July 1, 1958 L. A. RUNTON 2,841,046

SHOCK RESISTANT ROPE

Filed May 20, 1957

Fig. 1.

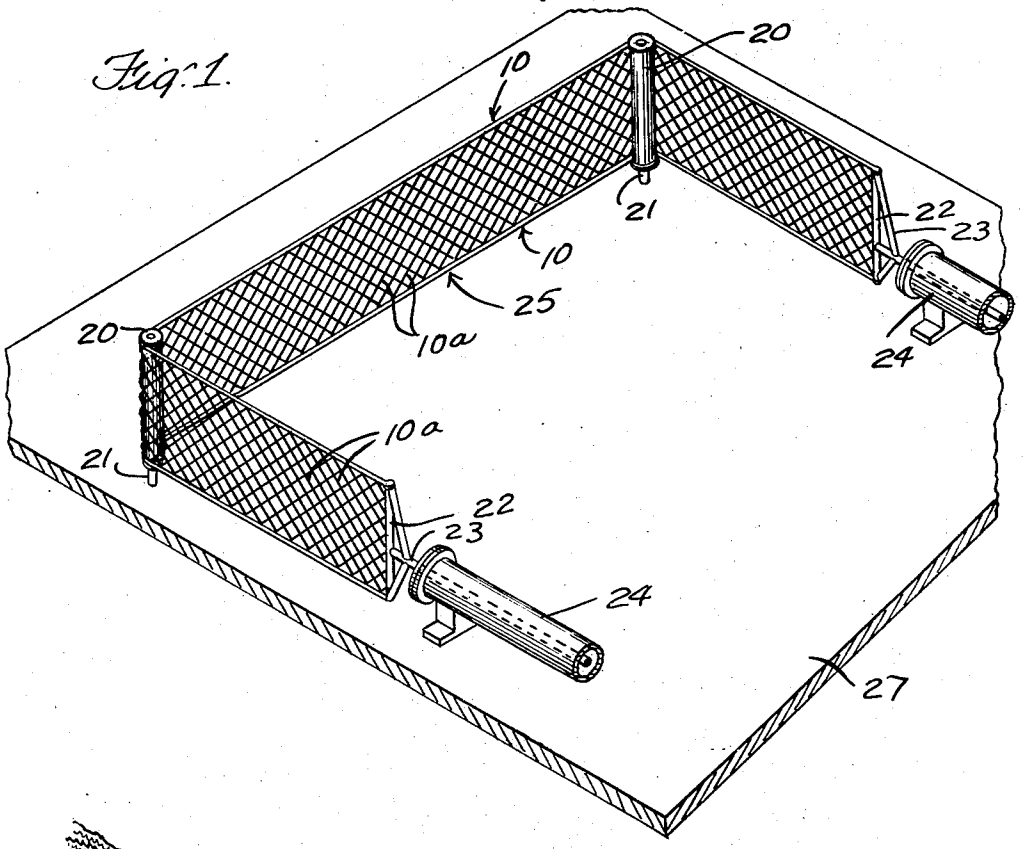
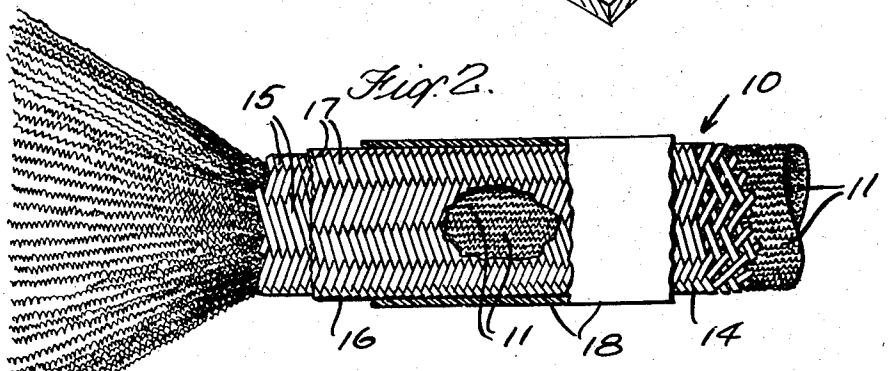


Fig. 2.



