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(54) **Shearing device for a band and the like**

(57) A shearing device is provided (1) for band or tape (10) comprising a die (20); a punch (30) suitable to be positioned on the side opposite the die (20) in relation to the band (10); a movement system (60) suitable to move the punch (30) in relation to the die (20) defining a rest configuration in which the punch (30) and the die (20) are mutually spaced apart and a working configura-

tion in which the punch (30) and the matrix (20) are mutually associated shearing said tape (10); said movement system (60) comprises a rotating body (61) defining a rotation axis (61 a); and a cam (62) positioned between the punch (30) and the rotating body (61) so as to define for the punch (30) a translation along a circular path (30b) in relation to the rotation axis (61 a).

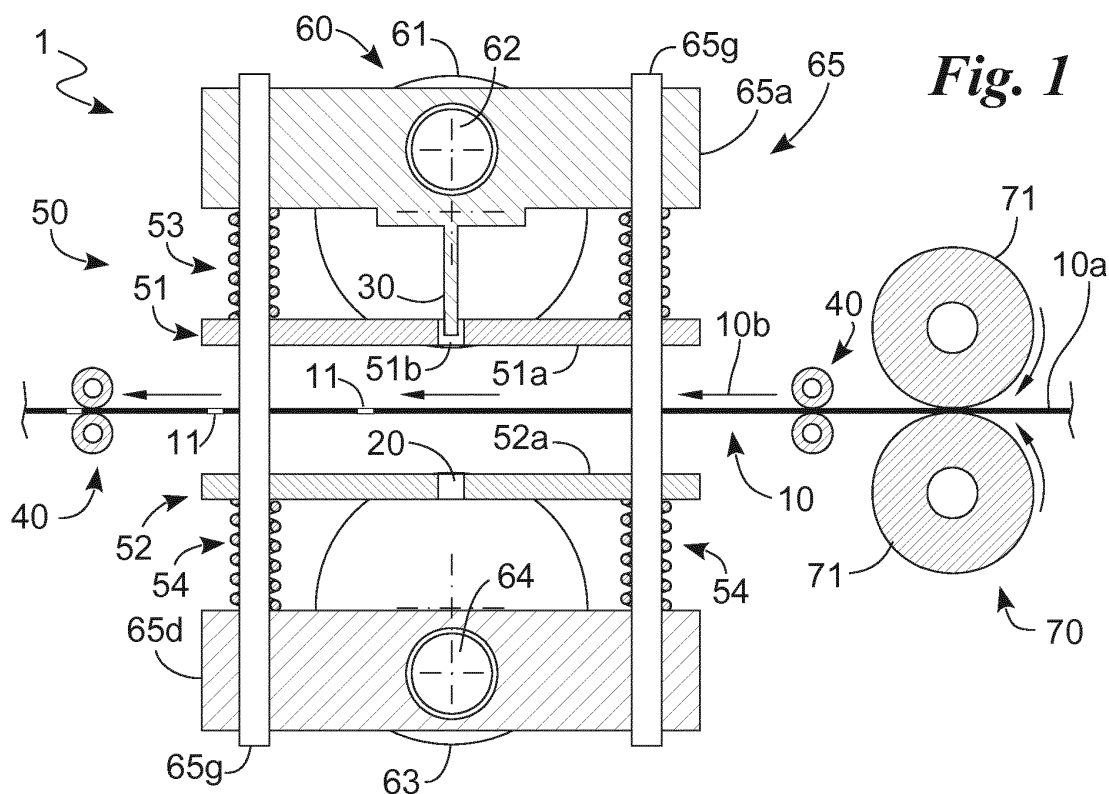


Fig. 1

Description

[0001] The present invention relates to a shearing device for a band and the like as recited in the preamble of the first claim.

[0002] Similar devices are described in the patent documents US-A-3264920, US-B-7117777, EP-A-2283944 and US-A-4485709. In particular, the invention relates to a particular device suitable to perform a shearing process of a band or tape and, in particular, to make appropriately spaced holes or slots on a metal tape.

[0003] As known, the shearing devices currently on the market comprise two main components: a movement apparatus suitable to move the band to be machined; and a cutting apparatus suitable to make the holes on the band.

