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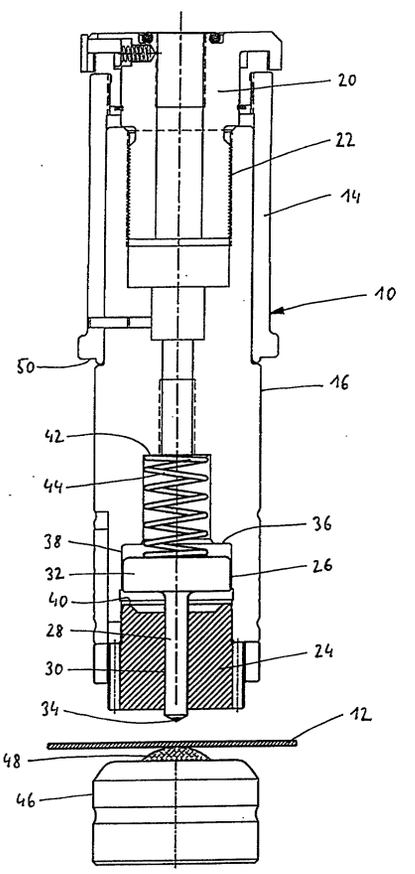
(54) Marking workpieces

(57) The present application is for providing a method for marking workpieces on punch presses, wherein a marking tool is forced by means of a punch stroke onto or into the surface of a sheet-shaped workpiece, which is displaceable in its plane, in which the marking tool has a tool tip (34) which, after being forced onto or into the workpiece, is maintained in a marking position, the workpiece is displaced in its plane corresponding to the contours of the symbol to be marked or inscribed, and subsequently the tool tip (34) is moved back into its position of rest wherein, if required, after an appropriate movement of the position of the workpiece, the marking process is repeated in accordance with the number of markings to be made.

Fig. 1



EP 1 099 509 A1

Description

[0001] The present invention relates to a method and apparatus for marking workpieces on a punching press, wherein the marking tool is forced by means of the punching stroke either against the surface of the workpiece to form a mark on the surface thereof or a certain depth into the surface of the workpiece to form the marking by inscribing. The workpiece, which is generally a piece of flat sheet metal is displaced within its plane in order to create a straight or curved marking line.

[0002] There is an increasing demand for providing the workpiece with individual identifications. In this connection the use of stamping dies is not always practical because the stamping is often also visible on the back of sheet metal workpiece. Difficulties in connection with stamping dies occur particularly when it is intended to punch parts of different lengths out of a sheet metal workpiece (e.g., in order to minimize waste) and wherein a certain orientation of the marking on the workpiece is desirable.

[0003] A known method for marking sheet metal consists of embossing dot matrices for producing an alphanumeric symbol with the aid of a pointed embossing tool. The workpiece must be moved stepwise after each dot has been embossed. This results in a multitude of required stamping stroke cycles, just to represent a single symbol. Besides the large amount of required time and the increased wear of the driving mechanism for the stroke, which is driven in a quasi load-free manner, the loud noise is considered to be a disadvantage. A coarser dot matrix does simplify the marking process, but it also results in a more unsatisfactory matrix.

[0004] A qualitatively appealing marking can be achieved by inscribing markings into the surface of the workpiece, wherein no waviness or "rear embossing" will occur. Borries Markiersystem GmbH of Pliezhausen, for example, offers a machine, by means of which inscribing of the desired identification is possible by displacing a tip forced into the surface of the workpiece in accordance with the contours of the marking.

[0005] It would seem that in principle one could employ such a known marking device in a punch press. However, if this were done, the space available for the main punching operation would be reduced and the progress of the main punching operation would be made more difficult. Also, such a prior marking device could only operate within a limited portion of the area of the punch press so that movement of the sheet metal workpiece in order to apply markings on different areas thereof would become more difficult.

[0006] It is an object of the present invention to create a new improved method and apparatus for marking a sheet metal workpiece, which method and apparatus can be integrated into a punching processes in a punch press.

[0007] This object is attained in accordance with the invention by a method and apparatus wherein the marking tool is equipped with a tip which, after having been forced against or into the surface of the workpiece, is maintained at a marking position, at which time the workpiece is displaced in its plane in accordance with the contour of a symbol to be marked, and thereafter the tip is moved away from the workpiece to its rest position.

[0008] The production of visually pleasing markings of any arbitrary symbol on or in the workpiece surface is made possible by means of the marking tool being placed on the punch press without any additional, space-consuming devices. At the same time the marking method is optimally integrated into the punching process so that, for example with a turret punch press, a sheet metal workpiece is first marked at the desired locations and thereafter is finished by means of the tools seated in other holders of the punch press. The marking tool may be arranged in a punch tool holder or in a holder on the workpiece support table of the punch press, so that the marking can be made from above or below the workpiece, as required. The orientation of the marking can be determined by means of the software which controls the workpiece driving mechanism.

