March 12, 1968 M. POULL ETAL 3,372,537

RADIALLY CLAMPING GRIPS

Filed Dec. 21, 1966 3 Sheets-Sheet 1

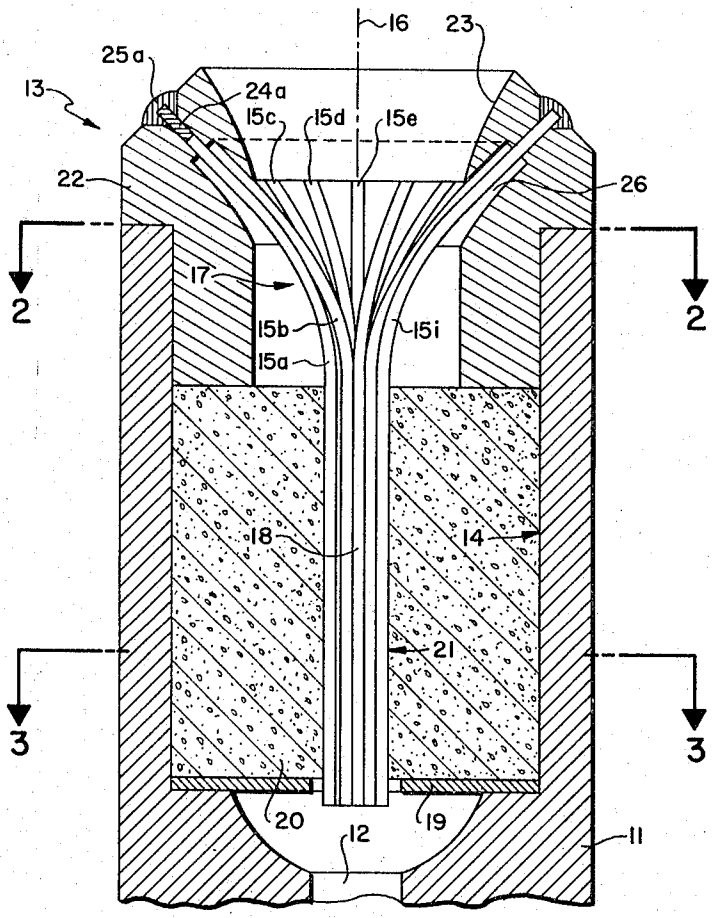


Fig. 1

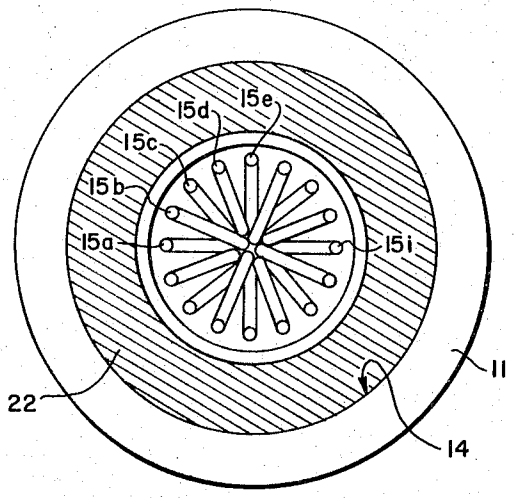


Fig. 2

MAURICE POULL
ERWIN ZURCHER
INVENTORS

BY Gray, Mase and Dunson
ATTORNEYS

March 12, 1968 M. POULL ETAL 3,372,537

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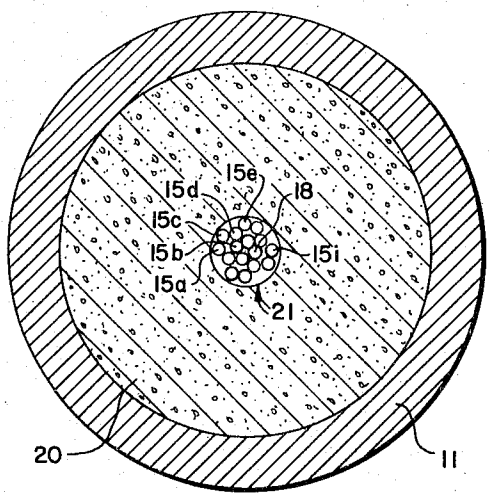


