

PATENT SPECIFICATION



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PROVISIONAL SPECIFICATION

Improvements in or relating to Gear Wheels

I, FRANK METCALF ASPIN, a British subject, of Walmer Place, 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention to be as follows:—

This invention relates to gear wheels and is particularly, though not exclusively, applicable to gear wheels and pinions such as are used for driving the rotary valves or cam shaft of an internal combustion engine.

"Split gears" are already known and is the term applied to gear pinions which have in addition to the toothed main driving portion, a second and similarly toothed portion with springs operating to preload the teeth by angular displacement of such second portion relatively to the first. By such means the drive transmitting faces of the teeth of the main portion are held in engagement with the complementary drive-receiving faces of the teeth of the gear wheel with which it meshes, thus eliminating "back lash" so long as such pre-loading exceeds reverse loads.

The main disadvantage of such split gears is however constructional because, in addition to the known disadvantages of springs there is the number of extra parts and the increased cost of manufacture and relative wear. Extra parts in addition to the springs include complementary bearing surfaces and locating means to keep the two portions of the gear from separating. Some of the known disadvantages of springs are fatigue and fracture.

The object of the invention is an improved construction of gear having the advantages without the disadvantages above mentioned.

According to the invention, the improved gear wheel comprises a main toothed driving portion, a second similarly toothed portion adjacent thereto and rubber cushioning means between them arranged to provide resilient relative angular displacement and pre-loading of the teeth. The term "rubber" is used herein to include natural rubber or any suitable synthetic rubber or rubber-like substance.

According to a preferred embodiment of the invention the rubber cushioning

means serves to secure the two parts together either with pressure between their adjacent faces or spaced apart from mutual frictional engagement.

In one example of the invention the gear wheel is formed with a main toothed portion whilst immediately adjacent thereto is a hub adapted to form a bearing for the second toothed portion. Such second toothed portion has a face adapted to bear against a complementary face of the main toothed portion and in each such face is an annular groove. Located in the annular space formed by such grooves is a rubber ring, which in cross section is waisted, intimately bonded by its faces to the bottoms of the grooves. The waisted shape prevents bonding at the peripheral edges so that the rubber will not merely be in shear stress in the plane of the complementary faces.

Instead of a complete annular rubber ring the rubber may be in two or more parts symmetrically located in the grooves or there may be a plurality of recesses holding plug-like portions of rubber the recesses being shaped to avoid shear action. Also, instead of the rubber being bonded direct to the gear parts it could be bonded to shells or backing washers adapted to be secured in the grooves in any suitable manner. The rubber may be of such normal thickness that the portions of the gear are drawn together or held slightly separated and the rubber may be designed to give sufficient support and location for the second toothed portion so that relative bearing surfaces as provided at the hub on the main portion can be omitted. The first example above described has the additional advantage that it can be torsionally stressed in either direction.

Another special advantage of the construction employing rubber instead of metal springs is that it is noticeably quieter and this is attributed in part to the absence of audible metal to metal contact such as friction in its housing spring bounce and bottoming and natural resonance of the springs whilst the rubber provides a damping of any resonance of the main and second toothed portions.

The first example above described obviously is capable of further modification without departing from the nature of the invention. By its simplicity the cost of production can obviously be reduced compared with gears embodying springs.

Dated this 15th day of July, 1942.

For the Applicant,
WILSON, GUNN & ELLIS,
Chartered Patent Agents,
54/56, Market Street, Manchester, 1.

COMPLETE SPECIFICATION

Improvements in or relating to Gear Wheels

I, FRANK METCALF ASPIN, a British subject, of Walmer Place, 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to gear wheels and is particularly, though not exclusively, applicable to gear wheels and pinions such as are used for driving the rotary valves or cam shaft of an internal combustion engine.

"Split gears" are already known and is the term applied to gear pinions which have in addition to the toothed main driving portion, a second and similarly toothed portion with springs operating to preload the teeth by angular displacement of such second portion relatively to the first. By such means the drive transmitting faces of the teeth of the main portion are held in engagement with the complementary drive-receiving faces of the teeth of the gear wheel, with which it meshes, thus eliminating "back lash" so long as such pre-loading exceeds reverse loads.

The main disadvantage of such split gears is however constructional because, in addition to the known disadvantages of springs there is the number of extra parts and the increased cost of manufacture and relative wear. Extra parts in addition to the springs include complementary bearing surfaces and locating means to keep the two portions of the gear from separating. Some of the known disadvantages of springs are fatigue and fracture.

The object of the invention is an improved construction of gear having the advantages without the disadvantages above mentioned.

According to the invention, the improved gear wheel comprises a main toothed driving portion, a second similarly toothed portion adjacent thereto and rubber cushioning means between them arranged to provide resilient relative angular displacement and pre-loading of the teeth characterised in that the said cushioning means is secured by two opposed faces respectively to the said two

toothed portions whereby it is stressed by relative lateral displacement of such faces in substantially parallel planes. "Rubber" is used herein to include natural rubber or any suitable synthetic rubber or rubber-like substance.