[0009] It is also advantageous in connection with the method of the invention that the tool tip need be moved only once into its marking position, so that the number of punch strokes which must be performed by the punch press is considerably reduced. The results are reduced noise generation and reduced wear of the stroke driving mechanism.

[0010] In one preferred embodiment of the invention, at least a portion of the punch stroke is absorbed by an elastic element which extends between a table for seating the workpiece and the punch tool holder.

[0011] Since punch presses are designed for very high processing forces, it can be very difficult under certain circumstances to move the stroke driving mechanism almost load-free into a precisely defined position. To compensate for this, it is possible by an elastic element to achieve considerably more precise movement of the tool tip on or into the surface of the workpiece. In the process, the elastic element translates the relatively large punch stroke of the punch press into an exactly defined contact pressure force of the tool tip, which leads to the desired marking position.

[0012] In a further preferred embodiment of the invention at least one marking is formed as center mark, wherein, following pressing the tool tip, the workpiece is maintained in its predefined position until the marking tool is retracted.

[0013] It is desirable for some applications to be able to set a center mark on the workpiece, for example in order to be able to position or center bolts or pins which are to be welded onto the workpiece. The provision of the center mark can be integrated into the marking process and apparatus in accordance with the invention, wherein it might be advantageous if, in connection with a center mark, the tool tip were pressed deeper into the workpiece than the usual inscribing depth.

[0014] For example, when making a center mark it is possible in a further development of the invention that by different positioning of the tool tip with respect to a counter-support, for example, the spring travel of the tool tip reaches its maximum before it has reached the deepest depth in the workpiece. While the inscribing of markings is performed by means of a resilient tool tip, the latter rests against a stop when making a center mark.

[0015] It has been shown to be practical to guide the workpiece by means of at least one support roller in the area of the workpiece table and/or the punch tool holder since, among other things, the support rollers or support balls provide the required counter support while not hampering the displacement of the workpiece.

[0016] In accordance with the invention, an apparatus for carrying out the method of the present invention comprises of a marking tool and a counter- support on the opposite side of the workpiece, wherein the marking tool has a tool tip which can be forced in against the restoring force of an elastic element and which can be fixed in place in a punch holder or in the workpiece table of a punch press. The counter-support can be fixed in place on the punch holder, in the table or on the punch holder. It is possible with the aid of the at least one marking tool with its resilient tool tip and the appropriate counter-support to execute the marking or center marking operations on a punch press with its workpiece which is movable in its plane. It is basically of no significance whether the marking tool is arranged below or above the workpiece, or whether marking tools are provided on both sides of the workpiece in order to mark both sides thereof in cooperation with appropriate counter-supports. With such an apparatus, one marking tool and one counter-support in combination can constitute one half of the apparatus above or below the workpiece.

[0017] The counter-support preferably has at least one rotatable support roller or support ball for the movable support of the workpiece. As previously mentioned, balls or rollers as the support offer the possibility of a dependable support, with mobility provided without damage to the surface or at least limiting frictional losses to occur only at the contact points.

[0018] The marking tool preferably has, besides the tool tip, rotatable support rollers or support balls, which are seated in an elastically spring-loaded manner.

[0019] With an arrangement of this type, during a punching stroke the workpiece first comes into contact with the support rollers or support balls, which subsequently yields elastically until, prior to reaching bottom dead center, the tool tip comes into contact with the surface of the workpiece. Contact pressure is then built up during the further downward movement.

[0020] In this case the spring travel of the support rollers or support balls is preferably greater than the spring travel of the tool tip. In this way it is possible when setting a center mark that the tool tip rests against a stop, because of which an exactly defined center mark depth results. Center marking requires a precise approach to its final position.

[0021] The resilience of the elastic elements of the support rollers is suitably less than that of the elastic element of the tool tip in order to achieve a sufficient contact pressure when applying the marking symbols, and in order to introduce only small forces into the workpieces by means of the support rollers or support balls, noting that the sheet metal workpiece can be comparatively thin. However, the resilience of the support roller or support balls should be sufficient for supporting the workpiece during the operation.

[0022] A cone-shaped tip of the inscribing element is preferably forced into the workpiece surface, so that an inscribing force is achieved regardless of the direction of movement. However, shapes which are not round are also conceivable which, when required, can be rotated in accordance with the direction of movement of the workpiece, or which can also specifically cut grooves of different thicknesses into the workpiece surface.

[0023] In accordance with yet another preferred embodiment, the marking tool has an adjustable support, by means of which the position of the tool tip and/or the prestress of its elastic element can be adjusted.

[0024] The adjustable support makes possible the individual adaptation of the contact depth, for example in order to improve the clarity of the symbols in the same material of the workpiece, or to make possible an adaptation to the material of the workpiece.

[0025] As mentioned above, with the present invention, it is possible to make a marking such as an ink marking or the like on the surface of the sheet metal instead of inscribing the marking into the sheet metal. Making an ink marking would use the same method and apparatus as described above with respect to inscribing except that the method and the equipment would be adjusted such that the marking tools such as a pen or the like would simply be forced with sufficient pressure against the surface of the workpiece, as opposed to entering into the surface of the workpiece. Any suitable pen could be used including for example, a ball-point pen, a roller ball pen, a felt tip pen or a grease pencil.

