

[54] **PROCEDURE FOR SETTING UP A COCOONERY FOR SILKWORMS AS WELL AS REMOVING COCOONS FROM THE COCOONERY AND APPARATUS THEREFOR**

[76] Inventor: **Gabriele Peressini**, Via Pennato, 7, Udine, Italy

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Oct. 7, 1971	Italy	83389 A/71

[52] U.S. Cl. .... **119/6**

[51] Int. Cl. .... **A01k 67/04**

[58] Field of Search ..... **119/6, 15, 1**

[56] **References Cited**

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*Primary Examiner*—Russell R. Kinsey

*Assistant Examiner*—J. N. Eskovitz

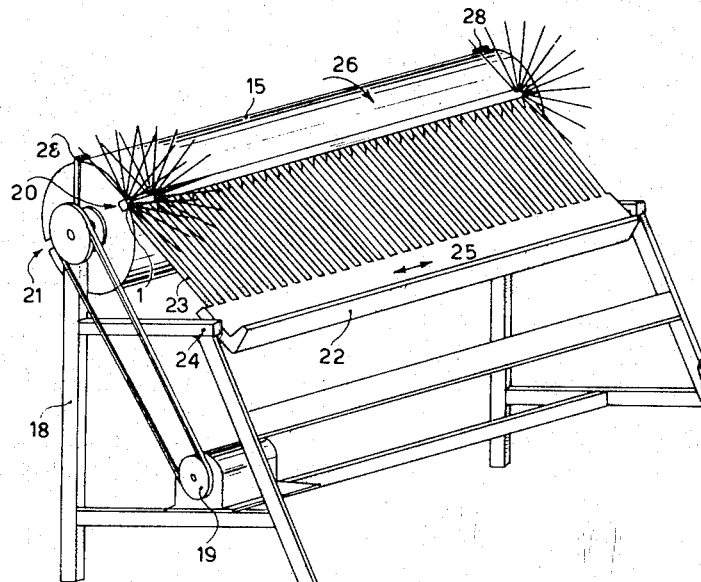
*Attorney*—Watson D. Harbaugh and Bruce K. Thomas

[57] **ABSTRACT**

An artificial cocoonery is disclosed which includes a semi-circular assembly of radially disposed circumferentially aligned flexible rods, the surfaces of the rods being suitable for the attachment of cocoons by the silkworm. A plurality of the semicircular assemblies of

rods is mounted so as to protrude from and be spaced along one side of an elongated shaft. The radial rods of one assembly are alternately oriented between the circumferential spaces of the rods of each adjacent assembly for hygienic sericulture. In one embodiment each semicircular assembly of radially disposed flexible rods is mounted from a hub or sleeve. A plurality of these hub-mounted assemblies is engaged or telescoped in abutting relationship upon a supporting shaft to form a cocoonery unit. In another embodiment, a machine for removing and harvesting the fully developed cocoons is disclosed having an elongated rotatable drum with means for attaching, one or more cocoonery units upon the surface of the drum with their longitudinal axes disposed radially from the axis of the drum and with the flexible rods, with the cocoons thereon, extending generally outwardly from the drum. The drum is mounted on a stand, having means to rotate the drum, and an elongated array of teeth in the form of a comb is pivotally and slidably mounted on an axis therefrom so that the extended ends of the teeth are substantially tangential to the drum surface and each tooth of the comb passes between the respective semicircular assemblies of the flexible rods of the cocoonery as the drum is rotated. An outermost tooth at each end of the comb passes adjacent to the outermost semicircular assembly of flexible rods. The spacing between each tooth of the comb and a rod as it sweeps thereby is sufficient to dislodge the cocoons. The comb is disposed at an angle to the periphery of the drum whereby a sloping surface is provided to convey the dislodged cocoons into a receptacle. The ends of the teeth of the comb may slidably engage the surface of the drum and maintain the sloping attitude of the comb about its longitudinal pivot.

