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SPRING BAND COUPLING OF A VARIABLE REDUCED LENGTH FOR INTERNAL COMBUSTION ENGINES

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FIG. 1

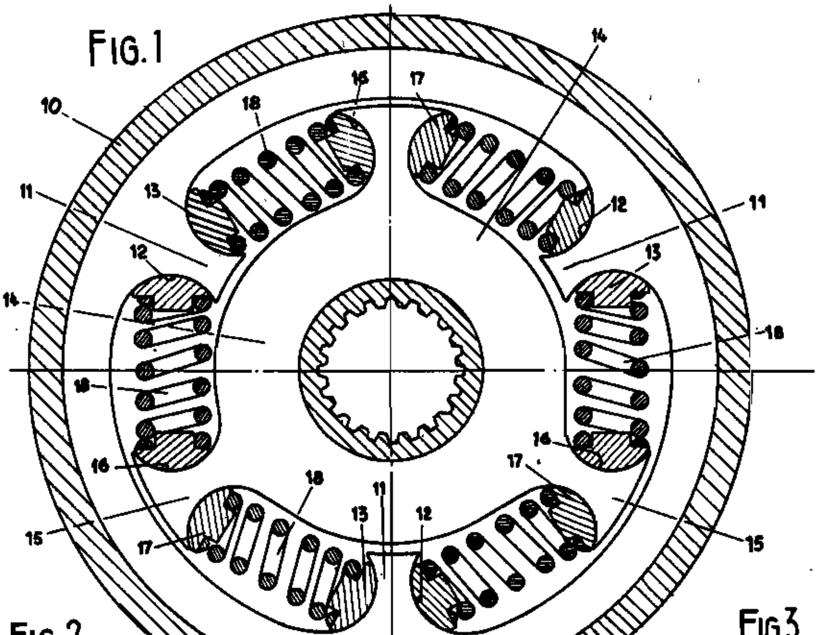


FIG. 2

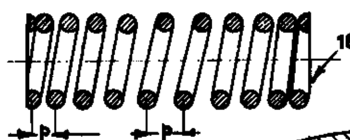


FIG. 3

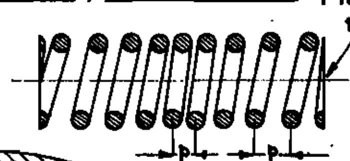
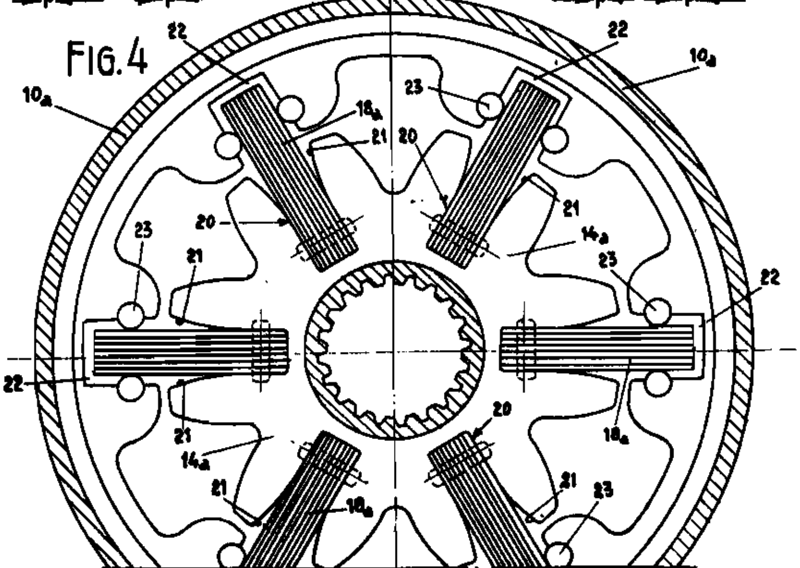


FIG. 4



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ALIEN PROPERTY CUSTODIAN

SPRING BAND COUPLING OF A VARIABLE REDUCED LENGTH FOR INTERNAL COMBUSTION ENGINES

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This invention concerns a spring band coupling of a variable reduced length for internal combustion engines.

It is known that a system made up of an axis and masses rigidly joined to it, has determined periods of torsional vibrations, and no matter how complicated this system may be, it can be reduced to an elementary cylindrical axis to which the theoretical inertia wheels are applied and which is quite equivalent to the real ensemble.

There are several methods of calculation which are fully proved out and which are to determine the reduced lengths between the theoretical inertia wheels and to calculate:

a. The real periods of torsional vibration,

b. The elastic line of torsional deformation along the geometrical axis, and

c. The inducted stresses.

That state of a system in which synchronism takes place between external periodical actions and the real period of torsional vibration of the system itself is defined as critical state.

It is acquired from experience that no utilisation state of an engine must coincide with its critical periods.

