PATENT SPECIFICATION (11) 1 575 340

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(21) Application No. 50988/77 (22) Filed 7 Dec. 1977 (19)

(31) Convention Application No. 2655909 (32) Filed 9 Dec. 1976 in

(33) Fed. Rep of Germany (DE)

(44) Complete Specification Published 17 Sep. 1980

(51) INT. CL.[3] F16H 55/44 55/04 55/30

(52) Index at Acceptance
F2Q 2D 2H 7H2A

(54) IMPROVEMENTS RELATING TO PULLEYS AND GEAR WHEELS

(71) We, BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT, of P.O. Box 40 02 40, 8 Munich, 40, Federal Republic of Germany, a German Company, and WINKELMANN & PANHOFF GmbH, of Schmalbachstrasse 2, 4730 Ahlen, Federal Republic of Germany, a German Company, do hereby declare this invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to pulleys and gear wheels and is applicable particularly but not exclusively to toothed pulleys for engagement with toothed belts.

The object of the invention is to provide an improved form of pulley or gear wheel made from sheet metal.

According to the invention we provide a pulley or gear wheel formed of sheet metal, having a rim and having a hub integral with a web, the hub being cup shaped with a cylindrical wall adapted to form a seat for a shaft end and with a bottom wall adapted to form an abutment for such shaft end, and the edge of the hub merging with the web of the wheel.

Subsidiary features of the invention are set out in the ensuing claims that are subsidiary to claim 1.

Three embodiments of the invention will be described by way of example with reference to the accompanying drawings in which:-

Figure 1 shows in section a toothed belt pulley composed of two formed sheet metal parts, the seat of the hub and the toothed rim being formed on one sheet metal part and the second sheet metal part being used as a reinforcement part.

Figure 2 is a front view of the toothed belt pulley of Figure 1.

Figure 3 shows in section a toothed belt pulley similar to Figures 1 and 2, wherein the reinforcement part is connected additionally to the other sheet metal part in the region of a radial web, and

Figure 4 shows a toothed belt pulley similar to Figures 1 to 3, wherein the toothed rim is formed on one sheet metal part and the hub seat is formed on the other sheet metal part.

A toothed belt pulley 1 as shown in Figures 1 and 2 is composed of two sheet metal parts 2 and 3 which are deep-formed to different depths in an approximately cup-shaped manner, the part 3 being disposed within the part 2. The two parts are permanently connected at connecting areas by soldering, namely in the region of the toothed rim 4 which is formed on the sheet metal part 2 axially at the periphery, and in the region of a radial bottom wall 5 of a cup-shaped hub 6 formed on the sheet metal part 2. Between a cylindrical seat 7 of the hub 6 and the toothed rim 4 radial and conical annular web zones 8, 9 and 10 respectively are formed in the sheet metal part 2. Formed on the sheet metal part 3 at the periphery is an axial ring 11 which abuts internally on the toothed rim 4 of the sheet metal part 2 and is soldered to it. By way of a conical annular web zone 12 and a radial annular web zone 13 the ring 11 of the sheet metal part 3 is connected with a centrally formed circular recess 14 which is adapted to the bottom wall 5 of the hub 6 of the sheet metal part 2 and is soldered to the said hub to lie flat against it. This arrangement of the two sheet metal parts 2 and 3 has the result that the hub consisting of the bottom wall 5 and the seat 7 is provided by means of the radial and conical annular web zones 8, 9, 10, 12 and 13 with a substantially box-section rigid connection with the toothed rim 4, the connecting surfaces of large area helping to make for greater rigidity. Because of this arrangement the toothed belt

pulley 1 can transmit considerable torques and other forces from the toothed rim 4 to a shaft connected with the hub 6, with very good true-running precision, minimal deformation during operation, and a long working life.

