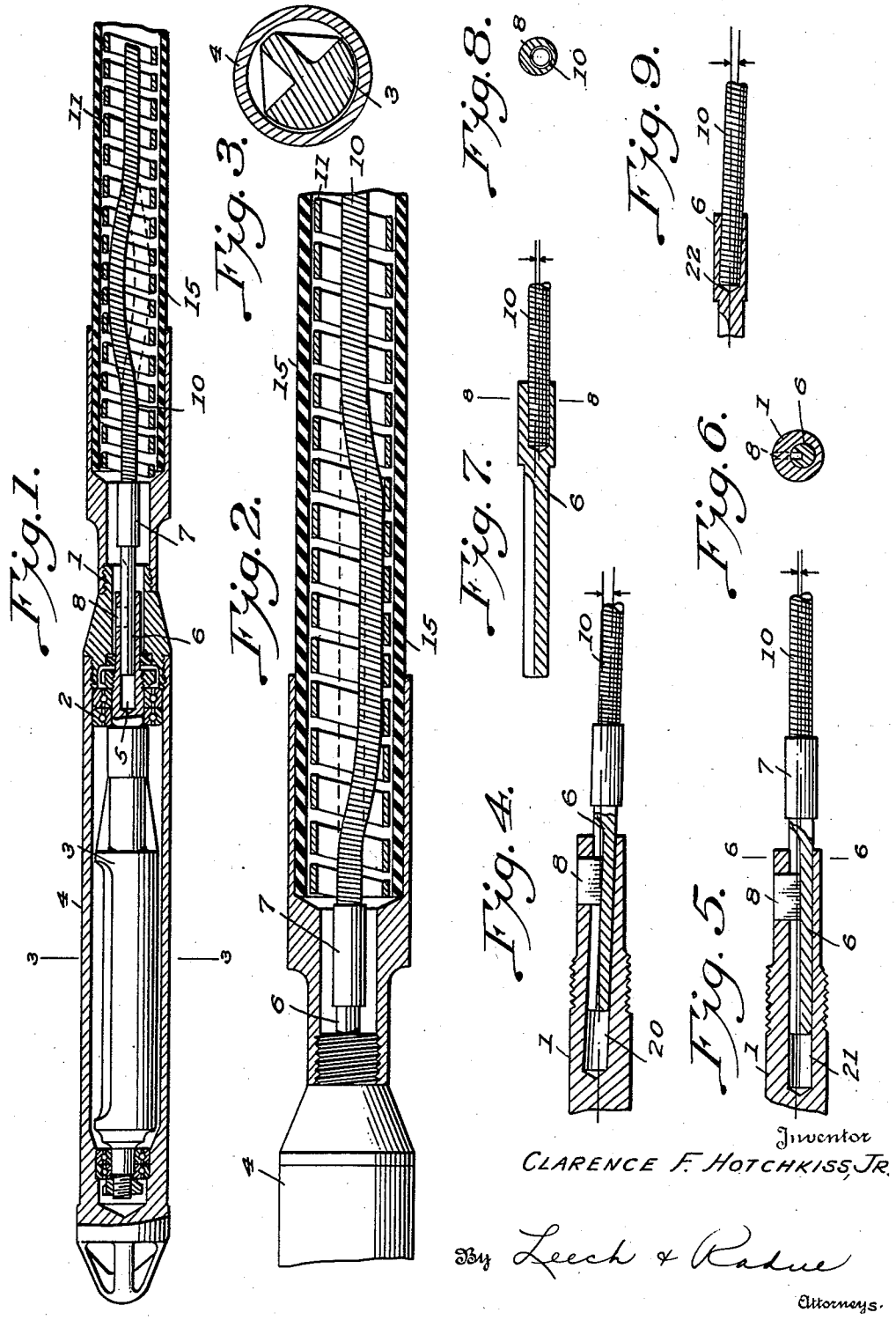
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FLEXIBLE SHAFTING

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FLEXIBLE SHAFTING

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This invention relates to flexible shafting and more particularly to the driven end of the flexible shafting and its cooperating fitting with a member to be rotated thereby.

The primary object of the invention is to minimize or prevent the terrific wear on the flexible shafting when used to drive a concrete vibrator by reason of its throw or contact with the conventional outer casing normally positioned around the shafting.