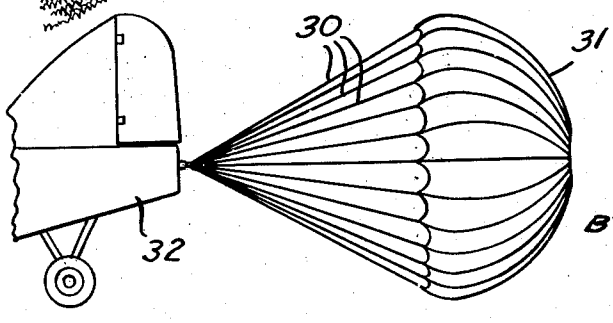


Fig. 3.

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SHOCK RESISTANT ROPE

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7 Claims. (Cl. 87—2)

This invention relates to ropes or cables having high tensile strength and capable of substantial elongation under shock load.

An object is to provide a rope or cable of the above type having novel and improved characteristics.

A more specific object is to provide an improved rope or cable which is adapted to withstand high shock loads such as in a harness for an airplane landing parachute or a runway net for arresting jet planes.

Another object is to provide a rope or cable in which the tensile strength is equal to substantially the full value of the total strength of the individual strands making up the cable.

Other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

It is recognized that when a plurality of strands are twisted into yarn and woven or braided together the total strength of the product is only a small fraction of the total strength of the individual strands due to the weakening effect at the cross-overs and the difference in tension of the various strands. When subjected to load the more highly tensioned or the weaker strands break, thereby increasing the load on the remaining strands which break progressively. At no time do all of the strands cooperate in withstanding the load.

The present invention overcomes this difficulty and provides a rope or cable composed of a large number of individual strands of high tensile strength and high elongation under load which are so arranged that all of the strands cooperate in withstanding the pull of the load.

More specifically the rope or cable is composed of a large number, for example, 300,000 or more strands of crimped continuous filaments composed of a high tenacity material such as nylon, high tenacity rayon, Fortesan or the like which are bound tightly in a bundle in which the filaments lie substantially parallel and under substantially equal tension. The filaments are crimped and heat-set in a predetermined uniform manner to provide substantial elongation under stress and the bundle is bound in a stretchable sheath or covering which holds the bundle compacted but does not restrain its elongations.

The invention will be better understood by referring to the following description, taken in connection with the accompanying drawing in which a specific embodiment has been set forth for purposes of illustration.

In the drawing:

Fig. 1 is a perspective view of a runway net for arresting jet planes; and

Fig. 2 is a detail view, on a larger scale, showing the construction of the rope or cable; and

Fig. 3 is a detail view showing the invention applied to a landing parachute for planes.

Referring to the drawing the rope or cable **10** is shown in Fig. 2 as composed of a bundle of strands **11** of crimped, continuous filaments of high tenacity material.

The bundle of crimped filaments **11** is encased in a braided tube **14** composed of yarns **15** of nylon or other

material having a high tensile strength which are braided together while under a high tension so as to hold the filaments **11** under a high compacting pressure which prevents relative displacement thereof during use. For additional protection and strength a second braided tube **16** composed of yarns **17**, similar to the yarns **15**, may be disposed over the tube **14** and a protective cover **18** of stretchable material such as natural or synthetic rubber or a plastic material is disposed over the assembly. The cover may for example be composed of latex, neoprene, polyethylene or a vinyl compound.

