

Oct. 29, 1963

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3,108,640

STRUCTURAL CONNECTION BETWEEN ROTATABLE PARTS

Filed April 16, 1962

FIG. 1

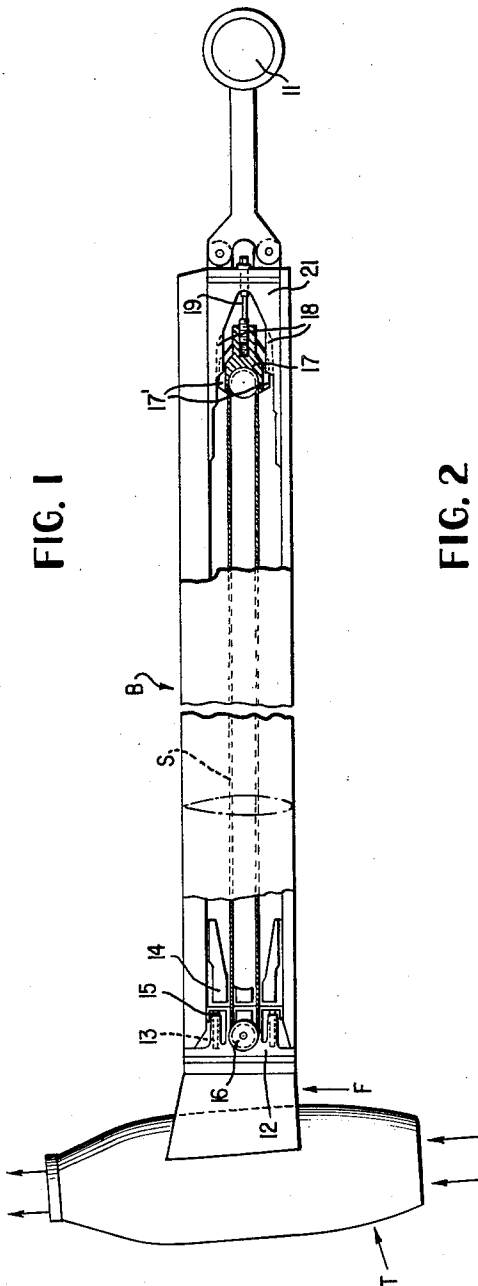
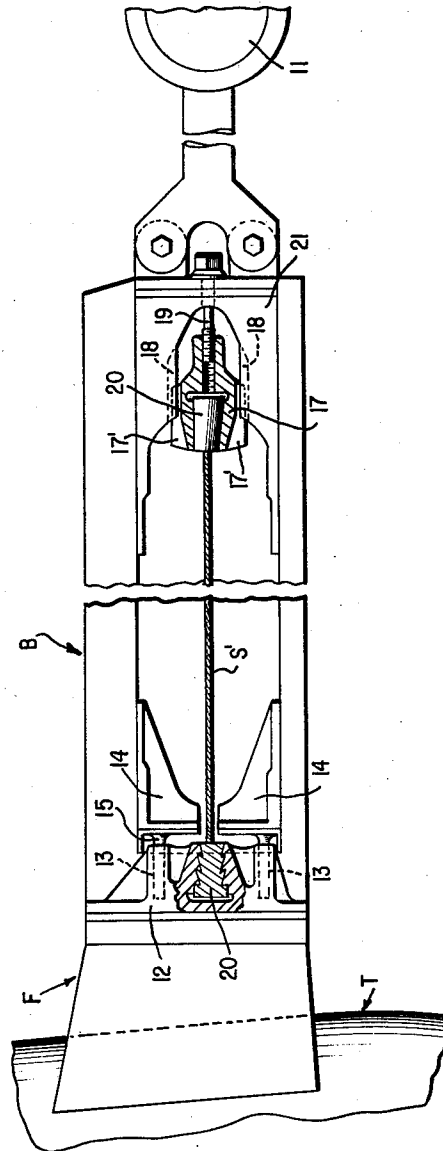


FIG. 2



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Filed Apr. 16, 1962, Ser. No. 187,476

Claims priority, application Germany Apr. 18, 1961
4 Claims. (Cl. 170-135.4)

The present invention relates to helicopter blade or propeller arrangement, and more particularly to the connection between a jet propulsion unit, especially of a ram jet unit, and the end of a propeller blade, especially in helicopters.