An object of the invention is to provide an improved driving means for concrete vibrators, plastic compactors or similar instrumentalities by means of a driven flexible shaft of the type formed from a spirally wound wire positioned in an outer metal casing. This broad combination has been used for many years, but when driving such tools or devices, the flexible shafting is projected by the eccentric action of the vibrator at a point near its driving end in such a manner that the spiral coil of the shafting strikes the outer casing and rapidly deteriorates the shafting.

The present invention has particular application in driving concrete compactors of the type using eccentrically mounted or offset weights attached to a driven spindle, as vibrators or compactors of this class create vibration of such magnitude that the flexible shafting is rapidly worn out adjacent the end of the shafting protruding from the casing and attached to the vibrator spindle.

The salient feature, therefore, of this invention is the provision of means for positioning the end of the flexible shaft with relation to the end fitting or the position of the end fitting with relation to the member to be rotated. The following specification and accompanying drawings disclose several forms of the invention and it will be observed that in each instance, the broad concept is the positive displacement of the end of the flexible shaft so that it will lie in offset lateral alignment with the normal longitudinal axis of the device to be rotated.

In the drawing:

Figure 1 is a longitudinal view, mostly in section of a conventional vibrator with the flexible shaft affixed centrally of the vibrator spindle and showing the position assumed by the shaft when it is rotated.

Figure 2 is an enlarged vertical section of the coupling portion of the flexible shaft and vibrator and spindle of this improvement showing the flexible shaft at rest and in dotted lines the position assumed when rotated.

Figure 3 is a cross sectional view taken on line 3—3 of Figure 1 showing a conventional form of the eccentric weight whose rotation creates the wear on the flexible shaft.

Figure 4 discloses the flexible shaft end fitting coupled with the vibrator spindle in non-axial alignment therewith.

Figure 5 is a modification showing the shaft fitting mounted eccentrically in the vibrator spindle.

Figure 6 is a vertical section taken on line 6—6 of Figure 5.

Figure 7 is a modification showing the flexible shafting per se mounted in an oblique bore in the shaft fitting.

Figure 8 is a vertical section taken on line 8—8 of Figure 7.

Figure 9 is a further modification showing the flexible shafting terminating in an eccentrically positioned bore in the shaft fitting.

As before stated, the crux of this invention is the distorting or positioning of the driven end of a flexible shaft with relation to the member to be rotated so that it will not be worn and damaged by contact with the metal of the enveloping casing which is positioned around the flexible shaft from its driving end fitting to the driven end which is coupled with a suitable source of rotating power.

Ordinarily in concrete compactors the flexible shafting immediately adjacent the end fitting, and specifically for a distance of 2 to 8 inches, is normally thrown outwardly by an eccentric or centrifugal action and other dynamic forces in the form of a spiral convolution and violently contacts and rubs against the inner surface of the outer protective casing to such an extent that the flexible shafting is rapidly worn and seriously damaged. Thus, in ordinary practice, flexible shaftings used for driving concrete vibrators will only stand up for a comparatively few hours when they must be replaced at a considerable money loss and expenditure of labor. By compensating for this initial swing out or centrifugal action of the flexible shaft adjacent its driven end, the wearing out of the flexible shafting is practically eliminated and, by following the teachings of this invention, the life of flexible shafts for driving concrete vibrators has been increased many fold.

To more fully explain and illustrate the invention, Figure 1 of the accompanying drawing illustrates a conventional concrete vibrator having the usual centrally and axially aligned flexible shaft for rotating the eccentric or offset

weight. When the flexible shafting is at rest, it extends centrally of its outer casing in a straight line but when rotated at a high speed, it is thrown out of alignment and strikes the casing as shown in both full and dotted lines. Here, numeral 1 denotes a rotary shaft or spindle mounted in suitable ball bearings 2 and carrying one or more eccentrically positioned weights 3 keyed onto the rotary spindle, the vibrator being mounted in a shell 4. This particular apparatus merely shows one type of concrete compactor in which the present invention has met with startling success.

The spindle 1 is provided with a central axial bore 5 within which is mounted the shaft fitting or tip 6 having a socket 7 and mounted in fixed relation therewith through the medium of a key or spline 8.

