

## PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) SHOCK-ABSORBING BEARING AND METHOD FOR MANUFACTURING IT

5 (71) We, JANOS KURUCZ, of 21 Rte Neuve, Orient, Vaud, Switzerland, a citizen of Hungary, and ANDRE MATTHEY, of 33 Les Jeannerets, Le Locle, Neuchâtel, Switzerland, a citizen of Switzerland, do hereby declare the 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:—

10 The present invention relates to a shock absorbing bearing for timepieces and small apparatus, as well as to a method for its manufacture.

15 The shock absorbing bearings known up to now comprise either a hole jewel and an end jewel independent one from another, moving when radial and axial shocks, respectively, are applied to the shaft, against the action of resilient return means, or a bearing body constituted by the hole jewel and by the end jewel forming a whole moving against the action of a resilient return device when axial and radial shocks are applied to the shaft.

20 In these several embodiments, the shock absorbing bearing comprises one or several return springs intended to absorb the shocks and to return into their central position the elements which have been moved during the shocks.

25 The main object of the present invention is to provide an improved shock absorbing bearing which does not require a return spring.

30 According to the present invention a shock absorbing bearing for a timepiece or other small mechanism comprises a cylindrical blind bush located in a housing, the blind hole in said bush being of circular section and extending into the bush axially from an end face thereof to form a bearing for a rotating shaft, said bush forming a fit with the housing to prevent lateral movement therein and the bush being formed with one or more ribs or flanges around its side face to engage complementary formations in the interior of

the housing for the purpose of preventing axial play of the bush in the housing, said bush being of a solid self lubricating plastics material which is resiliently deformable and at least the bearing hole having a relatively hardened surface.

The bearing may comprise a housing provided with a central recess in which is located, without play, a solid blind bearing bush, made of plastics material, in which is provided a blind hole which in operation will be engaged by the extremity of a shaft, in such a way that the axial and lateral shocks applied to the shaft are absorbed by the elasticity of the mass of plastics material, the bearing bush being axially and radially rigid with the housing.

The invention also comprises a method of manufacturing such a bearing including the steps of inserting into a housing a plastics material of a type which in the final state is self lubricating and resiliently deformable, compressing the heated plastics material between two punches to form a blind bearing bush, one of the punches being shaped to form a blind bearing hole in the end face of the bush and the other of the punches compressing the material to cause it to fill the interior of the housing, the pressure exerted between the punches being such as to cause the formation of a relatively hard surface skin on the plastics material at least around the bearing hole.

The method of manufacturing this bearing has the advantage that the blind bearing bush, in plastics material, is obtained by mouldings, in the housing itself, this housing thus constituting an element of the mould.

In order that the invention may be more clearly understood reference will now be made to the accompanying drawings which show, by way of example, several embodiments of the invention and in which:—

Figure 1 is a sectional view of a first embodiment of a shock absorbing bearing for the balance shaft of a time-piece, in which

one extremity of this shaft has been represented;

Figure 2 is a sectional view of the bearing of Figure 1, during its manufacture, in which is represented the equipment permitting the moulding of the bearing body in plastics material;

Figure 3 is a sectional view of a second embodiment of a shock absorbing bearing for the balance shaft of a timepiece, in which one extremity of this shaft has been represented;

Figure 4 is a sectional view of a third embodiment of a bearing for timepieces or other small mechanisms, in which is represented the equipment for the moulding of the bearing bush of plastics material; and

Figure 5 is a sectional view of a fourth embodiment of a bearing for timepieces or other small mechanisms.

The bearing represented in Figures 1 and 2 comprises a housing 1 intended to be forced into the balance cock of a clockwise mechanism and which is provided with an outer shoulder 1a.

The housing 1, preferably made of brass, is provided with a central recess 2 in which is located a blind bush 3 made of self-lubricating plastics material. This blind bush occupies the recess 2 in the housing without play, so that it is rigidly located, axially and radially, within the housing 1. To this end the housing is formed with an internal end flange and the side wall of the recess 2 is provided with an annular groove 4 providing a shoulder 1b against which a flange on the bush abuts, thus ensuring that no axial relative displacement can occur between the bush 3 and the housing 1.

