave reverse set curvature in a band of wire so that teeth on a side of the band opposite a base of the band face inwardly, cutting a plurality of concave segments from said band, positioning the concave segments in adjacent rows in alignment on the concave support with the teeth facing inwardly away from the support, and fastening the segments on the support as by clamping.



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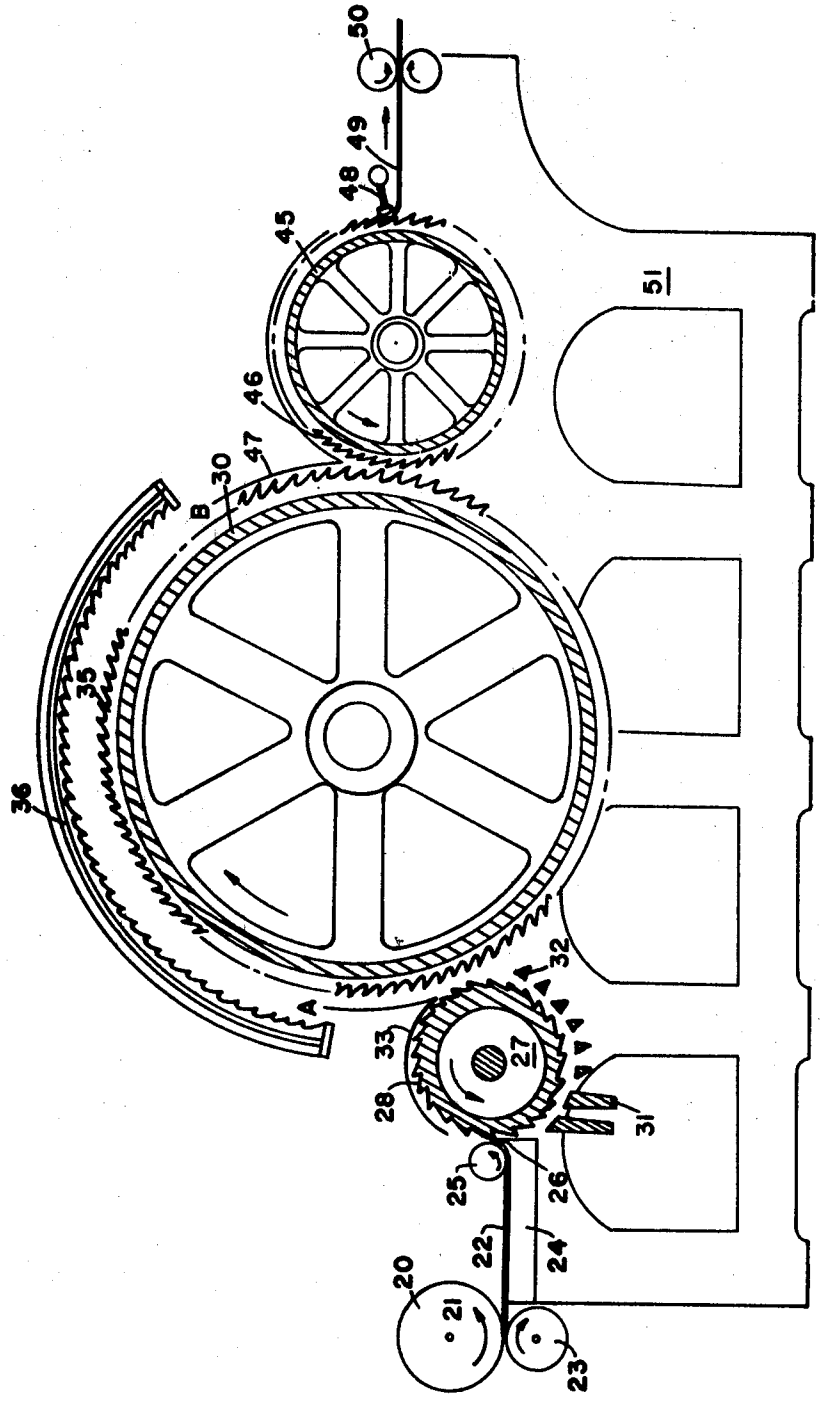


FIG. 1

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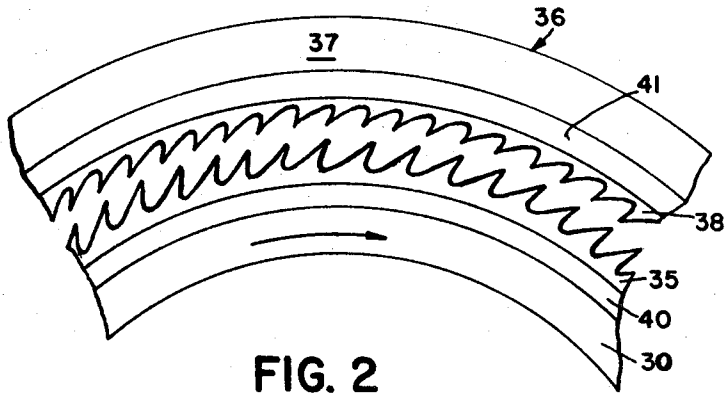


