(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 444 060 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
15.08.2007 Bulletin 2007/33

(21) Application number: **02789056.5**

(22) Date of filing: **13.11.2002**

(51) Int Cl.:
B21D 31/04 *(2006.01)* ***B26F 1/18*** *(2006.01)*

(86) International application number:
PCT/SE2002/002068

(87) International publication number:
WO 2003/041888 (22.05.2003 Gazette 2003/21)

(54) **METHOD AND ARRANGEMENT FOR MACHINING AN OBJECT**

VERFAHREN UND ANORDNUNG ZUR MASCHINELLEN BEARBEITUNG EINES OBJEKTS

PROCEDE ET AGENCEMENT POUR L'USINAGE D'UN OBJET

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SK TR

(30) Priority: **13.11.2001 SE 0103760**

(43) Date of publication of application:
11.08.2004 Bulletin 2004/33

(73) Proprietor: **Balcus ab**
713 12 Nora (SE)

(72) Inventor: **EKLÖF, Lars**
S-590 49 VIKINGSTAD (SE)

(74) Representative: **Winblad, Hans Peter**
Albihns Stockholm AB,
Box 5581
114 85 Stockholm (SE)

(56) References cited:
EP-A1- 0 340 619
DE-A1- 19 720 229
US-A- 4 621 397

EP 1 444 060 B1

Description

Technical field

[0001] The present invention relates on the one hand to a method for machining an object, according to the preamble of patent claim 1, and on the other hand to an arrangement for machining an object, according to the preamble of patent claim 8. The invention is aimed in particular at a method and arrangement for manufacturing expanded metal (see for example US-A-4 621 397).

State of the art

[0002] In the manufacture of expanded metal, a metal piece is supported by means of a stay from one side and is machined from the opposite side by means of a tool provided with teeth, which produces slits in the metal piece at the side of the stay and stretches the slit metal to form openings or meshes. In this connection, use is usually made of a toothed cutter which is pressed against the metal piece which is moved stepwise in the lateral direction relative to the cutter. This method is relatively slow and is difficult to use in the case of narrow, strip-shaped metal pieces.

[0003] In order to achieve more rapid manufacture of expanded metal, attempts have been made with rolling cutting by means of toothed wheels. After slitting and stretching have been completed, the teeth of the wheel, which usually also move the strip forward, are brought out of contact with the strip again. In this connection, it has been found that, with toothed wheels, the size of the mesh produced is limited by the fact that it must be possible for a tooth to come out of the mesh formed without striking with its front edge against the front mesh wall and deforming or tearing this.

[0004] In particular in the case of manufacturing expanded metal from narrow and thin strips, it is desirable to have a stable, secure and rapid feed by virtue of teeth being in engagement with the meshes and ensuring feed of the strip without slip. At the same time, it is desirable for it to be possible to stretch the metal considerably in order to obtain large meshes. It has hitherto proved impossible to achieve these two desires simultaneously.

[0005] Against this background, there is a need for improved solutions as far as the manufacture of expanded metal is concerned.

The object of the invention

[0006] One object of the invention is to produce an improved solution for machining objects, in particular in connection with the manufacture of expanded metal. Another object is to achieve a solution which is easy to adapt to different requirements.

Summary of the invention

[0007] The object of the invention are achieved on the one hand by using a method for machining objects, with features according to patent claim 1, and on the other hand by using an arrangement for machining objects, with features according to patent claim 8.

[0008] By machining the object in a direction at right angles to the surface of the object while the object is conveyed in the longitudinal direction, a smooth machining movement is made possible, and the fact that the machining tool is moved away and removed from the object, after machining has been performed, without contact with the machined location makes it possible for the machined location to remain intact.

[0009] By using a chain provided with teeth instead of a toothed wheel, a straight portion of the chain between two chain wheels can be positioned at a predetermined angle in relation to the longitudinal direction of the object and in this way bring about the desired smooth machining movement as the teeth gradually approach the object. At the location where machining is completed, the chain can in this connection, by means of a suitable guide, change the running angle so that the teeth can leave the machined object without coming into further contact with it.

[0010] To manufacture expanded metal, a strip can advantageously be machined by slitting and stretching along both edges, with a stay positioned between the edges. In this connection, a number of machining stations can be arranged one after another, with the width of the stay decreasing gradually in the various machining stations so that new mesh rows can be positioned increasingly closer to one another and a large number of mesh rows can be produced rapidly with a rapid feed movement of the object. By means of the solution according to the invention, larger meshes can be obtained than previously without the material breaking or being deformed.

[0011] The solution according to the invention can also be used in connections other than the manufacture of expanded metal, for example for stamping an object, punching or other types of machining.

[0012] Further advantages and features of solutions according to the invention emerge from the description and the other patent claims.

[0013] The invention is explained in greater detail below with the aid of illustrative embodiments shown in the drawing.

Description of figures

[0014] In the drawing:

Figs 1-3 show various stages of the manufacture of expanded metal, each figure showing on the one hand a side view and on the other hand a section marked in the side view;

Fig. 4 shows a side view of a solution according to

the invention;
Fig. 5 shows a view of a part for a chain link;
Fig. 6 shows a perspective view of the part in Fig. 5;
Fig. 7 shows a diagrammatic view of the part in Fig. 5;
Fig. 8 shows an end view of a chain link;
Fig. 9 shows a diagrammatic side view of a machining station according to the invention, and
Fig. 10 shows a section X-X in Fig. 9.

