Oct. 6, 1970 E. KOTTHAUS 3,531,843

CUTTER HEAD, PARTICULARLY FOR GEAR-CUTTING MACHINE

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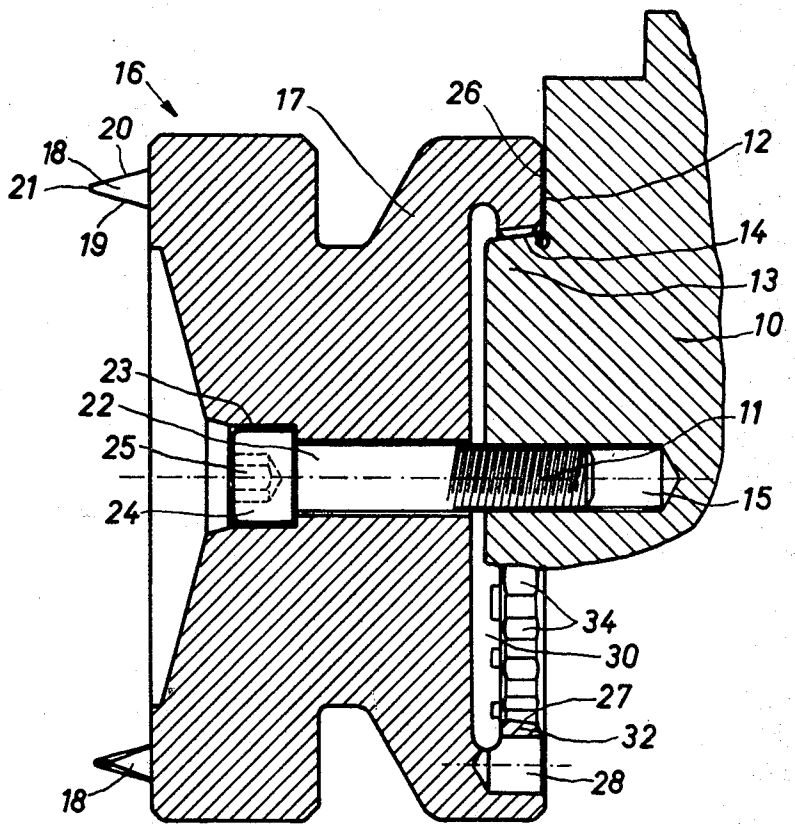
Fig. 1



ERICH KOTTHAUS, Inventor

By Wenderoth, Lind & Ponack

Attorneys

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Fig. 3

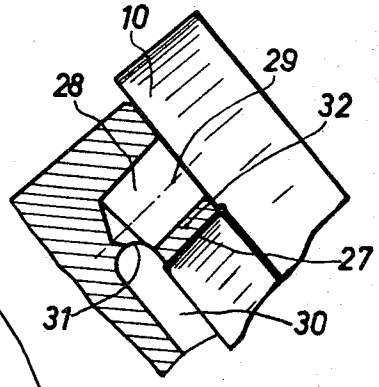

Fig. 2

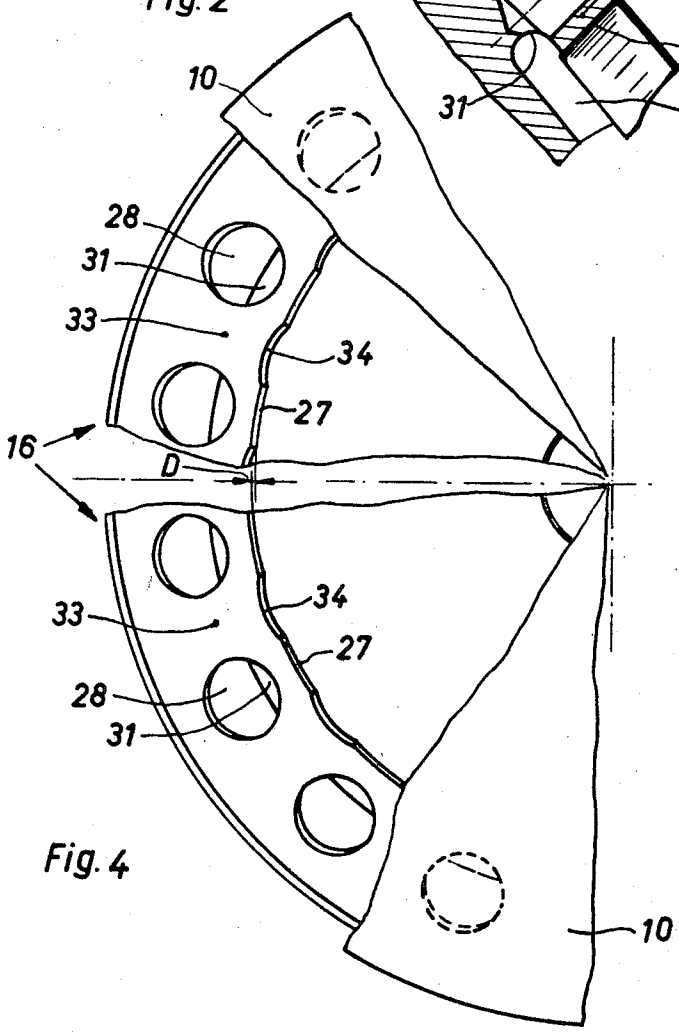

Fig. 4

ERICH KOTTHAUS, Inventor

By Wenderoth, Lind & Ponack
Attorneys

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CUTTER HEAD, PARTICULARLY FOR GEAR-CUTTING MACHINE

Erich Kotthaus, Kloten, Switzerland, assignor to Werkzeugmaschinenfabrik Oerlikon Buhrle AG, Zurich, Switzerland