FIG. 2

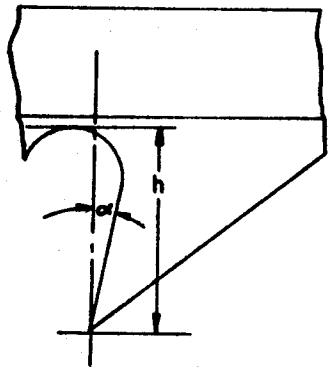


FIG. 3

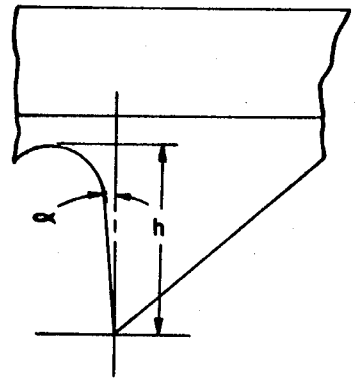


FIG. 4

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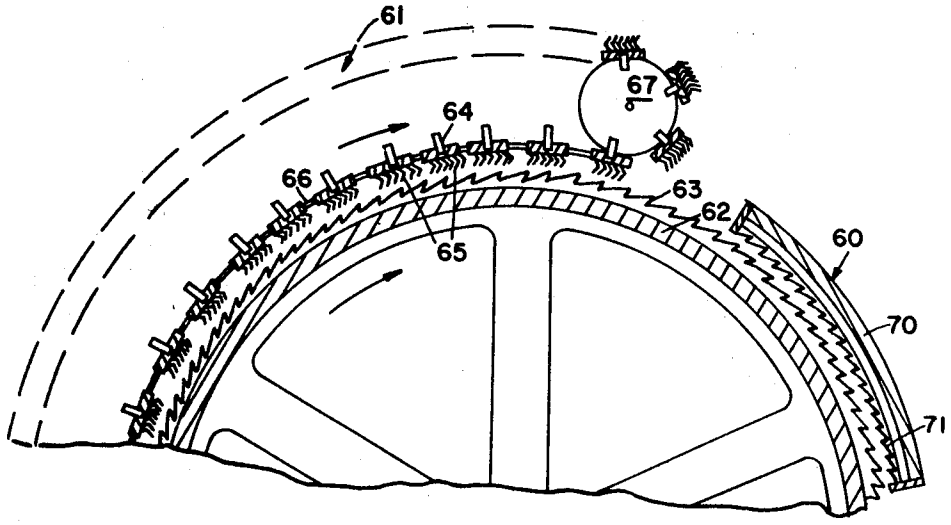


FIG. 5

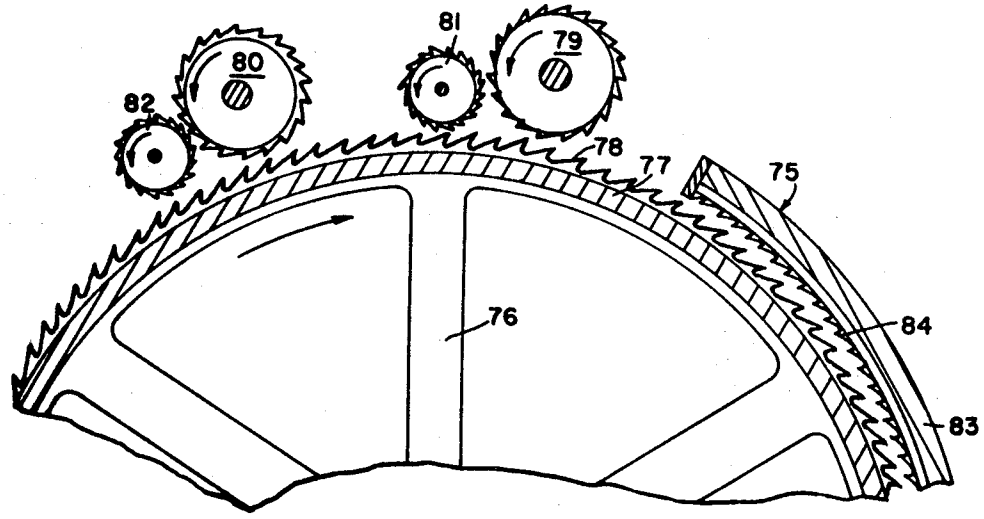


FIG. 6

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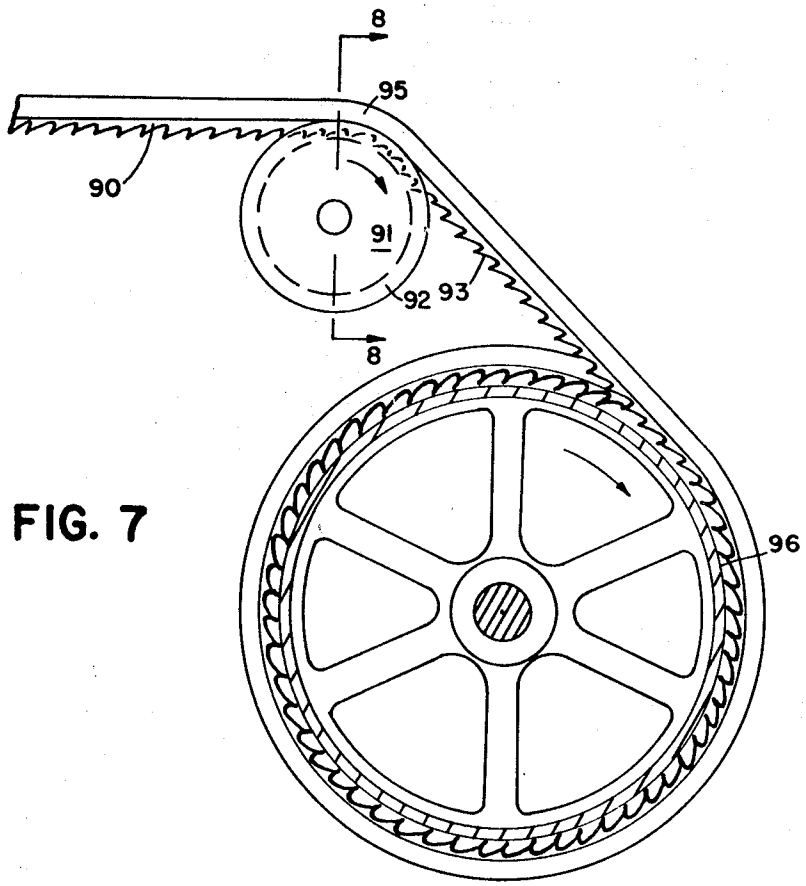