Description of illustrative embodiments

[0015] Figs 1-3 show how a flat object 1, here in the form of a metal strip, is converted by stepwise machining into an object of expanded-metal type. In a first stage according to Fig. 1, the strip is slit locally from below a little way inside the edge and is stretched at the slit locations so that raised, stretched portions 2 are created and form a wave-like pattern. The machining then continues according to Fig. 2 with slitting and stretching further in, with a displacement as shown in the longitudinal direction of the strip, so that openings 3 are formed. In the next stage, according to Fig. 3, slitting and stretching take place in a location in the longitudinal direction of the strip corresponding to that in Fig. 1, but further in, after which further slitting and stretching are carried out as required. As can be seen, the edge portion of the strip gradually rises upward at an angle after slitting and stretching. By simultaneously carrying out corresponding slitting and stretching at the opposite edge portion of the strip, efficient machining of the strip is achieved. If so desired, suitable portions of the strip can be left unmachined between machined portions.

[0016] A suitable method and a suitable arrangement for carrying out the machining shown in Figs 1-3 is shown in principle in Fig. 4. Here, the object 1 is fed in horizontally from the left in the drawing and is moved to the right under a stay 4, an edge portion of the object 1 intended for slitting and stretching projecting laterally beyond the stay 4 so as to be capable of being brought into contact with machining tools 5 arranged below the object 1, here in the form of cutting teeth on chain links 6 which together form a chain 7, of which only a portion is shown. An upper part of the chain 7 is, together with the object 1; moved to the right in the drawing and is in this connection supported on a support 8 which has a first ramp 9 which is inclined upward at an angle $\alpha°$ from the horizontal plane. During their movement up this ramp 9, the chain links 6 are raised gradually in the direction toward the object 1 and the stay 4, so that the tools 5 meet and penetrate the object 1 and in doing so slit and stretch portions 2. When the portions 2 have reached full height on a level with the horizontal line 10 above the object 1, the chain link 6 concerned which has brought about this stretching is located at the top of the first ramp 9 which, at a ridge 11, meets a second ramp 12 which is inclined downward at an angle $\beta°$ relative to the horizontal plane, the inclination of the second ramp 12 being greater than the inclination of the first ramp 9. Each chain link 6 is supported against the support 8 via two support rollers 13, namely a front support roller and a rear support roller, the front support roller forming the rear support roller for the chain link in front, and the rear support roller forming the front support roller for the chain link behind.

[0017] In the position of a chain link 6' shown in the drawing in Fig. 4, the front support roller 13' of this link has just passed the ridge 11 and is on its way down the ramp 12, while the rear support roller 13" is still on its way up the ramp 9. In this connection, the chain link 6' has been pivoted slightly in the clockwise direction relative to its previous position, its tool 5 being on its way out of the portion 2 it has produced in the object 1, essentially without coming into contact with this portion 2 or damaging the same. During continued forward travel of the chain link 6', it is pivoted increasingly in the clockwise direction until it has reached a position in which it and its support rollers are located entirely on the ramp 12, below the machined object 1, in a position corresponding to the position of the chain link 6" and still further down the ramp 12.

[0018] During movement between the ramps 9 and 12, each tool 5 will therefore be pivoted about a pivoting center located at a spacing from the object and at right angles to the direction of movement, so that it is pivoted out of contact with the machining location without striking against it.

[0019] The embodiment of a part for a chain link 6 is shown in greater detail in Figs 5-8. According to Figs 5-6, a body 14 is provided, at the top, with a tool 5 in the form of a cutter 15 which is mounted in a suitable recess and is suitably replaceably and reversibly mounted, for example by means of a fixing device 16 in the form of a screw. The cutter 15 is advantageously of the hard-metal type but can of course also be made in another suitable way and with a shape suitable for the purpose. Here, the cutter 15 is upwardly pointed and has a top 17 which, in the longitudinal direction of the chain link, is located between two holes arranged in the body 14, namely a front hole 18 and a rear hole 19. These holes are intended for spindles which interconnect adjacent chain links. Extending in the downward direction below the holes 18 and 19 is a plate-shaped guide tongue 20, the function of which is to guide the chain link 6 during its movement.

[0020] As emerged more clearly from Fig. 4, the chain link 6 is intended to be moved vertically upward, with its tool 5, at right angles to the horizontally positioned object 1. In order to make this possible, the centers of the holes 18, 19 are, according to Fig. 5, located on a line 21 which forms an angle $\alpha°$ with a horizontal line 22 which in turn forms a right angle with a vertical line 23 through the point 17 of the cutter 15.

[0021] In order to achieve the desired pivoting movement of a chain link 6 as it passes the ridge 11 on the first ramp 9, it is necessary for the chain link 6 to be designed with such a geometry that this is possible. It is therefore necessary for the top 17 of the cutter 15 to be positioned correctly in relation to the holes 18 and 19,

the size of the top angle δ of the cutter 15 also having an effect. A dimensional definition of the body 14 for a chain link 6 is shown in Fig. 7. At a given pitch of the chain 7, there is a predetermined spacing d between the holes 18 and 19, the vertical spacing h between the rear hole 19 and the top 17 and also the spacing b in the longitudinal direction of the chain between the rear hole 19 and the top 17 therefore having to be adapted to one another and to the size of the spacing d.

[0022] The embodiment of a chain link is shown in greater detail in Fig. 8 which shows, seen from the rear in the running direction of the chain 7 (from the left in Figs 4 and 5), a chain link 6 with two interconnected bodies 14 which have a mirror-inverted design in relation to one another and have their sides provided with cutters 15 facing one another. On a spindle 24, which is here passed through the front holes 18 in the bodies, and also through the rear holes 19 in bodies 14 (not visible here) in front, a spacer means 25 in the form of a sleeve is mounted between the bodies 14 in order to keep the bodies 14 at a predetermined mutual spacing, which can be changed by selecting a different size of spacer means 25 and a different length of the spindle 24. Mounted on the spindle 24 outside each body 14 is a support roller 13 which, according to Fig. 4, is intended to be supported against the support 8. These support rollers are axially locked on the spindle 24 in a conventional manner in order to maintain a predetermined spacing between the bodies 14 and their cutters 15. The support rollers 13 are also intended, for driving and guiding the chain 7, to be capable of being brought into engagement with suitable toothed wheels or equivalent at suitable locations along the chain.

