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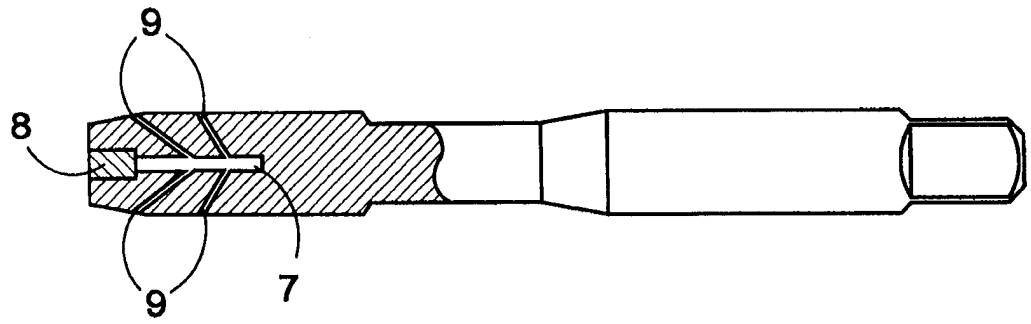
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(57) Abstract

A tool producing internal thread, such as a screw tap or a thread former, incorporates a minimal lubricant tank (7, 7') which is located in the tool. The cooling lubricant is conveyed to the chipping point via fine feed bores (9) only with the aid of centrifugal force.

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Tool producing internal thread

The present invention relates to a tool producing internal thread, which can be either a cutting screw tap or a non-cutting thread former. Conventionally the tool is either of high-speed steel or carbide metal.

A screw tap is a cutting tool for cutting internal thread with a shank for clamping in a tool support and with a thread cutting part, the so-called chamfer, consisting of screw turns, which is arranged on the free end and is interrupted by grooves for chips. Next after the chamfer comes the so-called guide or guide part, which also consists of screw turns interrupted by grooves for chips. Said guide part does not perform any cutting work, however, but serves, as the name implies, for the guiding and the uniform driving of the screw tap through the hole to be tapped. Tools producing internal thread without a guide part have also been proposed recently for rigid tapping, see Swedish patent application 9600927-9.

In principle there are two basic types of screw tap, namely the bottoming tap (also called blind hole tap) and the straight-through tap. As the names imply, holes open on one side with a bottom are involved in the first case, while bottomless holes open on two sides are involved in the second case. In the first case the chips have to be conveyed out of the hole, in the opposite axial direction to that of the tapping. The grooves for chips are consequently formed helically in the same direction as the direction of rotation of the tap, whereby they have a chip-conveying effect. Known bottoming taps are described e.g. in DE-U-86 23 509.5, DE-C- 3 037 568 and EP-A-641 620.

In the second case (i.e. with straight-through taps) it is more favourable if the chips are conveyed to the front, through the hole, in the same direction as the tapping

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direction. In this case, therefore, the grooves for chips are inclined against the direction of rotation of the tap and thereby have the effect of driving the chips towards the tap tip. Examples of straight-through screw taps are described for example in DE-A-3 419 850 and DE-U-83 24 835.8.

Also known are screw taps with straight, axially extending grooves for chips, which in principle convey the chips neither to the front nor to the rear. These are particularly suitable with short-chipping materials and with small thread depths. If this kind of tap is used, three different types of taps with straight-line grooves are often employed, namely a taper tap, a second tap and a plug tap.

Unlike the screw tap, the thread former does not produce any chips; it simply deforms the material. With thread formers also it is the practice to speak of a "chamfer" and a guide part, although the term chamfer is strictly speaking incorrect, since thread formers do not cut. For the sake of simplicity, however, this expression will also be used here for the tapering front part, in which, as in the case of screw taps, the deforming work for producing the thread is performed. A thread former according to the state of the art is described, for example, in DE-A- 2 414 635.

It is normal to use considerable amounts of coolants and lubricants when operating the tools producing thread described above. In recent times, however, a strong trend in general towards dry machining can be noted, not only in the production of thread but also, or even in particular, in turning, drilling and milling. The reasons for this are first and foremost to save on the costs of cooling lubricants and to protect the environment.

Various machining processes can be converted to dry

chipping relatively easily. The latter include e.g. turning and milling. Other processes present far greater problems when they are carried out dry. Screw tapping and thread forming are particularly problematical. In such cases the so-called minimal lubrication technique is often used as a possible solution. The minimal lubricant is fed via nozzles from the outside or centrally through the spindle and the tool. It is therefore often necessary, only account of the screw tapping process (or thread forming process), to install a minimal lubrication system on the machine. This naturally complicates the machine and makes it more expensive.

The invention is consequently based on the aim of saving on cooling lubricant costs and protecting the environment.