FIG. 7

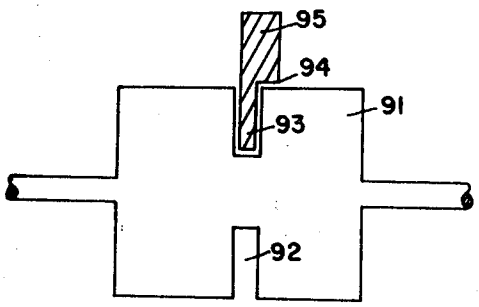


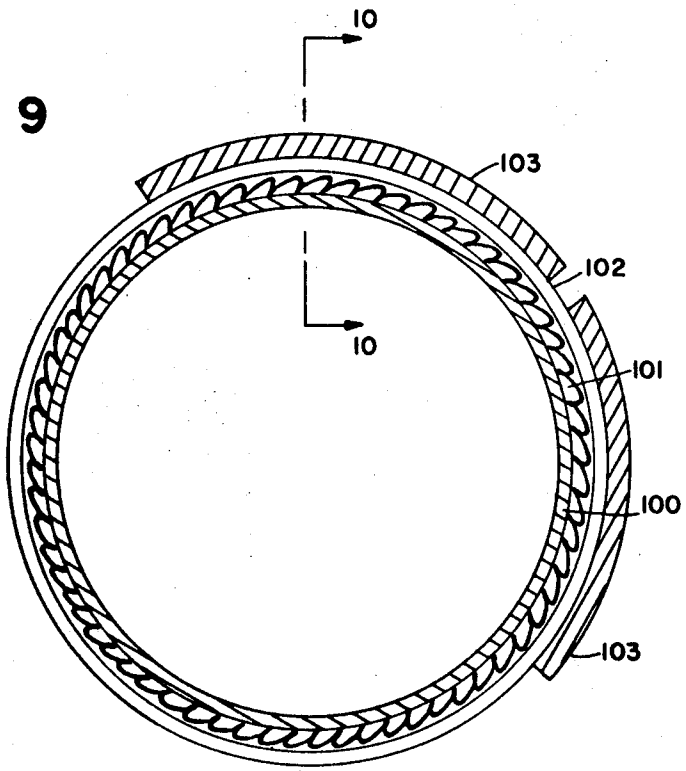
FIG. 8

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FIG. 9



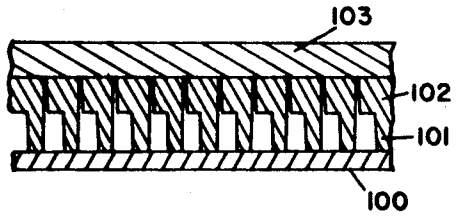


FIG. 10

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METHOD OF APPLYING CARD CLOTHING AND THE LIKE TO A CONCAVE

This is a division of copending application, Ser. No. 869,300, filed Oct. 24, 1969, which is a continuation-in-part of Ser. No. 793,715 filed Jan. 24, 1969, which is a continuation-in-part of Ser. No. 729,068, filed May 14, 1968, all now abandoned.

The invention concerns a novel method for making card clothing and the like on a concave support for positioning in carding relation to a main cylinder of a card making possible greatly improved carding of textile fibers.

Prior proposed methods for applying card clothing to a concave support are impractical for a number of reasons. In British Pat. No. 400,971 of Nov. 6, 1933, a series of elongated flat strips carrying metallic wire clothing are fastened successively about a concave support by screwing their edges to the support. The teeth are formed or ground to produce a concavity. Such a construction has the disadvantages of difficulty in fabrication, a discontinuous surface due to spaces between strips, and an impaired carding surface resulting from the grinding. In British Pat. No. 680,445 of Oct. 8, 1952, fillet clothing is stretched and clamped on a pair of hinged concave metal strips. Such has the disadvantages of difficulty in fabrication, a discontinuous surface, and the inherent disadvantages of fillet clothing.

The invention contemplates making a continuous concave surface suitable for carding and the like, such as illustrated at **36** (FIG. **1**). A concave support, such as the metal plate **37** (FIG. **2**), is covered by metallic card clothing made by passing a band of metallic wire **90** (FIG. **7**) having a base **95**, with integral metallic teeth **93** projecting therefrom, around an element such as the rotatable roll **91**, with the teeth extending inwardly toward the roll. Supporting the band in vertical relationship on a support portion of the roll (FIG. **8**) may include resting a shoulder **94** of the wire on the outer circumference of the roll with the teeth in guide mans illustrated as being defined by a groove **92** extending about the circumference of the roll. Confining the band may be accomplished by the groove, so that with the teeth extending therein, the band is maintained in position with the shoulder on the circumference of the roll, thus placing a predetermined reverse set concave curvature in the band as it is passed about the roll.

The band may be wound in adjacent or abutting rows as across a winding cylinder **100** (FIGS. **9** and **10**) with the teeth facing inwardly. Cutting a plurality of segments of wire may include severing the wire between the plates **103** placed over the cylinder **100**. The adjoining bases of the segments form a base portion having a predetermined reverse set. Fastening the segments upon the support producing the continuous concave toothed surface may be accomplished by clamping the ends to the ends of the metal plate as illustrated (FIGS. **1**, **5** and **6**), with the teeth being held in this position by reason of the curvature.

The invention will be described in terms of its best known use, which is the making of a surface for the improved carding of textile fibers.