[0004] In particular, the movement apparatus has a plurality of rollers, of which at least one motorised, suitable to move the tape and, in particular to flatten the tape so that it reaches the cutting apparatus almost perfectly flat.

[0005] The cutting apparatus comprises a support surface along which the tape travels; a die; and a punch suitable to be moved vertically so as to couple to the die and perform cutting of the band.

[0006] The functioning of such devices provides that the movement apparatus moves the tape so that the point in which to make the hole is positioned between the die and punch.

[0007] After reaching such configuration, the tape is stopped and the punch is moved vertically so as to engage the die and, consequently, shear the tape making the hole.

[0008] The prior art described above has several significant drawbacks.

[0009] A first important drawback is represented by the fact that the known shearing devices, on account of the need to stop the stroke of the tape during shearing, are slow and, consequently, characterised by relatively low productivity.

[0010] Another drawback is therefore represented by the fact that the production of perforated tapes and, therefore, the tapes themselves are characterised by high production costs.

[0011] A further drawback is represented by the fact that, at the moment of shearing, the tape is not completely aligned with the punch and, consequently, the holes thus made are not homogeneous in structure, spacing and shape and, above all, have burrs or other similar defects of workmanship.

[0012] In this situation the technical purpose of the present invention is to devise a shearing device for band or tape and the like able to substantially overcome the drawbacks mentioned above.

[0013] Within the sphere of said technical purpose one important aim of the invention is to have a shearing device for tape which makes it possible to obtain tapes of high quality, in particular with homogeneous spacing and ma-

chining characteristics as required.

[0014] Another important aim of the invention is to obtain a shearing device, which makes it possible to obtain high quality tapes at reduced cost.

5 **[0015]** The technical purpose and specified aims are achieved by a shearing device for band as claimed in the appended Claim 1.

[0016] Preferred embodiments are described in the dependent claims.

10 **[0017]** The characteristics and advantages of the invention are made clearer in the detailed description below of a preferred embodiment of the invention, with reference to the appended drawings, wherein:

15 **Fig. 1** shows a shearing device according to the invention;

Fig. 2 shows the shearing device in a different configuration;

20 **Fig. 3** shows another configuration of the shearing device for tape according to the invention; and

Fig. 4 shows a further configuration of the shearing device.

25 **[0018]** With reference to said drawings, reference numeral **1** globally denotes the shearing device for tape according to the invention.

[0019] It is suitable to be used for making holes **11**, slots or the like on a band or tape **10**, sheet or other similar structure defining a lying surface **10a**.

30 **[0020]** The shearing device **1** comprises a die **20**; a punch **30** suitable to be positioned opposite the die **20** in relation to the tape **10** and defining a preferred extension axis **30a** substantially transversal and preferably, substantially perpendicular to the surface **10a**; a support structure suitable keep at least the die **20** and the punch **30** in the correct position and provided with rollers **40** suitable to guide the movement of the belt **10** keeping it appropriately flat; an advancement member **50** suitable to move the tape **10** along a feed direction **10b** substantially parallel to the lying surface **10a**; and a movement system **60** suitable to reciprocally move the punch **30** and die **20** defining, for the device **1**, a rest configuration (Fig. 1) in which the punch **30** and the die **20** are spaced apart and a working configuration (Fig. 2) in which the punch **30** and the die **20** are reciprocally joined so as to shear the band **10**.

45 **[0021]** The movement system **60** is suitable to move at least the punch **30** defining for it, advantageously, a translation movement along a trajectory at least partially substantially circular **30b**, so that the movement of the punch **30** follows the advancement of the band **10**.

50 **[0022]** It, therefore, comprises a first rotating body **61** defining a rotation axis **61a** appropriately substantially parallel to the flat surface **10a**; and a cam **62** positioned between the punch **30** and the rotating body **61** so as to vary the configuration of the device **1** through an eccentric rotation of the punch **30** in relation to the rotation axis **61a**.

55 **[0023]** Preferably, the movement system **60** is suitable

to move the punch 30 and the die 20 eccentrically and simultaneously at substantially equal speeds.

