

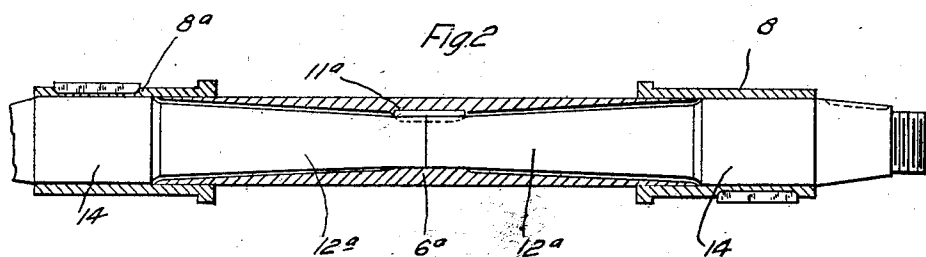
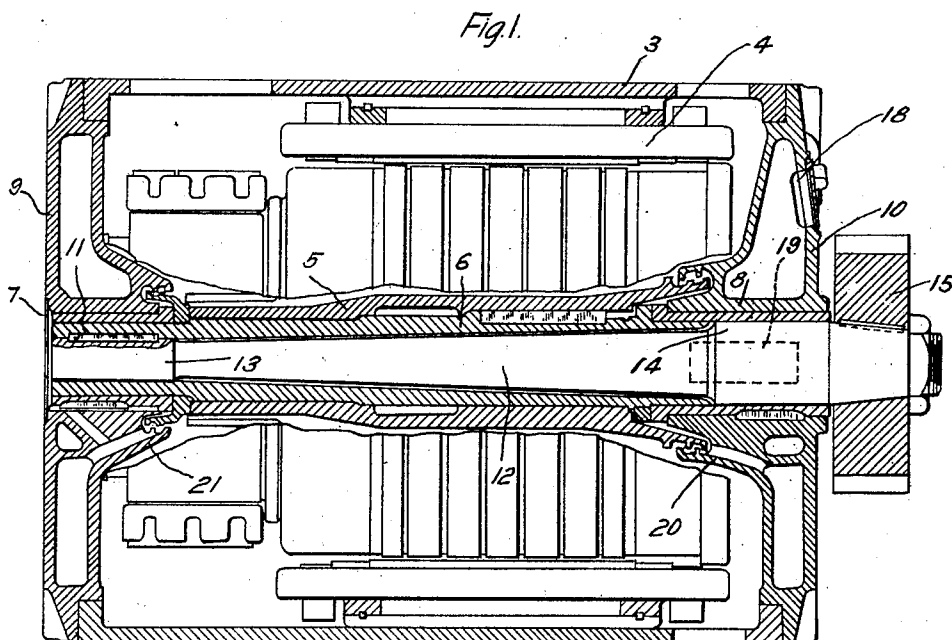
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J. M. LABBERTON ET AL.

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RESILIENT DRIVING CONNECTION

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WITNESSES:

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JOHN M. LABBERTON, OF WILKINSBURG, AND GEORGE M. EATON AND NORMAN W. STORER, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

RESILIENT DRIVING CONNECTION.

Application filed April 25, 1921. Serial No. 464,417.

To all whom it may concern:

Be it known that we, JOHN M. LABBERTON, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, and GEORGE M. EATON, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, and NORMAN W. STORER, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Resilient Driving Connections, of which the following is a specification.

Our invention relates to resilient driving connections and particularly to flexible shafts.

One of the objects of our invention is to provide a flexible shaft through which power is transmitted from a driving member to a driven member, of such form that shock or jars incident to the operation of the mechanism, or relative irregularities of movement therebetween will be absorbed or compensated for.

A further object of our invention is the provision of a flexible shaft of such construction that it will withstand bending strains and at the same time yield under torsional stresses.

Stated generally, our invention contemplates the provision of a flexible shaft that possesses both a high degree of strength and of resilience. Our invention is exceptionally applicable in connection with electric motors wherein the motor, through its shaft and a pinion thereon drives a gear. In such construction, any irregularity of tooth formation in either the gear or the pinion subjects the armature of the motor to shocks, and, in cases wherein there are pinions on both ends of the shaft, that drive rigidly connected gears, any irregularities in tooth formation tend to seriously injure the teeth and to cause an undue strain upon the mechanism associated with the gears and pinions.

Furthermore, in the case of alternating current motors, the vibration caused by the alternations of the current is frequently transmitted to the driven apparatus, and, when the frequency of alternating of the

current is low, the vibrations thus transmitted are quite likely to be highly objectionable.

The driving connections of railway motors are also subject to strains by reason of irregularities in the track.

While flexible shafts have heretofore been employed in drives of a similar character, such shafts have been objectionable in that, if made sufficiently flexible, they would not withstand heavy bending stresses, and provision against bending has been obtained at the expense of resilience.

Furthermore, in cases where the flexible shaft was mounted within, and was rotatable with, a hollow shaft, difficulty was encountered in properly lubricating the flexible shaft, with the result that the flexible shaft would wear rapidly, by reason of the relative rotative and transverse movements that took place between the hollow shaft and the flexible shaft mounted therein.

By means of our construction, we are enabled to properly lubricate the flexible shaft and to secure a proper degree of resilience without the sacrifice of capacity to withstand bending strains.

In the accompanying drawing, Figure 1 is a view, in longitudinal section, of a machine employing our invention, and

Fig. 2 is a modified form of shaft construction that is adapted to carry two pinions.