There are three main types of machines for carding textile fibers. These are commonly termed the revolving flat top card, the granular or flatless card and the roller top card. In all of these cards there is one surface on which the fibers are carried. This is a rotatable cylinder which has a plurality of teeth over its entire surface. These teeth may be either fillet clothing or metallic clothing. By various means fibers are placed on the teeth of this cylinder usually termed the main cylinder, and carried by the cylinder through a portion of its rotation and are carded by other teeth. After being carded, these fibers are removed from the main cylinder by doffer cylinders or other means well known in the art.

In the flat type card a series of revolving flats are placed adjacent the surface of the main cylinder over a portion of its periphery and these flats either move slowly in the same or opposite direction of the cylinder or may be stationary. The flats

are T-shaped in section and are usually a little longer on both sides than the cylinder is wide. The part of the flats that faces the cylinder is covered with card clothing. Usually the clothing of the flats is finer than the clothing on the cylinder and the teeth are more tightly set or closer together. The points of the clothing on these flats almost touch the cylinder. The exact distance varies but it is usually greater than 0.01 inch. The side of each flat pointing toward the feed end of the card is called the toe and the opposite side is called the heel. The flats, to provide good carding, are set so that the heel is slightly closer to the main cylinder than the toe of the flat. In standard operation as the fibers on the cylinder move past the slowly moving or stationary flats they are carded. In standard revolving flats to card the flats are removed from the surface of the cylinder at the front end and returned to the cylinder at the rear end. During this operation the flats are cleaned and fibers removed from between the teeth of the clothing to accomplish a more efficient carding operation.

In granular card the main cylinder has a cover placed over a portion of its periphery and the surface of this cover facing the cylinder has sandpaper, emery cloth, or other irregular particulate type of surface, such as illustrated in U.S. Letters Pat. No. 2,879,549, issued Mar. 31, 1959. This carding operation has been found satisfactory for clean synthetic fibers, but is not as satisfactory for the natural fibers or for fiber stock such as cotton which contains trash and waste particles. A variation of such a device is illustrated in U.S. Letters Pat. No. 3,402,432, issued Sept. 24, 1968.

The third type of card, i.e., roller top, has a group of rolls which are covered with teeth positioned adjacent the main cylinder. These rolls are rotatable and accomplish the carding operation along the line of tangency between the roll and main cylinder. Such cards are usually used when carding synthetic or wool fibers.

In revolving flat-type cards and roller top cards the teeth on the flats or rolls are set a specific distance from the teeth on the main cylinder. For example, in a revolving flat type card starting at the front end of the card the first flat and its first portion is a specific distance from the main cylinder and as you pass to the rear of the first flat this distance decreases. There is then a space of about nine-sixteenths of an inch between the teeth of the first flat and the teeth of the next flat. The second flat is also spaced a specific distance from the main cylinder and as you pass to the rear of the second flat this distance decreases and so on for the number of flats adjacent the card surface which may be **20**, **30**, or even more. With regard to the roller-type card the only carding action occurs at about the tangent line where the roller meets the main cylinder and there is considerable distance between rollers where no carding takes place.

Hence, in these prior art type carding apparatuses the carding action is only accomplished at intermittent tangent lines along the moving carding surface.

With regard to the granular-type card the carding surface is made up of granules which are irregular in shape, have little depth, and a poor ratio of thinness to height and also have relatively smooth surfaces; hence, the efficiency of the carding is poor. These granules may be replaced with wire teeth such as fillet clothing. This improves the carding action but the fillet teeth rapidly fill with dirt and short fibers and lose their carding effectiveness.

In my new carding apparatus the distance between the carding surface, i.e., main cylinder and my new carding teeth may be uniform over the entire surface and provide efficient carding over the entire surface rather than merely at tangents thereto. Preferably, my new carding teeth are set closer to the main cylinder at the discharge end than at the feed end of the cylinder. Preferably, the setting of the teeth at the discharge end of the main cylinder is less than 0.010 inch and about 0.008 inch.

Furthermore, my new apparatus has metallic teeth which are uniformly spaced over the surface nd produce very efficient carding. The plate has substantially the same curvature

as the roll and covers a portion of the periphery of the roll. The inside surface of the plate is covered with metallic clothing having its teeth disposed towards the roll.

The metallic teeth in accordance with the present invention do not overload and hence, need not be moved for cleaning purposes, but may be utilized in a stationary manner to further control the settings between he moving main cylinder and the carding teeth and allow for greatly improved carding action.

In accordance with the present invention my apparatus comprises a rotatable roll having card clothing, i.e., fillet clothing or metallic clothing on its surface for carrying fibers to be carded. A curved plate covers a portion of the periphery of the rotatable roll and is spaced substantially the same distance from the card clothing over substantially the entire area of said plate. The plate has metallic teeth on its inner surface adjacent the card clothing on the roll for continuously carding fibers as they are carried by the rotatable roll and pass the curved plate. The carded fibers are removed from the roll by standard means for removing fibers from a toothed rotatable roll as are well known in the art.

If desired, the curved plate may be positioned slightly closer to the card clothing at the front end of the card and slightly further away from the clothing at the rear end of the card to give uniformly increased carding action as the fibers pass from the feed to the product end of the card.

In accordance with the present invention the teeth on my curved plate must make an angle with the vertical of from −10° to +30° and preferably from about +10° to +20°. Furthermore, the teeth must have a minimum height of 0.010 inch and a maximum height of 0.075 inch. It is preferred that they have a height of between 0.020 inch to 0.045 inch. The desired angle and depth will vary with the type of stock that is being carded. Also, the number of teeth per square inch of surface of the new plate must be in the range of 175 teeth per square inch and 1,200 teeth per square inch and preferably from about 270 to 600 teeth per square inch.