[0024] As a result, the system 60 includes, in addition to the aforesaid elements, a supplementary rotating body **63** defining a supplementary rotation axis **63a** substantially parallel to the axis 61 a; a supplementary cam **64** positioned between the die 20 and supplementary rotating body 63; and a supplementary hinge suitable to allow the die 20 to move with a translation along an at least partially circular trajectory **60b** in relation to the supplementary cam 64.

[0025] In particular, the trajectory of the matrix is circular truncated, i.e. the circle which defines the trajectory is cut along a chord parallel to the plane of the die as illustrated in Figure 1.

[0026] Appropriately, the rotation axes 63a and 61 a lie on a plane substantially perpendicular to the flat surface 10a. The rotary movement is preferably provided by an electric motor, not shown in the drawing, and by a mechanism suitable to transmit the movement to both rotating bodies 61 and 63.

[0027] Lastly, the movement system 60 has a guide **65** suitable to guide the movement of at least the punch 30 so that, during its eccentric rotation, the punch 30 is in the correct position relative to the tape 10 and, in detail, the preferred extension axis 30a is always substantially perpendicular to the lying surface 10a.

[0028] In particular, in the case in which both the punch 30 and the die 20 rotate eccentrically in the movement system, the guide 65 is suitable to prevent a mutual rotation between the punch 30 and die 20.

[0029] The guide 65 comprises a support **65a** suitable to constrain the punch 30 to the cam 61; a hinge **65b**, for example, a bushing or a bearing, defining a relative rotation axis **65c** of the support 65a in relation to the cam 61; a supplementary support **65d** suitable to constrain the die 20 to the supplementary cam 64; a supplementary hinge **65e** defining a relative supplementary rotation axis **65f** of the supplementary support 65d in relation to the supplementary cam 64; and one or more profiles **65g** suitable to permit a translation of the punch 30 and the die 20 in a sliding direction **65h** substantially perpendicular to the surface 10a. Appropriately, the relative rotation axes 65c and 65f are substantially parallel to each other and, in particular, lie, during the translation of the punch 30 and the die 20, on a plane substantially perpendicular to the lying surface 10a.

[0030] The feed member 50 is suitable to move, at least by exploiting the eccentric movement of the punch 30, the tape 10 along the advancement direction 10b substantially perpendicular to the axes 61a and 63a and, in particular, to define, for each revolution of the punch 30, a constant feed of the tape 10 identifying the distance between two holes 11 known as the pitch.

[0031] The feed member 50 includes a moving body **51** constrained to the punch 30 and, in particular, to the support 65a so as to place itself between the tape 10 and said punch 30 and be moved by the system 60; and a

contrast body **52** suitable to be placed on the side opposite the moving body 51 in relation to the tape 10 so that the tape 10 can be clamped between said bodies 51 and 52.

[0032] The constraint between the mobile body 51 and the punch 30 is of the weak kind and, in detail suitable to allow the moving body 51 to translate in relation to the punch 30 in a direction substantially perpendicular to the lying surface 10a and, in particular, along the sliding direction 65h.

[0033] As a result, the feed member 50 presents, placed between the moving body 51 and punch 30, elastic means **53**, preferably compression springs, appropriately connected to the profiles 65g so that the moving body 51 moves in relation to the punch 30 solely in the sliding direction 65h.

[0034] It is identifiable in a plate defining a contact surface **51a** substantially parallel to the lying surface 10a and provided with a through cavity **51b** through which the punch 30 engages the die 20 shearing the tape 10.

[0035] Arranged on the side opposite the body 51 in relation to the tape 10, the feed member 50 presents the contrast body 52.

[0036] The contrast body 52 is suitable to be constrained to the support structure so as to remain substantially stationary during operation of the device 1. It therefore, comprises a roller conveyor or other similar component defining a sliding surface along which the moving body 51 moves the tape 10.

[0037] Alternatively and preferably, the contrast body 52 is connected to the die 20 and, in particular, constrained to the supplementary support 65d so as to be moved by exploiting the eccentric movement of the die.

[0038] In particular, the constraint between the contrast body 52 and supplementary support 65d is suitable to allow the contrast body 52 to move in relation to the supplementary support 65d in the sliding direction 65h.