[0023] Fig. 9 shows diagrammatically a machining station 26 which is intended for machining an object 1 and, together with a number of similar machining stations arranged one after another, can form a machining installation (not shown in greater detail here), for example for manufacturing expanded-metal products. Under the object 1, a chain 7 of the type described above runs via a front toothed wheel 27, which is driving, and a rear toothed wheel 28, which is free-running and is suitably (in a manner not shown in greater detail here) adjustable in its spacing relative to the front toothed wheel 27 in order to keep the chain suitably tensioned in the case of, for example, different designs of the support 8 which is mounted between the two toothed wheels 27, 28, at the upper strand of the chain 7, in which way the chain 7 runs over the ramps 9 and 12 there as it passes the ridge 11 on the support 8 and therefore does not run in an entirely straight manner between the toothed wheels. In this connection, the two toothed wheels 27, 28 are double, for engagement with respective support rollers 13 at the ends of the spindles 24, and are mounted on shafts mounted in a stand 29.

[0024] Mounted above the object 1 is the stay 4, here in the form of a chain 30, which, at the object 1, is supported upwardly via its lower strand against a support 31 and then runs via a toothed wheel 32 which, like the toothed wheels 27, 28, is of the double type and is suitably synchronized with the driving toothed wheel 27 so as to ensure that the links in the chain 30, each with its stay portion 33, form a completely continuous stay 4 when these links are, during the machining process, located above the support 8 and the stay 4 is in this connection loaded by the object 1. Both the support 31 and the shaft for the toothed wheel 32 are mounted in the stand 29 and are thus appropriately fixed. The object 1 is conveyed by means of the lower chain 7, the upper chain 30 running at the same speed.

[0025] Fig. 10 shows in greater detail in a section X-X in Fig. 9 how a machining station 26 is designed at the location where the machining of an object 1 takes place. The support 8 includes two outer straight guides 34, on which the support rollers 13 of the chain 7 roll. Between the two outer straight guides 34, there are two inner straight guides 35 which, each together with its outer straight guide 34, guide the guide tongues 20 on the links of the chain so as to keep the cutters 15 on the links in the correct position relative to the stay 4. A suitable mutual spacing between the outer straight guide 34 and the inner straight guide 35 is obtained by means of spacer elements 36. In a corresponding way, the desired dimension of the spacing between the two slit rows produced simultaneously and therefore of the width of the stay portion 33 is obtained by means of a spacer element 37 positioned between the two inner straight guides 35. The component parts of the support 8 are suitably held together by means of a number of fixing elements 38, for example screws. Like the bodies 14 in the chain links 6, each stay portion 33 is guided by means of a guide tongue 39 joined to it, which runs in a groove in the underside of the support 31.

[0026] As can be seen from Fig. 10, a number of machining stages have already been performed here, with the result that the edges of the object 1 have been raised from their original position. In this connection, it is desirable to prevent gradually rising, machined edge portions striking against support rollers 40 forming part of the chain 30, which run against the support 31 above. If appropriate, some form of deflection arrangement for the edge portions of the object 1 may be necessary in order to ensure good functioning.

[0027] By making an object 1 pass through a number of successive machining stations 26 with spacings of different size between mutually opposite cutters 15, it is possible to carry out machining from the edges inward, if appropriate with suitable interruptions between the slit rows in order to obtain the desired form of the product. In order in this connection to make the meshes in the expanded metal lie correctly in relation to one another, it is important that the successive machining stations are correctly synchronized in relation to one another. The metal strip which in this case forms the object 1 should not have too great a width, suitably roughly 400 mm at the most.

[0028] In order to obtain good machining of the object

1 during the manufacture of expanded metal, it is desirable for a number of tools 5 to be in contact with the object 1 at a time and therefore to be on their way up the ramp 9 simultaneously. The type of machining which can be performed is of course dependent on the properties and dimensions of the material selected. In order for it to be possible for, for example, great twisting and stretching to be carried out, it is necessary for the material to have good stretchability. Thus, for example, the more the material tolerates in machining, the steeper the ramp 9 can be made.

[0029] It has been found that, with a top angle δ of the cutter 15 of around 115°, it is possible according to Fig. 4 to achieve a mesh height (the spacing between the line 10 and the object 1) of 3.4 mm using a value of 3° for the angle α and 8° for the angle β. In this case, the dimensions h and b (Fig. 7) were 17.1 mm and 11.4 mm respectively. The length of the ramp 9 was then such that it was possible for four tools 5 to be in engagement with the object 1 at a time and was roughly 70 mm while the length of the ramp 12 was roughly 40 mm.

[0030] Depending on the material properties of the object 1, the angle α can in principle have a value in the range 0-45°, but should suitably lie in the range of roughly 1-12°, and should preferably lie in the range of roughly 3-8° in order to allow flexible machining. The design of the cutter 15 and the size of its top angle δ of course also have an effect on how machining can be carried out. This top angle is suitably selected to be obtuse so as not to generate excessive stresses in the material of the object being machined.

[0031] The invention has been described above in connection with the manufacture of objects of the expanded-metal type, but it is also conceivable within the scope of the invention to use the type of movement described for a tool and also the type of equipment in other connections as well, for example for stamping or punching an object 1 which is supported by the stay 4.

[0032] For the purpose of simplification, details relating to, for example, material selection, dimensions, lubrication and other issues within the normal know-how of a person skilled in the art have not been included in the description above.

