

The invention relates to a tool for use in machine tools, having a cutting head and at least one exchangeable cartridge, which may be detachably fastened to the cutting head, carries a cutting plate preferably in the form of a turnplate and under the action of an adjusting mechanism is adjustable on the cutting head in infeed direction of the cutting plate, the adjusting mechanism having a wedge element which rests with a wedge surface, which with its direction of displacement defines an acute angle and simultaneously forms a wedge slope, flat against an inclined shoulder of the exchangeable cartridge, said shoulder in the direction of the wedge slope deviating from a right angle relative to the infeed direction.

Tools with adjustable exchangeable cartridges may be adapted relatively easily to different workpiece dimensions and machining tasks and may therefore be utilized more universally than special-purpose tools with non-adjustable cutting plates. This advantage means, particularly in the case of small and medium workpiece ranges, that a few universal tools are sufficient for the purpose and there is no need to manufacture and stock a large number of special-purpose tools. On the other hand, adjustability and the resultant need to divide the tool into a plurality of parts causes problems in terms of stability and strength which, above all with high output requirements, often cannot be solved satisfactorily using the previously known jointing techniques.

Thus, it has already been proposed to set the exchangeable cartridge to the desired cutting depth with the aid of an adjusting screw, which is guided in infeed direction in the cutting head and rests loosely against an edge of the exchangeable cartridge, and then clamp the cartridge firmly on the cutting head with the aid of a fastening screw. During the machining process, there is exerted via the cutting plate onto the exchangeable cartridge a moment of tilt about the back edge, in contact with the cutting head and adjacent to the main cutting edge, of the exchangeable cartridge, said

moment of tilt having to be fully absorbed by the fastening screw because the adjusting screw does not contribute at all to absorption of said moment of tilt. Furthermore, in the case of a rotary tool, the centrifugal forces acting upon the exchangeable cartridge of the known tool also have to be absorbed exclusively by the fastening screw. Both types of load have the effect of reducing stability, particularly at the high speeds currently being pursued.

It is further known (DE-A-2339873) in a tool of the type described initially to use a screw-displaceable setting wedge, which may be clamped between an abutment ring and a cutting platelet block, to set the cutting depth. The cutting platelet block is in turn clamped firmly to the tool body by means of a fastening screw which, again, has to absorb most of the tilting moments and centrifugal forces. Also, with said tool, a further preloading part and a spring arrangement comprising a plurality of springs are required to prevent play of the cutting platelet during a setting process.

Proceeding from here, the object of the invention is to take measures which allow the forces and moments acting during the machining process on the exchangeable cartridge to be transmitted better than before into the cutting head and hence allow the total rigidity of the tool of the type described initially to be increased.

To achieve said object, the features indicated in claim 1 are proposed. Further advantageous refinements and developments of the invention are indicated in the dependent claims.

The invention is based on the idea that the adjusting mechanism, which generally rests against the exchangeable cartridge at the edge lying opposite the cutting edge of the cutting plate, should additionally be so constructed as to allow the tilting moments resulting from the cutting force and acting upon the exchangeable cartridge to be transmitted via

said adjusting mechanism to the cutting head, with simultaneous relief of the fastening means which secure the exchangeable cartridge on the cutting head. To achieve this, according to the invention the following combination of features is proposed:

- the wedge element takes the form of a wedge ram;
- the wedge element is displaceable along a guide of the cutting head aligned parallel to the cutting plate plane and substantially at right angles to the infeed direction;
- the inclined shoulder and the wedge surface facing said shoulder additionally have, at right angles to the wedge slope, an undercut forming a form closure between the exchangeable cartridge and the wedge ram.

According to a preferred embodiment of the invention, the inclined shoulder and the wedge surface facing said shoulder additionally have, at right angles to the wedge slope, an undercut slope which deviates from a right angle relative to the infeed direction and forms the form closure between the exchangeable cartridge and the wedge ram. The latter may, in terms of manufacturing engineering, be achieved particularly easily in that the wedge ram is supported with a cylindrical guide shaft in the wedge ram guide taking the form of a cylindrical fitting bore so as to be both axially displaceable and rotatable, with simultaneous automatic alignment relative to the inclined shoulder, provided with the undercut slope, of the exchangeable cartridge. Adjustment of the wedge ram is advantageously effected by a threaded pin, which engages axially into the wedge ram guide and is guided in a threaded bore of the cutting head.