Fig. 3

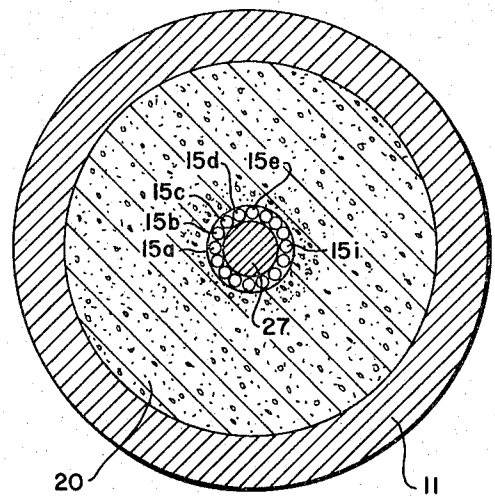


Fig. 4

MAURICE POULL
ERWIN ZURCHER
INVENTORS

BY Gray, Mase and Dunson
ATTORNEYS

March 12, 1968 M. POULL ETAL 3,372,537

RADIALLY CLAMPING GRIPS

Filed Dec. 21, 1966 3 Sheets-Sheet 3

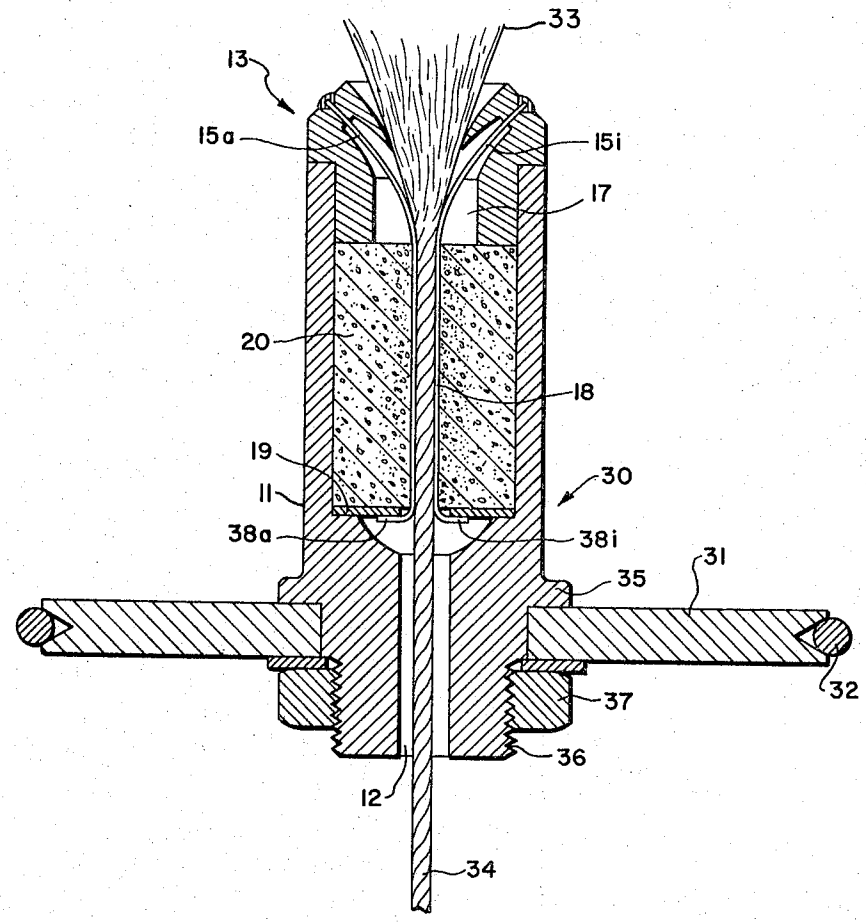


Fig. 5

MAURICE POULL
ERWIN ZURCHER
INVENTORS

BY Graf, Mase and Dunson
ATTORNEYS

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3,372,537

RADIALLY CLAMPING GRIPS

Maurice Poull, 41 Ave. de Vaudagne, Meyrin, Geneva, Switzerland, and Erwin Zurcher, 10 Rue Liotard, Geneva, Switzerland

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5 Claims. (Cl. 57—59)

ABSTRACT OF THE DISCLOSURE

This invention concerns a gripping device that includes a body having a central bore and a plurality of flexible filaments secured in the central bore. The flexible filaments form a bow-net and the narrow end of the bow-net is extended to form a bundle of filaments. The gripped object enters the gripping device through the bow-net and a uniform radial clamping force is exerted over the periphery of the gripped object as it is allowed to move axially. Provision is also made for damping out any vibratory effects generated by any irregularities in the diameter of gripped object as it moves through the filament bundle. Preferably the gripping device is adapted to rotate and is especially useful in spinning textile fibers into threads.

This invention relates to a clamping or gripping device. More particularly, it relates to a radially clamping device that allows axial sliding movement of the clamped object and is especially useful in the spinning of textile threads.

There are a number of radially clamping devices found in the art, in particular those found in lathes and drilling machines; these clamps are intended to immobilize the gripped object angularly but do not enable it to slide axially.