Claims

1. A method for machining an elongate object (1), where successively arranged tools (5) in turn approach and are pressed against the object to machine it during movement of the object in the longitudinal direction, the object being supported by a stay (4), and after which the tools are in turn brought out of contact with the object, **characterized in that** the tools (5) are, during machining of the object, moved along a rising first ramp (9) on a support (8), to a ridge (11) thereon, **in that** the tools, after machining has been completed, start to travel down a falling second ramp (12) on the support, and **in that** the tools (5), during movement from the first ramp to the second ramp, are moved together with the object and in this connection are, about a pivoting center located at a spacing from the object and at right angles to the direction of movement, pivoted out of engagement with the machining location, essentially without contact with it.

2. The method as claimed in claim 1, **characterized in that** each tool (5) is pivoted by virtue of two support locations (13', 13"), which are located at a mutual spacing in the conveying direction of the object (1) and intended to be supported against the support (8), simultaneously each being moved along a respective ramp of the two ramps (9, 12).

3. The method as claimed in claim 1 or 2, **characterized in that** the second ramp (12) has a greater inclination relative to the conveying direction than the first ramp (9).

4. The method as claimed in any one of claims 1-3, **characterized in that** the object (1) is strip-shaped and is slit and stretched along the strip outside at least one edge of the stay (4), so that openings (3) are formed in the object in mutually laterally displaced rows along at least one long side thereof.

5. The method as claimed in claim 4, **characterized in that** the object (1) is slit and stretched along the strip outside both the edges of the stay (4), so that openings (3) are formed in the object along both long sides thereof.

6. The method as claimed in claim 4 or 5, **characterized in that** mutually adjacent rows of openings (3) are made one after another, in successive machining stations (26).

7. The method as claimed in any one of claims 4-6, **characterized in that** the openings (3) are made with an obtuse top angle (δ).

8. An arrangement for machining an elongate object (1), with successively positioned tools (5) which are adapted so as in turn to approach and to be pressed against the object to machine it during simultaneous movement of the object in the longitudinal direction while the object is supported against a stay (4) arranged on its opposite side, and where the tools are adapted so as, after machining, in turn to be brought out of contact with the object, **characterized in that** the tools (5) are adapted so as, during machining of the object, to be moved along a rising first ramp (9) on a support (8), to a ridge (11) on the ramp and the support, **in that** the tools (5) are adapted so as, after machining has been completed, to start to travel

down a falling second ramp (12) on the support (8), and **in that** the tools (5) are adapted so as, as they pass the ridge (11) on the support, to be pivoted about a pivoting center located at a spacing from the object and out of engagement with the machining location.

9. The arrangement as claimed in claim 8, **characterized in that** each tool (5) is adapted so as, via two support locations (13', 13") located at a mutual spacing in the longitudinal direction of the object, to be in contact with the two ramps (9, 12) simultaneously during its pivoting movement.

10. The arrangement as claimed in claim 8 or 9, **characterized in that** the second ramp (12) has a greater inclination relative to the conveying direction than the first ramp (9).

11. The arrangement as claimed in any one of claims 8-10, **characterized in that** tools (5) are adapted so as, together with the stay (4), to slit and stretch a strip-shaped object at the slit outside at least one side of the stay, so that expanded-metal meshes (3) are formed in the object along at least one long side thereof.

12. The arrangement as claimed in claim 11, **characterized in that** tools (5) are adapted so as, together with the stay (4), to slit and stretch the object outside both sides of the stay (4), so that expanded-metal meshes are formed in the object along both long sides thereof.

13. The arrangement as claimed in any one of claims 8-12, **characterized in that** the tools (5) are each arranged on their own chain link (6) which forms part of a chain (7) and has two support locations (13', 13"), separated in the longitudinal direction of the chain, for contact with the support (8).

14. The arrangement as claimed in claim 13, **characterized in that** each chain link (6) has two tools (5) located directly opposite one another, each on its own side of the chain link and at a mutual spacing.

15. The arrangement as claimed in claim 13 or 14, **characterized in that** the chain (7) is adapted so as to be driven by means of a toothed wheel (27) arranged after the stay (8) seen in the conveying direction of the object.

16. The arrangement as claimed in any one of claims 8-15, **characterized in that** the stay (4) is formed by stay portions (33) which are arranged on chain links in a chain (30) and a number of which are adapted so as to be located adjacent to one another at a time directly opposite the support (8) during machining of the object.

17. The arrangement as claimed in any one of claims 8-16, **characterized in that** the tools (5) are distributed over a number of successive machining stations (26) which are adapted so as, from a first station to a last station, gradually to machine the object further in from at least one edge thereof.

Patentansprüche

1. Verfahren zum Bearbeiten eines länglichen Objekts (11), in dem sich aufeinanderfolgend angeordnete Werkzeuge (5) der Reihe nach dem Objekt annähern und an dieses gepresst werden, um es während Bewegung des Objekts in der Längsrichtung zu bearbeiten, wobei das Objekt durch einen Stay (4) gehalten wird, und wonach die Werkzeuge der Reihe nach außer Kontakt mit dem Objekt gebracht werden, **dadurch gekennzeichnet, dass** die Werkzeuge (5) während der Bearbeitung des Objekts entlang einer ansteigenden ersten Rampe (9) auf einer Abstützung (8) zu einem Grat (11) darauf bewegt werden, **dadurch**, dass die Werkzeuge, nachdem die Bearbeitung abgeschlossen worden ist, beginnen, sich auf einer abfallenden zweiten Rampe (12) auf der Abstützung nach unten zu bewegen und **dadurch**, dass die Werkzeuge (5) während der Bewegung von der ersten zu der zweiten Rampe zusammen mit dem Objekt bewegt werden und hierbei um einen Schwenkpunkt, angeordnet in einem Abstand von dem Objekt und in rechten Winkeln zu der Bewegungsrichtung, außer Eingriff mit der Bearbeitungsstelle geschwenkt werden, im Wesentlichen, ohne diese zu berühren.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** jedes Werkzeug (5) mittels zweier Stützstellen (13', 13") geschwenkt wird, die mit einem wechselseitigen Abstand in der Förderrichtung des Objekts (1) angeordnet sind und vorgesehen sind, um an der Abstützung (8) abgestützt zu werden, wobei jede gleichzeitig entlang einer jeweiligen der zwei Rampen (9, 12) bewegt wird.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die zweite Rampe (12) relativ zu der Förderrichtung eine größere Neigung als die erste Rampe (9) hat.