In order further to improve the transmission into the cutting head of the forces arising from the cutting force, the wedge

ram engages with its part-cylindrical surface lying opposite the wedge surface into a correspondingly open-edged, part-cylindrical guide groove of the cutting head, with - for reasons associated with manufacturing engineering - the part-cylindrical guide groove advantageously being aligned with the cylindrical fitting bore in the cutting head. The wedge ram advantageously takes the form of a cylindrical pin which in the region of its one end has a flat, ground taper and at its other end forms the cylindrical guide shaft.

In order also to allow forces acting upon the exchangeable cartridge at right angles to the infeed direction, e.g. centrifugal forces, to be transmitted to the cutting head without stressing the fastening means, either the cutting head or the exchangeable cartridge has a guide groove aligned in infeed direction for receiving a guide rib formed on the other part (exchangeable cartridge or cutting head). The guide rib or guide groove is advantageously disposed on the opposite side of the exchangeable cartridge to the cutting plate.

The exchangeable cartridge is advantageously detachably fastenable to the cutting head with the aid of a retaining screw, which engages through a hole, elongated in infeed direction and disposed either in the cutting head or in the exchangeable cartridge, and may be screwed into a threaded bore of the other part (exchangeable cartridge or cutting head).

According to a further advantageous embodiment of the invention, the cutting head has a bedding recess, whose edge is open at least towards a chip chamber, for receiving the exchangeable cartridge, the wedge ram engaging with its part having the wedge surface through an opening in the cutting head delimiting the wedge ram guide and into the open-edged recess. In order to keep as small as possible the gaps arising in the region of the chip chamber during adjustment of the exchangeable cartridge, a masking rib which engages over

the inclined shoulder and the wedge ram at the side of the chip chamber is advantageously formed on the exchangeable cassette. The surface of the masking rib which is aligned with the free cutting plate surface therefore advantageously forms part of the chip chamber periphery.

According to a further preferred embodiment of the invention, the exchangeable cartridge is displaceable on the cutting head substantially in an axial direction. The cutting head advantageously comprises a base member and two tool holders which preferably are connected by radial serrations and a common clamping plate to the base member, are radially adjustable relative to the base member, each carry one of the axially adjustable exchangeable cartridges and contain the radially aligned wedge ram guides. The bedding recess is advantageously open-edged radially outwards and axially towards the front, while the radially innerlying, parallel boundary walls of the exchangeable cartridge and the bedding recess define with the cutting head axis an acute angle converging towards the front of the cutting head. Improved rigidity in the region of the bedding tray and a compact construction are achieved by the last-mentioned measure.

The tool according to the invention may be used advantageously for the rough-machining of bores and, in so doing, may be used in particular as a double-edged roughing tool or a single-edged progressive cutting tool. The teaching of the invention may also be applied advantageously to radial or axial recess-turning tools, tools for turning the outside diameter of short tip cylinders, backward machining tools and chamfering tools. Finally, its use is also conceivable in twin-tooth cutters and in combination tools with a selected combination of the application variants described above.

The invention is described in greater detail hereinafter with reference to an embodiment which is illustrated diagrammatically in the drawings. The drawings show:

- Fig.1 a side view of a double-edged roughing tool having radially and axially adjustable cutting plates;
- Fig.2 an enlarged, part-sectional view of a cutout from Fig.1;
- Fig.3 a side view in the direction of the arrow III of Fig.2;
- Fig.4 an end view of the two radially adjustable tool holders of the tool.

The double-edged roughing tool illustrated in the drawings substantially comprises a base member 10 carrying a fitting journal 12 for connection to a machine spindle, two tool holders 14 which are adjustable relative to the base member 10 radially along radial serrations 16 and are fastenable to the base member 10 by means of a clamping plate 18 and fastening screws 20, as well as one exchangeable cartridge 24 disposed in an axially adjustable manner on each of the tool holders and carrying a cutting plate in the form of a turnplate 22. The turnplate, which has a polygonal contour and is provided with three cutting edges 23, is fastened by means of a cap screw 26, which engages through a central bore, in a bed of the exchangeable cartridge adapted to its contour. The exchangeable cartridge 24 is in turn disposed in a bedding recess 28 of the tool holder 14, which recess is adapted to the contour of the exchangeable cartridge and is open both in the direction of the chip chamber 30 as well as radially and at an axial end for passage of the relevant edge surfaces of the exchangeable cartridge. Formed on the opposite broad side of the exchangeable cartridge 24 to the turnplate 22 is a guide rib 32 which engages into a guide groove 34, which is aligned on the tool holder paraxially to the axis of rotation of the tool. Axial displaceability of the exchangeable cartridge relative to the tool holder as well as a radial