**16 Claims, 6 Drawing Figures**



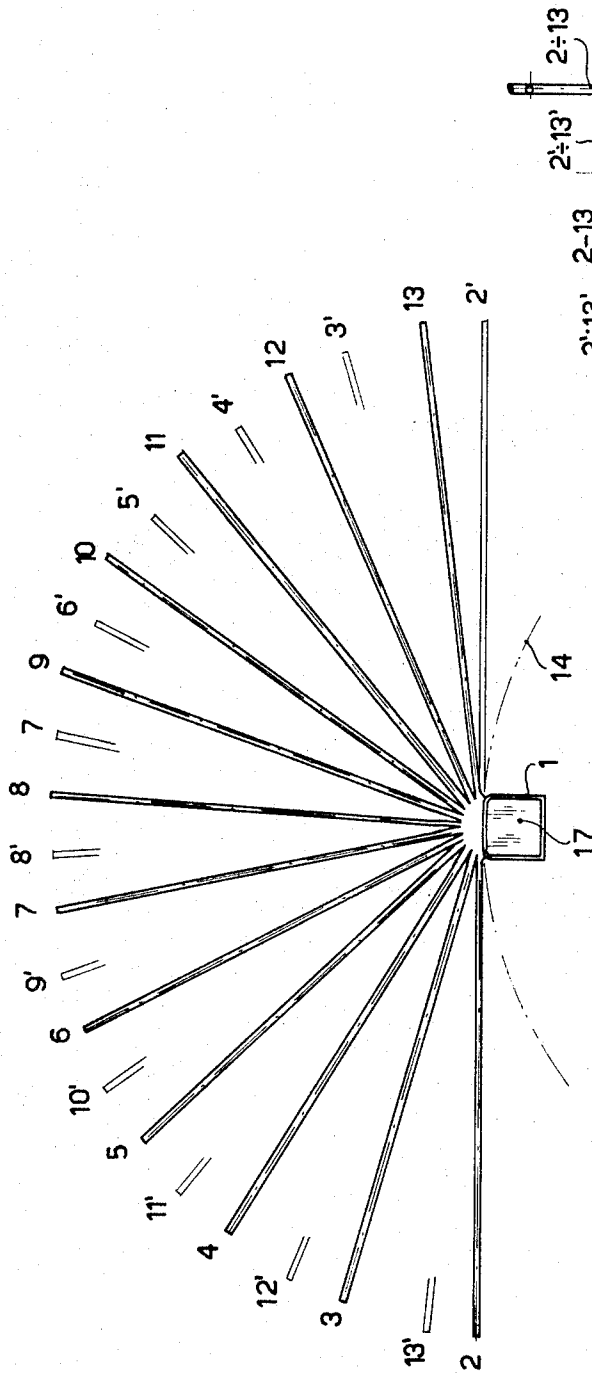


fig.1

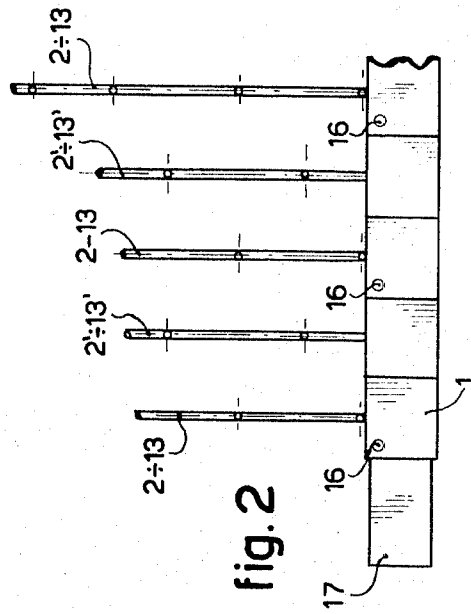


fig.2

INVENTOR:  
GABRIELE PERESSINI

By *Harbaugh & Thomas*  
Attorneys

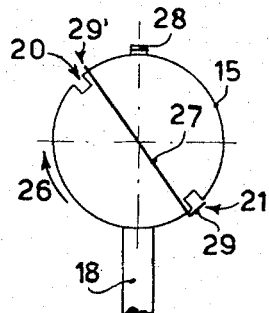
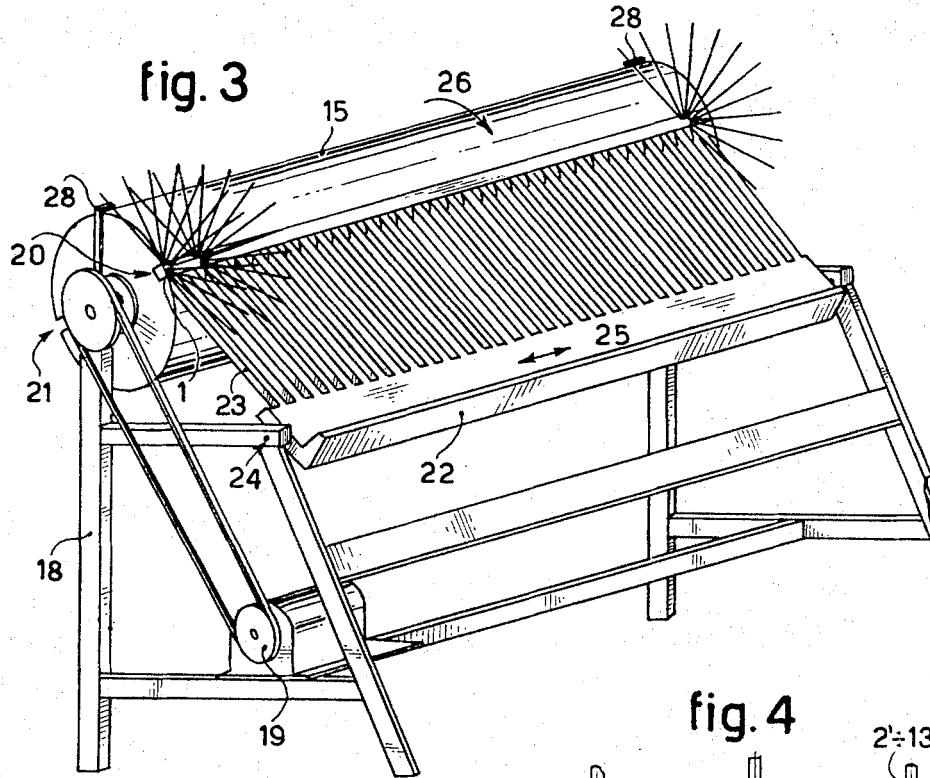


fig. 5

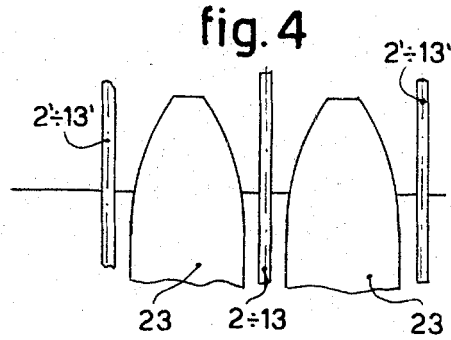


fig. 4

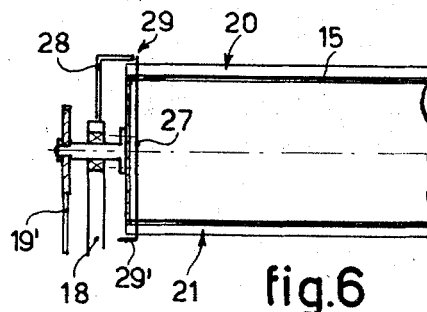


fig. 6

INVENTOR:  
GABRIELE PERESSINI  
By *Harbony & Thomas*  
Attorneys

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FOR SILKWORMS AS WELL AS REMOVING  
COCOONS FROM THE COCOONERY AND  
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**RELATED APPLICATIONS**

This application corresponds to patent application Ser. No. 83370 A/70, filed on the 31st of October, 1970 in Italy by the same inventor, and is related to Italian applications Ser. No. 83333 filed Apr. 20, 1971 and Ser. No. 83389 A/71, filed Oct. 7, 1971.

**BACKGROUND OF THE INVENTION**

As is well known, the domestication and cultivation of the silkworm requires extreme care and close supervision. However, in accordance with the prior art the sericulture systems actually in use consist in setting up the cocoonery with paper or straw or by using branches of trees so as to provide surroundings in which the silkworms will then spin their cocoons. In such cases the silkworms are in unhygienic surroundings, which lead to malformations in the cocoons and, quite often, make them spotted and/or rust-colored.

**SUMMARY OF THE INVENTION**

The present invention relates to a new hygienic sericulture procedure and apparatus suited to facilitate setting up a cocoonery for silkworms as well as the procedure and apparatus for the subsequent removal of cocoons from the cocoonery for stoving and filature operations.

The procedure and apparatus of this invention facilitates the above operations in a very short time and in exceptionally hygienic surroundings, such conditions being very important in the general economics of producing silk.

The present invention however, has the aim and objective of producing cocoonery in hygienic surroundings and of then removing the cocoons mechanically so that there are obtained both conditions of noteworthy hygiene during the removal of the cocoons and also conditions of speed of removal of the cocoons from the apparatus.

