Feb. 9, 1960 A. B. STEINRUCK 2,923,980

APPARATUS FOR MAKING NUBS

Filed July 8, 1954

FIG. 1.

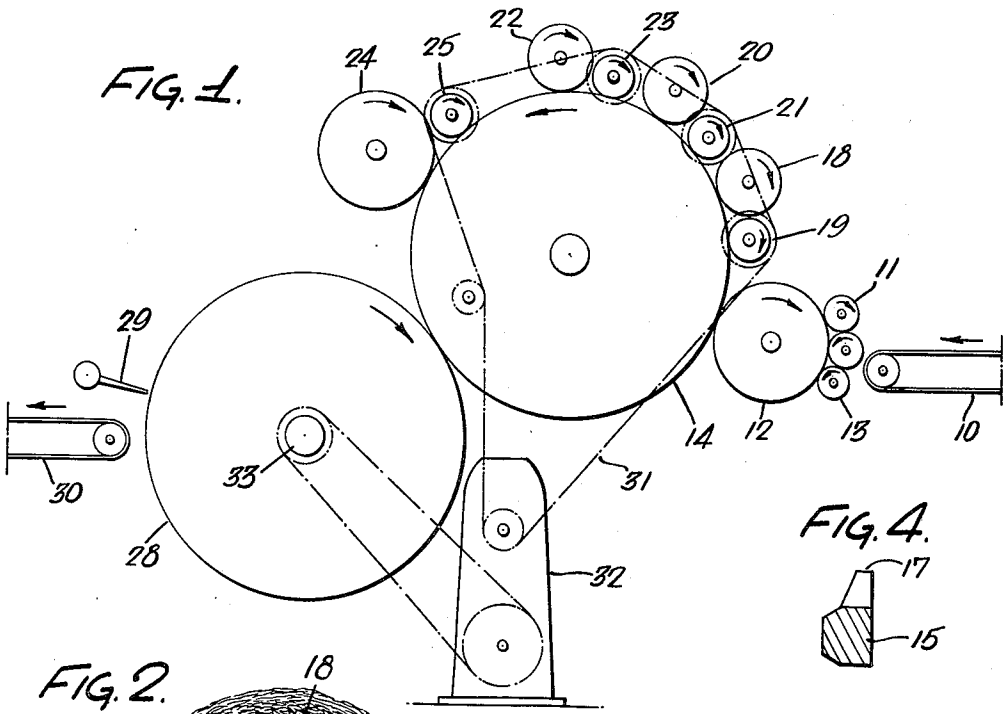


FIG. 4.

FIG. 2.

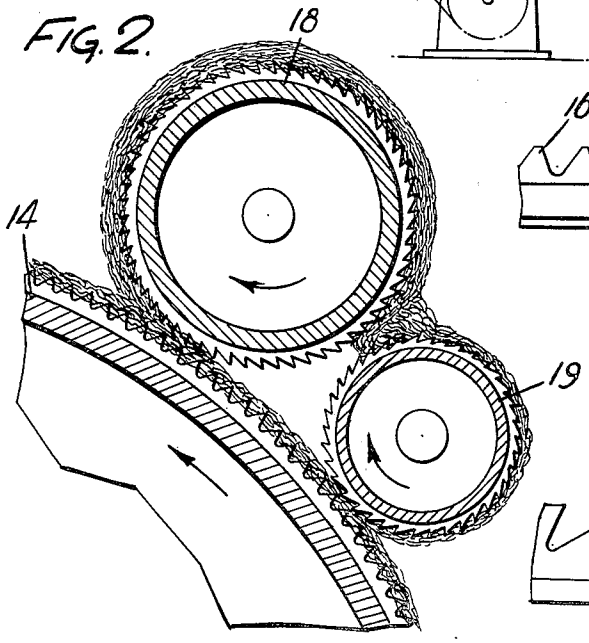


FIG. 3.