supporting and power transmission between exchangeable cartridge 24 and tool holder 14 are thereby guaranteed. Fastening of the exchangeable cartridge 24 to the tool holder 14 is effected with the aid of a cap screw 36, which engages from the rear through an oblong hole 38 of the tool holder into a threaded bore in the region of the guide rib 32 of the exchangeable cartridge 24.

For axial adjustment of the exchangeable cartridge 24, a radially extending fitting bore 42, in which a wedge ram in the form of a cylindrical pin with a ground wedge surface 44 is disposed so as to be longitudinally displaceable and rotatable, is disposed in the tool holder 14. The fitting bore 42 verges at its back end into a threaded bore 45, in which is disposed a threaded pin 48 for displacement of the wedge ram 46. The wedge ram 46 engages, with its end having the wedge surface 44, substantially radially into the bedding recess 28 and is guided there with its part-cylindrical surface 50 lying opposite the wedge surface 44 in a part-cylindrical groove, aligned with the relevant part of the fitting bore 42, in the bottom axial boundary wall of the bedding recess 28.

At another side, the exchangeable cartridge has, in the region of its edge facing the wedge ram 46, an inclined surface 54 which relative to the (axial) infeed direction is obliquely aligned in two directions, thereby forming a slope corresponding to the wedge slope and an undercut slope. In the direction of displacement of the wedge ram, the wedge slope with a radial plane defines an angle (wedge angle) of approximately 12° (Fig.2), while in the direction at right angles thereto the undercut slope with the radial plane defines an angle of approximately 15° (Fig.3). The undercut angle is so selected that, in the event of the action of cutting forces on the cutting edge 23 causing tilting about the tilting axis 56, the exchangeable cartridge 24 in the region of its inclined slope 54 cannot, owing to form closure,

be lifted out of the bedding recess 28. As a result, the fastening screw 36 which is tightened after the adjusting process is substantially relieved of the moment loads arising during the cutting process. During the adjusting process the wedge ram 46, owing to its rotatable mounting in the fitting bore 42, is automatically rotated by the inclined surface 54 of the exchangeable cartridge 24 into the inclined position shown in Fig.3. Towards the chip chamber 30, the part of the bedding recess 28 receiving the wedge ram 46 is covered by a masking rib 58.

As may be seen particularly in Figs.1 and 2, the radially innerlying boundary wall 60 of the bedding recess 28 and the adjacent boundary surface 62 of the exchangeable cartridge 24 define an acute angle converging with the axis of the tool towards the front in order to ensure that the tool holder still has an adequate strength and rigidity in the region of the bedding recess.



Claims

1. Tool for use in machine tools, having a cutting head (tool holder 14) and at least one exchangeable cartridge (24), which may be detachably fastened to the cutting head (14), carries a cutting plate preferably in the form of a turnplate (22) and under the action of an adjusting mechanism (46, 48) is adjustable on the cutting head (14) in infeed direction of the cutting plate (22), the adjusting mechanism having a wedge element (46) which rests with a wedge surface (44), which with its direction of displacement defines an acute angle and simultaneously forms a wedge slope, flat against an inclined shoulder (54) of the exchangeable cartridge (24), said shoulder in the direction of the wedge slope deviating from a right angle relative to the infeed direction, **characterized in that** the wedge element takes the form of a wedge ram (46) which is displaceable along a guide (fitting bore 42) of the cutting head (14) aligned parallel to the cutting plate plane and substantially at right angles to the infeed direction, and that the inclined shoulder (54) and the wedge surface (44) facing said shoulder additionally have, at right angles to the wedge slope, an undercut forming a form closure between the exchangeable cartridge (24) and the wedge ram (46).
2. Tool according to claim 1, **characterized in that** the inclined shoulder (54) and the wedge surface (44) facing said shoulder additionally have, at right angles to the wedge slope, an undercut slope which deviates from a right angle relative to the infeed direction and forms the form closure between the exchangeable cartridge (24) and the wedge ram (46).
3. Tool according to claim 1 or 2, **characterized in that** the wedge ram (46) is supported with a cylindrical guide shaft in the wedge ram guide in the form of a cylindrical



fitting bore (42) so as to be both displaceable and rotatable, with simultaneous automatic alignment of the wedge surface (44) relative to the inclined shoulder (54) of the exchangeable cartridge (24).