Our device is shown as applied to an electric motor such as is employed in driving railway vehicles. The motor comprises a stationary frame 3 that supports a shell structure 4 and an armature 5. The armature 5 is keyed to a hollow shaft 6 that is supported in bearings 7 and 8. The bearings 7 and 8 are carried in brackets 9 and 10, respectively, that close the ends of the motor frame 3.

The entire weight of the armature 5 is carried by the hollow shaft, or sleeve member, 6, and the shaft 6 is keyed at point 11 to a shaft 12 of steel or other flexible material, or the shaft 12 may have a press fit with the sleeve member 6. The shaft 12 is provided adjacent to one end with a reduced portion 13 and at its opposite end with an enlarged portion 14. A pinion 15 is keyed to the shaft at its thicker end.

It will be apparent that, at its reduced end, the shaft 12 is supported by the sleeve member 6 and is non-rotatable with respect thereto, while at its enlarged end, the shaft 12 is in direct bearing engagement with and is supported by, the bearing 8. The sleeve member extends only partially across the bearing face of the member 8, and clearance is provided between the shaft 12 and the sleeve 6 throughout the entire length of the sleeve with the exception of the relatively small portion thereof that lies within the bearing 7.

Lubrication may be introduced through the bearings 7 and 8, in any desired manner, as, for instance, through openings 18 in each of the end brackets 10 and into journal boxes 19 that have communication with the interior faces of the bearing members 7 and 8. Oil deflectors 20 and 21 are provided and function in the usual manner.

It will be apparent that the greatest bending stresses on the shaft 12 occur at its pinion end, that is at the bearing 8, and that the greatest resilience of the shaft is adjacent to its reduced end 13.

As the distance from the pinion end of the shaft, in a direction toward its reduced end, increases, the bending strain on the shaft decreases, and the torsional flexibility thereof increases, so that the greatest bending strain is applied to a portion of the shaft that is subject to the least torsional deflection and the greatest torsional deflection occurs in the portion where the smallest amount of bending strain is imposed.

Inasmuch as the variation in thickness of the shaft is uniform from one end to the other thereof, it will be clear that the combined bending and torsional strains are substantially the same at any point throughout the active length of the shaft.

An important feature of the invention resides in the manner in which the sleeve 6 and the shaft 12 are supported in the bearing 8. Our improved bearing permits the lubrication of both the enlarged end of the shaft 12 and of the adjacent end of the sleeve 6. If the sleeve 6 were to be extended to the outer end of the bearing 8, the enlarged end of the shaft 12 would have bearing engagement with the interior face of the sleeve. Such construction would prevent proper lubrication of the enlarged end of the shaft, and relative rotative movement thereof with respect to the sleeve 6, as well as its transverse movements therein, would subject their opposing bearing faces to excessive wear.

In Fig. 2, there is shown a construction of a form that may be employed in connection with motors with which it is desired to employ two pinions. In such construction, a sleeve member 6^a is provided

to serve as a shaft for the armature and is supported in bearings 8 and 8^a.

Two shaft members 12^a are provided that function in the same manner as that just described in connection with the shaft 12 of Fig. 1. In the modified construction, the shaft sections 12^a are secured to the sleeve 6^a by a press fit or key connection, at 11^a.

It will be apparent that pinions carried on the ends of the shafts 12^a will be flexible relative to each other and also flexible relative to the sleeve or motor shaft 6^a. The former feature is important in cases where the respective pinions have driving connection with a pair of rigidly connected gears, in that irregularities of tooth engagement between the gear and pinion at one end will not result in undue stresses either upon such members directly nor upon the driving connections at the opposite end of the shaft.

We claim as our invention:

1. The combination with a driving motor, of a hollow shaft therefor, a rod secured to the hollow shaft at one end and extending therethrough to a point beyond the other end of the hollow shaft, a bearing for the first-named end of the hollow shaft and a bearing for the other end of said shaft and for the rod, the free end of the rod and the bearing being so formed as to have co-operative bearing engagement.

2. The combination with a driving motor, of a hollow shaft therefor, a rod extending through the hollow shaft and secured to it at one end, a gear member secured to the free end of the rod, a bearing member for the first named end of the hollow shaft, and a bearing for the other end of the hollow shaft and for the adjacent end of the rod.

3. The combination with a driving motor, of a rotatable supporting member therefor and a flexible shaft having one of its ends connected to the rotatable member and its other end supported independently thereof, the shaft adjacent to its latter named end being of enlarged cross-sectional area and comparatively rigid.

4. The combination with a driving motor, of a rotatable supporting member therefor and a shaft having one of its ends connected to the rotatable member and its other end supported independently thereof and adapted to carry a gear wheel, the shaft being of comparatively small cross-sectional area adjacent to its first-named end and increasing in cross-sectional area in a direction towards its other end.

5. The combination with a driving motor, of a rotatable supporting member therefor and a shaft having one of its ends connected to the rotatable member and its other end supported independently thereof, the shaft adjacent to its first-named end being

of reduced cross-sectional area and adapted to yield readily under torsional stresses.

6. In driving mechanism, a flexible shaft, a bearing adjacent to one end of the shaft, a driving connection adjacent to the bearing, a driving connection adjacent to the other end of the shaft, and means for supporting the latter named end against strains,

the first-named end of the shaft being of relatively large cross-sectional area.

In testimony whereof, we have hereunto subscribed our names this 18th day of April, 1921.

JOHN M. LABBERTON.
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