The invention follows this aim by using an artificial cocoonery composed of shafts of required length, onto which there are fitted suitable half-circles of spokes.

These half-circles of spokes are constructed in such a way that, when they are installed alternately from their bases on a supporting shaft that is, one facing one way and the next facing the opposite way, the spokes of the former occupy, in section, the empty spaces of the latter. Thus each of the same circular assemblies can be identical in construction as far as the array of spokes thereon is concerned.

The half-circles of spokes, then, are arranged in groups of almost semicircular in shape, and each assembly of spokes is made of many circular or almost circular rod-like elements which are fixed into the supporting sleeve or hub within which the shaft is inserted. The spokes can also be cylindrical, tubular or be tapered in configuration.

The circular or almost circular elements of which the spokes are composed have, along their length, some small protrusions suitable for assisting fixture of cocoons but not in such a way as to hinder removal of the latter. The spokes or rods can have roughened surfaces

to facilitate the attachment of the cocoon thereto by the silkworm.

An apparatus for removing the cocoons that have been made along the elongated cocoonery of spokes or rods is provided. The apparatus comprises in general, a rotatable drum adapted to detachably receive the portable cocoonery units in succession and pass the spokes between the teeth of a comb which dislodges the cocoons and deposits them in a receptacle.

**DESCRIPTION OF THE DRAWINGS**

Illustrative and non-limiting embodiments of the invention are shown in the drawings in which:

FIG. 1 is a plan view of an assembly of spokes affixed to and extending from a supporting base or sleeve with the adjacent assembly of spokes shown in fragmentary form there-behind to illustrate the alternate spacing;

FIG. 2 is a fragmentary plan view to illustrate a portion of a cocoonery unit and showing the manner in which the adjacent assemblies of sleeve hubs and spokes are supported on the shaft and the axial spacing of the spokes;

FIG. 3 is a perspective view of the apparatus for removing the cocoons from the cocoonery units, one such unit (partially illustrated) having reached the comb of the machine;

FIG. 4 is an enlarged fragmentary plan view of three spokes and two comb teeth to illustrate the general spacing as they pass in relation to each other in the machine;

FIG. 5 is a fragmentary end view of the combing machine and the rod means for temporarily attaching the cocoonery units to the periphery of the rotatable drum; and

FIG. 6 is a fragmentary cross-sectional view taken along the axis of the drum to illustrate axle mounting, drive means and relationship of the stop means to turn the attaching rod to hold one cocoonery unit for passage through the teeth of the comb as the other is simultaneously released.

**THE PREFERRED EMBODIMENT**

Referring to FIG. 1, there is shown a semi-circle of 12 spokes, indicated by the numerals 2 to 13 and the adjacent semi-circle of spokes indicated by the numerals 2' to 13' which are only partially shown. Each set of spokes is positioned in the gaps left open by the other set of spokes. The spokes 2 to 13 are carried on the upper surface of the sleeve 1 and the spokes are asymmetrical in respect to the center of their attachment so as to increase the hygiene of the cocoonery. FIGS. 1 and 2 also illustrate the relationship of the adjacent sleeves 1 upon the supporting shaft 17 and the axial spacing of each spoke assembly from the adjacent assemblies forming a cocoonery unit as they are carried about the periphery or profile 14 of the drum 15 (FIG. 3). The external profile 14 of the drum conditions and holds the upper part of the sleeve to which the spokes are attached so that the cocoonery unit rotates with the drum. A reference mark 16 is provided on each of the sleeves 1 so that alternate placement upon the supporting shaft 17 is facilitated.

Accordingly, it is seen that with a plurality of sleeve and spoke assemblies telescoped upon the shaft 17 there is formed an elongated semi-circular array of uniformly spaced spokes comprising a portable cocoonery unit. Any desired number of spokes or flexible rods can

be attached to a single sleeve as long as proper hygienic spacing is provided for the cocoons. Each sleeve or hub can carry, for example, nine spokes or as many as 18 spokes. Preferably, each of the sleeves 1 carries 12 spokes. There can be from 18 to 36 rows of radially aligned spokes spread out to cover the semicircular array shown along a cocoonery unit. These spokes, however, are positioned alternately, for example with all the even numbers corresponding to the sleeves fixed one way round and with the odd numbers corresponding to the sleeves fixed the other way round, or vice versa. Thus, in the case of 24 spokes we shall have 12 spokes positioned on sleeves fixed one way round and 12 spokes positioned on sleeves fixed the other way round.