Due to the characteristics of the crimped filaments, the diameter of the bundle tends to decrease when the bundle is placed under tension. A braided tube also has the property of contracting to a smaller diameter when stretched, because of the increase in pitch of the turns of the individual yarn. Hence the contraction of the tube compensates for the decrease in diameter of the bundle and maintains the bundle under a compacting force regardless of the amount of stretch to which it is subjected.

In this way all of the individual strands are caused to take their part of the load and the total strength of the rope is nearly equal to the sum of the tensile strengths of the individual strands, as distinguished from the comparatively low total strength of a rope having the same number of strands in the form of twisted and plied yarns, wherein the strands are weakened at the points of cross-over and cannot be made to share their respective portions of the load.

The crimp amplitude and frequency determines the extensibility or stretch of the rope. Such a crimp may be produced in various known ways as by the use of a gear crimper with means for heat-setting the crimp in the case of nylon, or other thermoplastic filaments.

The strands are held in parallel relationship and under a uniform tension while being wrapped so that all of the strands are equally stressed and will assume their part of the total load.

When a rope of this type is subjected to a shock load the entire bundle stretches to absorb the shock and the pitch of the helical wrapping is extended to accommodate the elongation of the core. The protective covering layer **17** is adapted to stretch a corresponding amount so as to protect the stretched rope without interfering with its extensibility.

Fig. 1 illustrates the use of the above described rope in a runway net for arresting jet planes. In Fig. 1 a pair of such ropes **10** are strung around rollers **20** on fixed posts **21** and are passed over spreaders **22** to a coupling **23** of a hydraulic or pneumatic arresting cylinder **24**. Ropes **10***a* are tied into the form of a net **25** between the ropes **10**. The ropes **10***a* are similar to the ropes **10** but may be of somewhat smaller diameter.

The net **25** is shown as disposed at the end of a runway **27** which constitute an airport or carrier runway.

In operation, when a landing plane engages the net **25** the shock first stretches the ropes **10** and **10***a* and exerts a pull on the cylinders **24** which causes a movement of the pistons therein (not shown) against the restraining effect of the fluid in the cylinder. This movement of the pistons assists the rope in absorbing the shock until the plane is brought to rest.

The ropes **10** may also be used as shroud lines **30** forming a part of a parachute harness for attaching a landing parachute **31** to a plane **32** as shown in Fig. 3.

The ropes provide the necessary resilience and tensile strength for absorbing the shock as the parachute opens to exert a braking effect on the plane.

Other uses and adaptations will be apparent to a person skilled in the art.

What is claimed is:

1. A shock resistant rope comprising a bundle of

parallel crimped and set continuous filaments of a material having a high tensile strength and a braided tube of yarns composed of a material having a high tensile strength disposed around said bundle and holding the bundle under a compacting force.

2. A rope as set forth in claim 1 in which said filaments are composed of nylon.

3. A rope as set forth in claim 1 in which said filaments are composed of high tenacity rayon.

4. A shock resistant rope comprising a bundle of parallel crimped and set continuous filaments of a material having a high tensile strength and a case for said bundle comprising a pair of braided tubes; each composed of yarns having a high tensile strength and held under a tension to exert a compacting force on said bundle.

5. A shock resistant rope comprising a bundle of parallel crimped and set continuous filaments of a material having a high tensile strength and a case for said bundle comprising a pair of braided tubes; each composed of yarns having a high tensile strength and held under a tension to exert a compacting force on said bundle and a stretchable protective cover composed of a rubber-like material disposed around said case.

6. A runway net for arresting planes comprising a net composed of shock resistant ropes, said ropes being composed of parallel crimped and set continuous filaments of a material having a high tensile strength and a braided tube of yarns composed of a material having a high tensile strength disposed around said bundle and holding the bundle under a compacting force.

7. A parachute harness comprising shock resistant ropes, said ropes being composed of parallel crimped and set continuous filaments of a material having a high tensile strength and a braided tube of yarns composed of a material having a high tensile strength disposed around said bundle and holding the bundle under a compacting force.

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