It is further the aim of the invention to avoid the installation of a minimal lubrication system on the machine.

These and other aims clear to the skilled man are achieved by the present invention, in which a tool producing thread is manufactured with the features given in the characterising part of claim 1.

The invention will now be described in detail below by means of embodiments shown in the drawings, where

Figure 1 shows a spirally grooved screw tap according to the state of the art,

Figure 2 a cross-section of a screw tap according to a first embodiment of the invention,

Figure 3 a cross-section of a screw tap according to a second embodiment of the invention and

Figure 4 a cross-section of a screw tap according to a

third embodiment of the invention.

As shown in Figure 1, a commonly used bottoming screw tap incorporates a shank 1 and a square 2, which is disposed on the shank 1 for the transmission of a turning moment in a case. The shank bears a taper-shaped neck 3 with a screw head 4. The head 4 and the neck 3 are provided with for example three equidistant, helical grooves for chips 5. At the operative end the tool is normally provided with a conical tip 6, which has no function, but is there only on manufacturing grounds.

As already mentioned above, the commonly used screw tap (and also the commonly used thread former) incorporates a chamfer **a** and a guide part **b**. As can be seen from all the figures, the chamfer a tapers substantially uniformly to the front. Whereas the whole of the chipping takes place in the chamfer area a, the guide part b serves merely for the axial guiding of the tool in the already produced thread. According to the above-mentioned SE-A-9600927-9 the guide part b can be omitted for rigid screw tapping ("rigid tapping").

In order to achieve the aims mentioned above, a minimal lubricant tank is already located in the tool producing thread according to the invention, wherein the lubricant is conveyed via fine bores only with the aid of centrifugal force during the machining, without an additional external effect on the tool cutting edges. Moreover, no coolant is supplied from the outside during the whole period of use, the tank takes over this function.

According to the embodiment in Fig. 2 the screw head incorporates a minimal lubricant tank 7, which consists of a bore which issues on the distal end of the tool. The distal-end front part of the bore can be widened slightly and accommodate a closure 8. In so doing the conical tip 6

in Fig. 1 has preferably been removed. The nature of the closure 8 is not material to the invention. In addition to a screw a bolt, for example, can also be glued in or pressed in. A soft bolt of light metal such as aluminium is also conceivable, which is heat-sealed during the pressing in. Blind rivets are also possible.

Disposed obliquely or directly radially outwards from the tank 7 are feed bores 9 for feeding the lubricant to the chipping point, i.e. to the chamfer, and optionally also to the guide part. The necessary bore diameter of said feed bores depends on the viscosity of the minimal lubricant and lies in general in the range between 0.01 and 0.4 mm, preferably between 0.05 and 0.2 mm. The number of feed bores is not critical and can be e.g. from two to eight. Up to approximately 0.2 mm diameter the feed bores are normally manufactured by erosion; below 0.2 mm by laser drilling. Both methods can be used both for high-speed steel and for carbide metal.

The required amount of minimal lubricant is extremely small and normally lies between 1 and 20 ml per hour. In view of these very small amounts which are provided, a minimal lubricant with particularly good SPRITE effect (i.e. the property of the minimal lubricant to spread and distribute itself very rapidly on the surface of the tool and of the workpiece) is required. The use of simply any cutting oil, such as were known previously, is therefore not involved, but special minimal lubricants, such as are already known today.

According to the embodiment shown in Fig. 3 the shank 1 can also be used as a minimal lubrication tank. The tank bore 7' is moreover continuous, from the distal end of the tool up to the shank end. In order to be able to accommodate more lubricant, the bore can have a greater diameter in the shank than in the front part, see bore part 11. The rear end of the tank bore can also be sealed

by means of a closure (see closure 12), in the same way as the front end.

According to the embodiment in Fig. 4 the lubricant can be pressed to the front to the chipping point by means of a plunger 13 and a spring 14. The spring 14 is moreover located between the axially movable plunger 13 and the end closure 12'.

Thanks to the integral lubricant tank the screw tapping can also be performed in difficult materials without the use of expensive minimal lubrication devices and without additional lubrication from outside. In addition it is guaranteed that the lubricant comes out only when the tool rotates. Consequently only very small amounts are needed. Tests have shown that a lubricant volume of about 5 ml suffices for the whole life of a screw tap of the size M8 for the machining of heat treatable steel. The life of such a screw tap is about 90 minutes.

It should be clear that the outer geometry of the tool producing thread is immaterial for the inventive idea. Consequently the minimal lubricant tank according to the invention can be used for any screw tap and any thread former.

Claims

1. Tool producing internal thread, such as a screw tap or a thread former, *characterised in that* a lubricant tank (7, 7') is located in the tool.