The flexible shaft 10 is, as far as structure, more or less conventional and consists of one or more layers of spirally wound wire. The shaft is protected by a suitable flexible casing 11 made up of one or more metallic spiral members 11, and the interior diameter thereof is such that it does not bind the flexible shaft 10. However, when rotated at high speed, the portion of the flexible shafting near the driven end and ordinarily within a distance of 2 to 8 inches of the end fitting generates an outward swing or bulge probably due to a combined eccentric and centrifugal action, and this portion of the shafting strikes or rubs the metal of the outer casing with enough force to rapidly wear the shaft winding. This eccentric or whip action assumed by the driven flexible shaft is illustrated in Figure 1 where the shaft is shown thrown against the interior of the spiral casing 11.

To overcome this tendency and the outward wear, the present invention was developed after considerable experimentation and labor and broadly, the invention consists in distorting the shafting to place it out of true axial alignment with the driven spindle or to mount the fitting within the spindle or the flexible shafting within the fitting socket in non-axial alignment with these parts to compensate or overcome the tendency of the flexible shaft to move outwardly and wear against the inner surface of the outer casing. During extended tests with conventionally positioned shafting, the end portion of the shafting near the fitting shows a distinct spiral wear on the shafting and after a few hours weakens the shafting to such an extent that it must be replaced. The remainder of the shafting rotates within its outer casing with practically no wiping action thereagainst and the wear, therefore, occurs only near the driven end thereof.

Referring now to Figure 2, it will be observed that the flexible shafting 10 at an approximate point indicated by numeral 15, is deliberately bent or distorted outwardly in a direction opposite to the spiral bulge normally generated in this portion of the flexible shafting when it is under load. It is assumed in Figure 2 and throughout other figures that the flexible shafting is being driven in a clockwise direction. This distortion of the flexible shafting 10 compensates for the eccentric-centrifugal action and, therefore, when rotated at high speed, the portion adjacent the distorted part at 15 is moved or forced into the central portion of the outer casing, as shown in dotted lines, and the flexible shafting, therefore, does not rub or strike against the casing.

The several other figures of the drawing show different means of accomplishing the desired result. Thus, in Figure 4, the flexible shaft fitting 6 is mounted in an oblique or angular bore 20 so that the end portion of the shaft 10 is not in axial alignment with spindle 1.

Figures 5 and 6 show the end fitting 6 in a bore 21 which is parallel with but eccentric to the true center of the vibrator spindle.

Figures 7 and 8 show still another manner of accomplishing the desired results in which the flexible shafting 10 terminates and is secured within an eccentrically positioned bore in the socket portion 22 of the fitting.

In Figure 9, the flexible shafting terminates within the socket 22 of the end fitting at an oblique angle to the longitudinal center of the fitting.

Thus, in these several modified forms, the advantages described in detail above are inherent and in each embodiment the flexible shafting of the concrete vibrator is prevented from striking the inner wall of the outer protective casing through the compensating offset angle or position of the end fitting or terminus of the shaft in relation to the central longitudinal axis of the driven spindle.

What I claim is:

1. A flexible shaft for a concrete vibrator having an eccentric weight adapted to be rotated by a flexible shaft, said shaft being formed of a spirally wound wire encased in an outer casing, the combination therewith of a connection fitting secured to the driven end of the shaft, the portion of the said shaft adjacent the said fitting being laterally distorted in a direction opposite that of the direction of normal distortion of said shaft.

2. A flexible shaft for a concrete vibrator having an eccentric weight adapted to be rotated by a flexible shaft, said weight being mounted on a shaft connected to said flexible shaft, the portion of the said shaft adjacent the point of connection with the said weight being laterally distorted in a direction opposite that of the direction of normal distortion of said shaft.

3. A concrete vibrator including an eccentric weight adapted to be rotated by a flexible shaft, said weight being mounted on a shaft connected to said flexible shaft, and means for bringing the flexible shaft into axial alignment with the vibrator shaft when the flexible shaft is driven at high speed, said means comprising distorting the portion of the said flexible shaft adjacent its point of connection with the vibrator shaft in a direction opposite to that of the direction of centrifugal distortion of said flexible shaft.

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