Title: SYSTEM FOR CLAMPING A CUTTING HEAD TO AN ADAPTER, A CUTTING HEAD AND A FIXTURE

Abstract: The present invention concerns a system for fixing a cutting head (1) to an adapter (2) for a machine tool. The cutting head (1) includes a first linear flange (9), a second linear flange substantially parallel to the first linear flange (9) and means for holding a cutting bit. A holding jaw (4) is provided for being fixed to the adapter (2) and for engagement with at least one of the linear flanges (9) on the cutting head (1), and a clamping device (7) for clamping the at least one holding jaw (4) between the at least one flange (9) of the cutting head (1) and the adapter (2). At least one further clamping device is connected to the adapter (2) for engagement with the second or the linear flanges. Furthermore a cutting head and an adapter is defined.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
System for clamping a cutting head to an adapter, a cutting head and a fixture.

The present invention concerns a system for fixing a cutting head to an adapter of a machine tool, a cutting head and an adapter. The invention is intended for boring bars and all other similar tool holders used in machine tools. The present invention is particularly adapted for boring bars for internal and external turning.

During turning, vibrations or chatter, occurs due to the natural frequency of the tool being in the same area as the naturally occurring oscillations in the shear forces where the cutting takes place. This creates poor quality of the finished surface, noise and poor accuracy in the work piece. Technology has been developed attenuating such vibrations in that the relation between strength and mass of the cutting head has been optimized. This technology is described in patent application NO 2001 0380 of the applicant. This enables the cantilevered length to be increased. Such cutting heads are intended for being clamped to an adapter or a boring bar.

During machining with a machine tool it will in many cases be desirable to be able to change a cutting head quickly.

From the patent literature it is known holders for cutting tools of various type. In US 3,811,162 it is shown a clamping holder including a longitudinal track with a dove tail shaped cross section for in a longitudinal direction to take up a cutting tool with a quadratic steel bar to be secured to the notch, and that it includes a wedge-shaped liner that is clamped to this notch. Wedges and screws are shown to secure the tool. However this patent does not describe adapters and cutting heads for boring bars.

In US 5,322,395 it is shown a tool with a body defining a first seat secured to an anvil. A shear is held with a clamping body or a holding jaw.

In US 4,599,923 it is shown a tool holder having a dove tail shaped fixing part for connection to a tool holder. A wedge is used to hold the tool to the tool holder.

In EP 1,243,365 it is shown a tool holder for boring bars where a tool is put into a groove with various angles for jamming the tool.
None of the shown publications describes a system for fixing a cutting head to an adapter for a machine tool that is optimized in relation to strength and mass for not giving limitations in maximum cantilever length in combination with a fixing system that allows quick change of the cutting head and infinitely variable adjustment of the F-measure of the cutting bit. The F-measure defines the distance between the center of the adapter and the cutting bit (the point of the bit). Furthermore it is not shown a coupling mechanism or a system that is adapted such that the built length for the system not becomes excessive.

This is provided with a system, a cutting head and an adapter as defined in the enclosed patent claims, and that defines a system for fixing a cutting head to an adapter for a machine tool, where the cutting head includes a first substantially linear flange, and a second substantially linear flange substantially parallel to the first flange. The cutting head includes means for fixing a cutting bit. Furthermore the system includes at least one holding jaw for being fixed to the adapter and for engagement with at least one of the linear flanges of the cutting head, and at least one fixing device for holding the at least one holding jaw to the adapter and towards the at least one flange of the cutting head, and at least one further clamping device or fixture connected to the adapter for engagement with the second of the linear flanges.

The clamping device or fixture for clamping the at least one flange of the cutting head with the at least one holding clamp may include a bolt.

The at least one clamping device can be provided by a projection with a key way mutually adapted to the second linear flange of the cutting head.

The clamping device connected to the adapter for engagement with the second of the linear flanges may include a second holding jaw, and the second holding jaw can be clamped to the adapter with a second bolt.

The cutting head and the adapter can have mutually interfitting serrations parallel with the first and the second linear flange.

The cutting head may include a first substantially straight, linear, extended or longitudinal flange and a second substantially straight, extended, longitudinal flange substantially parallel to the first flange and a holding device for cutting bit.

Furthermore the invention concerns an adapter with two from each other facing sides there first side is adapted to face towards a cutting head and the
second side is adapted for being secured to a machine tool, and where the side facing the cutting head includes an area for abutting engagement with the cutting head. The adapter includes a further area on each side of the face that is adapted for abutting engagement with the cutting head, where at least one of these areas is adapted for being secured by a holding jaw for engagement with a on the cutting head placed flange.