[0039] To such purpose, the member 50 comprises supplementary elastic means **54**, preferably compression springs, positioned between the contrast body 52 and die 20 and appropriately joined to the profiles 65g so that the contrast body 52 moves in relation to the die 20 in the sliding direction 65h only.

[0040] The presence of the supplementary elastic means 54 causes the trajectory of the die 20 to be circular truncated, as previously described.

[0041] The contrast body 52 is also identifiable in a plate similar to that of the moving body and, therefore, defining a supplementary contact surface **52a** substantially parallel to the lying surface 10a and provided with a through cavity identifying the die 20 which the punch 30 engages.

[0042] Additionally, the shearing device 1 may comprise a supplementary feed member **70**, movable independently of said movement system 60 and suitable to control, alternatively and/or together with the feed member 50, the advancement of the tape 10 varying the pitch of the holes 11.

[0043] Said supplementary feed body 70 comprises two cylinders 71, of which at least one motorised, suitable to clamp the tape 10 between them and to rotate around axes substantially parallel to the surface 10a so as to move the tape 10 in the feed direction 10b.

[0044] The shearing device for tape 1, described above in a structural sense, defines through its operation, a new shearing method for tape.

[0045] The shearing method, exploiting the innovative translation along an eccentric circular trajectory 30b of the punch 30 and, preferably, of the die 20, defines a sequence of steps carried out cyclically at each rotation of the punch 30 and the die 20 around the rotation axes 61 a and 63a.

[0046] This sequence of steps and, thus, the shearing method comprises an approach step in which the bodies 51 and 52 are brought into contact with the tape 10; a feed step in which only the punch and the die and the connected bodies 51 and 52 make the tape 10 advance, defining the pitch of the holes 11; a cutting step suitable to be performed in parallel with the feed step and in which the punch 30 shears the tape 10 making the hole 11; and a separation step in which the bodies 51 and 52 are moved away from the tape 10.

[0047] In the approach step, the movement system 60 moves the punch 30 and the die 20 eccentrically in relation to the rotation axes 61 a and 63a determining for them, a movement having at least one vertical component, i.e. substantially perpendicular to the lying surface 10a, which brings the bodies 51 and 52 into contact with the tape 10 (Fig. 2).

[0048] Once this configuration is reached, the approach step is completed and the feed step begins.

[0049] In the feed step, the horizontal component of the translation with eccentric movement, namely the component of eccentric movement substantially parallel to the lying surface 10a, translates the punch 30, the matrix 20 and the bodies 51 and 52 which consequently make the tape 10 advance in said feed direction 10b. Simultaneously, the vertical component of the eccentric translation together with the profiles 65g, make the punch 30 and the die 20 move towards each other while translating in the sliding direction 65h, and thus, maintain substantially unchanged their inclination to the lying surface 10a.

[0050] In addition, the vertical component acting on the bodies 51 and 52 is absorbed by the compression of the elastic means 53 and 54, which, consequently, offload on the bodies 51 and 52 a force increasing the clamping of said bodies against the tape 10.

[0051] When the punch 30 comes substantially into contact with the tape 10, the method provides for the simultaneous performance of the cutting step and of the feed step, namely the making of the hole 11 while the tape 10 advances.

[0052] In fact, the vertical component provides for performing the cutting step by making the punch 30 engage the tape 10 and the die 20 making the hole 11, and sub-

sequently reverses such stroke, disengaging from the tape 10 and from the feed member 50.

[0053] Simultaneously, the horizontal component, using the engagement of the bodies 51 and 52 both to the tape 10 and to the punch 30, makes the punch 30, the die 20 and the bodies 51 and 52 and the tape 10 advance preventing their reciprocal sliding.

[0054] Once the punch 30 has been disengaged from the tape 10, the cutting step is concluded while the feed step continues until the bodies 51 and 52 are in contact with the tape 10.

[0055] Once the bodies 51 and 52 are detached from the tape 10 (Fig. 3) the feed step ends and the separation step begins in which the punch 30 and the die 20 complete their eccentric movement moving the bodies 51 and 52 away from the tape 10.

[0056] The shearing method may, lastly, comprises an adjustment step performed in parallel with the approach and/or detachment steps and in which the supplementary feed member 70 varies the pitch of the holes 11 by moving the tape 10 when the bodies 51 and 52 are not in contact with said tape.