The toothed belt pulley 101 of Figure 3 corresponds in basic construction to that of Figures 1 and 2. In this toothed belt pulley also, two cup-shaped sheet metal parts 102 and 103 are disposed within one another, and are soldered flat against one another both in the region of a bottom wall 105 and a recess 114 and also in the region of a toothed rim 104 and an axial ring 111. Additionally, in the arrangement shown in Figure 3, the sheet metal part 102 is provided at the edge of the hub 106 with seat 107 formed with an annular ridge 115 which is followed as seen in the outward direction by a radial annular web zone 108, the latter being soldered lying flat against a likewise radial annular web zone 113 of the sheet metal part 103. The two sheet metal parts 102 and 103 are followed in the outward direction by axially oppositely directed conical annular web zones 110 and 112 respectively, and the sheet metal part 102 by a further radial annular web zone 109, these merging into the axial toothed rim 104 and into the axial ring 111 respectively. The sheet metal part 103 here too is exclusively a reinforcing part and is of substantially greater wall thickness than the sheet metal part 102. Since the deformations of the sheet metal part 103 are relatively shallow, shaping those deformations does not involve any difficulty despite the greater wall thickness, but on the other hand that greater wall thickness in conjunction with connection regions of large area with the sheet metal part 102 and connection between the hub 106 formed on the relatively thin-walled sheet metal part 102 and the toothed rim 104 formed also on the sheet metal part 102 all help to make for good shape-retaining ability. This construction is particularly suitable for toothed belt pulleys of relatively large diameter such as are used for driving the cam shafts of internal combustion engines.

A toothed belt pulley 201 of Figure 4 corresponds in large measure to those of Figures 1, 2, and 3. In this case the cup-shaped hub 206 is formed on one sheet metal part 203 and the toothed rim 204 on the other sheet metal part 202 (which therefore does not act solely as a reinforcement). The sheet metal part 202 with a toothed rim 204 formed on it, has in this case a circular shallow recess 214 for receiving the surface of the bottom wall 205 of the hub 206 of the other sheet metal part 203. The edge of the hub 206 by the seat 207 is adjoined by an annular ridge 215 which merges directly into a conical annular web zone 212 of the sheet metal part 203, the latter in turn merging into a radial annular web zone 213 and its outer edge into an axial ring 211 constituting a connecting flange with the toothed rim 204 of the other sheet metal part 202. The other sheet metal part 202 has adjacent the outer edge of the recess 214, a relatively flat or comparatively shallow annular ridge 216 which merges into a conical annular web zone 210 extending to the end face of the sheet metal part 202 with a radial annular web zone 209 which is followed by the axial toothed rim 204. The conical annular web zones 210 and 212 of the two sheet metal parts are disposed so as to be in direct contact with one another and are connected by soldering, like the bottom wall 205 of the hub 206 with the recess 214 and the toothed rim 204 with the axial ring 211. The two inner annular ridges 215 and 216 and the outer annular web zones 209, 210 and 213 with the toothed rim 204 form in each case substantially box-shaped hollow structures of very good rigidity, whereby this construction is also able to tramsit high torques and other forces whilst requiring little space and manufacturing outlay, and maintaining good dimensional precision, whilst keeping the weight of the toothed belt pulley very light.

The hub construction described above in relation to toothed belt pulleys can advantageously be used also with similar machine parts, such as flat belt and V-belt pulleys and also gear wheels and toothed chain wheels (which latter we regard as and which shall be taken for the purposes of this specification as a form of pulley).

High dimensional precision can be achieved in the axial, radial and circumferential directions by use of the toothed belt pulleys described above, when secured to a smooth shaft end, whether by a force fit or by a screwed connection by means of a screw secured in the shaft end and where appropriate a fitted pin for the location of the rotational position. It is also possible in a simple manner to obtain very precise true running of the toothed rim relatively to the seat by a combination of accurate finishing of the tooth flanks and of the seat surface by calibration pressing.

WHAT WE CLAIM IS:-

1. A pulley or gear wheel formed of sheet metal, having a rim and having a hub integral with a web, the hub being cup shaped with a cylindrical wall adapted to form a seat for a shaft end and with a bottom wall adapted to form an abutment for such shaft end, and the edge of the hub merging with the web.