[0026] Thus, it is an object of the present invention to provide a new and improved method and apparatus for marking a workpiece, wherein the apparatus is incorporated within a punch press.

[0027] It is another object of the present invention to provide a new and improved method and apparatus for marking a sheet metal workpiece in conjunction with a punch press, wherein the marking can be either inscribed into the surface of the workpiece or made as an ink marking on the surface of the workpiece.

[0028] It is still another object of the present invention to provide a new and improved method and apparatus for marking a sheet metal workpiece in conjunction with a punch press, wherein the marking can be made on either side of the workpiece, with suitable support provided on the other side of the workpiece.

[0029] These and other objects of the present invention will become more apparent from the detailed description to follow.

[0030] The invention will now be described in detail with respect to preferred embodiments of the invention wherein:

Fig. 1 is a central cross sectional view of a marking tool for insertion into a punch holder,

Fig. 2 is a central cross sectional view of a marking tool for insertion into a holder on a workpiece supporting table of a punch press, wherein the right and left sides show two different positions,

Fig. 3 is a central cross sectional view of a marking tool similar to Figure 2, but showing a modification thereof, and

Fig. 4 is an enlarged view of a portion of Figure 1, but showing a modification thereof.

[0031] Referring now to the drawings, like elements are represented by like numerals throughout the several views.

[0032] Referring to Figure 1, the marking tool has a guide bush 14, in which a support 16 is axially guided, and a driving head 20, which are in engagement with each other via a threaded connection 22. By means of a guide insert 24, the support 16 holds an inscribing tool 26, which is axially movable with respect to the support 16 and has a tool shaft 28 which is guided in an appropriately fitted bore 30 of the guide insert 24, a pressure plate 32, formed at the top of the shaft 28, as well as an inscribing element 34, seated on the free lower end of the shaft 28. The inscribing element 34 is embodied as a pointed cone and can be made, for example, of a diamond, boron nitride, a hard metal, or an otherwise suitable material for inscribing the respective workpiece.

[0033] The axial mobility of the inscribing tool 26 in relation to the support 16 is limited by a first shoulder 36 of a bore 38 in the support 16, and by the top 40 of the guide insert 24 inserted into the bore 38. A compression spring 44, arranged under prestress between a second shoulder 42 and the pressure plate 32, urges the pressure plate 32 downwardly against the top 40 of the guide insert 24.

[0034] In the exemplary embodiment represented, the workpiece 12 is a sheet metal plate which rests on a tool holder 46 with a rotatably seated ball 48, wherein the contact point between the workpiece 12 and the ball 48 lies exactly in alignment with the inscribing element 34.

[0035] To inscribe a symbol on the workpiece 12, the workpiece is first appropriately aligned with the marking tool 10. Thereafter, lowering of the inscribing tool 26 is started by actuating the stroke driving mechanism of the punch press, which acts on the driving head 20, wherein the guide bush 14 is urged against the support 16 by means of a shoulder 50. In the course of the downward movement of the support 16 the inscribing tool 26 is initially moved along until the inscribing element 34 rests on the surface of the workpiece. The continued downward movement of the support 16 leads to compression of the compression spring 44, and therefore the pressure exerted on the pressure plate 32 steadily increases. Because of the pressure exerted by the compression spring, the inscribing element 34 penetrates the surface of the workpiece and reaches its maximum penetration depth at the end of the punch stroke.

[0036] An adjustment of the penetration depth of the inscribing element 34 can be performed by a relative turning of the driving head 20 in relation to the support 16. This changes the effective total combined length of support 16 and driving head 20. With this increased length of the support 16 and driving head 20 the inscribing element 34 reaches the surface of the workpiece earlier in the punch stroke, and the pressure built up by means of the compression spring 44 becomes correspondingly greater.

[0037] As soon as the inscribing element 34 reaches its inscribing position, the stroke driving mechanism of the punch press is blocked. Conversely, if the stroke driving mechanism of the punch press did not permit the marking tool to stop in the inscribing position, a separate detent device must be provided between the support 16 and the guide bush 14. With the inscribing element 34 held down, the workpiece 12 is now displaced in its plane in order to form the contours of the symbol to be inscribed, wherein any arbitrary orientation of the symbol is possible by an appropriate control of the workpiece driving mechanism. When the symbol has been completely inscribed in the workpiece, the stroke driving mechanism is reversed, wherein first the support 16 is moved away from the workpiece 12 because of the diminishing pressure force by the spring 44 and, following the contact of the pressure plate 32 with the top 40 of the guide insert 24, the inscribing element 34 is lifted off the workpiece 12. The workpiece 12 is appropriately horizontally displaced within its plane and the inscribing process is repeated for inscribing additional symbols.