[0057] In detail, in the adjustment step the cylinders 71 rotate alternately in the same or opposite direction to that of the translation, actuating the system in reverse, according to an eccentric trajectory 30b of the punch 30 and the die 20 so as to determine a translation of the tape 10 having respectively the same or opposite direction to that of the feed step and, thus, increase or decrease the pitch of the holes 11.

[0058] It is thus possible to obtain a desired pitch or even a pitch varying in the desired manner. The invention entails some important advantages.

[0059] A first important advantage lies in the fact that the movement described of the punch 30 allows it to cause the advancement of the tape 10 thus automatically aligning the dragging of the tape and the punching thereof. This characteristic makes it possible to avoid any relative movement between the punch 30 and the tape and, thus, to perform extremely precise shearing, i.e. free of burrs or other defects, which characterise the holes made with the known shearing devices.

[0060] This advantage is further increased by the presence of the bodies 51 and 52 which, by moving the tape 10 during the shearing and being constrained to the punch 30 and the die 20, make slippage between the tape 10 and punch 30 and, therefore, the formation of defects on the hole 11 almost impossible.

[0061] In detail, this aspect is additionally ensured by the presence of the elastic means 53 and 54 which, being compressed during the feed step, increase the clamping force of the bodies 51 and 52 to the tape 10 by preventing mutual slippage between them even during cutting.

[0062] Another advantage is identifiable in the high level of reliability and durability of the shearing device 1.

[0063] This advantage is given by both the constructive simplicity of the device 1 and by the presence of the guide 65 which, by allowing movements in the sliding direction

65h only, prevents misalignment between the various components of the device and, thus, a perfect coupling between the bodies 51 and 52 and between the punch 30 and die 20.

[0064] Modifications may be made to the invention described herein without departing from the scope of the inventive concept. All the elements as described and claimed herein may be replaced with equivalent elements and the scope of the invention includes all other details, materials, shapes and dimensions.

Claims

1. Shearing device (1) for band (10) comprising

- a die (20);
- a punch (30) suitable to be positioned on the side opposite said die (20) in relation to said band (10);
- a movement system (60) suitable to move at least said punch (30) in relation to said die (20) defining a rest configuration in which said punch (30) and said die (20) are mutually spaced apart and a working configuration in which said punch (30) is move towards said die (20) shearing said band (10);
- said movement system (60) comprising a rotating body (61) defining a rotation axis (61 a); and a cam (62) positioned between said punch (30) and said rotating body (61) so as to define for said punch (30) a movement along an at least partially circular trajectory (30b) in relation to said rotation axis (61 a),
- and **characterised in that** it comprises
- a feed member (50) suitable to move said band (10) by defining a feed direction (10b).
- in which said feed member (50) comprises a moving body (51) constrained to said punch (30) so as to position itself between said band (10) and said punch (30) and be eccentrically moved by the movement system (60); and a contrast body (52) suitable to position itself on the side opposite to said moving body (51) with respect to said band (10) so that said band (10) can be clamped between said bodies (51, 52).

2. Shearing device (1) according to claim 1 or 2, wherein said movement system (60) is suitable to move said die (20) and comprises a supplementary rotating body (63) defining a supplementary rotation axis (63a); and a supplementary cam (62) positioned between said matrix (20) and said supplementary rotating body (63) so as to define for said matrix (20) a translation along an at least partially circular trajectory (60b) in relation to said supplementary rotation axis (63a).

3. Shearing device (1) according to the previous claim, wherein said movement system (60) comprises a guide (65) suitable to be associated to said punch (30) and to said die (20) preventing a rotation of said punch (30) and of said die (20) in relation to said band (10).

4. Shearing device (1) according to one or more of the previous claims, wherein said moving body (51) is weakly constrained to said punch (30) so as to translate in relation to said punch (30) in a direction substantially perpendicular to said lying surface (10a).

5. Shearing device (1) according to one or more of the previous claims, comprising a supplementary feed member (70) movement system (60) suitable to control the advancement of the band (10) so as to allow a selection or variation of the pitch of said holes (11).