The bush 3 is provided with a blind hole 5 intended to receive the extremity 6a of a balance shaft, partially represented, designated by 6, which passes through a passage 7 provided in the bottom 1c of the support 1. The blind hole 5 of the body 3 is slightly frusto-conical.

The body 3 being of a solid plastics material which is resiliently deformable, the shocks, both axial and radial which are applied to the shaft, are absorbed by the elastic deformation of the bush itself, without special resilient means for returning it being necessary.

The method of manufacturing the above disclosed bearing consists in placing the housing 1 on a cylindrical punch 8 provided with a frusto-conical bearing surface 9 which, co-operating with the edge of the aperture 7 of the support, ensures the concentricity of these two elements, in placing in the recess 2 of the housing 1 a piece of plastics material, preferably of thermoplastic material, this piece of plastics material preferably comprising a small pellet located freely in the recess 2, then compressing this plastics material between the punch 8 and a second punch 10,

which is axially pressed towards punch 8. This latter punch is provided, at its centre, with a frusto-conical teat 8a arranged to form in the plastics material, a blind hole 5 intended to receive the end of the shaft.

The end face 11 of the punch 10 is concave, so as to form a convex upper face 12 on the bush 3. During the moulding operation, which is effected in situ, the housing 1 constituting an element itself on of the mould, the excess of plastics material escapes by the annular free space 13 (Figure 2) situated between the edge of the punch 10 and the frusto-conical entrance 14 of the housing 1, the annular edge 15 of the punch 10 cutting the plastics material at the moment where it comes in contact with surface 14.

The moulding is carried out under pressure and when hot, both in cases in which thermoplastic material is used, as well as in cases in which a thermosetting material is used, of the type in which the polymerisation, which would be carried out in situ, is started by heating.

Experience has shown that, provided the moulding is effected with sufficient pressure, there is formed, on the outer surfaces of the moulded piece, and consequently on the surface of the walls of the blind hole 5, a film harder than the rest of the material. This film prevents the extremity 6a of the shaft 6 from injuring the walls of the hole 5 when it exerts a strong pressure on the wall due to the shocks applied to the shaft.

Thus the manufacture of the present bearing is very simple and does not require special assembling means. Moreover, owing to the absence of the centering surfaces that are usually presented by the bearing support, in the case of the known bearings, the only dimensions of this element which have to be very precise are these of the wall of the hole 7 and of the outer cylindrical surface 13 of the housing fitting in the cock or in any other element of the frame of the clockwork or of the apparatus on which is used the bearing.

The bearing represented in Figure 3 comprises a housing 16, made of brass, intended to be forced into the base plate of a clockwork, provided with a central recess in which is located a bush 17 made of self-lubricating plastics material. This bush occupies with negligible play, the central recess of the housing 16, in the exception of the play 18, very low, greatly exaggerated in the drawing for the clarity thereof, due to the contraction which occurs in the plastics material when it is cooling after the moulding.

The support 16 is provided with an annular internal rib 16a, of trapezoidal cross section, the width of which decreases from its base towards its apex which extends into a groove in the material of the bearing body 17.

This rib 16a is situated substantially at



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mid-height of the support 16, in such a way that, during the cooling of the material 17, the contraction is effected from the two free faces thereof, upper and lower, in the direction of its central zone. Consequently, the plays are produced at the places indicated at 18 while, on the contrary, the pressure of the material 17 on the axial upper and lower faces of the rib 16a, indicated by the arrows 19, increases during the cooling of the material 17. Thus is ensured a perfect axial and radial assembling between the bearing body 17 and the support 16. Moreover, owing to the trapezoidal shape of the cross section of the rib 16a, the centring of the bearing body 17 with respect to the support 16 is also ensured.

