Full name(s) of Applicant(s)  We WALKERS LIMITED

Address(es) of Applicant(s) 23 Bowen Street, Maryborough, 4650, Queensland, Australia

hereby apply for the grant of a Standard patent for an invention entitled

"IMPROVED LUBRICATION SYSTEM FOR GEARS"

which is described in the accompanying provisional complete specification.

My/Our address for service is:

C/- SPRUSON & FERGUSON
PATENT ATTORNEYS
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Dated this TWENTY FOURTH day of SEPTEMBER, 19 81
WALKERS LIMITED

By: Registered Patent Attorney


The present invention relates to an improved lubrication system for gears. In particular, the invention
1. A lubricated gear train comprising a plurality of gears in meshing relationship, at least one gear being partly submerged in a bath of lubricating liquid in use, whereby the teeth of said at least one gear pass through said lubricating liquid during rotation of said gear; characterized in that said lubricated gear train comprises a curved trough of generally U-shaped cross-section having side portions and a base portion, said curved trough being positioned to receive therein a plurality of teeth of said gear and extending from said lubricating liquid along the circumference of said gear in the direction of rotation, said side portions being in juxtaposition with respective side walls of said plurality of teeth and said base portion being adjacent the circumferential edges of said teeth, whereby in use, lubricating liquid is collected between adjacent ones of said teeth during passage through said liquid and transported between said adjacent teeth and said trough to at least a further one of said gears.
7. A trough for use in lubricating gear trains in which a gear is partly submerged in a lubricating liquid bath, characterized in that said trough has a channel cross-section matching the radial cross-section of the gear teeth, said trough being adapted to be mounted around a circumferential portion of said gear extending from said bath to the region of engagement with a further gear, whereby lubricating liquid from said bath is conveyed to said further gear between said gear teeth and said trough.
COMPLETE SPECIFICATION

(Application Number: PF0908
Lodged: 24th September, 1981
Priority: LODGED AT SUB-OFFICE
Published: Sun. 0V. 1
0000 TWO DOLLARS

Complete Specification for the invention entitled:
"IMPROVED LUBRICATION SYSTEM FOR GEARS"

The following statement is a full description of this invention, including the best method of performing it known to me/us:

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Completed Specification Lodged:

Partial Specifications Lodged:

Accepted:

Lodge AUSTRALIAN
5 SEP 1982

Int. Class

Class

110'

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The present invention relates to an improved lubrication system for gears. In particular, the invention is directed to the improved lubrication of roller driving pinions of a sugar cane crushing mill, although the invention is not limited thereto.

In known systems for lubricating gear trains, at least one gear or pinion is wholly or partly submerged in a bath of lubricating liquid, such as oil, so that the teeth pass through the lubricating liquid as the gear or pinion is rotated. (The terms "gear" and "pinion" are used interchangeably throughout the specification). Lubricating liquid which has been collected on the teeth is then transferred to another meshing gear by direct contact.

A known oil bath lubrication system for a gear train comprising the roller pinions of a crushing mill is shown in Fig. 1. The oil level in the oil bath 7 is indicated by the line A. Driven pinions 5 and 6 are rotated in an anti-clockwise direction by the driving pinion 4 which rotates in a clockwise direction. The oil lubricant is collected by the leading edge of the teeth of the pinions 5 and 6 as shown at B. During rotation of the driven pinions 5 and 6, a considerable amount of the lubricant drains from the teeth thus leaving a thin film of lubricant only on the non-pressure side of the driven pinion teeth 5 and 6, i.e. the leading edge face of the teeth. Little or no lubricant is retained on the pressure side C of the teeth of the driven pinions 5 and 6, and hence, excessive wear of the pinion teeth occurs due to lack of sufficient lubrication at the contact between driving and driven pinions.

It is an object of the present invention to overcome
or substantially ameliorate the abovedescribed disadvantages by providing an improved lubrication system for gears.

According to one aspect of the present invention, there is provided a lubricated gear train comprising a plurality of gears in meshing relationship, at least one gear being adapted to be partly submerged in a lubricating liquid whereby the teeth of said at least one gear pass through said lubricating liquid during rotation of said gear, characterized in that said lubricated gear train comprises a curved trough of generally U-shaped cross-section having side portions and a base portion, said curved trough being positioned to receive therein a plurality of teeth of said gear and extending from said lubricating liquid along part of the circumference of said gear in the direction of rotation, said side portions being in juxtaposition with respective side walls of said plurality of teeth and said base portion being adjacent the circumferential edges of said plurality of teeth, whereby in use, lubricating liquid is collected between adjacent ones of said teeth during passage through said liquid and transported between said adjacent teeth and said curved trough to at least a further one of said gears.

The plurality of gears can form part of a pinion train for driving rollers in a sugar cane crushing mill. Preferably, the lubricating liquid is oil.

According to a further aspect of the present invention, there is provided a trough for use in lubricating gear trains in which a gear is partly submerged in a lubricating liquid bath, characterized in that said trough has a channel cross-section matching the radial cross-section of the gear teeth, said trough being adapted to be mounted
around a circumferential portion of said gear extending from said bath to the region of engagement with a further gear, whereby lubricating liquid from said bath is conveyed to said further gear between said gear teeth and said trough.

Notwithstanding any other forms that may fall within its scope, the invention will now be described with reference to a preferred embodiment thereof as illustrated in the accompanying drawings in which:

Fig. 1 is a schematic elevational view of a pinion train using a prior art lubrication system.