2. Tool according to claim 1, in which the lubricant tank is a so-called minimal lubricant tank.

3. Tool according to claim 1 or 2, in which the lubricant is guided to the thread-producing outer face of the tool via fine feed bores (9).

4. Tool according to claim 3, in which the diameter of the feed bores is between 0.01 and 0.4 mm.

5. Tool according to any one of the preceding claims, in which the lubricant tank is created by a central, axial bore in the tool, wherein it is sealed at the front distal end by means of a closure (8).

6. Tool according to claim 5, in which the above-mentioned bore in the tool is continuous, wherein a closure (12) is also disposed at the rear end (10).

7. Tool according to claim 6, in which the lubricant is pressed to the front with the aid of a plunger (13) and a spring (14).

AMENDED CLAIMS

[received by the International Bureau on 21 August 1998 (21.08.98); original claim 1 amended; remaining claims unchanged (1 page)]

1. Tool for producing internal threads, such as a screw tap or a thread former, *characterised in that* a lubricant tank (reservoir) (7, 7') is located in the tool and the said tank is enclosed in the tool.

2. Tool according to claim 1, in which the lubricant tank is a so-called minimal lubricant tank.

3. Tool according to claim 1 or 2, in which the lubricant is guided to the thread-producing outer face of the tool via fine feed bores (9).

4. Tool according to claim 3, in which the diameter of the feed bores is between 0.01 and 0.4 mm.

5. Tool according to any one of the preceding claims, in which the lubricant tank is created by a central, axial bore in the tool, wherein it is sealed at the front distal end by means of a closure (8).

6. Tool according to claim 5, in which the above-mentioned bore in the tool is continuous, wherein a closure (12) is also disposed at the rear end (10).

7. Tool according to claim 6, in which the lubricant is pressed to the front with the aid of a plunger (13) and a spring (14).