Working in critical state of an engine causes very intense stresses in the axis and such as to destroy the machine in many cases.

From a general point of view the organs of an engine can always be made to a size such as to keep the critical states far from utilisation, but in practice it often happens that this is impossible, because the organs that use the power supplied by a certain engine can have widely different features from one application to another (this is the case for screws of sea and aircraft which are different in the number of revolutions and the moment of inertia) and such as to include critical states.

The object of this invention is to allow application of one and the same engine to utilisation organs having widely variable features. According to the invention exclusion of the critical states from those of utilisation takes place by putting between the engine and the utilisation means a coupling that allows its theoretical reduced length to be varied under deformation.

In a characteristic embodiment, elastic elements are arranged between the conjugated parts of the coupling which become rigid in conformity with the yielding when a determined elastic yielding of them takes place. In one way of performance the aforesaid elastic elements consist of cylindrical spiral springs whose pitch varies with continuity between the ends and the intermediate zone, so that when a determined elastic yielding takes place, certain coil parts come into contact and vary the elongation constant of the spring as well as the reduced length of the system and consequently the vibration period of the same so that if the axis had started a torsional oscillation in synchronism with the outside impulses with a certain period, this synchronism will be lacking.

In another form of performance the elastic elements have one or more bending laminae (semi-ellipticals) which during the elastic yielding, come down gradually on rigid counter-supports thereby varying the theoretical reduced length and the period of synchronism will be lacking.

The invention will now be explained with reference to the annexed drawing which is given merely as an indicative example, but which does not confine the range of the invention in any way.

Fig. 1 is an elevation section view of a first embodiment of the coupling.

Figures 2 and 3 show two spiral springs with a variable pitch in sections.

Fig. 4 is an elevation section view of a second form of performance of the coupling.

With reference to fig. 1, the coupling comprises a drum **10** in one with the engine shaft and with appendices **11** in its inside surface. Sideways in these there are notches **12** of a round shape where gudgeon pins with cylindrical heads **13** are housed.

Co-axial with drum **10** and inside it, there is a plate **14** keyed with the driven shaft and having at its periphery appendices **15**, which like appendices **11**, are provided sideways with notches **16** where the respective gudgeon pins with cylindrical heads **17** are housed.

Joining between the two parts of the coupling (drum **10** and disk **14**) takes place by means of the spiral springs **18** which react through the respective gudgeon pins **13** and **17**, with the notches **12** and **16**. It is evident that a torsional couple of the driving shaft is elastically sent to the driven shaft.

With reference to figures 2 and 3, the pitch —*p*— of the helicoidal coils of springs **18** increases and decreases respectively with continuity from the head to the middle part of them. In this way the elastic constant of the spring is varied and with an increase in its elastic yielding, the said spring has a tendency to become more rigid and hence the period of vibration of the revolving masses is modified.

Fig. 4 shows a variation of performance, in which laminated springs **18a** take the place of the helicoidal springs **18**, these laminated springs being given by plate **14a**. To wit, there are the radial notches **20** in said plate having towards the end some tracts with a course deviating substantially curve **21**.

Drum **10a** too has radial notches **22** provided sideways with rollers **23** or the like to engage with the free ends of the laminated springs **18a**. A torsional couple sent from the driving shaft to the driven shaft causes bending of the aforesaid laminated springs which by adhering with one or the other of the radial surfaces **21**, vary in an equivalent way the theoretical reduced length and hence the period of oscillation.

It is clear that the interposition of the coupling within certain limits according to the invention extinguishes the torsional vibrations just when they are about to take place because the reduced length of the system is modified. Consequently the period of vibration of the said system is modified and if the shaft had started a torsional (pendular) oscillation in synchronism with the outside impulses=with a certain period=this synchronism is then lacking.

It will be easily understood that in giving proportions to the coupling, reduced lengths are brought about, which are such as to exclude periods of particularly dangerous vibrations, and exclusion of the lower harmonics is intrusted to the variability of the reduced length obtained as described.

This spring band coupling is suitable for all those cases in which a shaft to which revolving masses, or those which can in any way be considered as such, are connected, has to undergo a series of periodical impulses, particularly for sea and aircraft engines in which the periodical impulses due to gas pressure reach very high values and at the same time it is of the greatest importance to reduce the sizes of the power transmission organs for reasons of weight and the space taken up. For these particular uses the coupling must be applied between the engine and the screw; if there is a revolution reduction gear, the coupling is either after or before the revolution reduction gear, but this last solution is preferable because the stresses to be lessened for the teeth of the reduction gear and furthermore the coupling can be lighter because the torsional moment is less.

The coupling can be movable together with the transmission shaft, or not movable, namely, fixed to the crown of reaction of an epicycloidal reduction gear.

It is understood that the particulars of performance and application in practice can vary in any way without leaving the field of the invention.

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