[0038] During the horizontal displacement of the workpiece 12, the roller body 48 of the counter-support 46 follows this movement, wherein an optimal counter-support directly in alignment with the inscribing element 34 always exists. Because the roller ball 48 turns, sliding movements against the underside of the workpiece 12 are prevented, so that the underside of the workpiece 12 is not detrimentally affected.

[0039] Where the marking tool of Figure 1 is used in a punch press the guide bush 14 is adapted to the tool holder and the driving head 20 is adapted to the stroke driving mechanism of the punch press.

[0040] The compression spring 44 can be replaced with a pneumatically or hydraulically operating pressure spring.

[0041] Figure 2 illustrates a marking tool 100, which can be inserted into a support on the workpiece supporting table of a punch press. The marking tool 100 has a housing 102, which has a circular bore 104, in which is received a ring-shaped holder 106. The ring-shaped holder 106 is resiliently axially supported in the punching direction by means of several helical springs 110, which are located within the circumference of a first shoulder 108. The holder 106 has two or more recesses 112, in which inserts 116, which rotatably receive support balls 118, have been fixed in place by means of threaded bolts 114. Even in the maximum retracted resilient state, as shown on the right side of Figure 2, the support balls 118 project upwardly past the upper edge of the housing 102. In its uppermost position, as shown on the left side of Figure 2, the upward movement of holder 106 is limited by a retaining ring 120, against which an annular shoulder 122 of the ring-shaped holder 106 rests. It would also be within the invention to provide a separately embodied holder with an associated helical spring in place of a ring-shaped holder 106.

[0042] The marking tool 100 moreover has a cone-shaped tool tip 124 made of a suitable material, for example a hard alloy. The tool tip 124 has been inserted via a screw thread 126 into a bore 128 of a tool holder 130, which is resiliently supported by means of a helical spring 132 on a bottom cover 134. In this embodiment, the cover 134 has been screwed into a screw thread in the bottom of housing 102. This arrangement allows the replacement of the tool tip 124 without the necessity to completely dismantle the marking tool.

[0043] The tool holder 130 is guided in a guide bore 135 of a housing element 136, which is screwed together with the housing 102 by means of a screw connection. A rotation guard 138 in the form of a bolt prevents relative rotation between the tool holder 130 and the housing element 136.

[0044] A detent flange 142 provided on the tool holder 130, together with its detent face 144 on the housing element 136, limits upward movement of the tool holder 130. In the other direction, the maximum retracted resilient position of the tool holder 130 with the tool tip 124 is limited by the bottom face 146 of the tool holder 130 engaging the bottom cover 134, wherein the travel of the springs 110 of inserts 116 is greater than the travel of spring 132 the of tool holder 130. In the uppermost position of the springs 110 and 132 and the inserts 116 the support balls 118 project upwardly past the tool tip 124, while in the maximum retracted resilient state of the inserts 116 and of the tool holder 130, the tool tip 124 projects upwardly slightly past the tops of the support balls 118.

[0045] A tool corresponding to the marking tool 100 and having a further tool tip can be provided in the area of the punch holder of the respective punch press. It is also within the invention to provide only a simple counter-support with support balls, which can be aligned with the support balls 118 of the marking tool 100. A reverse arrangement is also within the invention, wherein only a counter-support with support balls 118 is provided on the table side, and a tool similar to the tool 100 is provided in the punch holder.

[0046] During operation, a workpiece to be marked, normally a sheet metal piece, initially rests on the support balls 118 of the tool 100 and is not in contact with the tool tip 124. In this position the sheet metal workpiece can be displaced horizontally in its plane without the tool tip 124 causing damage to the surface. After the sheet metal workpiece has been moved into a position in which it is to be marked, a punch stroke is initiated. In the course of this stroke, the sheet metal workpiece is moved downwardly, for example by pressure balls on the top of the workpiece, wherein the inserts 116 are lowered against the force of the helical springs 110. The tool tip 124 reaches the surface of the sheet metal workpiece, and the prestressed spring 132 of the tool holder 130 is compressed by means of continued lowering, because of which a contact pressure force of the tool tip 124 is built up on the surface of the sheet metal workpiece. The tip 124 slightly penetrates into the material of the workpiece under this contact pressure force. If symbols are to be inscribed into the surface of the workpiece, the bottom dead center position is set in such a way that the tool holder 130 does not yet rest against the bottom cover 134. Therefore the penetration depth of the tool tip 124 remains relatively slight. Thereafter the sheet metal workpiece is displaced horizontally in its plane in accordance with the contours of a symbol to be inscribed. The top dead center position of the punch holder is then again approached. Now the position of the sheet metal workpiece can be moved and, if desired, further symbols can be inscribed.

[0047] The provision of a center mark in a workpiece is also possible by means of the marking tool 100, for example as an alignment aid for pins or bolts to be welded onto the workpiece during subsequent work steps. To this end the sheet metal workpiece at bottom dead center is moved further downward by means of an increased punch stroke, or by means of a tool tip 124, which can be adjusted in a suitable manner, or by means of a position adjustment of the pressure balls, or the like, because of which the bottom face 146 rests against the bottom cover 134 before bottom dead center has been reached. By means of the subsequent lowering by a further short distance, a center mark of a desired depth is made which clearly extends to a depth which is deeper than the inscribed symbols.