4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** das Objekt (1) streifenförmig ist und entlang des Streifens außerhalb von wenigstens einem Rand des Stays (4) geschnitten und gestreckt wird, so dass in dem Objekt in wechselseitig versetzten Reihen, entlang wenigstens einer Langseite davon, Öffnungen (3) ausge-

bildet werden.

5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** das Objekt (1) entlang des Streifens außerhalb beider der Ränder des Stays (4) geschnitten und gestreckt wird, so dass in dem Objekt entlang beiden Seiten davon Öffnungen (3) ausgebildet werden.

6. Verfahren nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** die wechselseitig angrenzenden Reihen von Öffnungen (3) eine nach der anderen in aufeinanderfolgenden Bearbeitungsstationen (26) erzeugt werden.

7. Verfahren nach einem der Ansprüche 4 bis 6, **dadurch gekennzeichnet, dass** die Öffnungen (3) mit einem stumpfen oberen Winkel (δ) erzeugt werden.

8. Anordnung zum Bearbeiten eines länglichen Objekts (1) mit aufeinanderfolgend positionierten Werkzeugen (5), die so eingerichtet sind, um sich der Reihe nach dem Objekt anzunähern und an dieses gepresst zu werden, um es während gleichzeitiger Bewegung des Objekts in der Längsrichtung zu bearbeiten, während das Objekt an einem Stay (4), der auf seiner gegenüberliegenden Seite angeordnet ist, gehalten wird, und in der die Werkzeuge so eingerichtet sind, um nach der Bearbeitung der Reihe nach außer Kontakt mit dem Objekt gebracht zu werden, **dadurch gekennzeichnet, dass** die Werkzeuge (5) so eingerichtet sind, um während der Bearbeitung des Objekts entlang einer ansteigenden ersten Rampe (9) auf einer Abstützung (8) zu einem Grat (11) auf der Rampe und dem Träger bewegt zu werden, **dadurch**, dass die Werkzeuge (5) so eingerichtet sind, um, nachdem die Bearbeitung abgeschlossen wurde, zu beginnen, sich auf einer abfallenden zweiten Rampe (12) auf der Abstützung (8) nach unten zu bewegen, und **dadurch**, dass die Werkzeuge (5) so eingerichtet sind, um, während sie den Grat (11) auf der Abstützung (11) passieren, um einen Schwenkpunkt, angeordnet mit einem Abstand von dem Objekt, außer Eingriff mit der Bearbeitungsstelle geschwenkt zu werden.

9. Anordnung nach Anspruch 8, **dadurch gekennzeichnet, dass** jedes Werkzeug (5) so eingerichtet ist, um über zwei Stützstellen (13', 13"), angeordnet in einem wechselseitigen Abstand in der Längsrichtung des Objekts, um simultan während seiner Schwenkbewegung in Kontakt mit den zwei Rampen (9, 12) zu sein, geschwenkt zu werden.

10. Anordnung nach Anspruch 8 oder 9, **dadurch gekennzeichnet, dass** die zweite Rampe (12) relativ zu der Förderrichtung eine größere Neigung als die erste Rampe (9) hat.

11. Anordnung nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** die Werkzeuge (5) so eingerichtet sind, um, zusammen mit dem Stay (4), an dem Schlitz außerhalb wenigstens einer Seite des Stays ein streifenförmiges Objekt zu schneiden und zu strecken, so dass in dem Objekt (3) wenigstens entlang einer Langseite davon Streckmetallmaschen (3) ausgebildet werden.

12. Anordnung nach Anspruch 11, **dadurch gekennzeichnet, dass** die Werkzeuge (5) so eingerichtet sind, um zusammen mit dem Stay (4) das Objekt außerhalb beider Seiten des Werkstückhalters (4) zu schneiden und zu strecken, so dass entlang von beiden Langseiten davon Streckmetallmaschen in dem Objekt ausgebildet werden.

13. Anordnung nach einem der Ansprüche 8 bis 12, **dadurch gekennzeichnet, dass** die Werkzeuge (5) jedes auf seinem eigenen Kettenglied (6) angeordnet sind, das einen Teil der Kette (7) bildet, und zwei Stützstellen (13', 13"), getrennt in der Längsrichtung der Kette, aufweist, um mit der Abstützung (8) in Kontakt zu kommen.

14. Anordnung nach Anspruch 13, **dadurch gekennzeichnet, dass** jedes Kettenglied (6) zwei Werkzeuge (5) hat, die einander direkt gegenüberliegend, jedes auf seiner eigenen Seite des Kettengliedes, und in einem wechselseitigem Abstand angeordnet sind,

15. Anordnung nach Anspruch 13 oder 14, **dadurch gekennzeichnet, dass** die Kette (7) so eingerichtet ist, um mittels eines Zahnrades (27), das, in der Förderrichtung des Objekts gesehen, hinter dem Werkstückträger (4) angeordnet ist, bewegt zu werden.