It should be pointed out at this time that all of the above figures are extremely critical to the satisfactory operation of my improved carding plate and to eliminate the loading problem of fibers in the teeth of my new plate. The optimum plate has teeth at an angle of 15° and a depth of 0.032 inch with 350 teeth per square inch.

SImilar tooth configurations including height, density and angle have been used on other carding elements. Such, however, have not been used on curved supports as here where it has been found that loading may be avoided thereby.

It should also be noted that my invention may be used in conjunction with revolving flat-type cards or with roller-type cards where the fibers are first carded by revolving flats or rollers covering a portion of the carrying surface nd the finished carding accomplished by placing a smaller plate adjacent the carrying surface in accordance with the present invention to further card the fibers.

Another advantage of the present invention is that smaller diameter main cylinders may readily be used with equal or better carding results.

It should also be noted that metallic clothing has many known advantages over fillet clothing that the metallic clothing is more durable and is not required to be ground as often.

Though there are a number of ways of producing a curved surface having teeth on its inner surface, I have also developed a new method of placing metallic teeth on the inside of a curved surface in a very uniform manner in a very simple operation.

In accordance with my method for producing curved carding plates I place a set in the desired metallic wire. This set in the wire is in the opposite direction as is normally placed, that is, the teeth form the inside of the curvature and the base of the teeth from the outside of the curvature. The opposite is true when winding metallic clothing by standard techniques. I wind the reverse set metallic wire about a cylinder with the teeth against the surface of the cylinder. After the clothing has been wound in this manner on the cylinder the bottom, or base, of the teeth is ground to provide an even surface. One or more plates of metal, plastic, wood, or similar materials are secured to the ground base. The plates may be secured to the base of the teeth by glue, welding, or other well known techniques for securing materials to metal. The clothing is cut down to the surface of the inner cylinder between plates. The teeth are uniformly placed over the entire curved surface.

The present invention will be more fully described when taken in conjunction with the accompanying drawings wherein:

FIG. **1** is a side elevational view of the apparatus of the present invention;

FIG. **2** is an enlarged cross-sectional view of the improved carding surfaces of the present invention;

FIG. **3** is an enlarged cross-sectional view of a single tooth;

FIG. **4** is an enlarged cross-sectional view of a modification of a single tooth;

FIG. **5** is an enlarged cross-sectional view of an embodiment of the apparatus of the present invention;

FIG. **6** is an enlarged cross-sectional view of another embodiment of the apparatus of the present invention;

FIG. **7** is a cross-sectional view of apparatus for producing surfaces in accordance with the present invention;

FIG. **8** is an enlarged cross-sectional view taken along line **8—8** of FIG. **7**;

FIG. **9** is a cross-sectional view of plates produced in accordance with the present invention; and

FIG. **10** is an enlarged cross-sectional view taken along line **10—10** of FIG. **9**.

Referring to FIG. **1** there is shown a standard card machine with one major exception in that the flats have been replaced by a carding surface in accordance with he present invention. The sketch is not meant to be to scale as the size of the teeth in the card clothing, for instance, is exaggerated for purposes of clarity. At the left is the feed end or back of the card. A picker lap **20** having a rod **21** passing through the center with the sides of this rod held in a slide, not shown for the purposes of clarity, but as is well known in the art feeds the layer of fibers **22** to the card. This lap rests on a roll **23** called the lap roll and which may be fluted if desired. The fiber lap is drawn over the feed plate **24** by the feed roll **25** which is driven to provide a uniform feed to the card. The feed roll is usually fluted and is weighted so that will have a good grip on the fibers. As the roll slowly rotates the fringe of the layer of fibers is picked up by the licker-in **27** which rotates in the direction shown. Wire teeth **28** cover the surface of the licker-in and grab the fringe and take individual fibers or tufts of fibers about the surface of the licker-in and present them to the main cylinder **30** of the card. As the teeth of the licker-in pass the fringe of the fiber layer they hook fibers; however, they do not grab short fibers or trash and these are thrown by the centrifugal force of the licker-in onto the mute knives **31** and the licker-in screen **32** and are removed as in standard carding practices.

The main cylinder of the card rotates in the direction of the arrow shown and has teeth **35** over its entire surface. Though metallic teeth are shown these of course could be fillet clothing teeth. The teeth point in the direction shown and pick fibers from the licker-in as the cylinder rotates. The surface velocity of the main cylinder is faster than the surface velocity of the licker-in and hence, the teeth on the main cylinder strip the fibers from the licker-in cylinder. The fibers on the main cylinder of the card pass between the area covered by the improved carding surface **36** of the present invention. The top of the licker-in and the area of the main cylinder between the licker-in and the carding surface **36** is generally covered by a metallic plate **33** to prevent undue air currents.

As is more clearly shown in the enlargement in FIG. **2** the carding surface **36** comprise a metal plate **37** and on its inner surface are metallic teeth **38**. The teeth are pointed in the direction as shown in the drawings. The plate is stationary and may be set a specific distance from the main cylinder. Usually this distance is about 0.01 inch. Very often, to give even better

carding, the distance may be slightly greater at the feed end of the card, that is towards the left of the drawing, and slightly closer at the doffing end of the card, i.e., the right of the main cylinder. The plate being stationary may be set with extreme accuracy and maintained with that accuracy and the entire area from points A to B is carding area of the card. As is shown in FIG. 2, the main cylinder **30** of the card has the teeth **35** mounted on its surface with the teeth of the main cylinder pointed in the direction shown and with the main cylinder moving in the direction of the arrow shown. The teeth have a shoulder **40** at their bottom portion to keep rows of teeth separated and present a toothed surface of individual teeth. Mounted adjacent this main cylinder and extremely close as previously described, is the carding surface **36** which comprises the metal plate **37** and mounted on this metal plate are metallic teeth **38** pointed in the direction, as shown in the drawings. These teeth also have a shoulder **41** at their base portion to keep the teeth a specific distance apart from adjacent rows.

