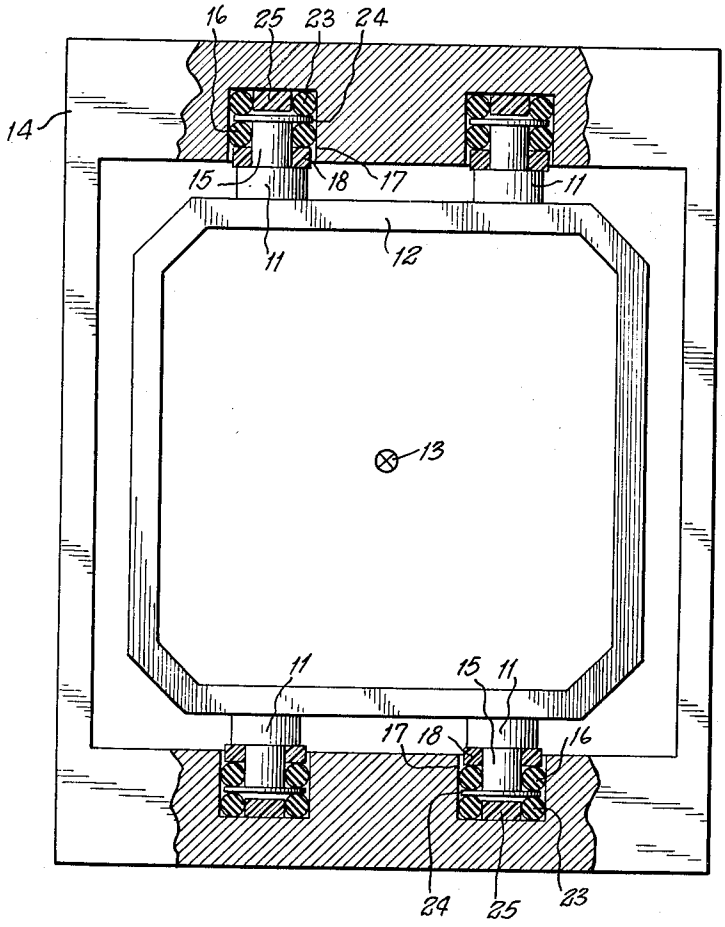
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VIBRATION-RESISTANT MOUNTING

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VIBRATION-RESISTANT MOUNTING

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5 Claims. (Cl. 248—358)

This invention is concerned with a vibration-resistant mounting. More specifically, the vibration-absorbing mounting according to this invention is particularly applicable to instruments having rotating parts, e.g. gyroscopes and the like.

An object of this invention is to provide vibration mounting of a superior character for reducing the deleterious effects of vibration on the moving parts of a sensitive instrument such as a gyroscope or the like.

Another object of this invention is to provide vibration-absorbing mounting for gyroscopes or the like wherein the mounting supports have vibration-absorbing means therewith, and wherein the supports are symmetrical in all planes about the center of gravity of the instrument.

Another object of the invention is to provide a vibration-absorbing mounting which has, in addition to resilient material mounting, features providing for a high degree of damping at the natural period of vibration of the suspended portion of the instrument.

Still another object of this invention is to provide semi-elastic snubbers in conjunction with the resilient mounting so that limiting of the vibratory movements is had without undue shock to the instrument proper.

Briefly, the invention pertains to a vibration-resistant mounting for gyroscopes and the like which operates to isolate the sensitive works thereof from outer supporting means. Such mounting includes a plurality of supports located symmetrically with respect to the center of gravity of the suspended portion thereof, and wherein each of said supports comprises, among other things, an extension for relatively joining said outer support means and said isolating portion; resilient means surrounding said extension for absorbing lateral vibratory movements relative thereto; and additional resilient means for absorbing longitudinal vibratory movements relative to said extension.

The invention may take various forms, among which is a specific embodiment that is described below and illustrated in the drawing, in which:

The figure is a plan view partly broken away in cross-section, illustrating a mounting for the schematically shown framework of a gyroscope or the like.

Although various elastic mounting devices have been employed to absorb vibration heretofore, the resilient mounting according to this invention enables superior results to be obtained by reason of the fact that there is resilient material situated to absorb vibratory movements, both longitudinally and laterally relative to the mounting studs. In addition, this mounting provides for damping to minimize the amplification of vibratory motions which would tend to take place with the ordinary mounting heretofore known. This amplification is due to the natural period of resonant frequency which any mounting system must necessarily have.

In a support according to this invention there is employed a plurality of studs **11** which are integral with or firmly attached to a frame **12** that carries the sensitive

instrument or gyro. It is pointed out that in the drawing the gyro, or instrument that is carried by the frame **12**, has its center of gravity at a point **13**, which is located in the plane of the paper as well as being symmetrically located between the pairs of studs **11**.

In the illustration there is a supporting framework or member **14**, which might take various forms but which is illustrated as an outer casing that may be solidly mounted in an aircraft or similar vehicle. It will be noted that although the stud **11** is illustrated as being integral with or firmly attached to the frame **12** and extending into a recess in the support member **14**, this arrangement may be reversed, i.e. the stud **11** could be integrally carried by the frame support **14** while a recess could be in the frame **12** for the instrument.