[0048] Figure 3 illustrates another embodiment 200 of a marking tool. The embodiment of Figure 3 is similar to the embodiment of Figure 2 except for certain modifications. Accordingly, those elements in Figure 3 which are identical to Figure 2 are represented by the same numeral. Those elements which have been modified have been raised by 100 relative to the numeral used to describe the related part in Figure 2.

[0049] In contrast to Figure 2, Figure 3 shows a dia-

mond tool tip 224 which is seated in a shaft 226. This shaft 226 has been fixed in place by means of an attachment screw 228 on a tool holder 230. The essential difference of the tool holder 230 in comparison with the tool holder 130 of Fig. 2 is that the tool holder 230 has an increased free space between its bottom face 246 and the bottom cover 234, so that even with the holder 106 being maximally retracted resiliently and resting against the first shoulder 108, the spring travel of the tool holder 230 is not at its maximum compression. Therefore the marking tool represented in Fig. 3 is only suitable for inscribing symbols wherein the greater hardness of the diamond tip 224 provides a longer service life, while the increased travel of spring 132 protects the diamond tip from shocks caused by engaging the detent 142.

[0050] As described above, the described tools for marking and possibly providing center marks can be used on the workpiece supporting table side as well as on the punch holder side, so that processing of both sides of the workpiece is possible.

[0051] Figure 4 illustrates a modification of the present invention wherein, instead of an inscribing element, there is provided an ink point 334 for marking the surface of the workpiece 12 without penetrating same. Ink point 334 is shown at the lower end of a shaft 334 mounted in guide insert 24 of Figure 1. All of the above described features of all embodiments of the invention can utilize an ink element 134 to mark the surface of a workpiece in place of the previously described elements for inscribing the workpiece and/or forming a center mark. As would be understood by one of ordinary skill in the art, when using an ink marking point 334, one would simply adjust movements of all of the other movable parts such that instead of penetrating the workpiece, the apparatus would move the ink point 334 to a position whereat it exerted sufficient force onto the workpiece to form an ink marking. As with the other embodiments, the workpiece 12 could then be displaced horizontally within its plane so as to form an ink symbol of straight or curved lines. Any type of known ink point could be used such as a ball-point, a roller ball point, a felt tip or a grease pencil.

[0052] Although the invention has been described in considerable detail with respect to preferred embodiments thereof, it will be apparent that the invention is capable of numerous modifications and variations, apparent to those skilled in the art, without departing from the spirit and scope of the invention.

Claims

1. A method for marking workpieces on punch presses, wherein a marking tool (34, 124, 224, 334) is forced by means of a punch stroke onto or into the surface of a sheet-shaped workpiece, which is displaceable in its plane, characterized in that the marking tool has a tool tip (34, 124, 224, 334) which, after being forced onto or into the workpiece, is maintained in a marking position, the workpiece is displaced in its plane corresponding to the contours of the symbol to be marked or inscribed, and subsequently the tool tip (34, 124, 224, 334) is moved back into its position of rest wherein, if required, after an appropriate movement of the position of the workpiece, the marking process is repeated in accordance with the number of markings to be made.

2. The method in accordance with claim 1, characterized in that marking tools (34, 124, 224, 226, 334) are arranged in a punch holder of the punch press and/or in a holder of the workpiece support table.

3. The method in accordance with claim 1 or 2, characterized in that at least a portion of the punch stroke is absorbed by an elastic element (44, 132) which is provided extending between a workpiece supporting table and the punch tool holder.

4. The method in accordance with claim 3, characterized in that at least one marking is set as a center mark, wherein, after the tool tip (34, 124, 224) has entered the workpiece, the tool tip is maintained in its predetermined position until the marking tool is retracted.

5. The method in accordance with claim 4, characterized in that in connection with center marks the tool tip (34, 124, 224) is pushed deeper into the workpiece than during the inscribing process, and preferably in the course of providing a center mark the spring travel of the tool tip (34, 124, 224) reaches its maximum before the lowest depth penetration into the workpiece has been reached.

6. The method in accordance with one of the preceding claims, characterized in that the workpiece is guided by at least one support roller or support ball (48, 118) in the area of the workpiece support table and/or the punch holder.

7. An apparatus for executing a method in accordance with one of the preceding claims, characterized in that it consists of at least one marking tool (34, 124, 224, 334) and at least one counter-support on the side of the workpiece located opposite the marking tool, wherein the marking tool has a tool tip (34, 124, 224, 334), which can be pressed in against the restoring force of an elastic element (44, 132) and can be fixed in place on a punch holder or the holder at the workpiece supporting table of a punch press, and the counter-support can be fixed in place on the other side of the workpiece.

8. The apparatus in accordance with claim 7, charac-

terized in that the counter-support has at least one rotatable support roller or support ball for the movable support of the workpiece.

9. The apparatus in accordance with claim 7 or 8, characterized in that, besides the tool tip (34, 124, 224, 334), the marking tool has rotatable support rollers or support balls (118), which are seated in an elastically spring-loaded manner, the spring travel of the support rollers or support balls (118) preferably being greater than the spring travel of the tool tip (34, 124, 224, 334).

10. The apparatus in accordance with claim 9, characterized in that in the rest position the tool tip (124, 224) projects less than the support rollers or support balls (118), but wherein the latter can be resiliently retracted into a lower position than the tool tip (124, 224), the resiliency of the elastic elements (110) of the support rollers (118) preferably being less than the resiliency of the elastic element (132) of the tool tip (124, 224).

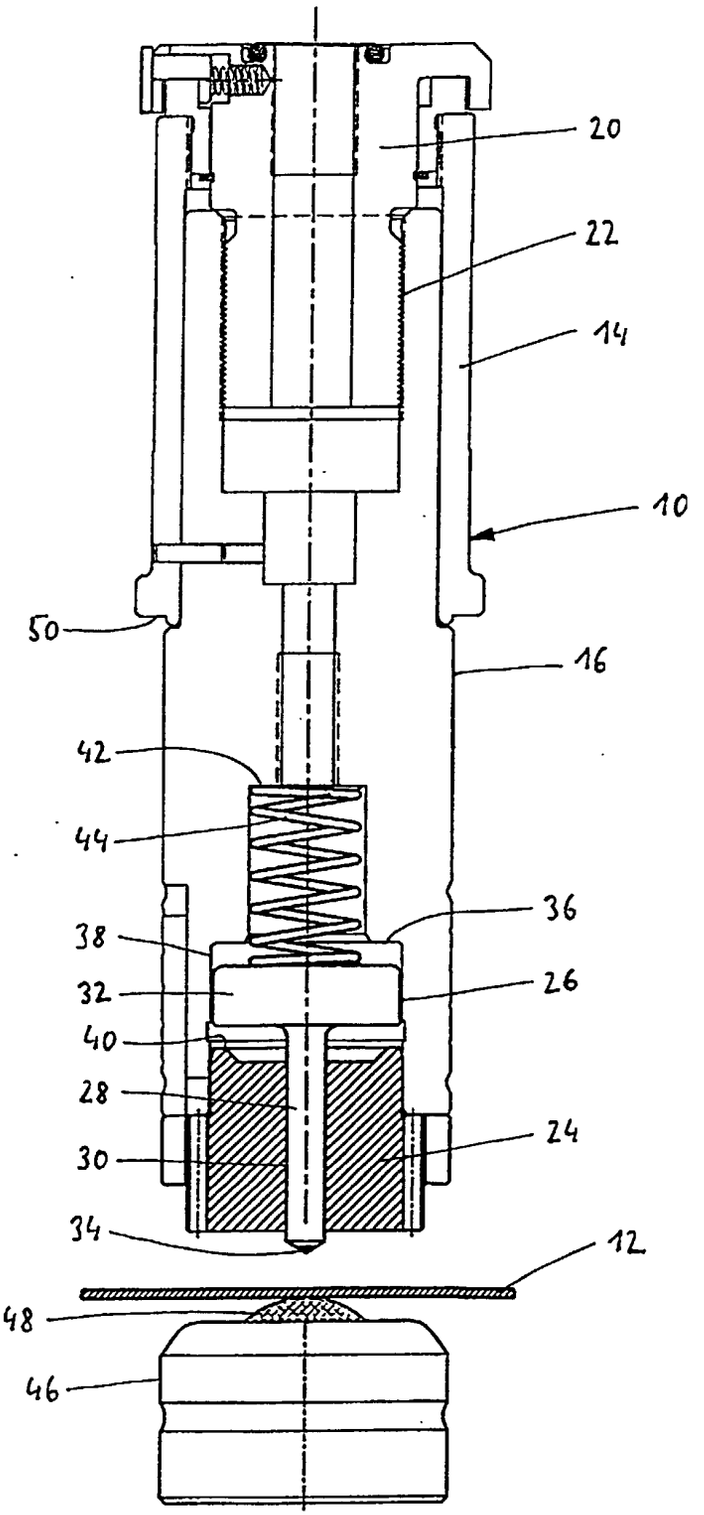
11. The apparatus in accordance with one of claims 7 to 10, characterized in that the tool tip (34, 124, 224) consists of diamond, boron nitride or a hard alloy.

12. The apparatus in accordance with one of claims 7 to 11, characterized in that the tool tip (34, 124, 224) is cone-shaped.

13. The apparatus in accordance with one of claims 7 to 12, characterized in that an adjustable support (16, 18, 20, 22, 126, 130, 226, 228) is associated with the marking tool (34, 124, 224, 334), by means of which the position of the tool tip (34, 124, 224, 334) and/or the prestress of its restoring spring can be adjusted.