Fig. 1

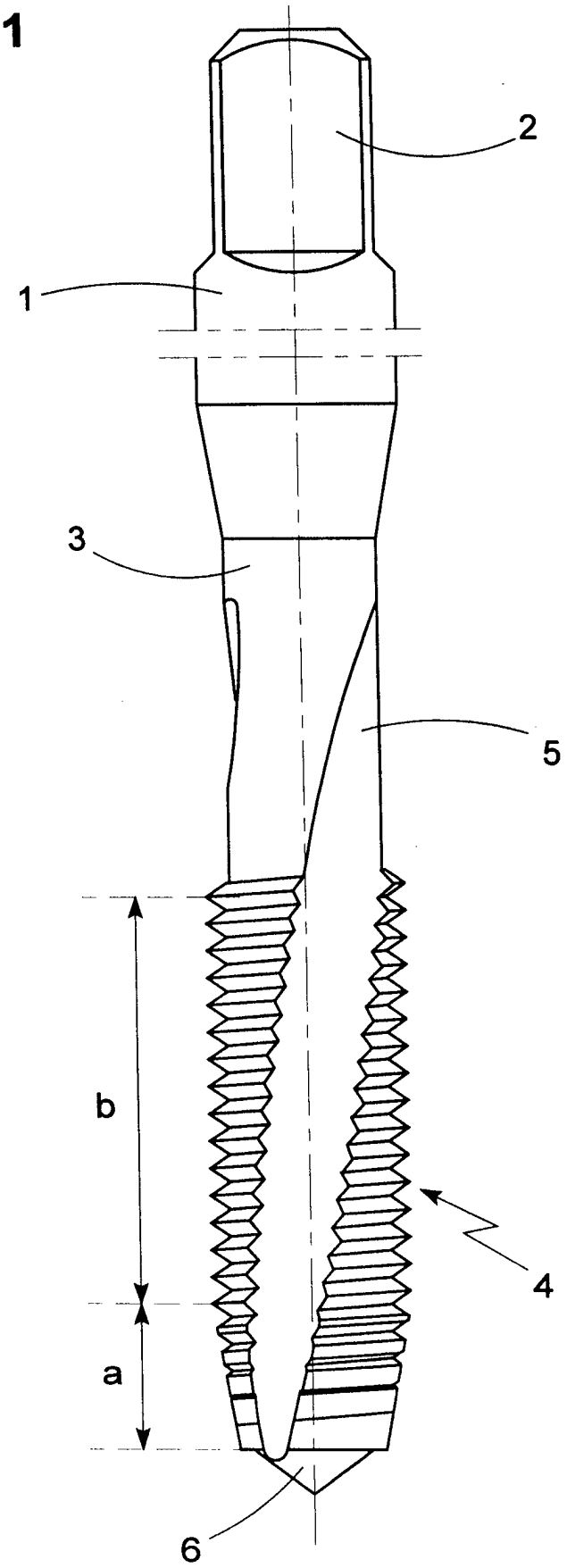


Fig. 2

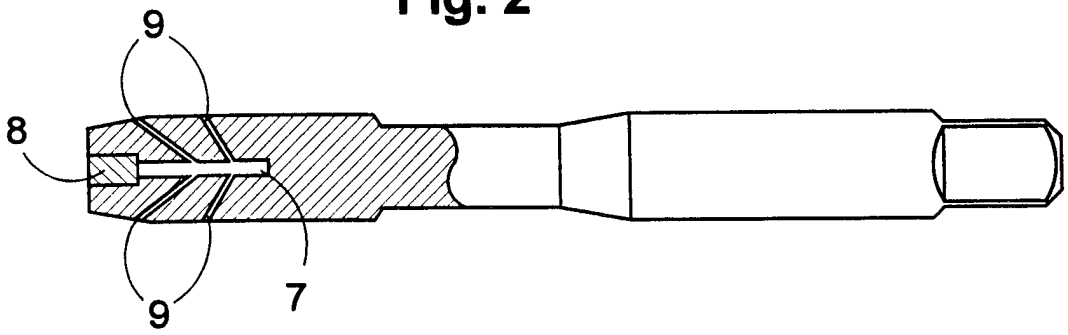


Fig. 3

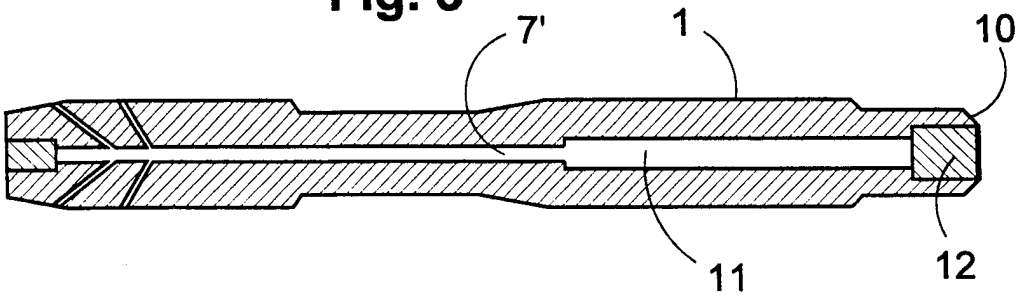
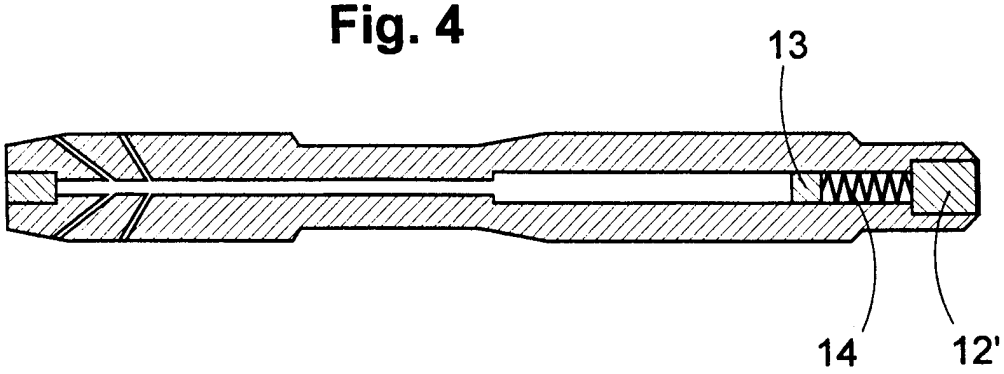


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00623

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B23G 5/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC6: B23B, B23G

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)

EDOC, WPIL, JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2460172 A1 (SOCIETE NOUVELLE DELTAL), 23 January 1981 (23.01.81), page 4, line 7 - line 14, figures 3,4	1-3,5
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Y	Derwent's abstract, No 85- 10742/02, week 8502, ABSTRACT OF SU, 1093409 (GILIN V F), 23 May 1984 (23.05.84)	7
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A	Derwent info.; SU647071 A, KUZIN V A, "Thread tap with axial coolant feed channel - has annular grooves on external surface of guide insert and internal cavity in body", 790215, figur 1, abstract	1-3
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4762444 A (MENA), 9 August 1988 (09.08.88), column 2, line 21 - line 30, figure 4	1-3,5
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A	US 4705435 A (CHRISTOFFEL), 10 November 1987 (10.11.87), figure 5, abstract	1-2
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INTERNATIONAL SEARCH REPORT

Information on patent family members

09/06/98

International application No.
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