To suit the dynamics of the work of the silkworms the spokes can decrease in length gradually as the center of the semicircle is approached. Thus, the spokes 2 to 7 are progressively shorter as are the spokes 13 to 8. The shaft 17 can be any suitable length to suit the space and other requirements. A shaft length of one meter is normally used.

As soon as the silkworms have made their cocoons along the semicircle of spokes, the shafts 17, with the sleeves 1 attached, are taken and installed on the rotating drum 15 of the machine shown in FIG. 3. The drum 15 is coupled up to the rake 22 whose teeth 23 pass through hollows present axially in the shaft; that is, they coincide with the areas where the sleeves 1 join onto each other. The rake 22 is free to move sideways along its axis 24 so that it automatically positions itself between the semicircle of spokes.

By this means the spokes pass between the teeth 23, and the cocoons on them meet resistance from the teeth of the rake. The strength of the anchorage of the cocoons is such that the spokes bend and the cocoon is removed from the spoke; such removal can be facilitated by the spoke itself being tapered; the cocoon then falls into a collecting bin 25.

The spokes which compose the cocoonery can be made of a flexible material, such as plastic for example, and have diameters varying from 1.5 to 4mm. Although the invention is not limited by the dimensions of the parts, excellent results have been obtained with spokes of 2.5mm. diameter at the extreme ends of each sleeve and of 2mm. diameter in between.

The length of the spokes varies from about 130mm. to about 240mm., and excellent results have been obtained with spokes of 180mm. length, progressively decreasing to a length of about 150mm. at the center of the sleeve.

The length of the sleeve 1 can vary from 20 to 40mm., and good results have been obtained with a length of 28mm. The teeth 23 of the comb of the machine to remove the cocoons are spaced out in relation to the spacing of the semi-circles of spokes and in a preferred lay-out they have a gap between them of about 8mm. with a pitch of 28mm., said teeth being tapered at the end (see FIG. 4) so as to facilitate positioning.

The combing machine is provided with the supporting trestle 18. The drum 15 is rotatably mounted thereon by means of suitable bearings shown in FIG. 6 and is driven by the motor 19, supported at the bottom of the trestle, through a suitable drive belt or the like. One or more slots, illustrated at 20 and 21 are provided along the profile 14 of the drum 15 as a means for attaching the cocoonery units to the drum with their

shafts and sleeve assemblies held therein for rotation with the drum.

The rake 22 is pivotally mounted on the axis or spindle 24 supported by the trestle 18. The rake has the plurality of teeth 23 arranged in planar relationship. As shown in FIG. 4, the teeth 23 are tapered at their ends where they are in contact with drum 15.

The rake 22 is free to move sideways in the directions of the arrow 25 on the spindle 24 and leans on the drum which turns in the direction of the arrow 26. By this means, if the semicircles of spokes 1 are not well centered, they can move the rake 22 sideways since the spokes 2 to 13 and 2' to 13' act on the tapered ends of the teeth as in FIG. 4.

The shafts 17 with the sleeves 1 can lie free inside the slots 20 and 21 or can be previously fixed down with suitable fastenings as will be described. For the fixture of the shafts there can be used a system as shown in FIGS. 5 and 6 or another similar system.

To illustrate, in the drum 15 or beside it there can be an iron bar 27 which has two teeth or projections 29 and 29', one of the teeth being at an angle of 90° to the plane on which the other is positioned. The framework 18 is provided with the fixed stop 28 at each end of the drum and spaced over its profile so as to contact the teeth 29 as the drum rotates it thereby. When the drum is rotated in the direction of the arrow 26, the tooth 29' comes up against the stop 28 and is turned until it covers the slot 21, while simultaneously the slot 20 is uncovered as the tooth 29 turns outward. This locks one cocoonery unit on the drum as the other is released.

Where there is a system of this kind or a similar system or the like on each side of the drum, it is possible to fix down one shaft and at the same time to release the other shaft.

The machine of this invention for removing the cocoons, can have an automatic system for fixture of the shaft to the drum so that the machine operator has only to insert the shaft of the cocoonery unit in the slot provided on the drum; the fixture and release of the shaft being automatic as the drum rotates.