Each of the studs **11**, with its mounting, is identical in construction and only one need be described in detail. Surrounding a smaller-diameter extension **15** of the stud **11**, there is a resilient material ring **16** which contacts the inner surface of a recess **17** in the supporting member **14**. Also surrounding the extension **15**, there is a rectangular cross-section snubber ring **18** which has an outside diameter less than the inside diameter of recess **17**, by a predetermined amount, to allow a desired amplitude of vibratory movement laterally prior to the snubbing action.

Beyond the end of extension **15**, for absorbing longitudinal vibratory movement, there is a resilient material pad which is made up of a circular cross-section resilient material ring **23** which contacts the end, or flat surface, of the recess **17** and also is held in place by the sides of the same recess **17**. Each of the resilient rings **16** and **23** has a stiffness which is inversely proportional to the distance of the ring from the center of gravity **13**. In addition, there is a disc **24** which is located at the end of, and attached to the end of extension **15** of the stud **11**. This disc **24** is also in contact with the resilient ring **23** for transmitting longitudinal movements of the stud **11**, via its extension **15** and the disc **24**, to the ring **23**. It will be noted that lateral movements of extension **15** will cause a sliding of the disc **24** across the surface of ring **23**. This will, of course, provide damping for this mode of oscillation.

For the purpose of limiting the amplitude of the vibratory movements, both laterally and longitudinally, there are semi-resilient means for snubbing movements that exceed a predetermined amplitude depending upon clearances involved. There is a longitudinal snubber disc **25** located in the middle of the ring **23** and having a thickness such that there is a predetermined clearance between disc **24** and the surface of the disc **25** when the other side of disc **25** is in contact with the end or bottom surface of the recess **17**.

The snubbers **18** and **25** are constructed of any satisfactory semi-resilient material, e.g. "nylon" or "Teflon," etc. A "semi-resilient material" is a material having a lower modulus of resilience than the material of which the rings **16** and **23** are formed. The purpose is to act to limit the vibratory movements without causing undue shock on the instrument.

In operation, it will be noted that the damping of vibration is compound in effect, since lateral movements of the stud **11** as effected at the extension **15** are resiliently dissipated in squeezing the ring **16**, while longitudinal movements of the stud **11** and its extension **15** are resiliently dissipated by squeezing of the ring **23** (on account of the movements being transmitted thereto via the disc **24** attached to the end of extension **15**). At the same time, damping of any natural period vibration, which would otherwise be amplified, is obtained. This damping is created by the sliding movement between the surface of extension **15** and the ring **16**, as to longitudinal

movements, while similar sliding movement is caused between the surface of disc **24** and the ring **23**, for damping lateral vibratory movements.

In addition, it will be noted that the location of the centerline of studs **11** is in the same plane as the center of gravity **13**, so that any lineal accelerations to which the instrument is subjected will not create any torque on the instrument.

While a particular embodiment of the invention has been described in considerable detail in accordance with the applicable statutes, this is not to be taken as in any way limiting the invention but merely as being descriptive of a single embodiment thereof.

It is claimed:

1. A vibration-resistant mounting including in combination a first member having a recess with an inner wall surface and with a base surface, a second member, a supporting element carried by said second member, said element having an end extending into said recess, first resilient means surrounding a portion of said element within said recess, said first resilient means normally contacting said element and said inner wall surface, a resilient snubber member having a lower modulus of resilience than said first resilient means and means mounting said snubber member in a fixed position on said element with a predetermined clearance between the snubber and the inner wall surface.

2. A mounting as in claim 1 in which said supporting element carries a disk, a second resilient means disposed between said disk and said base surface, said second resilient means normally contacting said disk and said base surface, a second snubber member having a lower modulus of resilience than said second resilient member and means mounting said second snubber member on said base surface with a predetermined clearance between said disk and said second snubber member.

3. A vibration-resistant mounting including in combination a stationary member, a member having a center of gravity adapted to be supported on said stationary member, one of said members being formed with a plurality of recesses, each of said recesses having an inner wall surface and a base surface, respective supporting

elements carried by the other member, each of said elements having an end extending into a respective recess, respective first resilient means surrounding portions of the respective elements within said recesses, each of said first resilient means normally contacting its associated element and its associated inner wall surface, respective resilient snubber means each having a lower modulus of resilience than said first resilient means and means mounting the respective snubber members in fixed positions on said elements with a predetermined clearance between each snubber element and its associated inner wall surface.

4. A vibration-resistant mounting as in claim 3 in which each of said supporting elements carries a disk, and in which said mounting includes respective second resilient means disposed between said disks and said base surfaces, respective second snubber members each having a lower modulus of resilience than said resilient means and means mounting said second snubber members between the respective ends of said elements and said base surfaces to permit a predetermined relative movement between said ends and said second snubber members before said second snubber members are clamped between said ends and said base surfaces.

5. A vibration-resistant mounting as in claim 4 in which each of said first resilient means has a stiffness which is inversely proportional to the distance of the means from said center of gravity.

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CERTIFICATE OF CORRECTION

January 5, 1960

Patent No. 2,919,882

Clare E. Barkalow

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 25, for the claim reference numeral "4" read -- 3 --.

Signed and sealed this 31st day of May 1960.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON

Commissioner of Patents