The area that is adapted for abutting engagement with the cutting head may include a from the area outwards extending body for instance in the form of a threaded peg, for engagement with an adjustment element on the cutting head. The adjustment element can be a screw that is screwed towards the peg. Alternatively may, in a longitudinal direction adjustable, peg in the cutting head extend into a groove in the cutting head and into a suitable groove or bore in the adapter.

The adapter can be adapted to be secured by a holding jaw on the second area adjacent the area for abutting engagement with the cutting head.

One of the areas on each side of the face is adapted for abutting engagement with the cutting head and may include a holding part with a key way mutually adapted to the second linear flange of the cutting head.

When the solution of the invention was designed, it was emphasized that change of cutting heads can be done quickly to save time. Furthermore, it has been emphasized that the solution does not have any loose parts such that the cutting head can be loosened, pulled out to the side, and a new cutting head can be pushed in from the side and be tightened without having too release more elements from the adapter.

The nozzle or outlet for cutting fluid can be placed high and a bit to the side of the adapter, such that the jet gets well above the clamping mechanism of cutting bit and will always hit the point area of the cutting bit. On large cutting bits, it is a problem that the clamping mechanism to some cutting bits are bulky and it is very difficult to make the cutting bit fluid jet hit the point of the cutting bit. This is solved in the shown solution.

The present invention also provides a cutting head, which is a volume product. An adapter is more of an investment, and one can according to the invention have a number of cutting heads for various operations for one adapter.
Accordingly, the solution according to the present invention is a cost-effective solution. According to the invention the cutting head can be made substantially simpler and therefore cheaper than other cutting heads. The coupling faces of the cutting head may include simple faces as opposed to the known solutions where the coupling face for instance has several holes, recessions, key ways and conical faces. The invention ensures that the position of the cutting bit is maintained when the cutting head is changed.

Furthermore it is desirable to provide a product that is easier to use in that the cutting head is easier and faster to change, the cutting head is cheaper to manufacture, the F-measured between the adapter and the cutting bit can easily be adjusted infinitely, and the position during changing between the various cutting heads can be repeated. The fact that the position the cutting head has on the adapter easily can be repeated represents a considerable simplification and can give a considerable saving in used time and is accordingly an economic solution.

Short description of the enclosed figures.

Fig. 1 is a drawing of the front side of a cutting head according to one embodiment of the invention;

Fig. 2 is a side elevation of the embodiment of the invention shown on fig. 1;

Fig. 3 is a perspective view of a further embodiment of the invention; and

Fig. 4 is a perspective view of yet another embodiment of the invention.

In the following the invention will be described in view of the shown embodiments.

From fig. 1 it is shown an attachment device, an adapter 2 and a cutting head 1 according to the invention. The attachment device includes a first or upper holding jaw 4 secured with a clamping device in this case an upper or first bolt 7. The first jaw 4 is equipped with nozzles 8 for cutting liquid. A lower or second holding jaw 5 is shown fixed to the adapter 2 by a lower or second bolt 6. The cutting head 1 is equipped with means for securing a cutting bit and is shaped with a first flange 9 and a second flange parallel to the first flange, in addition to serrations on the side of the cutting head 1 that is abutting the adapter 2. The
adapter 2 is equipped with mating serrations 3 for mutual interlocking engagement with the cutting head 1.

When the cutting head 1 on the adapter 2 is to be changed, the holding bolts 6, 7 can be loosened such that a cutting head 1 can be slid in the direction of the serrations 3 and the parallel flanges and may be exchanged with another cutting head. A new cutting head can be placed on the adapter 2 by sliding it in the same way as the previous adapter was removed. A mechanism (not shown) may ensure that a cutting head receives a predetermined position on the adapter 2.

When the cutting head 1 is to be clamped on to the adapter 2, the holding bolts 6, 7 are tightened and the holding jaws 4, 5 thereby press the cutting head 1 towards the adapter 2. The serrations 3 ensure that the placement of the cutting head 1 in relation to the adapter 2 is maintained. The holding jaws 4, 5 are shaped such that they impose a force towards the cutting head 1 and the adapter 2 when the holding bolts 6, 7 are tightened without the holding bolts 6, 7 being exposed for bending moment. This design will be further described with reference to the other embodiments.