There are also clamps that allow sliding motion in particular clamps in which the clamping member includes one or more elastic or movable blades. Such clamps do not exert a radial force that is uniformly distributed. At best, the clamping member includes at least three elastic or movable blades that are arranged regularly about the axis of the clamp so that they each exert a force on the gripped object which is directed towards the axis of the clamp, i.e., radially, but which is localized within a limited azimuth; the total clamping force is thus not uniformly distributed over the entire periphery of the gripped object. Such clamps are, therefore, ill-suited to grip delicate objects such as textile threads.

Briefly described, this invention includes a gripping device wherein the clamping member comprises a plurality of wear-resistant filaments regularly distributed about the axis of the main body and arched to form a bow-net of circular cross-section whose narrow end is extended to form a bundle, and a resilient sleeve surrounding the bundle and made of deformable material having a high elastic damping coefficient.

One object of this invention is to provide a gripping device that distributes a uniform radial pressure over the periphery of the gripped object but also slows axial movement of the gripped object.

Another object of this invention is to provide a device that is especially suitable for twisting a roving of fibers into a thread.

Another object of this invention is to provide a gripping device that damps out vibrations in the clamping members caused by irregularities of the gripped object as it moves axially.

One advantage of this invention is its suitability for the electrostatic spinning process as described in copending U.S. patent application Ser. No. 564,845.

Still other objects and advantages will be apparent from the description that follows, the drawings, and the claims herein.

In the drawings:

FIG. 1 is a sectional view of part of the gripping device taken through the central axis.

FIG. 2 is a sectional view along the line 2—2 of FIG. 1.

FIG. 3 is a sectional view along the line 3—3 of FIG. 1.

FIG. 4 is a sectional view similar to that of FIG. 3 but with a gripped object in the gripping device.

FIG. 5 is a sectional view similar to that of FIG. 1 but showing the gripping device being used as a twisting member for spinning textile fibers.

Referring to FIG. 1, the gripping device includes a cylindrical body **11** having an axial bore **12** and a clamping member **13** force-fitted into a hollowed-out portion **14** of bore **12**. The clamping member **13** includes a plurality of filaments numbering sixteen in the illustrated example, such as filaments **15***a*, . . . , **15***e*, . . . , **15***i*, which are uniformly distributed about the axis **16** of the body **1**. Each of these filaments is arched to form a meridian curve of a bow-net **17** whose end is extended to form a bundle **18**. A sleeve **20**, made of deformable material having a high elastic damping coefficient, is slipped over the bundle **18**. The sleeve material is, for example, a natural foam, rubber, a synthetic foam or the like. The outer diameter of the sleeve **20** and that of its axial hole **21** are selected so that when the sleeve **20** is forced into the housing **14**, against the bottom upon which it bears through the intermediary of a washer **19**, the deformable material or sleeve **20** clamps the bundle **18**. The ends of the filaments (**15***a*–**15***i*) at the open side of the bow-net **17** are anchored to an inlet crown **22** having a conical profile **23** whose apex is directed toward the interior of the bow-net **17**. This anchoring consists, in the illustrated example, in threading the ends of the filaments (**15***a*–**15***i*) into oblique holes in the periphery of the crown **22** and keeping them in position by a fixative. Thus the end of filament **15***a* is threaded into oblique hole **24***a* and this end is immobilized by a drop of solder **25***a*. An internal groove **26** is provided to increase the free length of the filaments (**15***a*–**15***i*) adding to their flexibility.

Although the ends of the filaments (**15***a*–**15***i*) forming the large diameter part of the bow-net **17** are evenly distributed in a single row, as may be seen in FIG. 2, the filament portions forming the bundle **18** are clustered in several superimposed layers, as can be seen in FIG. 3.

The operation of the gripping device thus formed is fairly straightforward. As soon as a long object of circular cross section, such as rod **27** (FIG. 4) is introduced into the bow-net **17**, it moves the filaments (**15***a*–**15***i*), forming the bundle **18**, apart and the filaments (**15***a*–**15***i*) exert a radial gripping force that is evenly distributed over the entire periphery of the object or rod **27**. This gripping force, which is due to the inherent elasticity of the filaments (**15***a*–**15***i*) and to the elasticity of the material forming the sleeve **20**, angularly immobilizes the object **27** in relation to the body **11** of the gripping device, but enables the object **27** to slide axially without great effort. If rod **27** is to slide at high speed in the gripping device, irregularities in its diameter could generate vibrations within the group of filaments (**15***a*–**15***i*) and make the angular immobilization of the rod **27** unstable. In order to inhibit these vibrations, the sleeve **20** is made of a material having a high elastic damping coefficient.

The threads or filaments (**15***a*–**15***i*) forming the bow-net **17** and bundle **18** are made of a material having both good flexibility and good resistance to wear. This is necessary in order that they do not deteriorate due to the

axial sliding motion of the gripped object **27**. A good material for the filaments (**15***a*–**15***i*) is, for example, steel or glass.