The support 16 is provided, on its inner axial face, designated by 20, with a blind hole of two diameters 21 and 21a, intended to receive respectively a portion of the shaft, designated by 22, and its end part designated by 22a. Owing to this arrangement, very strong radial shocks which could be applied to the shaft, exceeding the capacity of absorbing of the plastics material 17, and which could produce a breaking of the terminal portion 22 of the shaft, are absorbed by the fact that the shaft abuts against the wall of the part 21 of the blind hole.

The embodiment of Figure 4 distinguishes from this of Figure 3 principally by the shape of the bearing element 23, made of plastics material, constituting the bearing body, the central hole of which is a blind hole 24 merely cylindrical. As a modification, this hole could be traversing. The bearing body, designated by 16 for the reason that it is identical to this one of the first embodiment of Figure 1, is assembled to the bearing body 23 by means of its inner recess 16a, as in the first embodiment.

In this figure, the upper punch 25 and the lower punch 26, used for the hot moulding of the bearing body 23, have been represented.

Finally, in the embodiment of Figure 5, the bearing for timepiece or for small apparatus is less high than in the above mentioned embodiments. Dus to this circumstance, the upper shoulder, designated by 27a, of the support 27, constitutes the annular rib embedded in the plastic material of the bearing body, designated by 28. This material presses on the axial upper and lower faces of the rib 27a, after cooling. The cross section of the rib 27a is likely of trapezoidal shape, as in the previous embodiment.

In this last embodiment, the bearing body extends towards the outer face of the bearing, higher than in the previous embodiments, so that the rib 27a of the support 27 is substantially in the middle portion of the body 28 and the cooling of the material, after moulding, produces the desired effect of pressure of this material on the upper and lower faces of the rib.

It is to be noted that the invention is not limited to bearings for balance shaft, but could be applied to any bearing of timepieces or small apparatus.

#### WHAT WE CLAIM IS:—

1. A shock absorbing bearing for a time-piece or other small mechanism comprising a cylindrical blind bush located in a housing, the blind hole in said bush being of circular section and extending into the bush axially from an end face thereof to form a bearing for a rotating shaft, said bush forming a fit with the housing to prevent lateral movement therein and the bush being formed with one or more ribs or flanges around its side face to engage complementary formations in the interior of the housing for the purpose of preventing axial play of the bush in the housing, said bush being of a solid self lubricating plastics material which is resiliently deformable and at least the bearing hole having a relatively hardened surface.

2. A bearing as claimed in claim 1 in which the housing is formed with an internal end flange and with a groove in the internal face of the side wall forming a shoulder against which a flange around the blind bush abuts, the flange and shoulder preventing axial movement of the bush in the housing.

3. A bearing as claimed in claim 1 in which the internal face of the housing is formed with one or more annular channels having widths which reduce progressively outwards and are engaged by tapered flanges around the blind bush so arranged that the bush remains centered in the housing when it contracts on cooling.

4. A bearing as claimed in any one of the preceding claims in which the diameter of the bearing hole in the blind bush is stepped, the inner part being of a smaller diameter than the outer.

5. A bearing as claimed in any one of the preceding claims in which a frusto-conical surface is formed on the blind bush around the end of the bearing hole.

6. A method of manufacturing a shock absorbing bearing as claimed in claim 1 including the steps of inserting into a housing a plastics material of a type which in the final state is self lubricating and resiliently deformable, compressing the heated plastics material between two punches to form a blind bearing bush, one of the punches being shaped to form a blind bearing hole in the end face of the bush, and the other of the punches compressing the material to cause it to fill the interior of the housing, the pressure exerted between the punches being such as to cause the formation of a relatively hard surface skin on the plastics material at least around the bearing hole.

7. A bearing substantially as herein des-

mid-height of the support 16, in such a way that, during the cooling of the material 17, the contraction is effected from the two free faces thereof, upper and lower, in the direction of its central zone. Consequently, the plays are produced at the places indicated at 18 while, on the contrary, the pressure of the material 17 on the axial upper and lower faces of the rib 16a, indicated by the arrows 19, increases during the cooling of the material 17. Thus is ensured a perfect axial and radial assembling between the bearing body 17 and the support 16. Moreover, owing to the trapezoidal shape of the cross section of the rib 16a, the centring of the bearing body 17 with respect to the support 16 is also ensured.