The fibers, after being carded by my improved carding surface, are presented to a standard doffing cylinder **45** which rotates in the direction of the arrow shown. This doffing cylinder also has suitable teeth **46** mounted on its surface and again these teeth are pointed in the direction as shown in the drawings. Generally the doffer and the space between the doffing cylinder and the carding surface is covered by a plate **47** to prevent undue air currents during the carding operation.

The surface velocity of the doffing cylinder is only a fraction of the surface velocity of the main cylinder and hence, the fibers on the main cylinder are condensed onto the doffing cylinder in the form of a web. As the doffing cylinder rotates it presents this web to the doffing comb **48**. The doffing comb resembles a fine saw which reciprocates at high speeds and removes the fibers from the doffing cylinder in the form of a fibrous web **49**. The fibrous web is then presented to calendar rolls **50** and to standard coiler cans as are well known in the art. The entire mechanism is mounted on a suitable framing **51** so that it is an integral unit and is driven by suitable belts, drives, and gears as are well known in the art and which have not been shown for the purposes of clarity.

The major problem with prior art stationary flats which are covered with fillet clothing are of course that they load up heavily and hence reduce the carding efficiency of the flats. Contrasted to this my teeth do not overload provided they meet certain critical requirements. As shown in FIGS. 3 and 4 my metallic teeth on my improved carding surface must make an angle α with the vertical of from $-10°$ to $+30°$. A minus angle is shown in FIG. 4 and a plus angle shown in FIG. 3. It is preferred that the angle be from 10° to 20° and the best results are obtained when this angle is 15°. Though the angle is of extreme importance the height (h) of the teeth is also extremely important and must be from 0.010 inch to 0.075 inch and preferably from 0.02 inch to 0.045 inch. We have found that the best results are obtained with most stocks when the height of the teeth is from 0.026 inch to 0.032 inch. If the height is less than 0.010 inch there is not sufficient area to produce sufficient carding, whereas, if the height is more than 0.075 inch the teeth will readily overload with fibers and again reduce the efficiency of the carding. The angle and the height will depend for the most part on the type stock that is being carded, that is, the trashier or dirtier the stock and less the angle should be and the greater the capacity desired through the card the less the angle should be. However, the greater the angle generally the better the carding operation.

It should also be noted that metallic clothing is extremely durable and can be ground more accurately than fillet clothing. The extreme accuracy with which my improved carding surface may be set with respect to the main cylinder also reduces possibilities of damage to the card clothing.

The setting of my improved carding plate is important and the great degree of control available in setting my plate greatly improves the carding efficiency. It is preferred that the edge of the plate closest to the discharge end of a card be set closer to the main cylinder than the edge of the plate closest to the feed end of the card. For example, if four of my new plates are used to replace the flats of a standard card the plate next to the licker-in might be set at 0.034 inch, the second plate at 0.022 inch, the third plate at 0.015 inch and the fourth plate closest to the doffing cylinder at 0.008 inch. It is important that the teeth on the plate closest to the doffer be set within 0.010 inch of the teeth on the main cylinder to effect good carding.

Referring to FIG. 5, there is shown an embodiment of the present invention wherein my improved carding surface **60** is used in combination with the standard revolving flats **61**. This is a simple modification which may be made to present day cards merely by reducing the area that the flats cover on the surface of the main cylinder of the card or even by just replacing the front plate of the card with my improved carding surface. The main cylinder **62** of the card rotates in the direction of the arrow shown and has suitable teeth **63** positioned as shown in the drawing. The teeth as shown are metallic teeth, however, fillet clothing teeth could also be used. The revolving flats **64** are T-shaped in section and are a little longer on both sides than the cylinder is wide. The part of the flats that faces the cylinder is covered with card clothing **65**. The clothing of the flats is finer than the clothing of the cylinder and usually the teeth are more tightly set. The flats are connected by links **66** and to a chain. This chain is supported by suitable pulleys **67** one of which is shown. The distance between the points on the flats and the points on the main cylinder is usually about 0.01 inch. The side of the flat pointing toward the left of the drawing is called the toe and the opposite side is called the heel. The heel is generally a little closer to the main cylinder teeth than the toe. This is done to improve the operation and prevent the possibility of damage to the main cylinder of the card. As can be seen there is a distance between the teeth of one flat and the teeth of the next flat though the holding means for the teeth of the flat are virtually touching each other as must be the case to prevent undesirable air currents. Generally the curved area or actual carding area of each flat is about thirteen-sixteenths of an inch and the distance from the teeth of one flat to the teeth of the next flat is about nine-sixteenths of an inch. Mounted in front of these revolving flats is my improved carding surface **60** comprising a metal plate **70** having metallic teeth **71** mounted on its inner surface adjacent the main cylinder of the card with the teeth pointed as shown in the drawings. The metal plate may be set very accurately to the teeth of the main cylinder. As can be readily seen the entire area of the metal plate provides carding action, whereas, on the revolving flat portion actually only about 60 percent of the surface provides carding action.