16. Anordnung nach einem der Ansprüche 8 bis 15, **dadurch gekennzeichnet, dass** der Werkstückträger (4) durch Werkstückträgerteile (33) gebildet wird, die auf Kettengliedern in einer Kette (30) angeordnet sind und von denen eine Anzahl so eingerichtet ist, um während der Bearbeitung des Objekts jeweils direkt gegenüber der Abstützung (8) angrenzend aneinander angeordnet zu sein.

17. Anordnung nach einem der Ansprüche 18 bis 16, **dadurch gekennzeichnet, dass** die Werkzeuge (5) über eine Anzahl von aufeinanderfolgenden Bearbeitungsstationen (26) verteilt sind, die so eingerichtet sind, um das Objekt von wenigstens einer Kante davon von einer ersten Station zu einer letzten Station stufenweise weiterzubearbeiten.

Revendications

1. Procédé d'usinage d'un objet allongé (1), dans le-

quel des outils agencés de manière consécutive (5) s'approchent et sont appuyés à tour de rôle contre l'objet pour l'usiner durant le déplacement de l'objet dans le sens longitudinal, l'objet étant supporté par un appui (4), et après quoi les outils sont à tour de rôle mis hors de contact avec l'objet, **caractérisé en ce que** les outils (5) sont, durant l'usinage de l'objet, déplacés le long d'une première rampe de montée (9) sur un support (8), jusqu'à une nervure (11) sur celui-ci, **en ce que** les outils, une fois l'usinage terminé, commencent à descendre le long d'une seconde rampe de descente (12) sur le support, et **en ce que** les outils (5), durant le déplacement depuis la première rampe jusqu'à la seconde rampe, sont déplacés conjointement à l'objet et à cette occasion pivotent, autour d'un centre de pivot situé à distance de l'objet et à angles droits par rapport au sens de déplacement, hors de prise avec la zone d'usinage, essentiellement sans contact avec elle.

2. Procédé selon la revendication 1, **caractérisé en ce que** chaque outil (5) pivote grâce à deux zones de support (13', 13 "), qui sont situées à distance l'une de l'autre dans le sens d'acheminement de l'objet (1) et sont conçues pour être supportées contre le support (8), chacune étant simultanément déplacée le long d'une rampe respective parmi les deux rampes (9, 12).

3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que** la seconde rampe (12) présente une inclinaison plus importante par rapport au sens d'acheminement que la première rampe (9).

4. Procédé selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** l'objet (1) se présente sous forme de bande et est fendu et étiré le long de la bande à l'extérieur d'au moins un bord de l'appui (4), de façon à ce que des ouvertures (3) soient formées dans l'objet dans des rangées déplacées latéralement les unes par rapport aux autres le long d'au moins un côté long de celui-ci.

5. Procédé selon la revendication 4, **caractérisé en ce que** l'objet (1) est fendu et étiré le long de la bande à l'extérieur des deux bords de l'appui (4), de façon à ce que des ouvertures (3) soient formées dans l'objet le long des deux côtés longs de celui-ci.

6. Procédé selon la revendication 4 ou 5, **caractérisé en ce que** des rangées d'ouverture (3) adjacentes les unes aux autres sont fabriquées l'une après l'autre, dans des stations d'usinage consécutives (26).

7. Procédé selon l'une quelconque des revendications 4 à 6, **caractérisé en ce que** les ouvertures (3) sont fabriquées avec un angle supérieur obtus (δ).

8. Agencement destiné à usiner un objet allongé (1), avec des outils positionnés de manière consécutive (5) qui sont adaptés pour s'approcher et être appuyés à tour de rôle contre l'objet pour l'usiner durant le déplacement simultané de l'objet dans le sens longitudinal pendant que l'objet est supporté contre un appui (4) agencée sur son côté opposé, et dans lequel les outils sont adaptés pour, après l'usinage, être à tour de rôle mis hors de contact avec l'objet, **caractérisé en ce que** les outils (5) sont adaptés pour, durant l'usinage de l'objet, être déplacés le long d'une première rampe de montée (9) sur un support (8), jusqu'à une nervure (11) sur la rampe et le support, **en ce que** les outils (5) sont adaptés pour, une fois l'usinage terminé, commencer à descendre le long d'une seconde rampe de descente (12) sur le support (8), et **en ce que** les outils (5) sont adaptés pour, lorsqu'ils dépassent la nervure (11) sur le support, pivoter autour d'un centre de pivot situé à distance de l'objet et hors de prise avec la zone d'usinage.

9. Agencement selon la revendication 8, **caractérisé en ce que** chaque outil (5) est adapté pour, via deux zones de support (13', 13 ") situées à distance l'une de l'autre dans le sens longitudinal de l'objet, être en contact avec les deux rampes (9, 12) simultanément durant son déplacement de pivot.

10. Agencement selon la revendication 8 ou 9, **caractérisé en ce que** la seconde rampe (12) présente une inclinaison plus importante par rapport au sens d'acheminement que la première rampe (9).

11. Agencement selon l'une quelconque des revendications 8 à 10, **caractérisé en ce que** les outils (5) sont adaptés pour, conjointement à l'appui (4), fendre et étirer un objet en forme de bande au niveau de la fente à l'extérieur d'au moins un côté de l'entretoise, de façon à ce que des mailles métalliques élargies (3) soient formées dans l'objet le long d'au moins un côté long de celui-ci.

12. Agencement selon la revendication 11, **caractérisé en ce que** les outils (5) sont adaptés pour, conjointement à l'appui (4), fendre et étirer l'objet à l'extérieur des deux côtés de l'appui (4), de façon à ce que des mailles métalliques élargies soient formées dans l'objet le long des deux côtés longs de celui-ci.