4. Tool according to one of claims 1 to 3, characterized in that the wedge ram (46) is displaceable by means of a threaded pin (48) which preferably engages axially into the wedge ram guide (42) and is guided in a threaded bore (45) of the cutting head (14).
5. Tool according to one of claims 1 to 4, characterized in that the wedge ram (46) engages with its part-cylindrical surface (50) lying opposite the wedge surface (44) into a corresponding part-cylindrical guide groove (52) of the cutting head (14).
6. Tool according to claim 5, characterized in that the part-cylindrical guide groove (52) is aligned with the cylindrical fitting bore (42).
7. Tool according to one of claims 2 to 6, characterized in that the wedge ram (46) is formed by a cylindrical pin which in the region of its one end has a flat, ground taper and at its other end forms the cylindrical guide shaft.
8. Tool according to one of claims 1 to 7, characterized in that the cutting head (14) has a guide groove (34) aligned in infeed direction for receiving a guide rib (32) formed on the exchangeable cartridge (24).
9. Tool according to one of claims 1 to 8, characterized in that the exchangeable cartridge (24) has a guide groove aligned in infeed direction for receiving a guide rib formed on the cutting head (14).



10. Tool according to claim 8 or 9, characterized in that the guide rib (32) or guide groove (34) is disposed on the opposite side of the exchangeable cartridge (24) to the cutting plate (22).
11. Tool according to one of claims 1 to 10, characterized in that the exchangeable cartridge (24) is fastenable to the cutting head (14) with the aid of a cap screw (36) which engages through a hole (38), disposed in the cutting head (14) and elongated in infeed direction, and may be screwed into a threaded bore (40) of the exchangeable cartridge (24).
12. Tool according to one of claims 1 to 10, characterized in that the exchangeable cartridge (24) is fastenable to the cutting head (14) with the aid of a cap screw which engages through a hole, disposed in the exchangeable cartridge and elongated in infeed direction, and may be screwed into a threaded bore of the cutting head.
13. Tool according to one of claims 1 to 12, characterized in that the cutting head (14) has a bedding recess (28), whose edge is open at least towards a chip chamber (30), for receiving the exchangeable cartridge (24), and that the wedge ram (46) engages with its part having the wedge surface (44) through an opening in the cutting head (14) into the bedding recess.
14. Tool according to claim 13, characterized in that a masking rib (58), which engages over the bedding recess (48) in the region of the wedge ram (46) at the side of the chip chamber (30), is formed on the exchangeable cartridge (24).
15. Tool according to claim 14, characterized in that the surface of the masking rib (58) which is aligned with the



free cutting plate surface forms part of the chip chamber periphery (30).

16. Tool according to one of claims 1 to 15, characterized in that the exchangeable cartridge (24) is displaceable in an axial direction of the tool.
17. Tool according to one of claims 13 to 16, characterized in that the bedding recess (28) is open-edged radially outwards and axially towards the front.
18. Tool according to claim 16 or 17, characterized in that the exchangeable cartridge (24) and the bedding recess (28) have boundary walls (60, 62) which are parallel to one another and with the tool axis define an acute angle converging towards the front of the cutting head (14).
19. Tool according to one of claims 1 to 18, characterized in that at least two exchangeable cartridges (24), which are adjustable in infeed direction independently of one another, are disposed at an angular distance from one another on the cutting head (14).
20. Tool according to one of claims 1 to 19, characterized in that the cutting head comprises a base member (10) and two tool holders (14) which preferably are connected by radial serrations and a common clamping plate to the base member (10), are radially adjustable relative to the base member, each carry one preferably axially adjustable exchangeable cartridge (24) and each contain one radially aligned wedge ram guide.