Referring to FIG. 6, there is shown another embodiment of the present invention wherein my improved carding surface **75** is combined with a roller top card **76**. The roller top card comprises a main cylinder **77** rotating in the direction of the arrow as shown and having suitable teeth **78** over its entire surface. As shown in the drawings these teeth are metallic clothing though they could be fillet clothing and teeth point in the direction as shown in the drawing. Over a portion of the surface of the main cylinder there are worker rolls **79** and **80** and stripper rolls **81** and **82** combined with said worker rolls. The worker and stripper rolls rotate in the directions of their respective arrows. There may be just one pair of rolls or there may be a number of them. These rolls re covered with suitable wire teeth made of metallic wire or fillet clothing over their surfaces. As the worker roll rotates it picks up fibers from the main cylinder of the card, moves them about its surface to present them to the stripper roll, which in turn, presents them back to the main cylinder of the card for further carding action. As may be seen, the carding actually occurs at those lines where the rolls meet the main cylinder hence, the carding action is at these tangent lines. Mounted in front of the worker stripper rolls, again it may be merely a replacement of the front plate of a roller top card, is my improved carding surface **75** comprising a metal plate **83** having metallic teeth **84**

mounted on its inside surface. The teeth point in the direction as shown in the drawing. Again these teeth may be mounted with extreme accuracy with respect to the teeth on the main cylinder of the card and present all of the advantages as described hereinbefore in conjunction with FIG. 5.

Any of the known cardable fibers may be carded by the apparatus of the present invention. Examples of such fibers are the natural fibers, such as cotton and wool, or the synthetic fibers such as rayon, nylon, polyester, etc.

There are different ways of making my improved carding surfaces. FIGS. 7 through 10 show my preferred technique for making my carding surface. Referring to FIG. 7, metallic wire 90 is supplied from a coil or other suitable source as is well known. Metallic wire is produced by punching the teeth out of one side of a narrow band of steel. The opposite side of the band is thicker than the side having the teeth. The wire is passed about a rotatable roll 91 more clearly shown in FIG. 8, which has a groove 92 about its circumference. The teeth 93 of the wire fit into this groove and the shoulder 94 of the wire rests on the outer circumference of the roll. This places a curvature in the wire with the inner portion of the curvature being the teeth and the outer portion being the base 95 of the wire. The wire is wound with the teeth on the surface of a suitable cylinder 96. The cylinder may be metal, plastic, or other material. The cylinder or the grooved roll may be traversed very slowly so that the teeth are wound adjacent or abutting previous rows. Techniques for driving the cylinder or traversing the cylinder and roll are well known in the art and it is believed need not be described here.

As is more clearly shown in FIG. 9, the cylinder 100 is completely covered with the inverted teeth 101. The base 102 of the teeth is ground and a plate 103 is placed on top of these teeth and secured thereto. Though only two plates are shown about this cylinder the entire surface of the cylinder may be covered. A cross-sectional view is shown in FIG. 10. The teeth are equally spaced over the entire surface of the cylinder. The teeth are cut between plates down to the surface of the inner cylinder to produce the carding surface of the present invention. The ends of the carding surface may be finished by grinding and placing another piece of metal at each end if desired. The teeth do not necessarily have to be glued, but could be clamped to the metal plate and would be held in this position by reason of their curvature.

Though I have shown a preferred technique for producing my improved carding surface there are other techniques for doing this rather than winding the teeth in the inverted manner as described. Such techniques would be to cut uniform strips of metallic wire and place them on the inner surface. Such technique would probably be more time consuming but could accomplish the carding surface in accordance with the present invention.

The invention will be more fully described when taken in conjunction with the following examples:

EXAMPLE I

A standard lap of cotton fibers is processed on a card engine equipped with my new curved plates having card clothing mounted on their inside surface in accordance with the present invention. The lap weight is 40 pounds and the fibers have a staple length of 1 3/32 inch.

The entire lap is processed into 60-grain weight sliver at the rate of 30 pounds per hour.

The two similar laps of the same type fiber are processed into 60-grain sliver at the rate of 30 pounds per hour. One lap is processed on a standard card engine equipped with revolving top flats and the other on a standard card engine equipped with a granular top.

The slivers produced on each type card are spun into 24's size yarns by standard textile processes. The three comparative experiments are the same with the exception of the type of flats used in carding the cotton fibers.

The webs produced on each card and the resultant yarns spun from these webs are tested for various properties by standard textile testing methods. The results of these tests are given in he following table.

TABLE 1

	Revolving top flats	Granular top	Curved plate with metallic clothing
Test (web):			
Percent fly waste (by weight)	.015	.015	.015
Percent flat strips (by weight)	2	0	0
Percent variation (coefficient of variation)	4.85	3.85	3.95
Number of neps per square inch	66	35	15
Test (yarn):			
Size	23.95	23.19	23.58
Break (actual)	99	103	103
Break factor	2,334	2,373	2,433
Uster (coeff. of variation)	20.01	19.08	19.44
Neps and trash per 1000 yds	156	125	101
Yarn grade (U.S. Standards)	B—	B—	B—
Thin spots (Uster)	221	155	160
Thick spots (Uster)	144	88	88

As may be seen from the above test results both the web and the yarn produced by the card engine of the present invention unexpectedly have less neps and trash than do similar webs and yarns produced by standard cards. This is true even though less waste has been removed from the starting lap of cotton fibers than is usually removed when using a card equipped with revolving top flats.

Yarns produced from the webs made in accordance with the present invention also unexpectedly have less variation and better evenness than standard yarns and have a better overall general quality than do standard yarns.

EXAMPLE II

The procedure of Example I is followed exactly as described in Example I with the exception that in all instances, the starting lap is polyester fiber, i ½denier, i ½-inch staple length instead of the cotton fiber lap.

The webs and yarns produced are tested in the same manner as in Example I. The results of these tests are given in the following table.

TABLE 2

Test (web):	Revolving top flats	Granular top	Curved plate with metallic clothing
Percent fly waste (by weight)	.015	.015	.015
Percent flat strips (by weight)	2	0	0
Percent variation (coefficient of variation)	5.25	4.4	5.2
Size	24.15	24.10	23.85
Break (actual)	164	166	169
Break factor	3,944	3,990	4,012
Uster (coeff. of variation)	14.48	14.97	14.63
Yarn grade (U.S. Standards)	1	2	2
Neps and trash per 1000 yards	3	5	3
Thin spots (Uster)	106	171	101
Thick spots (Uster)	13	6	13

In accordance with the present invention the sliver produced using my new carding apparatus is more uniform

and has less trash or waste than sliver produced by the prior art methods using the same starting material of natural fibers.