The sleeves 1 carry the upper part where the spokes are fixed and this latter has the same or almost the same diameter as the drum 15 for removing the cocoons. On the drum 15 of the machine for removing the cocoons there can be positioned two or more shafts 17. If desired good results have been obtained with two shafts on a drum of about 300 - 330mm. diameter.

The speed of rotation of a drum of 330mm. can vary from 0.5 to 6 rotations per minute; good results have been obtained with a speed of about 2 rotations per minute.

As is plainly shown in the description, the invention carries out fully its aim of mechanizing the tending of silkworms and allows the use of hygienic materials with a life of many years together with a reduction of usage costs.

The whole is accomplished with rapid formation of the cocoonery together with rapid removal of the cocoons and is accompanied by a qualitative and quantitative improvement of the product joined to a noteworthy reduction in the labor force used.

What is claimed is:

1. A device for the propagation of silkworm cocoons comprising:
  - a cocoonery unit including an elongated member having a plurality of radially disposed axially and

circumferentially spaced spoke members thereon, the surfaces of said spoke members being adapted for the attachment of cocoons by silkworms; said plurality of radial spoke members are circumferentially spaced and approximates semicircular assemblies; a sleeve member is provided for the support of each of said assemblies of spoke members; said sleeve members are engageable upon said elongated member in telescoping abutting, non-rotatable relationship with said spoke members projecting from said one side thereof; and means to dislodge said cocoons therefrom having teeth adapted to pass longitudinally between said circumferential spaces between said spoke members as said spoke members and teeth are moved in relation to each other.

2. A device in accordance with claim 1 in which: said means to dislodge said cocoons includes a rotatable drum member; means positioned on said drum member to attach the elongated member of a cocoonery unit to said drum member in opposite peripheral sides thereof; and said attaching means on one side engaging a cocoonery unit for rotation with said drum and disengaging the opposite cocoonery unit after it has passed said teeth of said dislodging means.

3. A device in accordance with claim 1 in which: said plurality of radial spoke members are disposed in circumferentially spaced semicircular rows along one side of said elongated member; and said means to dislodge said cocoons comprises a rotatable drum member; means on said drum to attach the other side of said elongated member thereto with its axis radially spaced from the parallel to the axis of rotation of said drum member; and said means to dislodge said cocoons comprises a comb member the teeth of which are spaced to pass between said semicircular rows of said spoke member as said drum is rotated.

4. A device in accordance with claim 3 in which: the spokes in any one semicircular row on a side of said elongated member are substantially opposite the circumferential spaces between pairs of spokes of an adjacent semicircular row.

5. A device in accordance with claim 1 in which: said rows of spoke members are less than semicircular in configuration along said one side of said elongated member; each row of spoke members is arranged asymmetrically in relation to the center of said semicircle; and said rows of semicircular spoke members are detachably mounted upon said elongated member and adapted to be alternated thereon to complete a semicircular configuration.

6. A device in accordance with claim 1 in which: said semicircular assemblies of radial spoke members supported from a sleeve member are asymmetrically spaced whereby placement of the sleeves on said elongated member in alternate sequence disposes said spoke members in positions substantially opposite the circumferential spaces between the pairs of spokes on an adjacent sleeve member; and

indicia are provided for each of said assemblies to indicate said alternate disposition upon said elongated member.

7. A device in accordance with claim 3 in which: said rotatable drum is provided with elongated recessed seats for at least two of said elongated members supporting said spoke members outwardly therefrom whereby said one side of said an elongated member therein is substantially flush with the peripheral surface of said drum; and

said comb member is pivotally mounted on an axis substantially parallel to the axis of rotation of said drum with the ends of the teeth thereof engaging said peripheral surface between said rows of spoke members;

said comb member being supported in an inclined relationship against said drum by said tooth ends whereby to dislodge and convey said cocoons from said cocoonery unit.

8. A device in accordance with claim 3 in which: said rows of spokes are arranged in a semicircular array with the spokes at the edges of the semicircle being longer than the intermediate spokes.

9. A device in accordance with claim 3 in which: said rotatable drum is provided with elongated recessed seats for at least two of said elongated members supporting said spoke members outwardly therefrom whereby said one side of said an elongated member therein is substantially flush with the peripheral surface of said drum;

said means to attach said elongated member to said drum includes;

a bar member rotatably attached to an end of said drum member on a diametric axis intersecting the ends of said recessed seats;

said bar member having a tab member extending from each end;

said tab members being radially disposed from the axis of said bar member and adapted to be rotated over an end of said elongated member within said recessed seats; and

a fixed stop member is provided in the path of rotation of said tab members whereby rotation of said drum alternately releases one tab member from said elongated member and locks the other tab member over an elongated member placed therein.