13. Agencement selon l'une quelconque des revendications 8 à 12, **caractérisé en ce que** les outils (5) sont chacun agencés sur leur propre maillon de chaîne (6) qui fait partie d'une chaîne (7) et présente deux zones de support (13', 13"), séparées dans le sens longitudinal de la chaîne, pour un contact avec le support (8).

14. Agencement selon la revendication 13, **caractérisé en ce que** chaque maillon de chaîne (6) présente deux outils (5) situés directement de manière opposée l'un à l'autre, chacun sur son propre côté du maillon de chaîne et à distance l'un de l'autre.

15. Agencement selon la revendication 13 ou 14, **caractérisé en ce que** la chaîne (7) est adaptée pour être entraînée au moyen d'une roue dentée (27) agencée après l'appui (8) vue dans le sens d'acheminement de l'objet.

16. Agencement selon l'une quelconque des revendications 8 à 15, **caractérisé en ce que** l'appui (4) est formée par des parties d'appui (33) qui sont agencées sur des maillons de chaîne dans une chaîne (30) et dont un certain nombre sont adaptés pour être situés de manière adjacente les uns aux autres à un moment directement opposé au support (8) durant l'usinage de l'objet.

17. Agencement selon l'une quelconque des revendications 8 à 16, **caractérisé en ce que** les outils (5) sont répartis sur un certain nombre de stations d'usinage consécutives (26) qui sont adaptées pour, depuis une première station jusqu'à une dernière station, continuer à usiner progressivement l'objet depuis au moins un bord de celui-ci.