It is known to drive the propeller of helicopters by means of ram jet units arranged at the end of the blade. This kind of propulsion unit is particularly suited therefor because ram jet units operate economically at the high velocities which occur at the ends of the blade. On the other hand, large centrifugal forces occur with high peripheral velocities to which the fastening and mounting elements of the jet unit and the propeller blades are subjected.

The present invention aims at providing a connection between the end of the blade and the propulsion unit and a suspension of the latter in the radial direction, which connection is capable of favorably absorb the high stresses and loads occurring during operation and, in particular, to relieve the propeller blade far-reaching insofar as sturdiness, rigidity and strength of materials thereof are concerned.

The present invention proposes as solution to this purpose to clamp the housing of the jet propulsion unit or of the base thereof against the end of the blade by means of a rope, cable, chain, tie rod, or the like clamping member which extends in the direction of the longitudinal axis of the propeller blade.

With a length of the cable extending over the entire radial extent of the propeller blade and with a fastening or securing of the cable to the rotor shaft or within the blade root, the propeller blade may be made in its entirety from a simple and light structural material, such as synthetic resin, since the cross section of the blade—in addition to other loads and stresses—is no longer subjected principally to tractional forces or tensile stresses as was the case heretofore; instead the tractional forces are absorbed exclusively by the cable which may, additionally be installed under an initial or pre-stress. The cable system occupies very little space within the propeller blade or within the hollow blade girder so that sufficient room is left for the accommodation of the fuel supply lines and of the electric wiring.

A rectilinear guide arrangement in accordance with the present invention which is provided between the propulsion unit housing or the base of the propulsion unit, on the one hand, and the end of the propeller blade, on the other, assures also with a greater lengthening or stretching of the cable as compared to the considerably smaller lengthening of the propeller blade, that during operation the center of gravity of the propulsion unit will continue to remain on the longitudinal axis of the propeller blade and that constant angular position of the longitudinal axis of the propulsion unit is maintained with respect to the aforementioned longitudinal axis, in order to obtain load conditions for the propeller blade which are as favorable as possible and optimum air inlet conditions for the propulsion drive unit. Furthermore, the rectilinear guide arrangement between the base of the propulsion unit and the end of the blade absorbs the circumferential forces and transmits the same to the propeller blade.

Accordingly, it is an object of the present invention to

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provide a connection between the blades of a helicopter and a propulsion drive unit mounted at the outer end thereof which obviates the aforementioned shortcomings and inadequacies encountered in the prior art devices.

It is another object of the present invention to provide a connection between the propulsion drive unit especially ram jet and the out end of a helicopter blade which is capable of withstanding the forces that occur as a result of the high velocities occurring thereat and yet relieves the blade of tensional stresses caused by centrifugal forces acting on the drive unit.

Still another object of the present invention resides in the provision of a clamping arrangement for clamping a jet drive unit against the outer end of a helicopter propeller blade which makes possible the use of relatively simple material for the blade construction and leaves adequate space on the inside of the blade for the accommodation of the fuel lines, wirings, etc., therein.

Another object of the present invention resides in the provision of a connection between a propulsion drive unit and the outer end of a propeller blade which, notwithstanding its removal of tensional stresses within the propeller blade, assures the maintenance of proper position of the drive unit at the outer end of the blade.

These and other objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, two embodiments in accordance with the present invention, and wherein

FIGURE 1 is a plan view, with parts broken away, of a propeller blade provided with a double cable system in accordance with the present invention, and

FIGURE 2 is a plan view, also with parts broken away, of a propeller blade with a single cable system in accordance with the present invention.

Referring now to the drawing wherein like reference numerals are used throughout the various views to designate like parts, a ram jet unit generally designated by reference character T is arranged at the outer end of the propeller blade generally designated by reference character B which rotates around the shaft 11 thereof. A base member 12 is secured to the base of the drive unit generally designated by reference character F and is provided with recesses or apertures 13 extending in the direction of the longitudinal axis of the propeller blade B, while correspondingly shaped ledge members or bolts 15, which are disposed on a head piece 14 inserted into the outer end of the blade, are guided within these apertures 13.