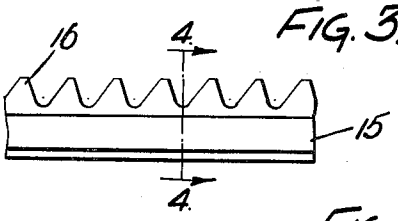
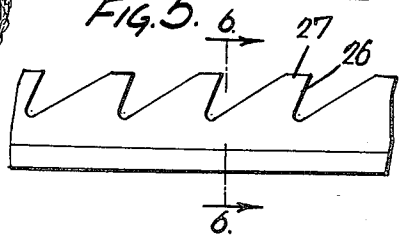


FIG. 6.



FIG. 5.



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APPARATUS FOR MAKING NUBS

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10 Claims. (Cl. 19—99)

This invention relates to apparatus and methods for making nubs from fibrous material, and may be applied to the making of nubs from both synthetic and natural fibers.

Prior to the present invention nubs were produced by methods which may almost be regarded as fortuitous, on carding machines and Garnett machines which were originally designed for carding and garnetting fibrous material into webs and slivers free of neps or nubs. These prior machines use for producing nubs where machines on which the cylinder clothing had deteriorated through usage to a point where the machines could no longer produce the desired web or sliver free from small nubs. If the fancy and fancy stripper were clothed with metallic wire, material would be wound between the threads of the wire until it covered the points to produce smooth rolls, so that these rolls could no longer serve their normal function of clearing the main cylinder with which they coact in carding. The relative surface speeds of the various cooperating cylinders were maintained when the machines were transferred to the nub making operation, as in the usual carding or garnetting machine, with the exception that the speed of the feed rolls was increased and the doffer surface speed was decreased to induce overloading of the carding cylinder.

While these prior machines will produce nubs, in many instances it has been necessary to use as high as ten machines in a row to reduce the fiber stock to the desired small hard nubs. The method of overloading these machines in the nub making process has resulted in frequent shut-downs to clear them of stock. The shut-down periods frequently occur at approximately four-hour intervals, and after clearing the machine considerable time is spent in reloading the cylinders in order to produce nubs once more.

With the foregoing in mind the principal object of the invention has been to provide novel apparatus and methods for making nubs, with the capability of making any desired type of nub from any type of fiber stock.

Another object has been to provide novel apparatus and methods adapted to greatly reduce the number of machines required to produce the finished nubs, and to obtain greater productive capacity than heretofore possible.

A further object has been to provide novel apparatus and methods for making nubs in a continuous operation, and to avoid the necessity for shutting down the machines at frequent intervals.

A further object has been to provide apparatus and methods for making nubs embodying novel features in the cylinder clothing for nubbing the fibrous material without excessively loading the cylinders of the apparatus.

A further object of the present invention has been to provide novel apparatus and methods for making nubs from fibrous material in which the nub size and the degree of hardness of the nub may be controlled by appropriate adjustment of clearances and relative speeds.

A still further object has been to provide novel apparatus and methods having the features and characteristics set forth which is of relatively simplified construction and operation and entirely efficient and effective in use.

These and other objects, and the various features and details of the operation and construction, are hereinafter more fully set forth and described with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic side elevation of a textile fiber nubbing machine made in accordance with the invention;

Fig. 2 is a fragmentary view illustrating a portion of the main cylinder and the collecting roll and nub forming roll;

Fig. 3 is a side elevation of a segment of the wire clothing used on the main cylinder;

Fig. 4 is a transverse cross-section taken on line 4—4 of Fig. 3;

Fig. 5 is a side elevation of a segment of the wire clothing used on the collector and doffer cylinders, and

Fig. 6 is a transverse cross-section taken on the line 6—6 of Fig. 5.