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U.S. Cl. 29—105 6 Claims

ABSTRACT OF THE DISCLOSURE

A cutter head for a gear-cutting machine and the like having a disc-shaped body with a seating surface at the rear disposed at right angles to the axis of the body. An elastically resilient hub in the interior of and connected to the body having a conical centering bore with the axis of the bore coinciding with the axis of the body. Radially-disposed ribs extend in an axial direction over the entire width of the hub connect the hub to the body. The wall of the conical bore has recesses in the region of the ribs whereby the hub is more elastically resilient between the ribs than in the region of the ribs. The ribs are formed by a number of bores disposed in a circle concentric to the centering bore of the hub.

The invention relates to a cutter head, particularly for a gear-cutting machine having a disc-shaped body with a seating surface at the rear disposed at right-angles to the axis of the body, with an elastically resilient hub in the interior of and connected to the body and having a conical centering bore, the axis of which coincides with the axis of the body.

In the case of a known cutter head of this type, the outer side of the hub extending along the axis is separated from the body by an annular gap and only the front or rear end of the hub, viewed in the axial direction, is connected to the body by a web engaging on this end. It is indeed possible, by suitable dimensioning of the web, to construct this latter to be so elastically resilient that the elevation of the stresses in the hub which occurs when the hub is pushed on to a mandrel of a thickness which is somewhat greater than the desired thickness, until its seating face bears against an abutment face on the mandrel, is transmitted to the body itself to a lesser degree than if the hub were solidly connected to the body. As a result of the unilateral attachment of the web on one end of the hub, the other end thereof is however not in immediate connection with the body and so has a reduced resistance to expansion in a radial direction than the end which is connected to the web. This asymmetry produces an uneven distribution along the hub of the pressure pressing the hub against the mandrel, and this may be the cause of an eccentric positioning of the body in relation to the mandrel.

The object of the present invention is to obviate this disadvantage. The cutter head according to the invention is characterised in that the hub is connected to the body of the cutter head by radially-disposed ribs extending in an axial direction over the entire width of the hub, the wall of the conical bore having recesses in the zone of the ribs and the hub being more elastically resilient between the ribs than in the zone of the ribs.

By way of example, an embodiment of the cutter head according to the invention is described in detail hereinafter, with reference to the attached drawings, in which:

FIG. 1 is an axial cross-section through a face cutter head and the end of the arbor supporting it;

FIG. 2 is a partial rear view of the cutter head after removal of the arbor according to a second embodiment;

FIG. 3 is a sectional view of the cutter head shown in FIG. 2 and

FIG. 4 is the same as FIG. 2 with the cutter head hub expanded.

According to FIG. 1, a work spindle **10** is mounted about an axis **11** in a spindle stock housing (not shown) of a gear-cutting machine. FIG. 1 shows only a part of the front end of this work spindle **10** which has a plane end face **12** disposed at right-angles to the axis **11**. From this end face **12**, a conically shaped pin-member **13** protrudes having a peripheral surface **14** equiaxial with the axis **11**. Likewise equiaxial in the pin-member **13** is a threaded bore **15**.

Mounted on the work spindle **10** is a cutter head **16** having a disc-shaped body **17**, from which a series of cutters **18** project, in fact in the direction of the axis **11**. They are usually disposed in a circle concentric with the axis **11**, though they may however also be disposed along one or a plurality of spirals surrounding the axes. The end faces of the cutters, i.e. the faces which encounter the workpiece as the cutter head rotates, have inner and outer lateral edges **19** and **20** as well as front edges **21**. In the case of many cutter heads, only the inner and front edges **19** and **21** form a cutting action, while in the case of others this action is performed by only the outer and the front edges **20**, **21**. There are also cutter heads in which the inner edge **19** and outer edge **20** cut alternately, while the front edge **21** of each cutter performs a cutting action. Then again, there are cutter heads on which only every second cutter **18** cuts, applying its front edge **21** and side edge **19** or **20**. There are also various other arrangements of cutters **18**.

The cutters **18** are adjustably anchored in the cutter head **16** in a manner which is not shown in the drawings.

The cutter head **16** is mounted on the spindle by a screw bolt **22**. The bolt **22** passes through a central bore **23** in the disc **17** and is screwed into the threaded bore **15** of the work spindle. The bolt **22** has a head **24** having a hexagonal recess **25** for insertion of a key. The head **24** is located in the interior of the disc-shaped body **17**.