According to FIGURE 1, a roller 16 is supported within the base member 12 about which is slung an endless cable S, which on the other hand, is suspended in an adjustable tensioning or stretching device disposed in the blade root 21 which is displaceably provided in the longitudinal direction. The tensioning device consists of the element 17 for the suspension of the cable S and is provided with guide strips or ledge portions 17' which are guided within guide grooves 18 disposed within the blade root 21. A thread is provided within element 17 into which engages a threaded bolt 19 with the aid of which the cable S is tensioned, whereby the bolt 19 is supported against the blade root 21.

According to FIGURE 2, only a single cable system S' is provided to the two ends of which are secured conical end pieces 20 which are suspended in corresponding apertures provided within the base member 12 and within part 17 of the tensioning device. The end pieces 20 may additionally be provided with a profiled shape along the outer circumference thereof in order to increase the form-locking engagement thereof with the parts receiving the same which may be provided with complementary configurations along the internal contours thereof.

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While I have shown and described only two embodiments in accordance with the present invention, it is understood that the same is not limited thereto, but is susceptible of many changes and modifications within the spirit and scope thereof as known to a person skilled in the art, and I therefore do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

I claim:

1. In a propeller blade assembly for a helicopter-like vehicle having a propulsion drive unit including a base portion and a propeller blade means, said blade means having an inner end and an outer end with respect to said vehicle and said propulsion drive unit base portion being secured to the outer end of said blade means, the improvement essentially consisting of an improved connecting means for connecting said propulsion drive unit to said outer end of the blade means and for suspending said propulsion drive unit radially to absorb the high stresses and loads on the connecting means occurring during operation of the propulsion drive unit, said connecting means comprising means for clamping the base portion of said drive unit against the outer end of said blade means under compression to absorb the centrifugal forces of the drive unit and blade means including cable means extending substantially in the longitudinal direction of and over the entire length of said blade means and on the inside thereof, adjustable tensioning means adjustingly connecting said cable means with the root of said blade means, and rectilinear guide means between said base portion and said outer end of the blade means including a base member provided on said propulsion drive unit and having aperture means extending substantially in the longitudinal direction of said blade means, and a head piece disposed in the outer end of said blade means, said head piece having complementary pin means thereon guided within said aperture means in the assembled condition of said connecting means, said cable means being secured to said base member.

2. In a propeller blade assembly for a helicopter-like vehicle having a propulsion drive unit including a base portion and a propeller blade means, said blade means having an inner end and an outer end with respect to said vehicle and said propulsion drive unit base portion being secured to the outer end of said blade means,

the improvement essentially consisting of an improved connecting means for connecting said propulsion drive unit to said outer end of the blade means and for suspending said propulsion drive unit radially to

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absorb the high stresses and loads on the connecting means occurring during operation of the propulsion drive unit,

said connecting means comprising

means for clamping the base portion of said drive unit against the outer end of said blade means under compression to absorb the centrifugal forces of the drive unit and blade means including cable means extending substantially in the longitudinal direction of and over the entire length of said blade means and on the inside thereof,

adjustable tensioning means adjustingly connecting said cable means with the root of said blade means including an element for suspending said cable means, the root of said blade means being provided with guide grooves therein, said element having guide strips guided within said guide grooves, said cable means being secured to said element, and bolt means threadably connected to said element and supported against the root of said blade means for adjusting the tension of said cable means, and

rectilinear guide means between said base portion and said outer end of the blade means including a base member provided on said propulsion drive unit and having aperture means extending substantially in the longitudinal direction of said blade means, and a head piece disposed in the outer end of said blade means, said head piece having complementary pin means thereon guided within said aperture means in the assembled condition of said connecting means, said cable means being secured to said base member.

3. An assembly as defined in claim 2, wherein said cable means is an endless cable secured to said base member by a roller attached thereto.

4. An assembly as defined in claim 2, wherein said cable means is a single cable system having tapered end pieces secured thereto and seated in complementary apertures provided in said base member and said element.

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