The support 16 is provided, on its inner axial face, designated by 20, with a blind hole of two diameters 21 and 21a, intended to receive respectively a portion of the shaft, designated by 22, and its end part designated by 22a. Owing to this arrangement, very strong radial shocks which could be applied to the shaft, exceeding the capacity of absorbing of the plastics material 17, and which could produce a breaking of the terminal portion 22 of the shaft, are absorbed by the fact that the shaft abuts against the wall of the part 21 of the blind hole.

The embodiment of Figure 4 distinguishes from this of Figure 3 principally by the shape of the bearing element 23, made of plastics material, constituting the bearing body, the central hole of which is a blind hole 24 merely cylindrical. As a modification, this hole could be traversing. The bearing body, designated by 16 for the reason that it is identical to this one of the first embodiment of Figure 1, is assembled to the bearing body 23 by means of its inner recess 16a, as in the first embodiment.

In this figure, the upper punch 25 and the lower punch 26, used for the hot moulding of the bearing body 23, have been represented.

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In this last embodiment, the bearing body extends towards the outer face of the bearing, higher than in the previous embodiments, so that the rib 27a of the support 27 is substantially in the middle portion of the body 28 and the cooling of the material, after moulding, produces the desired effect of pressure of this material on the upper and lower faces of the rib.

It is to be noted that the invention is not limited to bearings for balance shaft, but could be applied to any bearing of timepieces or small apparatus.

#### WHAT WE CLAIM IS:—

1. A shock absorbing bearing for a time-piece or other small mechanism comprising a cylindrical blind bush located in a housing, the blind hole in said bush being of circular section and extending into the bush axially from an end face thereof to form a bearing for a rotating shaft, said bush forming a fit with the housing to prevent lateral movement therein and the bush being formed with one or more ribs or flanges around its side face to engage complementary formations in the interior of the housing for the purpose of preventing axial play of the bush in the housing, said bush being of a solid self lubricating plastics material which is resiliently deformable and at least the bearing hole having a relatively hardened surface.

2. A bearing as claimed in claim 1 in which the housing is formed with an internal end flange and with a groove in the internal face of the side wall forming a shoulder against which a flange around the blind bush abuts, the flange and shoulder preventing axial movement of the bush in the housing.

3. A bearing as claimed in claim 1 in which the internal face of the housing is formed with one or more annular channels having widths which reduce progressively outwards and are engaged by tapered flanges around the blind bush so arranged that the bush remains centered in the housing when it contracts on cooling.

4. A bearing as claimed in any one of the preceding claims in which the diameter of the bearing hole in the blind bush is stepped, the inner part being of a smaller diameter than the outer.

5. A bearing as claimed in any one of the preceding claims in which a frusto-conical surface is formed on the blind bush around the end of the bearing hole.

6. A method of manufacturing a shock absorbing bearing as claimed in claim 1 including the steps of inserting into a housing a plastics material of a type which in the final state is self lubricating and resiliently deformable, compressing the heated plastics material between two punches to form a blind bearing bush, one of the punches being shaped to form a blind bearing hole in the end face of the bush, and the other of the punches compressing the material to cause it to fill the interior of the housing, the pressure exerted between the punches being such as to cause the formation of a relatively hard surface skin on the plastics material at least around the bearing hole.

7. A bearing substantially as herein des-

cribed with reference to Figures 1 and 2 of the accompanying drawings.

8. A bearing substantially as herein described with reference to Figure 3 of the accompanying drawings.

9. A bearing substantially as herein described with reference to Figure 4 of the accompanying drawings.

10. A bearing substantially as herein described with reference to Figure 5 of the accompanying drawings.

11. A timepiece or other small mechanism incorporating one or more shock absorbing bearings as claimed in any one of claims 1 to 5 or 7 to 10.

12. A method of manufacturing a shock absorbing bearing substantially as herein described with reference to the accompanying drawings.

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