Various constructional variants can be adopted without affecting the concept of the clamp. For example, instead of the groove **26**, an individual recess can be provided at the inlet of each hole. The groove or recess is, however, optional and it can be dispensed with if the flexibility of the filaments (**15***a*–**15***i*) is sufficient.

The fixing of the filament ends by solder such as **25***a* can be replaced by fixing with a drop of glue, in particular when the inlet crown **22** is of nonmetallic material, for example, of synthetic material or of wood.

The gripping device as described is particularly well suited to being used in spinning to twist a plurality of textile fibers intended to form a thread. The gripping device in this case is positioned in the path of the fibers and is driven at high rotary speed about its axis **16**. This is shown in FIG. 5 where the gripping device **30** can be seen to be secured by the shoulder **35**, the thread **36**, and the nut **37** to a pulley **31** which is rotated by a belt **32** actuated by a motor (not shown). The gripping device is placed in the path of a group of fibers, there shown in the form of a roving **33**. This roving **33** enters the bow-net **17**, moves the bundle **18** apart, which by its radial gripping action renders the fibers axially fixed with respect to the body **11** that is secured to pulley **31**, and leaves the gripping device **30** through the bore **12** in the form of a twisted thread **34**. To prevent the fibers which protrude from the surface of the thread **34** from hooking the ends **38***a* . . . , **38***i* . . . , of the filaments **15***a* . . . , **15***i* . . . , forming the bundle **18**, these ends **38***a* . . . , **38***i* . . . are bent outwardly against the bearing washer **19**. This arrangement, moreover, enables the whole clamping member **13** to be withdrawn as a unit, this being useful if provision has to be made for the rapid replacement of the clamping member to adapt it to the production of threads having different diameters.

It will be understood of course that while the forms of the invention herein shown and described constitutes the preferred embodiments of the invention, it is not intended herein to illustrate all of the possible equivalent forms or ramifications of the invention. It will also be understood that the words used are words of description rather than of limitation, and that various changes, such as changes in shape, relative size, and arrangement of parts may be substituted without departing from the spirit and scope of the invention herein disclosed.

What is claimed is:

1. A gripping device for radially clamping an object while allowing sliding motion, comprising:

(a) a body having a central bore; and

(b) a plurality of flexible filaments arranged to form a bow-net at one end and a bundle at the other end, said filaments positioned in said central bore and attached to said body at said bow-net end, whereby the gripped object enters said bow-net and is held axially immobile with respect to said body by uniform pressure of said filaments on the periphery of said gripped object and allowed to slide along the axis of said body.

2. A gripping device for radially clamping an object while allowing sliding motion, comprising:

(a) a body having a central bore;

(b) a plurality of flexible filaments distributed about the axis of said central bore, said filaments being arched to form a bow-net of circular cross-section having the narrow end extended to form a bundle; and

(c) a resilient sleeve surrounding said bundle, said resilient sleeve being a deformable material having a high elastic damping coefficient.

3. A gripping device for spinning textile fibers into threads, said gripping device exerting a radially clamping force while allowing sliding motion, comprising:

(a) a cylindrical body having an axial bore;

(b) at least one radially acting clamping member secured within said bore including a plurality of filaments regularly distributed about the axis of said cylindrical body and arched to form a bow-net of circular cross-section, the narrow end of said bow-net being extended to form a bundle of said filaments;

(c) a resilient sleeve surrounding said bundle of filaments, said resilient sleeve being a deformable material having a high damping co-efficient; and

(d) means for rotating said cylindrical body thereby twisting a plurality of fibers entering said bow-net into a thread.

4. A gripping device for spinning textile fibers into threads, said gripping device exerting a radially clamping force while allowing sliding motion according to claim **3** wherein said filaments at the end of said bundle of filaments are bent in a radial direction.

5. A gripping device for radially clamping an object while allowing sliding motion, comprising:

(a) a body having a central bore;

(b) a plurality of flexible filaments arranged to form a bow-net at one end and a bundle at the other end, said filaments positioned in said central bore and attached to said body at said bow-net end; whereby the gripped object enters said bow-net and is held axially immobile with respect to said body by uniform pressure of said filaments on the periphery of said gripped object and allowed to slide along the axis of said body; and

(c) means for urging each said filament of said bundle toward the axis of said central bore.

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FRANK J. COHEN, *Primary Examiner.*

DONALD E. WATKINS, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,372,537 March 12, 1968

Maurice Poull et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, lines 26 and 58, and column 4, line 40, "axially", each occurrence, should read -- angularly --.

Signed and sealed this 24th day of February 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents