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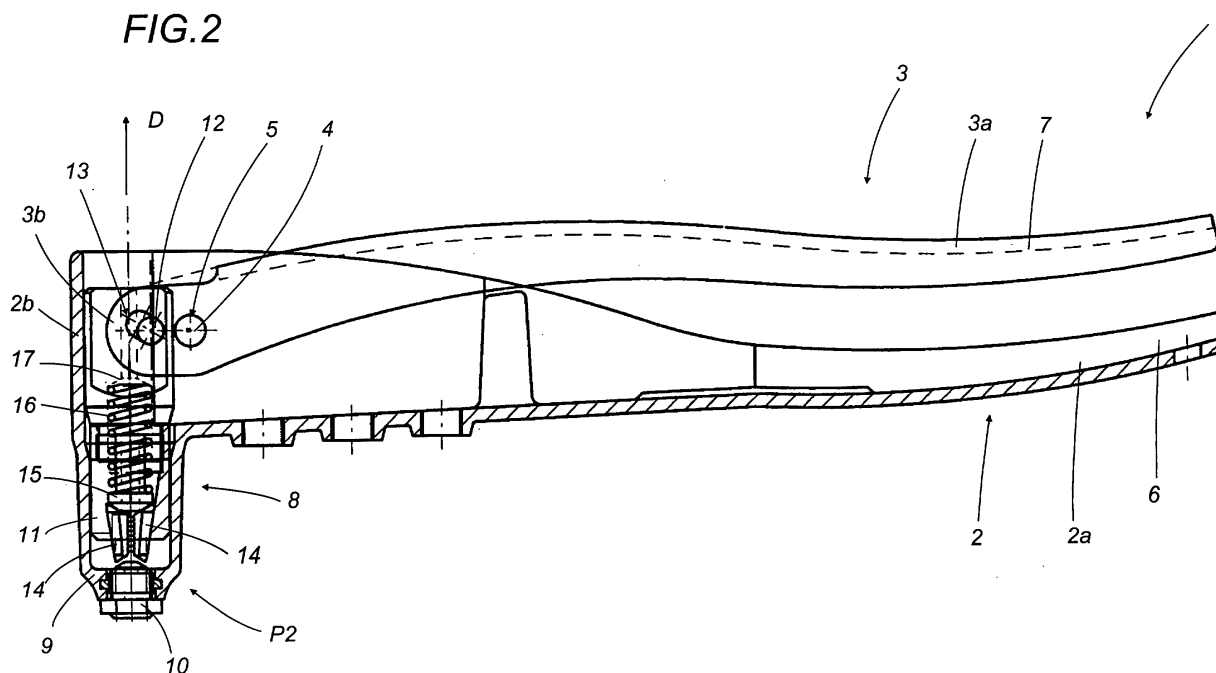
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(54) **A hand riveting tool**

(57) A hand riveting tool (1) for break mandrel rivets comprises two actuating and support elements (2,3) pivoted to each other crossways on a pivot pin (4) about which the two elements (2,3) themselves rotate. On one side of the pin (4), each element (2,3) presents a short portion (2b,3b) forming part of a device (8) for gripping and pulling the rivet mandrels. A sliding guide (9) to guide the movement of the slider (11) is defined by the short portion (2b) of one of the supporting and actuating

elements (2,3) relative to which the other element (3) acts as a lever in such a way as to cause the slider (11) to slide in the guide (9) in the mandrel pulling direction (D) when the handles (6,7) are moved towards each other. The short portion (3b) of the actuating and support element (3) that acts as a lever has a slot (13) which is slidably engaged with a second pin (12) that is rigidly supported by the slider (11) and that is parallel to the first pin (4).

FIG.2



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Description

[0001] The present invention relates to a hand riveting tool.

[0002] In particular, the present invention relates to a hand riveting tool used to apply rivets by gripping, pulling and breaking the mandrel positioned coaxially inside each rivet.

[0003] Customary hand riveting tools of this type usually comprise two supporting and actuating elements pivoted to each other crossways on a pivot pin about which the two elements themselves rotate. On opposite sides of the pin, each element presents a long first portion forming a handle, by which the riveting tool can be held, and a short second portion forming part of a device for gripping and pulling the rivet mandrels.

[0004] In addition to the two short portions of the supporting and actuating elements, the gripping and pulling device usually comprises: two jaws for clamping the mandrels; a slider which moves in the mandrel pulling direction and which engages with the jaws in such a way as to drive them from an advanced position where they receive the mandrels to a retracted position where they clamp and pull the mandrels; and a slider sliding guide. The sliding guide is supported by the short portion of one of the two supporting and actuating elements relative to which the other element acts as a lever in such a way as to cause the slider to slide in the guide in the aforementioned pulling direction when the handles are moved towards each other.

[0005] The short portion of the supporting and actuating element that acts as lever is coupled to the slider and, more specifically, to a curved slot made in the slider, by a second pin protruding from the short portion itself and parallel to the pivot pin which connects the two supporting and actuating elements.

[0006] In a riveting tool of this type, the average effort that the user has to exert in order to grip, pull and break off the rivet mandrels is quite considerable since the slider operates on the supporting and actuating element that acts as a resisting lever arm whose length is constant and equal to the distance between the first pin and the second and whose projection onto a plane normal to the aforementioned pulling direction increases as the angle made by the two handles decreases. In other terms, this type of coupling between the lever and the slider disadvantageously amplifies the resisting action of the mandrels.

[0007] The present invention has for an object to provide a hand riveting tool that significantly reduces the average effort which the user is required to exert to grip, pull and break the rivet mandrels.

[0008] Accordingly, the present invention provides a hand riveting tool for break mandrel rivets; the riveting tool comprising gripping and pulling means for engaging and pulling up the mandrels, and means for actuating the gripping and pulling means; said gripping and pulling means comprising means for clamping the mandrels

and means for driving the clamping means in a mandrel pulling direction; the riveting tool being characterised in that the drive means have at least one variable length lever arm actuated by the actuating means and applying on the actuating means a resisting action that is correlated according to a constant proportionality factor to the resisting action exerted by the mandrels.

[0009] The invention will now be described with reference to the accompanying drawings which illustrate a preferred embodiment of it and in which:

- Figure 1 is a side view, with some parts in cross section, of a preferred embodiment of the hand riveting tool according to the present invention, in a first working position; and
- Figure 2 shows the riveting tool of Figure 1 in a second working position.

[0010] With reference to Figures 1 and 2, the numeral 1 denotes in its entirety a hand riveting tool designed to apply rivets (not illustrated) of the type with break mandrels (not illustrated).

[0011] The riveting tool 1 comprises two supporting and actuating elements 2, 3 pivoted to each other crossways on a pivot pin 4 about which the two elements 2 and 3 themselves rotate. The pivot pin 4 is supported at its two opposite ends by the element 2 and is rotatably fitted inside a through hole 5 made in the element 3.

[0012] On opposite sides of the pin 4, each element 2, 3 presents a long first portion 2a, 3a forming handles, 6, 7 by which the riveting tool 1 can be held, and a short second portion 2b, 3b forming part of a device 8 for gripping and pulling the rivet mandrels.

[0013] Looking in more detail, the portion 2b is shaped to form a substantially cylindrical hollow body 9 extending transversally to the portion 2a and, at the end opposite the portion 2a, is delimited by an interchangeable nozzle 10 which receives the mandrels.

[0014] The body 9 slidably houses and guides inside it a hollow slider 11 that can move in a straight line in a mandrel pulling direction D between a first limit position P1 (Figure 1), where the slider 11 is close to the nozzle 10, and a second limit position P2 (Figure 2), where the slider 11 and the nozzle 10 are positioned at a defined maximum distance from each other.

[0015] The slider 11 rigidly supports a second pin 12, which extends transversally to the direction D and parallel to the pin 4, and which is slidably engaged in a slot 13 made in the second portion 3b of the element 3.

[0016] In this way, the second portion 3b, with the slot 13, forms a lever arm which engages with the slider 11 and whose length is given by the variable distance between the pins 4 and 12.

[0017] The gripping and pulling device 8 further comprises two jaws 14 for gripping, clamping and pulling the mandrels.

[0018] The jaws 14 are housed at least partially inside the slider 11 and are slidably engaged with a tapered

inside wall of the slider 11. Each of the jaws 14 has a first end facing the nozzle 10 and a second end, opposite the first end, coupled with a truncated cone shaped pushing element 15 also positioned inside the slider 11.

[0019] The element 15 is in turn coupled with a helical spring 16 which extends in the direction D between the element 15 itself and an end wall 17 of the slider 11, the end wall 17 being located at the end opposite the nozzle 10.

[0020] Below is a description of how the riveting tool 1 operates, starting from the working position illustrated in Figure 1. In the working position, the angle made by the handles 6 and 7 is at its largest, the slider 11 is located at its position P1 where it is close to the nozzle 10, the spring 16 is in position of minimum loading, the element 15 is at its smallest distance from the nozzle 10 and the jaws 14 are located in a forward mandrel receiving position where the jaws 14 themselves are furthest apart.

[0021] The position shown in Figure 1 is also the position where the distance between the pins 4 and 12 is at its largest.

[0022] To clamp, pull and break the rivet mandrel, the user grips the handles 6 and 7 and moves them closer together until their position relative to each other is that illustrated in Figure 2.

[0023] In the position shown in Figure 2, the angle made by the handles 6 and 7 is at its smallest, the slider 11 is located at its position P2, the spring 16 is in position of maximum loading, the element 15 is at its largest distance from the nozzle 10 and the jaws 14 are located in a retracted mandrel pulling position where the jaws 14 themselves are closest together. The position shown in Figure 2 is also the position where the distance between the pins 4 and 12 is at its smallest.

[0024] Notice that when the slider 11 is at the position P2, the pins 4 and 12 both lie in a plane normal to the direction D.

[0025] During the passage of the slider 11 from the position P1 to the position P2, that is to say, as the handles 6 and 7 are moved close to each other, the portion 3b of the element 3, with the slot 13, acts as a resisting lever arm formed by the element 3 pivoted on the pin 4 to drive the slider 11 in the direction D away from the nozzle 10.

[0026] The movement of the slider 11 in the direction D causes the jaws 14 to slide relative to the tapered inside wall of the slider 11 against the opposing action of the spring 16. As a result of this sliding motion, the jaws 14 move closer to each other and, at the same time, away from the nozzle 10, to reach the position illustrated in Figure 2.

[0027] During the passage of the slider 11 from the position P1 to the position P2, the pin 12 moves in a straight line in the direction D relative to the pin 4, and the distance between the pins 4 and 12 decreases from the largest to the smallest value in proportion to the movement of the pin 12 away from the nozzle 10. More-

over, as the distance between the pins 4 and 12 decreases, the projection of this distance onto the aforementioned plane normal to the direction D remains constant. Thus, the slider 11 applies to the element 3 a resisting moment which, advantageously, is correlated to the resisting force of the mandrels according to a constant proportionality factor.

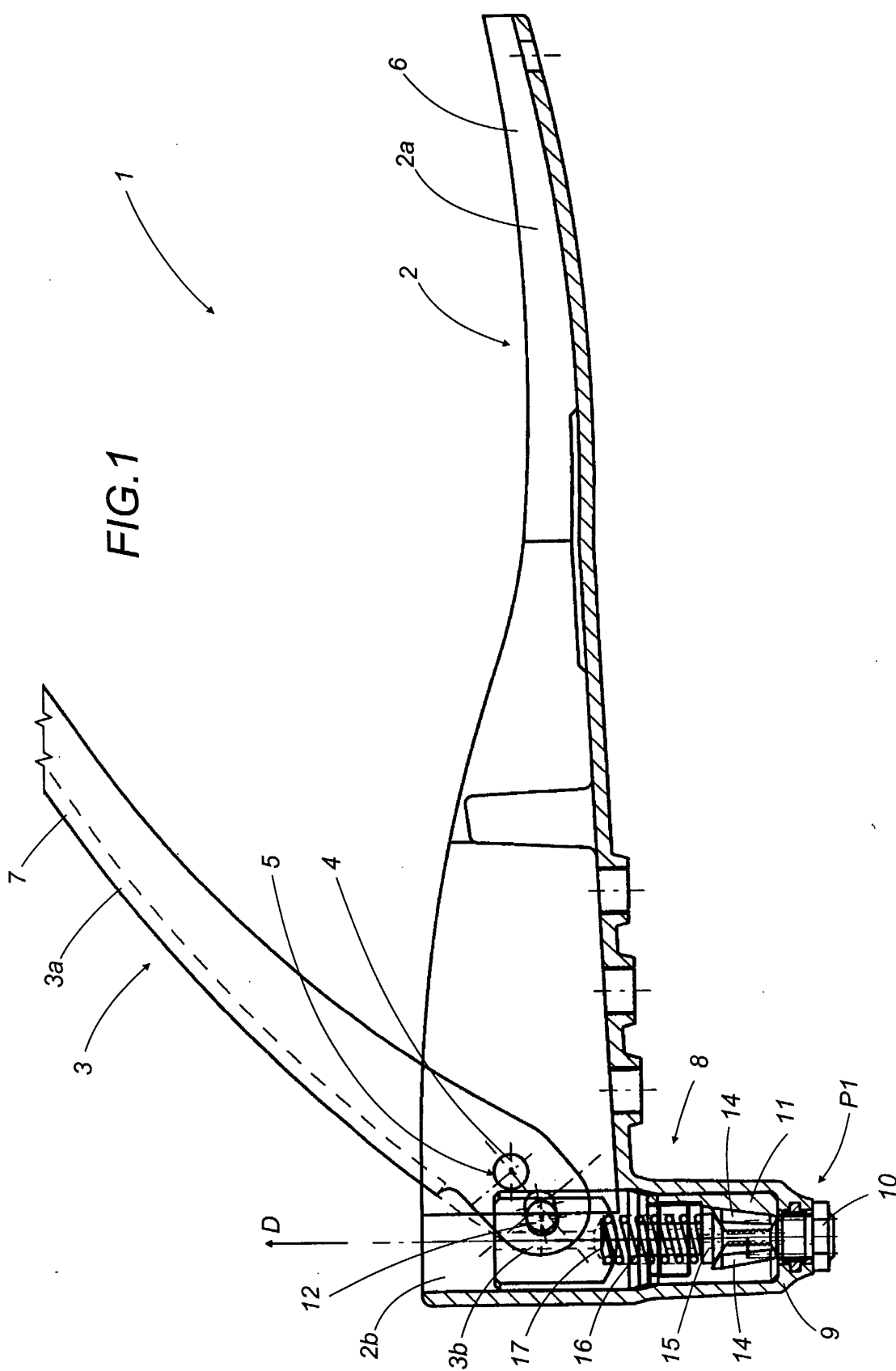
[0028] It follows, therefore, that the average effort which the user exerts to grip, pull and break the rivet mandrels is significantly reduced since it is linked to the resistance of the mandrels according to a proportionality factor that remains constant as the handles 6 and 7 move closer together.

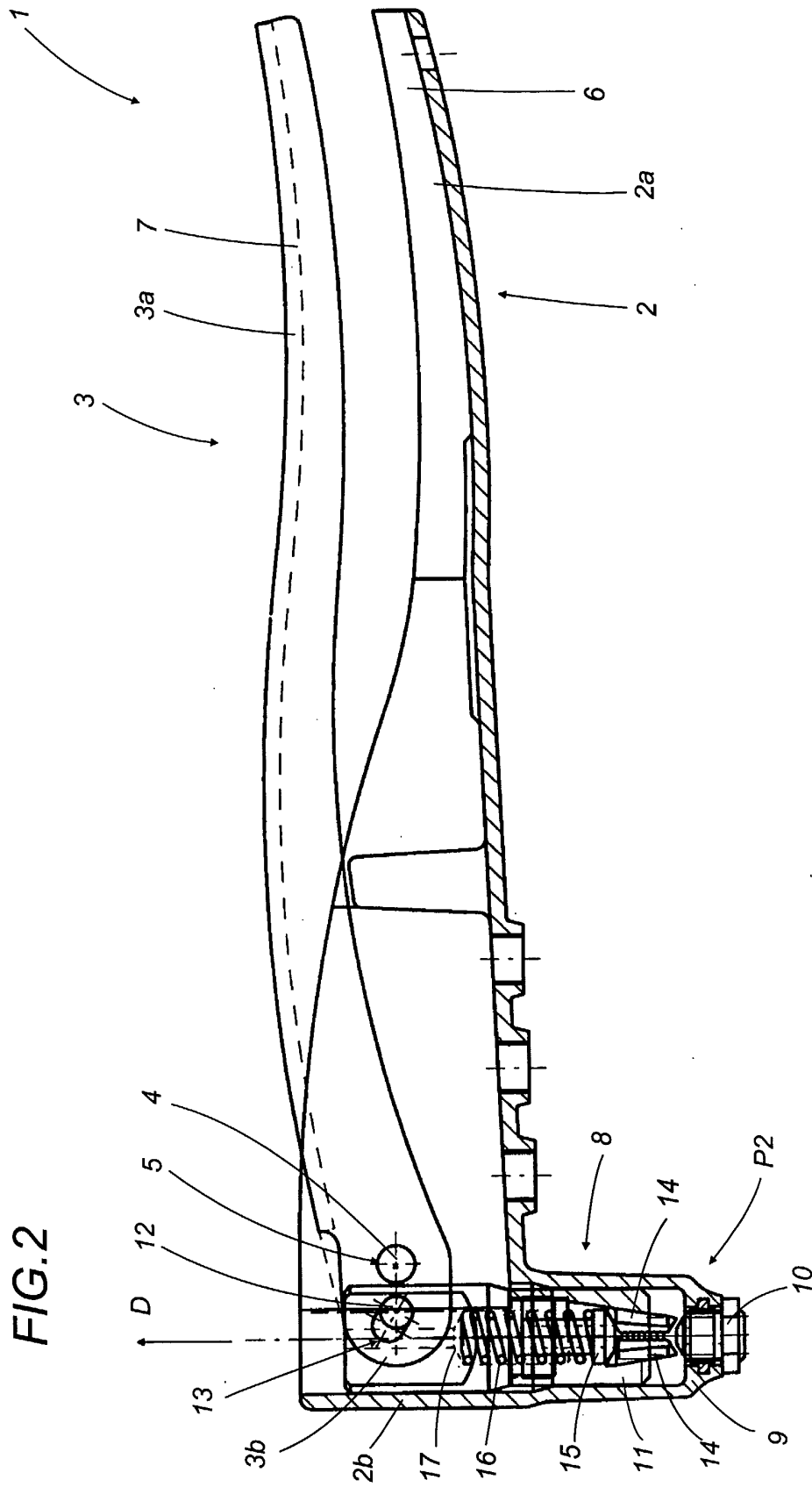
Claims

1. A hand riveting tool for break mandrel rivets; the riveting tool (1) comprising gripping and pulling means (8) for engaging and pulling up the mandrels, and means (6, 7) for actuating the gripping and pulling means (8); said gripping and pulling means (8) comprising means (14) for clamping the mandrels and means (3b, 13, 9, 11) for driving the clamping means (14) in a mandrel pulling direction (D); the riveting tool (1) being **characterised in that** the drive means (3b, 13, 9, 11) have at least one variable length lever arm (3b, 13) actuated by the actuating means (6, 7) and applying on the actuating means (6, 7) a resisting action that is correlated according to a constant proportionality factor to the resisting action exerted by the mandrels.
2. The riveting tool according to claim 1, **characterised in that** it comprises two supporting and actuating elements (2, 3) pivoted to each other crossways on a pivot pin (4) about which the two elements (2, 3) themselves rotate; each of the supporting and actuating elements (2, 3) presenting, on opposite sides of the pin (4), a first portion (2a, 3a) forming handles (6, 7) by which the riveting tool (1) can be held, and a second portion (2b, 3b) forming part of the gripping and pulling means (8).
3. The riveting tool according to claim 2, **characterised in that** the lever arm (3b, 13) is a resisting lever arm (3b, 13) formed by at least part of the second portion (3b) of one of the supporting and actuating elements (2, 3).
4. The riveting tool according to claim 3, **characterised in that** the resisting lever arm (3b, 13) varies in length according to the variation in the size of the angle made by the handles (6, 7).
5. The riveting tool according to claim 4, **characterised in that** the projection of the resisting lever arm (3b, 13) onto a plane normal to the pulling direction

(D) is constant and independent of the variation in the size of the angle made by the handles (6, 7).

6. The riveting tool according to any of the foregoing claims from 3 to 5, **characterised in that** the actuating means (3b, 13, 9, 11) comprise a slider (11) for driving the clamping means (14) in the pulling direction (D) and a sliding guide (9) to guide the movement of the slider (11) in the pulling direction (D); the slider (11) being engaged with the resisting lever arm (3b, 13) and the guide (9) being defined by the second portion (2b) of the other of the supporting and actuating elements (2, 3). 5
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7. The riveting tool according to claim 6, **characterised in that** the slider (11) supports a second pin (12) parallel to the first pin (4); the second portion (3b) that forms the resisting lever arm (3b, 13) having in it a slot (13) in which the second pin (12) is slidably engaged. 15
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8. The riveting tool according to claim 7, **characterised in that** the second pin (12) moves in a straight line in the pulling direction (D). 25
9. The riveting tool according to any of the foregoing claims from 6 to 8, **characterised in that** the clamping means (14) comprise at least two jaws (14); the slider (11) being engaged with the jaws (14) in such a way as to move the jaws (14) from an advanced mandrel receiving position where the distance between them is at its largest, to a retracted mandrel clamping and pulling position where the distance between the jaws (14) is at its smallest. 30
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10. The riveting tool according to claim 9, **characterised in that** it comprises elastic means (16) that oppose the clamping action of the jaws (14) and/or the sliding motion of the slider (11) in the pulling direction (D). 40
11. The riveting tool according to claim 10, **characterised in that** the elastic means (16) comprise a helical spring (16). 45
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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5343

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	US 3 561 249 A (FREEMAN RICHARD B) 9 February 1971 (1971-02-09) * the whole document *	1-11	B21J15/38
X	NL 7 408 634 A (BEARGRIP GEREEDSCHAPPENFABRIEK) 30 December 1975 (1975-12-30) * the whole document *	1-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 1 August 2002	Examiner Marc Augé
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention 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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 42 5343

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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01-08-2002

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US 3561249	A	09-02-1971	NONE	
NL 7408634	A	30-12-1975	NONE	

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