The cutting head may in the other embodiments include a protrusion 2c with an area for securing a cutting bit and a ramp 1c that provides a room for chips that are created in a cutting process. The protrusion 2c extends from a main part 6c, and the transition between the main part 6c and the protrusion 2c forms an S-shape 4c including a concave and a convex surface facing away from the surface that abuts the adapter 2. The transition between the main part 6c and the protrusion 2c create a radius R1. The main part 6c may include an angled face in relation to a plane parallel to the coupling face of the adapter 2.

This construction contributes to a low weight for the system and results in simple machining of the cutting head which again provides an economic product.

From fig. 2 it is shown a side elevation of the embodiment shown on fig. 1 where the serrations 3 of the adapter 2 and the mutually engaging serrations in the cutting head 1 are clearly shown. Furthermore it is shown how the upper holding jaw 4 presses towards the flange 9 of the cutting head 1 when the upper holding bolt (not shown on fig. 2) is tightened. From fig. 2 it is shown that the upper holding jaw 4 is recessed in a portion abutting the adapter 2 such that the holding jaw 4 presses towards both the adapter 2 and flange 9 on the cutting head 1 when the
upper holding bolt is tightened. Alternatively the adapter 2 can be recessed, to
ensure that the flange 9 is clamped by the holding jaw 4 without the holding bolt
being exposed to bending moment. The holding jaw 4 may in this way form a
bridge between the adapter 2 and the upper flange 9 on the cutting head 1, and
that is tightened towards these elements by the holding bolt 7.

Similarly the figure shows how the lower holding jaw 5 will clamp the lower
flange on the cutting head 1 towards the adapter 2 when the lower holding bolt 6 is
tightened. A pin 10 is secured to the adapter 2. An adjustment screw (not shown)
in the cutting head 1 can abut pin 10 on the adapter 2 and be used to maintain a
position of the cutting head 1 when the cutting head is removed and then
repositioned. The adapter 2 is adapted to be secured to a boring bar, or may be a
part of the boring bar itself.

From fig. 3 it is shown another embodiment of the invention where a cutting
head 11 for fixing a cutting bit is secured to an adapter 12. An upper holding jaw
14 for clamping the cutting head 11 to the adapter 12 is shown clamped via a
holding bolt 17. The holding jaw 14 furthermore includes nozzles 18 for cutting
liquid. The cutting 11 is provided with an upper flange part 19 and a lower flange
part 21 for holding the cutting head 11 to the adapter 2. The two flanges 19, 21 are
parallel such that a cutting head 11 can be parallelly displaced in the adapter 12.
The flanges 19, 21 are shown with a wedge shape in a transversal direction such
that the cutting head 11 can be wedged down in a corresponding holding part 22
with key ways in the adapter 12 and in the holding jaw 14. The holding part 22
substitutes the lower holding jaw 5 shown on fig. 1 and 2. The holding bolt 17 is
shown placed somewhat at an angle in relation to the face between the adapter 12
and the cutting head 11 to press the cutting head 11 into the wedge shaped
holding part 22 of the adapter 12 at the same time as the cutting head 11 is
pressed towards the adapter 12. A boring in the cutting head 11 is shown for
further installation of an adjustment screw adapted to abut a pin in the adapter 12,
to be able to adjust the position of the cutting head in relation to the adapter, and
to thereby maintain a position after removal and reinstallation of the cutting head
11 on the adapter 12.

From fig. 4 it is shown an embodiment that reassembles the embodiment
shown on fig. 3, but where an upper holding jaw 34 includes a more clearly angled
face 44 between the holding jaw 34 and the adapter 32. The holding bolt 37 is shown angled at a certain angle adapted to the inclined face 44 and an inclined or angled contact face on the upper or first flange 39 of the cutting head 31. A boring 43 for an adjustment screw (not shown) is placed in the cutting head 31.

In the shown embodiments, the position of the cutting head in relation to the adapter can be adjusted in a direction sideways, such that an F-measure between the cutting bit of the cutting head and the center of the adapter can be adjusted.

When the holding bolt 37 on fig. 4 is tightened, the holding jaw 34 will press the cutting head 31 in and down and ensure that flange 41 with a conical shape is pressed down into a corresponding conical recess in the wedge shaped holding part 42. Nozzles 38 for bringing forward cutting liquid is shown placed in the upper holding jaw 34.