Furthermore, yarn produced from such sliver has improved strength and uniformity as well as less trash than yarn produced from sliver carded by the prior techniques.

Also, since there are no flats strips produced in my new carding techniques it has a considerable economic advantage over the prior art methods and apparatus for carding.

It should be understood that various standard parts have been omitted from the description and the drawings such as driving pulleys, belts, gears, speed ratio mechanism, frames, etc. These are all standard and are well known in the art and have only been omitted for purposes of clarity in both the drawings and description. It should also be understood that suitable changes, modifications, and variations may be made without departing from the spirit and scope of the present invention.

I claim:

1. The method of applying wire card clothing and the like for making a toothed surface defining a uniform segment of a cylinder on a corresponding concave support comprising:

A. passing a band of metallic wire having a base with integral metallic teeth projecting therefrom around an element with the teeth of the metallic wire extending inwardly toward the element;

B. supporting the band on a support portion of said element while so passing the band about the element;

C. confining the band of metallic wire in guide means in position with the teeth so extending while so passing the band about the element thus placing a predetermined reverse set concave curvature in the band with the teeth facing inwardly;

D. cutting a plurality of segments of wire thus curved from said band;

E. positioning said segments in alignment with said concave support with the teeth facing inwardly across said concave support closely adjacent each other; and

F. fastening said segments in such position fixed upon said support producing said toothed surface.

2. The method set forth in claim 1 including supporting the band on a shoulder on said base on a rotatable roller with said teeth in a groove.

3. The method of making a continuous concave toothed surface defining a uniform segment of a cylinder on a corresponding concave support comprising:

A. cutting teeth out of one side of a narrow band of steel wire with a base on the opposite side of said band;

B. passing said band around an element with the band in vertical relationship on said element;

C. confining the band in guide means with the band in such vertical position with the base side remote from said element while so passing the band about the element;

D. then placing a predetermined concave set curvature corresponding to said concave support in the band so that the teeth face inwardly with such curvature remaining therein;

E. cutting a plurality of curved toothed segments from said band;

F. positioning said curved segments in alignment on said support with the teeth facing inwardly across said concave support closely adjacent each other; and

G. fastening said curved segments in such position fixed upon said support producing said continuous concave toothed surface.

4. The method set forth in claim 3 including, fastening said segments upon said support by gluing.

5. The method set forth in claim 3 including, fastening said segments upon said support by clamping.

6. The method set forth in claim 3 including, positioning a plurality of said supports each of which includes a metal plate having a concave surface about a main cylinder with said toothed surfaces carried thereby in fixed carding relation to the main cylinder.

7. The method of making a concave carding surface and the like on a support having a predetermined concave curvature therein, said concave curvature corresponding to the card clothing of the main cylinder of a carding machine comprising:

A. cutting teeth on one side of a narrow band of steel wire producing a base on the opposite side of said band;

B. confining the band with a curvature therein placing a predetermined concave reverse curvature corresponding to said concave support in the band with the band so confined so that said one side faces inwardly with the reverse curvature remaining therein:

C. cutting a plurality of segments from said band;

D. positioning concave segments in alignment on said support, with the teeth facing inwardly, across said concave support closely adjacent each other; and

E. fastening said concave segments in such position fixed upon said support producing said concave surface.

8. The method of making a concave carding surface on a support having a predetermined concave curvature therein, said concave curvature corresponding to card clothing of a main cylinder of a carding machine comprising:

A. making a base portion with inwardly projecting spaced teeth of such configuration as to avoid loading thereof with textile fibers during carding, carried thereon defining a carding surface;

B. clamping opposite ends of said base portion on said support, with a reverse concave curvature in the base portion corresponding with the concave curvature of the support, with the teeth projecting inwardly away from said support; and

C. utilizing the reverse concave curvature in the base portion for holding the teeth in such clamped position on said support;

D. whereby said support may be positioned with said inwardly projecting teeth in carding relation disposed toward the teeth of the clothing of the main cylinder so that the carding occurs continuously over substantially the entire carding surface defined by said inwardly projecting teeth, and whereby an enlarged carding area may be thus provided permitting elimination of card flats, rolls and the like while affording improved carding with less waste.

9. The method set forth in claim 8 including, placing said concave curvature in the base portion as a reverse set prior to clamping the base portion on the support; and clamping opposite ends of the base portion on respective opposite ends of the support.

10. A method for manufacturing an improved carding surface for use in carding relation to a main cylinder comprising: placing a reverse set concave curvature in metallic card clothing, winding the metallic clothing on the outside of a winding cylinder the curvature of which corresponds to the curvature of the main cylinder with the teeth of said clothing disposed toward the surface of said winding cylinder and the base of said clothing extending outwardly from said winding cylinder providing an outer cylindrical surface, and removing said metallic clothing from said winding cylinder.

11. The method set forth in claim 10 including, severing the metallic clothing to produce a plurality of curved segments having metallic teeth of their inner surfaces, placing the reverse curved segments on a support having a concave curvature corresponding to the main cylinder, and clamping said base on said support with the teeth extending inwardly.

12. A method for manufacturing an improved carding surface for use in carding relation to a main cylinder comprising: placing a reverse set concave curvature in metallic card clothing to produce a plurality of reverse curved segments having metallic teeth on their inner surfaces, aligning the reverse curved segments on a support having a concave curvature corresponding to the main cylinder, and fastening the reverse curved segments on said support with the teeth extending inwardly away from said support forming a carding surface for use in carding relation to the main cylinder.