The primary functions of an ordinary carding machine are to lay the individual fibers as much as possible in parallel lines and to remove any neps or nubs from the fibrous material incident to this basic carding operation. The purpose of the present machine and process is almost the reverse of this, and involves the treatment of the fibrous mass to convert it, to the fullest extent possible, into individual nubs which are to be incorporated into webs or slivers by introduction into the fibrous mass on a carding machine in a subsequent operation. Although the function of the lickerin in the present machine is identical with that of a carding machine, and although the organization of the system of cylinders and rollers is also otherwise similar in general arrangement to a carding machine, these two machines differ from each other in relative spacing, in cylinder and roller clothing, and in relative speeds, so markedly that these basically opposite results are attained in the two cases.

Referring now to the drawing by reference characters, the mass of raw staple fibers which is to be converted into nubs is passed by a feed apron **10** into feed rolls **11**, and thence by lickerin **12** past clearer roll **13** to the main cylinder **14** of the machine. Up to this point, both the structure and function of the machine may be identical with those of a typical carding machine. From this point on, however, basic differences begin to appear.

The first such difference is in the clothing of the main cylinder. In the typical carding cylinder, the teeth are rather deep, they are sharply pointed on their ends, and they have a relatively large rake angle. Each of these characteristics is designed to promote the carding function. In contradistinction to this, the teeth of the main cylinder of this invention are designed to hold any carding action to the very minimum. To this end, the teeth of the main cylinder, which may be formed on the peripheries of metallic clothing wires, have a rake angle which is of very small magnitude, being in most cases of less than ten degrees positive, and indeed in many cases having an actual negative angle, as illustrated in Figures 3 and 4 of the drawing. As there illustrated, the individual wires **15** which are secured in side by side relationship and extend peripherally of the cylinder to provide its clothing have teeth which are very low and have negative rake angles. These teeth may, for example, have a negative rake angle of —10°, and a punch angle of 38° between successive teeth. The wire may be of the order of 0.144 in height from base to top, and

is cut off toward the tip at 17 to provide a chisel-shaped tooth.

By reason of these characteristics, and provision of a relatively large tooth gullet radius, the impelling and carding characteristics of this clothing are vastly reduced as compared to a conventional carding machine, and these differences contribute greatly to the efficient manufacture of nubs, by the particular apparatus and process features to be discussed hereinafter. These features include the provision of a series of collecting cylinders 18, 20, 22 and 24 and nubbing cylinders 19, 21, 23 and 25, which are similar in superficial arrangement to the collecting and stripper rolls of a conventional carding machine but vastly different in their details of construction and operation.

As illustrated in the drawing, the stock is carried upwardly in a counter-clockwise direction by the teeth of the main cylinder 14 into the teeth of the clockwise-rotating collecting cylinder 18, which rotates at a much slower peripheral rate than the main cylinder, e.g. at a ratio of 1:45. The stock is thus compacted against the teeth of cylinder 18 and fed around this roll into the bight between this collecting cylinder 18 and nubbing cylinder 19, for conversion into nubs, as the fibrous mass is thicker than the spacing between the co-acting cylinder clothing teeth, as clearly indicated in Figure 2.

The points at which the stock is transferred from the main cylinder to each of the collecting cylinders in a conventional carding machine are major carding points. Since this action is undesirable in the present machine, a special type of collecting cylinder clothing tooth is adopted to avoid it, and this, together with the features of spacing and main cylinder tooth formation discussed above, enables me to obtain nub formation to the virtual exclusion of carding action.