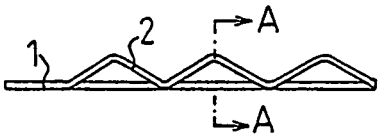

FIG.1a

FIG.1b

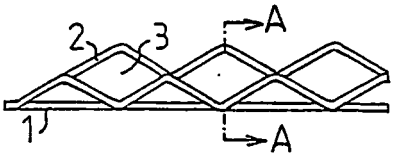

FIG.2a

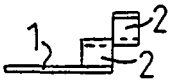

FIG.2b

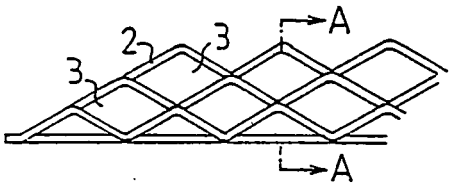

FIG.3a

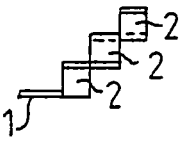

FIG.3b

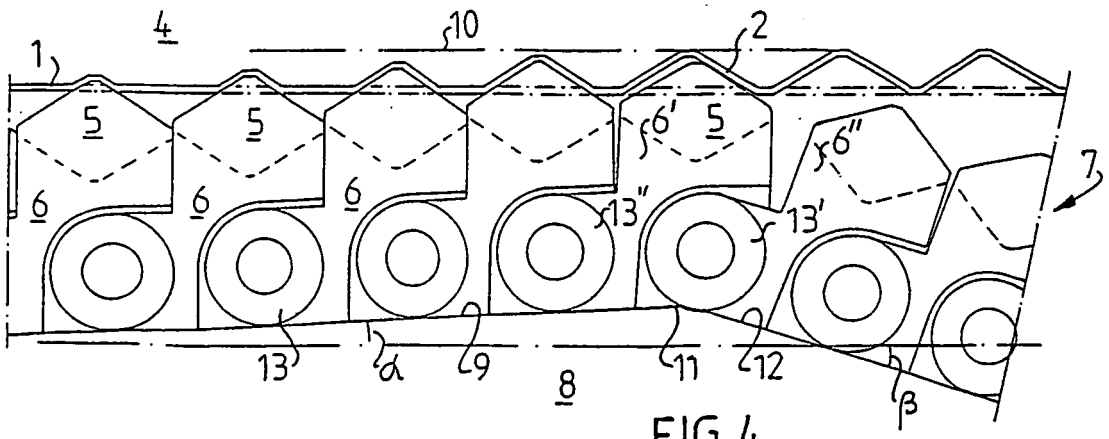

FIG.4

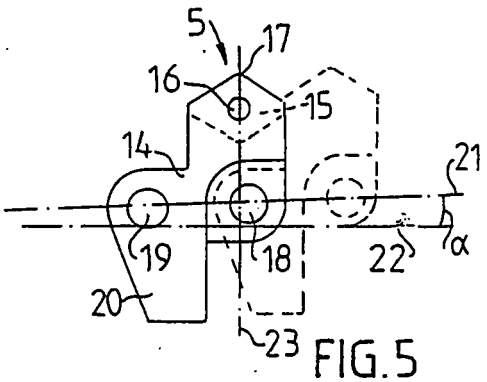

FIG.5

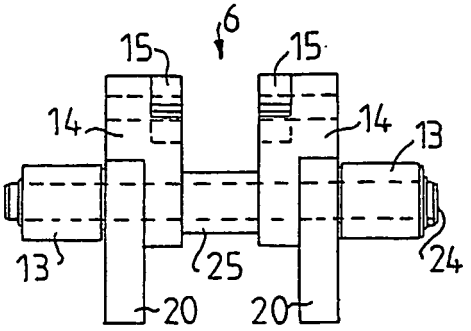

FIG.8

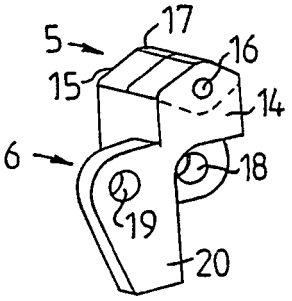

FIG.6

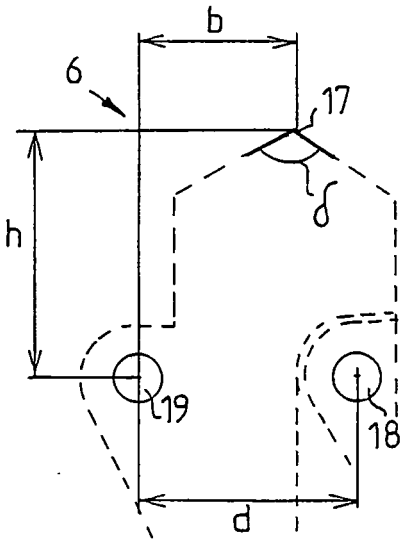

FIG.7

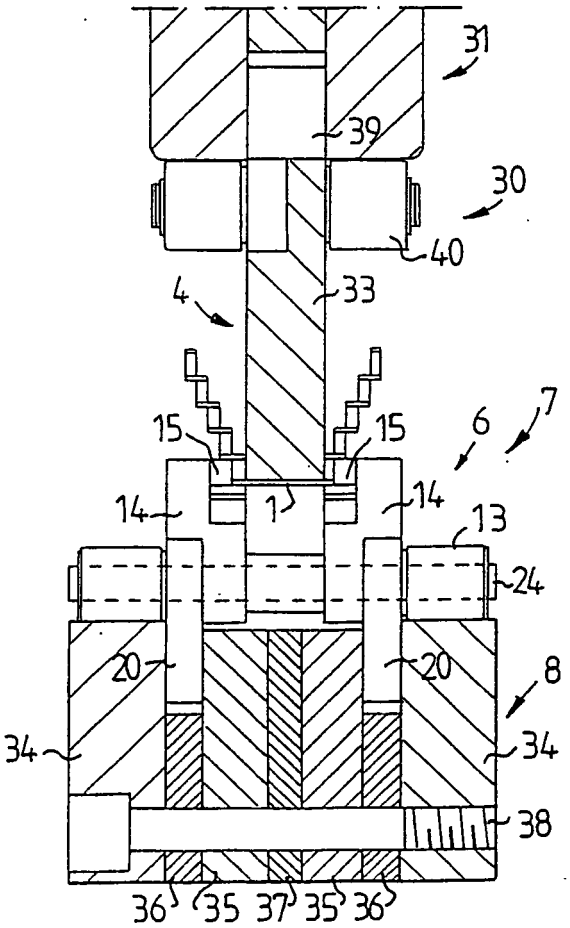

FIG.10

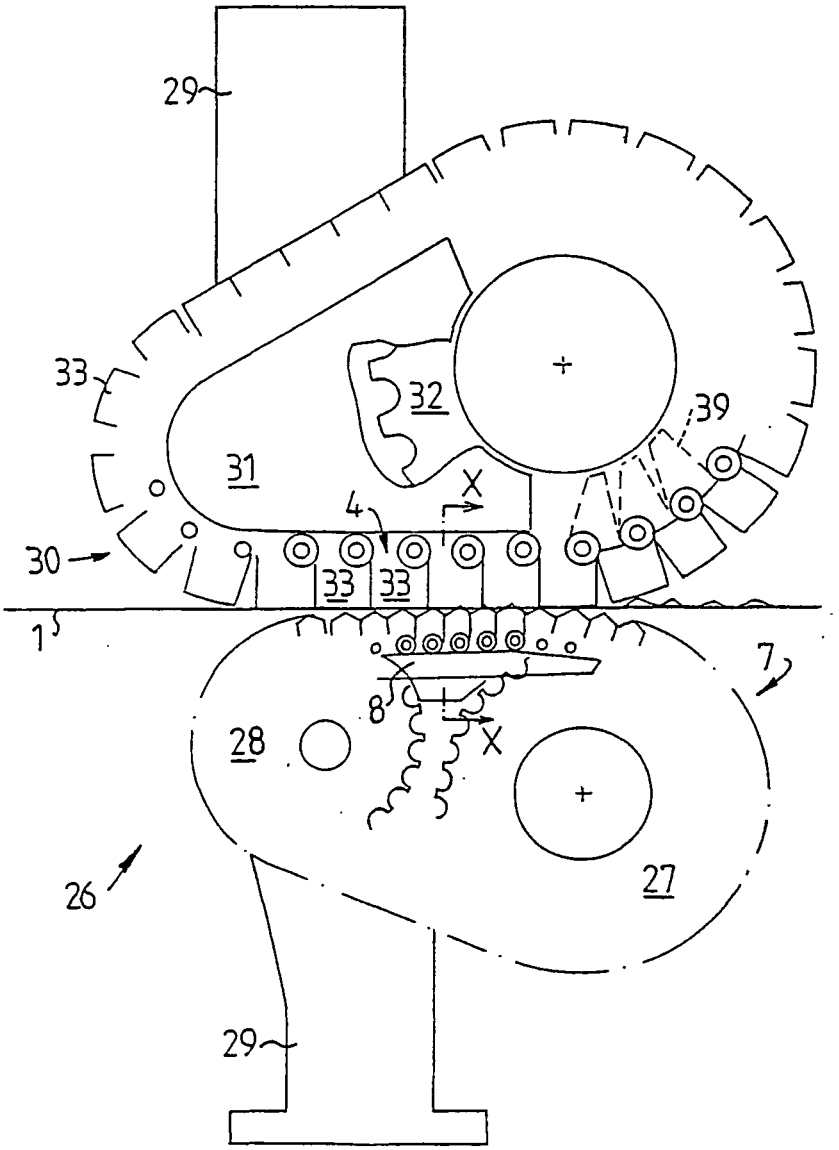

FIG.9

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4621397 A **[0001]**