14. The apparatus in accordance with one of claims 7 to 13, wherein the tool tip is an ink point for marking the surface of the workpiece.

Fig. 1



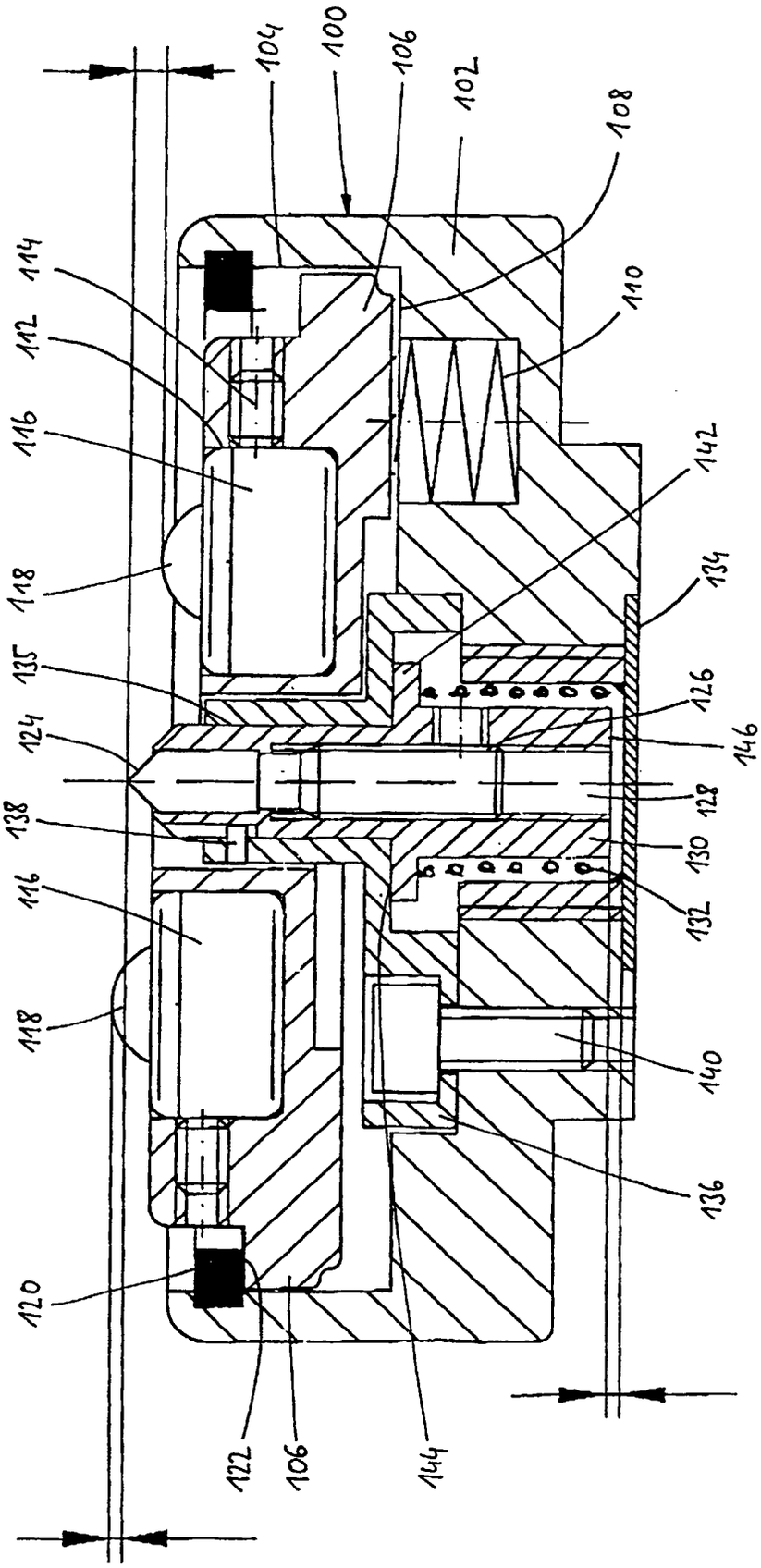

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Fig. 2

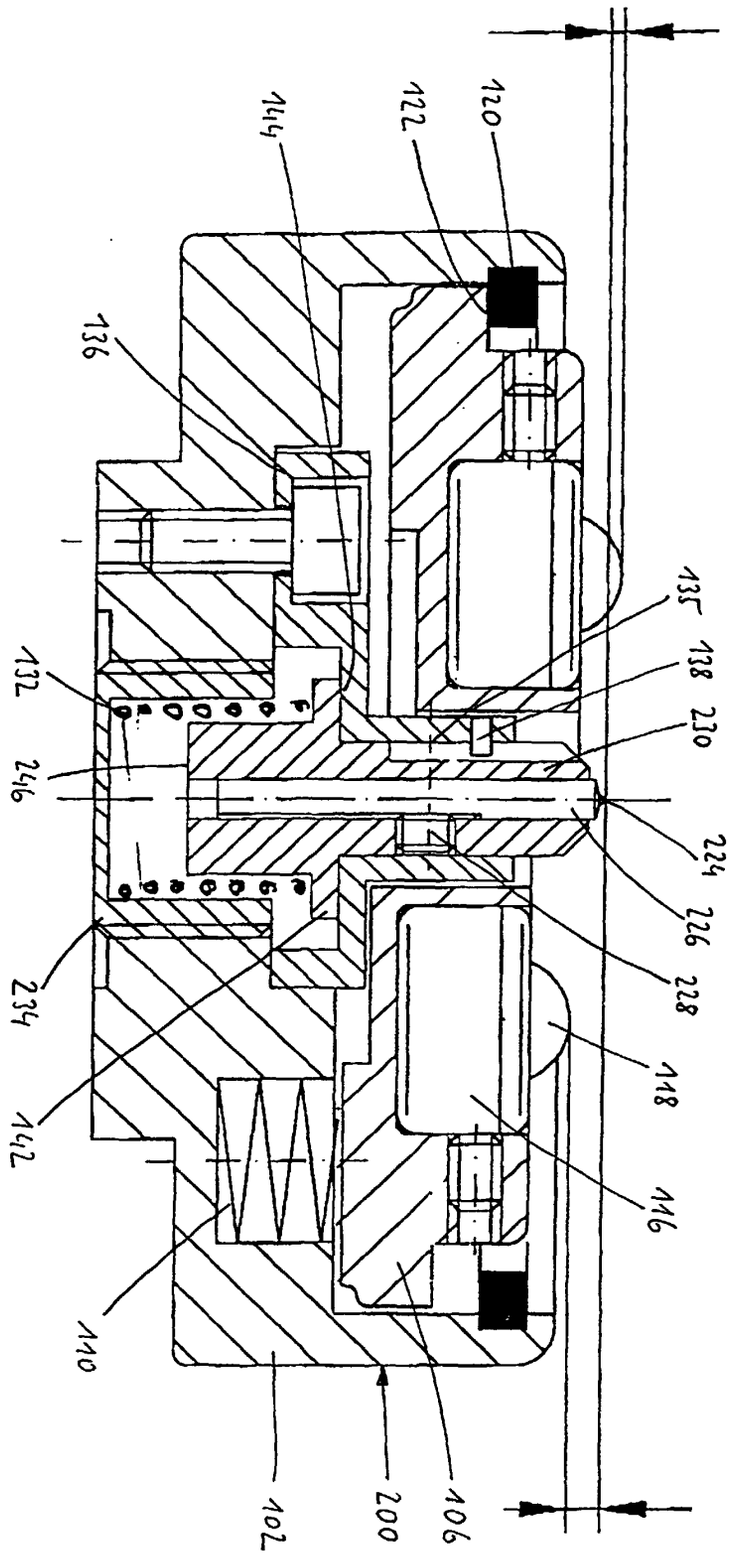
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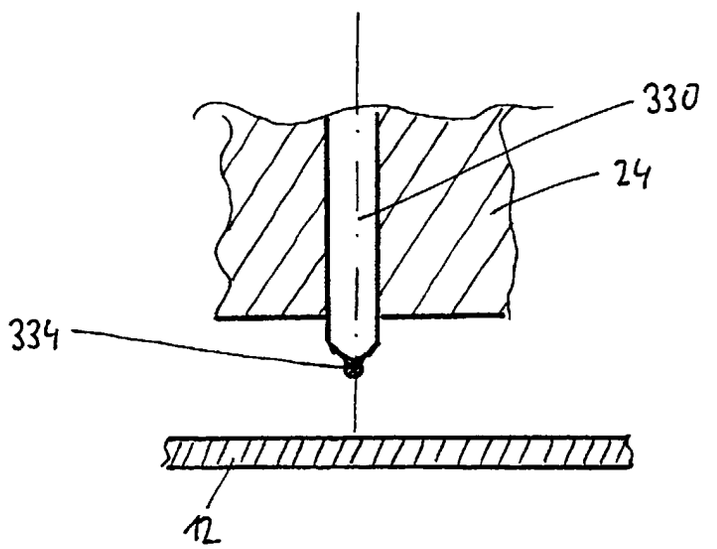
Fig. 3

Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 00 12 2534

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	JP 08 281340 A (AMADA METRECS CO LTD) 29 October 1996 (1996-10-29) * figures 1,3,8,9,16 * ---	1-7, 11-13	B23P23/00 B44C1/24
X	US 5 682 657 A (HIROSE SHUNZO) 4 November 1997 (1997-11-04) * figures 2B,5 * ---	1-7, 11-13	
A	DE 37 35 422 A (BORRIES OTTO KG) 11 May 1989 (1989-05-11) * figure 1 * -----	1,7	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B23P
B44C
B21D
B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	11 December 2000	Wankmüller

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 12 2534

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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