As illustrated in Figures 5 and 6, the teeth 26 of the collector rolls have flat tops 27 to minimize any carding effect, and to offset any tendency a more pointed tooth would have to open up formed nubs. These teeth may be formed on metallic wire members to provide the collector cylinder clothing rings, and they may have a rake angle of 37°, punch angle of 25°, and total wire height of 0.182 inch. The cylinder 18 may clear the cylinder 14 by 0.035 inch, and the successive collecting cylinders 20, 22 and 24 may clear by a similar or smaller distance, so as to obtain more intensive working and smaller nubs in the direction of progression of the material through the machine. Successive collector cylinders 20, 22, and 24 may be set progressively closer, with cylinder 18 set at 0.035 inch and cylinder 24 at 0.020 inch, for example. As a consequence nubs will be reworked by nub forming cylinders 19, 21, 23 and 25 respectively until they are reduced to a size sufficiently small to pass beneath the last collecting cylinder 24. The nub forming cylinder 19 may be spaced from its coacting collecting cylinder 18 by a distance of approximately one-eighth inch, and succeeding nub forming cylinders 21, 23 and 25 may be spaced similarly, or somewhat more closely with respect to their coacting collecting cylinders 20, 22, and 24, respectively. When a number of these nub forming machines are arranged in series to act successively in formation of nubs and reduction of their size with respect to a fibrous mass, the nub forming cylinders of succeeding machines should preferably be spaced somewhat more closely to their coacting collecting cylinders than in the first such machine.

The nub formnig cylinders 19, 21, 23 and 25 may have the same type of clothing as discussed above in connection with collecting cylinders 18, 20, 22, and 24, or they may be provided with a more conventional type of cylinder clothing. In any case, the operation of these nub forming cylinders is distinctly different from that of the stripper cylinders of the conventional carding machine, since these cylinders are the primary working element of the present invention. Instead of running the cylinders 19 at a peripheral speed in excess of the cylinders 18, as in the case of the conventional carding machine, I run them at a rate which is very considerably less than that of the collecting cylinders. The surface speed of the cylinder 18 may bear a ratio of from 2:1 to 5:1 to that of the cylinder 19, and as a consequence of this fact the cylinder 18 will constantly feed a mass of fibers into the bight between the cylinders 18 and 19 at a rate sufficient to provide an accumulation in this bight, with the result that the desired nubs will be formed in the resulting entanglement, and these nubs will be removed by the cylinder 19 in its clockwise rotation, after being formed in the neighborhood of the bight between the cylinders. The nubby mass will then be drawn in a clockwise direction around the cylinder 19 and restored to the much more rapidly rotating cylinder 14.

Nubs of relatively large size returned to the cylinder 14 in this manner will, because of their thickness, be returned to collecting cylinder 18 and reworked between cylinders 18 and 19 to reduce them to smaller size, while the smaller nubs will be passed forwardly on cylinder 14 and out of the machine or into the range of action of succeeding collecting cylinders and nub forming cylinders designated by the reference characters 20–24, respectively. While the fibrous mass is progressively converted into relatively discrete nubs in this manner, there is sufficient entanglement between the elements of the mass to enable it to be conveyed, with the necessary degree of coherence, through the successive stages of the machine as discussed above.

It will be evident that the portions of the fibrous mass which may not be collected on cylinder 18 will be caught by cylinders 20, 22, or 24, or by a succession of these cylinders, so that by the time the entire mass is passed through the machine, the nub forming operation is either completed or at a relatively advanced stage whereby it may be completed in a subsequent nub forming machine.

After passing beyond collecting cylinder 24, the nubby mass is passed to doffer 28 which performs the conventional function of removing the fibrous mass from the main cylinder. Here again, however, the machine differs from the typical carding machine, since the doffing point is a major carding point in conventional carding. In order to avoid this carding action, which would tend to destroy the nubs which have been formed in the early progress of the fibrous material through the machine, the doffer cylinder 28 is provided with metallic clothing of the same type discussed above in connection with collecting cylinders 18, 20, 22, and 24, so that the fibrous material is caught up by the doffer 28 which conveys the fibrous material to the comb 29, whence it is discharged from the machine by the endless conveyor 30.