2. A pulley or gear wheel according to claim 1, wherein the hub has an annular ridge at its outer edge.

3. A pulley or gear wheel according to claim 1 or claim 2 wherein the edge of the hub is followed as seen in the outward direction by radial and/or conical annular web zones.

4. A pulley or gear wheel according to any of claims 1 to 3 wherein the bottom wall of the hub is of double wall construction composed of two sheet metal parts, one of said sheet metal parts extending to connecting areas being a flat region of the web and/or being internally of the rim of the other sheet metal part, the two sheet metal parts being permanently connected to each other both at the bottom wall of the hub and at the said connecting area(s).

5. A pulley or gear wheel according to claim 4 wherein one of the two sheet metal parts has a recess in which the bottom wall of the hub of the other is received.

6. A pulley or gear wheel according to claim 4 in combination with claim 2, wherein one of the two sheet metal parts has the annular ridge and the other is so connected to it at the outer rim of the annular ridge.

7. A pulley or gear wheel according to any of claims 4 to 6 wherein one of the sheet metal parts acts solely as a reinforcement part for the other.

8. A pulley or gear wheel according to claim 7 wherein the sheet metal part that acts as reinforcement part for the other is of substantially greater wall thickness than that other.

9. A pulley or gear wheel according to any preceding claim wherein the rim is of toothed configuration thereby constituting the wheel as a toothed belt pulley or a gear wheel or a toothed chain wheel.

10. A pulley or gear wheel according to claim 9 in combination with any of claims 4 to 6 wherein one of the sheet metal parts has the cylindrical side wall of the hub and the other has the toothed rim.

11. A pulley or gear wheel according to any of claims 1 to 8 wherein the rim is flanged or grooved thereby constituting the wheel as a flat belt or a V-belt pulley.

12. A pulley or gear wheel formed of sheet material, substantially as shown in and hereinbefore described with reference to Figures 1 and 2 of Figure 3 or Figure 4 of the accompanying drawings.

13. The combination of a pulley or gear wheel according to any preceding claim and a shaft, the end of the shaft being seated and a close fit in the cyindrical side wall of the hub and the shaft in close abutment with the bottom wall of the hub.

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Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1980.
Published by The Patent Office, 25 Southampton Buildings,

1575340 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig.1

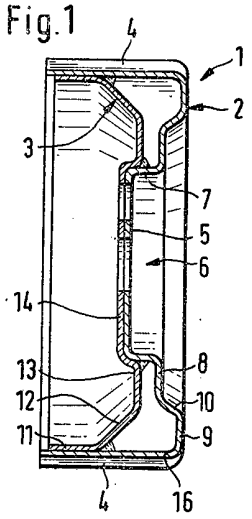

Fig.2

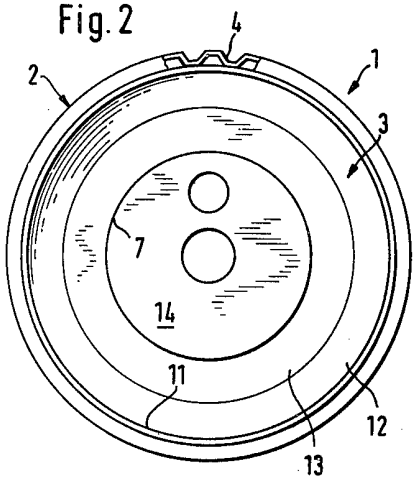

Fig.3

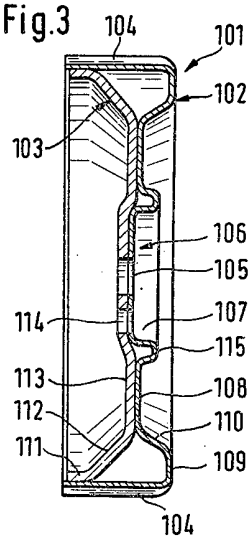

Fig.4