Fig. 2 is a schematic elevational view of a pinion train using the lubrication system of a preferred embodiment of the invention.

Fig. 3 is an end elevational view of the pinion train of Fig. 2.

The pinions shown in Figs. 1 and 2 are adapted to drive the rollers of a sugar cane crushing mill, although they can be used in other suitable applications. Power is transmitted to the shaft 1 of the top roller from a drive gear shaft (not shown). The top roller pinion 4 operates in mesh with the feed roller pinion 5 and the delivery roller pinion 6 and conveys power to the feed roller shaft 2 and the delivery roller shaft 3.

In the known apparatus of Fig. 1, pinions 5 and 6 are lubricated by immersion in an open oil bath which forms part of the pinion guard system 7. The lower tips of the teeth of the feed roller pinion 5 and the delivery roller pinion 6 only are partly submerged in the lubricant while the top roller pinion 4 is lubricated by oil which is carried up by the feed roller pinion 5 and the delivery roller pinion 6.
As described hereinbefore, the lubricant is retained on the non-pressure side of the pinion teeth only, and adequate lubrication is not provided for the pressure side (C) thereby permitting excessive wear of the pinion teeth to occur.

In the lubricated gear train of the preferred embodiment shown in Fig. 2, troughs 8 are provided which fit closely to at least a portion of the pinions 5 and 6. The troughs 8 are in the form of a curved member of U-shaped cross-section, the sides of the trough fitting closely to the flat lateral sides of the pinion teeth, and the base of the trough being curved to fit closely to the top lands of the teeth of pinions 5 and 6 as shown in Fig. 2. Preferably, the troughs 8 extend into the lubricant bath. The troughs 8 extend along the circumference of the pinions 5 and 6 in the direction of rotation thereof. Typically, each trough extends to the region of engagement between the driving pinion 4 and the corresponding driven pinion 5 or 6. Preferably, the side portions of the troughs 8 extend to cover the respective region of engagement between the driving and driven pinions, the base portions ending before the respective region of engagement to allow the pinion teeth to mesh.

Thus, the lubricant is collected between the teeth of the driven pinions 5 and 6 as they pass through the lubricant bath into a respective one of the curved troughs 8. The lubricant is thus trapped between the sides of the trough, the base of the trough, and the opposite faces of adjacent teeth, thereby ensuring that large quantities of the lubricant are transferred to the load or pressure side of the teeth of the driving pinion 4.
Preferably, the troughs are held in place by mounting brackets 9 which allow the position of the troughs to be adjusted. In this manner, the troughs 8 can be fixed at a minimum clearance from the tips or top lands of the teeth of the driven pinions 5 and 6 as they pass through the troughs 8. To achieve this, the curvature of the inside of the base portion matches the arc described by the tips of the teeth. As the sides of the trough fit closely to the flat side faces of the teeth, the oil is trapped between the teeth and provides adequate lubrication for the driving pinion.
The claims defining the invention are as follows:

1. A lubricated gear train comprising a plurality of gears in meshing relationship, at least one gear being partly submerged in a bath of lubricating liquid in use, whereby the teeth of said at least one gear pass through said lubricating liquid during rotation of said gear; characterized in that said lubricated gear train comprises a curved trough of generally U-shaped cross-section having side portions and a base portion, said curved trough being positioned to receive therein a plurality of teeth of said gear and extending from said lubricating liquid along the circumference of said gear in the direction of rotation, said side portions being in juxtaposition with respective side walls of said plurality of teeth and said base portion being adjacent the circumferential edges of said teeth, whereby in use, lubricating liquid is collected between adjacent ones of said teeth during passage through said liquid and transported between said adjacent teeth and said trough to at least a further one of said gears.

2. A lubricated gear train as claimed in claim 1, wherein said trough extends from within the lubricating liquid bath to the region of engagement with said further gear, said base portion terminating before said region of engagement, and said side portions extending circumferentially beyond said region of engagement.

3. A lubricated gear train as claimed in claim 1 or 2, wherein said trough is adjustably held in position by mounting brackets.

4. A lubricated gear train as claimed in any
in said lubricating liquid bath, and a driving gear above and
in engagement with said two driven gears, each said driven
gear having a said trough extending from the lubricating
liquid bath to said driving gear.

5. A lubricated gear train as claimed in any
preceding claim, wherein said lubricating liquid is oil.

6. A lubricated gear train as claimed in any
preceding claim, wherein said gear train forms part of a
sugar cane crushing mill.

7. A trough for use in lubricating gear trains in
which a gear is partly submerged in a lubricating liquid
bath, characterized in that said trough has a channel
cross-section matching the radial cross-section of the gear
teeth, said trough being adapted to be mounted around a
circumferential portion of said gear extending from said bath
to the region of engagement with a further gear, whereby
lubricating liquid from said bath is conveyed to said further
gear between said gear teeth and said trough.

8. A lubricated gear train substantially as
described herein with reference to Figs. 2 and 3 of the
accompanying drawings.

DATED this SIXTH day of SEPTEMBER, 1982
WALKERS LIMITED
Patent Attorneys for the Applicant
SPRISON & FERGUSON
Roller pinion 4 is lubricated by oil which is carried up by the feed roller pinion 5 and the delivery roller pinion 6.