As discussed above, the relative speeds of the main cylinder and the collecting cylinders in relation to the nubbing cylinders constitutes an important feature of this invention, and these relative speeds, as well as the spacing features discussed above, may be adjusted to a desired extent, depending upon the fibrous material under treatment and the type of nub desired. In order to facilitate the relative speed adjustment desired, the nubbing cylinders may be driven by an endless conveyor 31 through a variable speed device 32 from the shaft 33 of the doffer cylinder 28. The collecting cylinders 18, 20, 22 and 24, as well as the main cylinder 14 and doffer cylinder 28 may, on the other hand, be driven through separate transmission arrangements in order that the speed of the nubbing cylinders may be varied relatively to these other cylinders at will.

In practice of the invention it has been found that the degree of moisture content of the fibrous mass has an important bearing upon the size and hardness of the nubs. For example, addition of water, in the form of an emulsion, will tend to produce a smaller and harder nub as the water content increases up to about 30%. A de-

sirable emulsion for use in this connection may include approximately 5% of stock oil along with the water.

A desirable combination of machines for producing nubs in the practice of the invention may include two machines as discussed above, arranged in parallel for operation upon the original fibrous masses and a single machine for receiving the product of both of the primary machines and completing the nub forming operation to produce nubs of the size and hardness desired. It is possible to operate three machines in a parallel-series arrangement of this kind, since the second machine to receive the nubby masses may operate at approximately double the speed of the machines which operate upon the original fibrous masses.

While I have described the invention in relation to a particular detailed embodiment, those skilled in the art will be aware that it may be varied and refined in a number of regards without departing from its basic spirit. I therefore wish it to be understood that the invention is not to be limited in interpretation except by the scope of the following claims.

I claim:

1. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, and a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween.

2. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth, a series of collecting cylinders rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through circles spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, and a nub forming cylinder rotating in the same direction as each said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinders having peripheral teeth rotating therewith in circles spaced from said collecting cylinders a distance less than the thickness of the fibrous mass formed on said collecting cylinders, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween.

3. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth with not more than a slight positive rake angle, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main collecting cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, and a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween.

4. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic chisel-shaped teeth with not more than a slight positive rake angle, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, and a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween.

5. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic short chisel-shaped teeth with not more than a slight positive rake angle, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, and a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween.

6. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween, and a doffer having flat-top teeth rotating in proximity to said cylinder to remove formed nubs therefrom.

7. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having periph-

eral metallic teeth, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween, and a doffer rotating in proximity to said cylinder to remove formed nubs therefrom, both said collecting cylinder and said doffer having flat-top teeth.

8. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, and a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having flattened peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, said teeth on said main, collecting and nub forming cylinders being flattened in the plane of rotation, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween.

9. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth, a collecting cylinder rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through a circle spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, a nub forming cylinder rotating in the same direction as said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinder having peripheral teeth rotating therewith in a circle spaced from said collecting cylinder a distance less than the thickness of the fibrous mass formed on said collecting cylinder, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween, said nubbing cylinder being driven through a variable speed drive whereby to adjust the rate of its rotation relative to said other cylinders.

10. In a nub forming machine, the combination comprising means to feed a fibrous mass of predetermined thickness onto a rotating main cylinder having peripheral metallic teeth, a series of collecting cylinders rotating at a much slower peripheral rate than said main cylinder and having peripheral collecting teeth movable with said collecting cylinder through circles spaced from said main cylinder a distance less than the thickness of the fibrous mass formed on said main cylinder, said teeth on said main and collecting cylinders being flattened in the plane of rotation, and a nub forming cylinder rotating in the same direction as each said collecting cylinder and at a peripheral rate substantially less than that of said collecting cylinder, the nub forming cylinders having peripheral teeth rotating therewith in circles spaced from said collecting cylinders a distance less than the thickness of the fibrous mass formed on said collecting cylinders, whereby nubs are formed by the coaction of the teeth of said collecting and nub forming cylinders on the fibrous mass accumulated in the bight therebetween, succeeding collecting cylinders of the series being more closely spaced to said main cylinders than those which precede them in the line of travel of the material through the machine.

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