10. A device for the propopation of silkworm cocoons comprising:

a cocoonery unit including an elongated member having a plurality of radially disposed axially and circumferentially spaced rows of spoke members extending from one side thereof, the surfaces of said spoke members being adapted for the attachment of cocoons by silkworms;

means to dislodge said cocoons from said spoke members including a rotatable drum member and a comb member associated therewith;

releasable attaching means to hold said elongated member to the surface of said drum member with said spoke members extending outwardly therefrom;

said comb member comprising a coplanar array of substantially uniform length and equally spaced teeth members pivotally mounted on an axis substantially parallel to the axis of rotation of said drum member;

the lengths of said teeth members being greater than the lengths of said spoke members;  
 the space between said teeth members being greater than the effective diameter of a spoke member but less than the effective diameter of said cocoons;  
 said pivotal axis of said comb member being spaced from the rotational axis of said drum member a distance less than the length of said spoke members, whereby upon pivoting said comb member toward said drum member into the path of said cocoonery unit attached thereto brings the teeth thereof in tangential relationship with the surface of said drum member, and the array of said teeth of said comb member defines an inclined plane to receive and gravitationally convey the dislodged cocoons away from said drum member.

11. A device for the propagation of silkworm cocoons in accordance with claim 10 in which said comb member is slidably mounted on its pivotal axis whereby to be registerable with the space between said rows of spoke members.

12. A sericulture device comprising:  
 cocoonery units each including an elongated support member having a plurality of radially disposed, axially and circumferentially spaced rows of spoke members, the surfaces of said spoke members being adapted for the attachment of cocoons by silkworms;

means to dislodge said cocoons from said cocoonery units including an elongated rotatable drum member;

means to rotate said drum member on its longitudinal axis;

means for attaching cocoonery units to said drum member with the longitudinal axis thereof radially spaced from and substantially parallel to axis of rotation of said drum member;

comb means associated with said drum member having teeth adapted to pass between said rows of spoke members to dislodge the cocoons therefrom as the rotation of the drum member carries the cocoonery units past said comb means;

means for releasing said cocoonery units from said drum member after the cocoons have been removed;

said cocoonery attaching and releasing means being operable to engage one cocoonery unit on one side of said drum member approaching said comb means and simultaneously release the cocoonery unit on the other side of said drum member after it has passed said comb means; and

said comb means being disposed in tangential relationship with said drum member and at an inclined angle thereto whereby said cocoons on being dis-

lodged are conveyed away from the paths of rotation of successive spoke members.

13. A sericulture device in accordance with claim 12 in which:

said drum means is provided with elongated recesses to receive said elongated support member substantially flush with the peripheral surface of said drum member;

said comb means comprises a unitized elongated planar array of spaced teeth;

said unitized teeth being pivotally supported on an axis substantially parallel to and spaced from the axis of rotation of said drum member;

the extended ends of said teeth slidably engaging the peripheral surface of said drum member and being positionable between said rows of spoke members with the plane thereof at an inclined angle thereto; the length of said teeth of said comb means being longer than the longest of said spoke members; and the width of said teeth being sufficient to substantially bridge the space between said rows of spoke members.

14. A sericulture device in accordance with claim 13 in which:

the extended ends of said teeth of said comb means are beveled at their points of sliding contact with the periphery of said drum member.

15. A sericulture device in accordance with claim 12 in which:

said means for attaching and releasing said cocoonery units are oppositely disposed at each end of said drum means for rotation therewith;

a fixed stop member is provided in the path of said attaching means in its released position at one end of said drum means whereby contact with said stop member moves said attaching means to the attached position in relation to a cocoonery unit approaching said comb means and simultaneously moves the opposite attaching means at the same end of said drum means to its released position.

16. A sericultural device in accordance with claim 15 in which:

the attaching and releasing means at each end of said drum member each comprise a diametric rod member carried by said drum member for rotation about the longitudinal axis of said rod member;

each rod member is provided with a radial tab member at each end;

said tab members being circumferentially spaced about 90° from each other; and

a pair of said fixed stop members is provided in the path of rotation of said tab members for simultaneous contact therewith.

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