In the shown embodiments, it is shown fixing devices in form of holding bolts for tightening the holding jaws. However other forms of fixing of the holding jaws or clamps can be used, without parting from the invention. For instance the holding jaws can be secured with fixing devices in the form of a handle with a cam for clamping the jaw, or can be tightened in any other way.
Claims:

1. System for clamping a cutting head (1, 11, 31) to an adapter (2, 12, 32) for a machine tool, characterized in that the cutting head (1, 11, 31) includes a first substantially linear flange (9, 19, 39), a second substantially linear flange (21, 41) substantially parallel to the first flange (9, 19, 39) and means for securing a cutting bit; at least one holding jaw (4, 14, 34) for engagement with at least one of the linear flanges (9, 19, 39) on the cutting head (1, 11, 31); a clamping device (7, 17, 37) for clamping the at least one holding jaw (4, 12, 34) to the adapter (2, 12, 32) and towards at least one flange (9, 19, 39) on the cutting head (1, 11, 31); and at least one further clamping device connected to the adapter (2, 12, 32) for engagement with the other of the linear flanges (21, 41).

2. System according to claim 1, characterized in that the clamping device (7) for clamping the at least one flange (9) on the cutting head (1, 11, 31) with the at least one holding jaw (4) includes a bolt.

3. System according to claim 1, characterized in that the at least one further clamping device includes a holding part (22) with a key way mutually adapted to the second linear flange (21, 41) of the cutting head (11).

4. System according to claim 1, characterized in that the further clamping device connected to the adapter (2) for engagement with the second of the linear flanges includes a second holding jaw (5), and that the second holding jaw (5) is clamped to the adapter (2) with a second bolt (6).
5. System according to claim 1, characterized in that the cutting head (1) and the adapter (2) includes mutually interfitting serrations (3) parallel to the first and the second linear flange.

6. Cutting head (1, 11, 31) for being clamped to an adapter for a machine tool, characterized in that it includes a first linear flange (9, 19, 39) and a second linear flange (21, 41) substantially parallel to the first linear flange (8, 19, 39); and a holding device for a cutting bit.

7. Adapter (2, 12, 32) with two from each other facing sides where the first side is adapted to face towards a cutting head (1, 11, 31) and the other side is adapted for being secured to a machine tool, and where the side facing towards the cutting head includes an area for abutting engagement with the cutting head (1, 11, 31), characterized in that the adapter includes a further area on each side of the face that is adapted for abutting engagement with the cutting head, where at least one of these areas is adapted for clamping of a holding jaw (4, 14, 34) for engagement with a on the cutting head (1, 11, 31) placed flange (9, 19, 39).

8. Adapter according to claim 7, characterized in that the area that is adapted for abutting engagement with the cutting head includes a from the area extending body (10) for engagement with an adjustment element on the cutting head (1, 11, 31).

9. Adapter according to claim 7, characterized in that it is adapted for being fixed by a holding jaw (5) on the other area next to the area for abutting engagement with the cutting head (1, 11, 31).

10. Adapter according to claim 7, characterized in that one of the areas of each side of the face that is adapted for abutting engagement with a cutting head, includes a holding part (22)
with a key way mutually adapted to the second linear flange (21) of the cutting head (11).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B23B 29/04
According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>AU 245808 A (RAY &amp; GILBERT PROPRIETARY LIMITED), 3 November 1960 (03.11.1960), page 1, line 18 - line 41, figures 1,3</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>US 2398913 A (D.S. ANTHONY ET AL), 23 April 1946 (23.04.1946), whole document</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>US 5079797 A (JOSEPH PANO), 14 January 1992 (14.01.1992), figure 2, abstract</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>US 2453959 A (D.S. ANTHONY ET AL), 16 November 1948 (16.11.1948), whole document</td>
<td>1-10</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

Date of actual completion of the international search 19 October 2005

Date of mailing of the international search report 20/10/2005

Name and mailing address of the ISA/Swedish Patent Office
Box 50355, S-102 42 STOCKHOLM
Fax number: +46 8 665 02 86

Authorized officer
Björn Lindkvist/MP
Telephone No. +46 8 782 25 00

Form PCT/ISA/219 (second sheet) (April 2005)
<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>245808</td>
<td>A</td>
<td>03/11/1960</td>
<td>NONE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>2398913</td>
<td>A</td>
<td>23/04/1946</td>
<td>NONE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>5079979</td>
<td>A</td>
<td>14/01/1992</td>
<td>DE 4028353 A,C</td>
<td>21/03/1991</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IL 91576 A</td>
<td>16/02/1992</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>JP 2902086 B</td>
<td>07/06/1999</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>JP 3142107 A</td>
<td>17/06/1991</td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>2453959</td>
<td>A</td>
<td>16/11/1948</td>
<td>NONE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>