According to a preferred embodiment of the invention the rubber cushioning means serves to secure the two parts together either with pressure between their adjacent faces or spaced apart from mutual frictional engagement.

The accompanying drawing is an axial section of one example of a gear wheel made in accordance with the invention.

As shown in the drawing, the gear wheel is formed with a main toothed portion 10 whilst immediately adjacent thereto is a hub 11 adapted to form a bearing for the second toothed portion 12. Such second toothed portion 12 has a face 13 adapted to bear against a complementary face of the main toothed portion and in each such face is an annular groove. Located in the annular space formed by such grooves is a rubber ring 14, which in cross section is waisted, intimately bonded by its end faces to the bottoms of the grooves. The waisted shape prevents bonding at the peripheral edges so that the rubber will be under torsional stress due to relative movement of its bonded end faces, and will not be subject to direct shear stress.

Instead of a complete annular rubber ring the rubber may be in two or more parts symmetrically located in the grooves or there may be a plurality of recesses holding-plug-like portions of rubber, the recesses being shaped for clearance at their outer edges to avoid shear action, as for example conical. Also, instead of the rubber being bonded direct to the gear parts it could be bonded to shells or backing washers adapted to be secured in the grooves in any suitable manner. In such latter construction the rubber may be of such normal thickness that when such shells or backing washers are secured in position the portions of the gear are drawn together. Alternatively the rubber may be of such normal thickness that the complementary faces are held slightly

separated or the rubber may be designed to give sufficient support and location for the second toothed portion so that relative metal-to-metal bearing surfaces as provided at the hub on the main portion can be omitted. The construction such as in the first example above described may be such that the rubber can be stressed by relative rotation of the two toothed portions in either direction.

Another special advantage of the construction employing rubber instead of metal springs is that it is noticeably quieter and this is attributed in part to the absence of audible metal-to-metal contact such as friction in its housing, spring bounce and bottoming and natural resonance of the springs whilst the rubber provides a damping of any resonance of the main and second toothed portions.

The first example above described obviously is capable of further modification without departing from the nature of the invention. By its simplicity the cost of production can obviously be reduced compared with gears embodying springs.

Obviously, in this invention as in any construction of split gear wheel the two toothed portions must be given relative movement before being put into mesh with another gear wheel as it is necessary thereby to stress the cushioning means so as to pre-load the teeth for taking up back-lash. In the present invention, also the teeth before such relative movement for preloading may be out of line or in line, in which latter case the relative movement for preloading must be of the order of at least one tooth pitch. The construction of the present invention differs further from previous constructions in that it may be constructed so that the two portions may be moved in either relative direction for the purpose of stressing the rubber and preloading the teeth, as may be determined by the direction in which the main load is being transmitted.

A construction of split gear wheel has been proposed in which the resilient member comprises a plurality of rubber plugs located in cylindrical recesses in the adjacent faces of the toothed portions, but in such construction the rubber is not under torsional stress only due to relative movement of its opposed faces constituting areas of attachment but only under direct shear in the plane of adjacent faces of the toothed parts.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An improved gear wheel comprising a main toothed driving portion, a second

similarly toothed portion adjacent thereto and rubber cushioning means between them arranged to provide resilient relative angular displacement and pre-loading of the teeth, characterised in that the said cushioning means is secured by two opposed faces respectively to the said two toothed portions whereby it is stressed by relative lateral displacement of such faces in substantially parallel planes.

2. An improved gear wheel, according to Claim 1, characterised in that the rubber cushioning means serves also to secure the two portions thereof from separation.

3. An improved gear wheel according to Claim 2, characterised in that the rubber cushioning means is also under tensional stress which serves also to hold the two toothed portions together with pressure between their adjacent faces.

4. An improved gear wheel according to Claim 2, characterised in that the rubber cushioning means while serving to secure the two portions from separation serves also to hold the two toothed portions just spaced apart from mutual frictional engagement.

5. An improved gear wheel according to any of the preceding Claims, characterised in that the rubber cushioning means is secured by being intimately bonded direct to the two toothed portions.

6. An improved gear wheel according to any of the preceding Claims, characterised in that the rubber cushioning means is located in a recess between the said two toothed portions which recess is so shaped that for normal relative rotational displacement of the said two toothed portions the rubber is not subjected to shear stress between any shoulders or edges of such portions.

7. An improved gear wheel, according to any of the preceding Claims, characterised in that the rubber is located in an annular space formed between the two toothed portions of the gear and is bonded to such portions by its opposed end faces.

8. An improved gear wheel comprising a main toothed driving portion, a second similarly toothed portion adjacent thereto and rubber cushioning means between them arranged to provide resilient relative angular displacement and pre-loading of the teeth, characterised in that the said cushioning means comprises a ring secured only by its end faces to the said toothed portions and coaxially with them so that it is stressed torsionally by relative rotational displacement of its end faces.

9. An improved gear wheel constructed substantially as herein described with

reference to and as illustrated in the
accompanying drawing.

Dated this 29th day of September, 1943.
For the Applicant,
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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1944.

[This Drawing is a full-size reproduction of the Original.]