The rear seating surface **26** of the cutter head **16** is pressed against the end face **12** of the work spindle **10** by the bolt **22**, in order to secure the cutter head exactly in a plane extending at right-angles to the axis **11**. The cutter head is fitted on to the conical surface **14** of the spindle pin **13** by means of a conical bore **27**, the connection being by a press fit, when the cutter head **16** is flush against the face **12** of the spindle **10**. The spindle **10** drives the cutter head **16** by means of a spline (not shown) disposed on the end face **12** of the spindle **10** and engaging in a groove (not shown) on the rear face **26** of the cutter head **16**. In some cases, this spline may also ensure a definite angular position between the cutter head **16** and the spindle **10**.

According to the invention, a number of bores **28** are disposed in the rear face **26**, their axes **29** being in a circle concentric with the spindle axis **11**. These bore axes **29** may be disposed either parallel with the spindle axis **11** or, as shown in FIG. 3, they may be inclined at an angle to the spindle axis **11**. This angle corresponds to the angle enclosed by the generatrix of the conical face of the bore **27** and the spindle axis **11**. This angle is for example 7°7′30″.

The conical bore **27** discharges into a hollow space **30**, the diameter of which is so selected that passages **31** are formed between the circularly-disposed bores **28** and the said hollow space **30**. The conical bore **27**, the circle of bores **28**, the hollow space **30** and the passages **31** bound an elastically resilient hub **32**, the axis of which coincides with the axis of the body, the hub being connected to the

disc-shaped body **17** only by ribs **33**. In the zone of these radially disposed ribs **33** are provided, in the wall of the conical bore **27** and extending over the entire width of the hub **32**, recesses **34** which prevent the pin-member **13** of the work spindle **10** bearing on the hub **32** in the zone of the ribs **33**. These recesses may have a circularly cylindrical limitation. As can be seen particularly in FIG. 3, the ribs **33** which are substantially bound by the walls of the bores **28**, extend in an axial direction over the entire width of the hub **32** which is more resilient between the ribs **33** than in the region of the ribs.

The device described functions in the following manner:

So long as the diameter of the conical bolt **13** of the work spindle **10** and of the conical bore **27** of the cutter head **16** are exactly matched and are at the same temperature, there is no difficulty in so securing the cutter head **16** on the work spindle **10** by means of the bolt **15** that the seating face **26** of the cutter head **16** bears flush on the end face **12** of the work spindle **10**. However, if a cold cutter head has to be fitted on a spindle which has become heated by work, then the bores **28** and the recesses **34** make it possible for the conical bore in the hub **32** of the cutter head **16** to expand without considerable forces being necessary in order to bring the seating face **26** of the cutter head to bear on the end face **12** of the work spindle **10**.

In the event of the pin-member **13** becoming expanded, e.g. by heating, the hub **32** may be elastically deformed in the region between the ribs **33**. As can be seen from FIG. 4, the radius of the conical bore **27** has expanded by the amount D, so that, as can be seen from FIG. 4, the bores **28** deform without considerable stresses arising in the disc-shaped body **17** of the cutter head. In the case of a preferred embodiment, the maximum diameter of the conical pin-member **13** of the work spindle **10** is 130.11 mm. with a tolerance of −0 and +0.008 mm., while the maximum diameter of the conical bore **27** is likewise 130.11 mm. with an admissible tolerance of +0 and −0.008 mm., the cone being in both cases 1:4, i.e. the angle of inclination is, as already mentioned, 7°7′7″, for with a length of the cone of 4 units, the difference in diameters represents 4 units .

I claim:

1. A cutter head for a gear-cutting machine and the like comprising a disc-shaped body having a seating surface at the rear disposed at right angles to the axis of said body, an elastically resilient hub in the interior of and connected to said body having a conical centering bore, the axis of said bore coinciding with the axis of said body, radially-disposed ribs (**33**) extending in an axial direction over the entire width of said hub (**32**) connecting said hub (**32**) to said body (**17**), the wall of said conical bore (**27**) having recesses (**34**) in the region of said ribs (**33**) whereby said hub (**32**) is more elastically resilient between said ribs (**33**) than in the region of said ribs (**33**).

2. A cutter head according to claim **1** wherein said ribs (**33**) are formed by a number of bores (**28**) disposed in a circle concentric to said bore (**27**) of said hub.

3. A cutter head according to claim **2** wherein both said centering bore (**27**) and said bores (**28**) which are disposed in a circle terminate in a hollow space (**30**) in the interior of said body (**17**).

4. A cutter head according to claim **3** wherein the axes of said bores which are disposed in a circle are inclined by the same angle in relation to the axis of said body as is the generatrix of said conical bore wall (**27**).

5. A cutter head according to claim **1** wherein said recesses (**34**) in the region of said ribs (**33**) extend over the full width of said hub (**32**).

6. A cutter head according to claim **5** wherein said recesses have a circularly cylindrical limitation.

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HARRISON L. HINSON, Primary Examiner

U.S. Cl. X.R.

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