6. A method for shearing band (10) comprising a shearing device (1) comprising:

- a die (20);
- a punch (30) suitable to be positioned on the side opposite said die in relation to said band (10);
- a movement system (60) moving at least said punch (30) in relation to said die (20) defining a rest configuration in which said punch (30) and said die (20) are mutually spaced apart and a working configuration in which said punch (30) is moved towards said die (20) shearing said band (10);
- said movement system (60) comprising a rotating body (61) defining a rotation axis (61 a); and a cam (62) positioned between said punch (30) and said rotating body (61) so as to define for said punch (30) a movement along an at least partially circular trajectory (30b) in relation to said rotation axis (61 a);
- a feed body (50) comprising a moving body (51) constrained to said punch (30) so as to position itself between said band (10) and said punch (30) and a contrast body (52) suitable to be placed on the side opposite said moving body (51) in relation to said band (10) so that said band (10) can be clamped between said bodies (51, 52); said shearing method comprising an approach step, prior to said cutting step, in which said bodies (51, 52) clamp said band (10) between them,
- **characterised by** comprising a step of advancement wherein said eccentric motion of at least said punch (30) pushes said bodies (51,52) making said band advance (10) and said cutting step is carried out in parallel with said feed step.

7. Shearing method according to the previous claim,

comprising an adjustment step in which a supplementary feed member (70) varies the machining pitch by moving said band (10) when said bodies (51, 52) are not in contact with said band (10).

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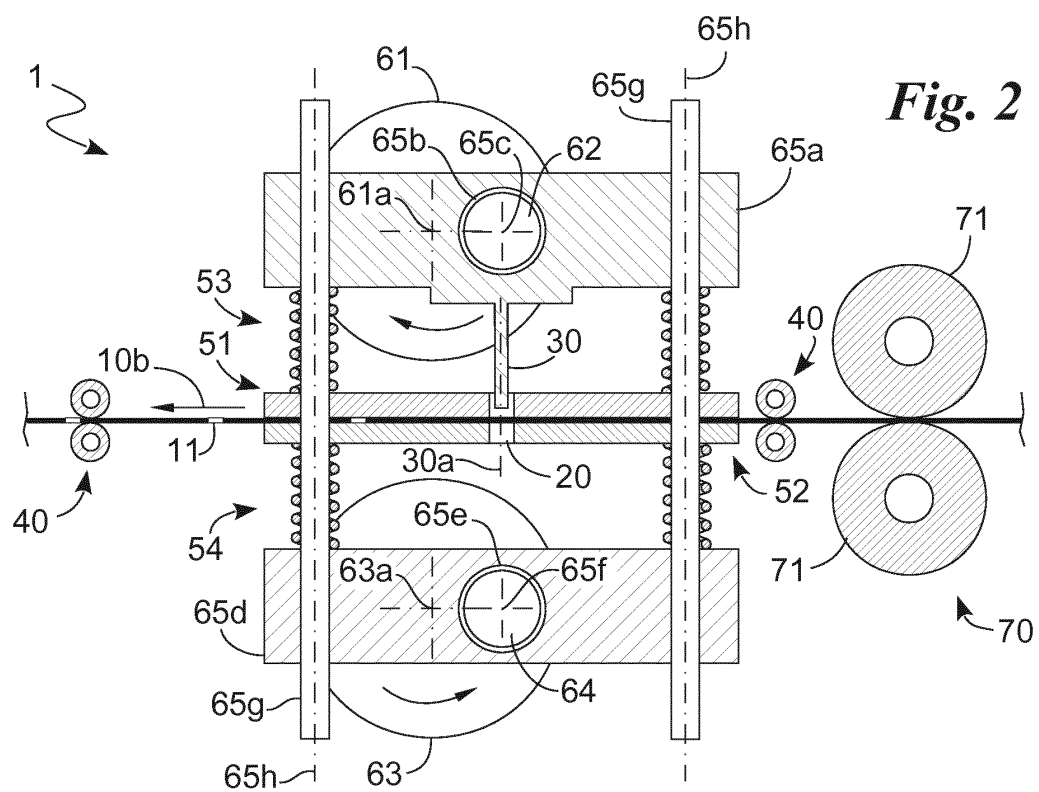
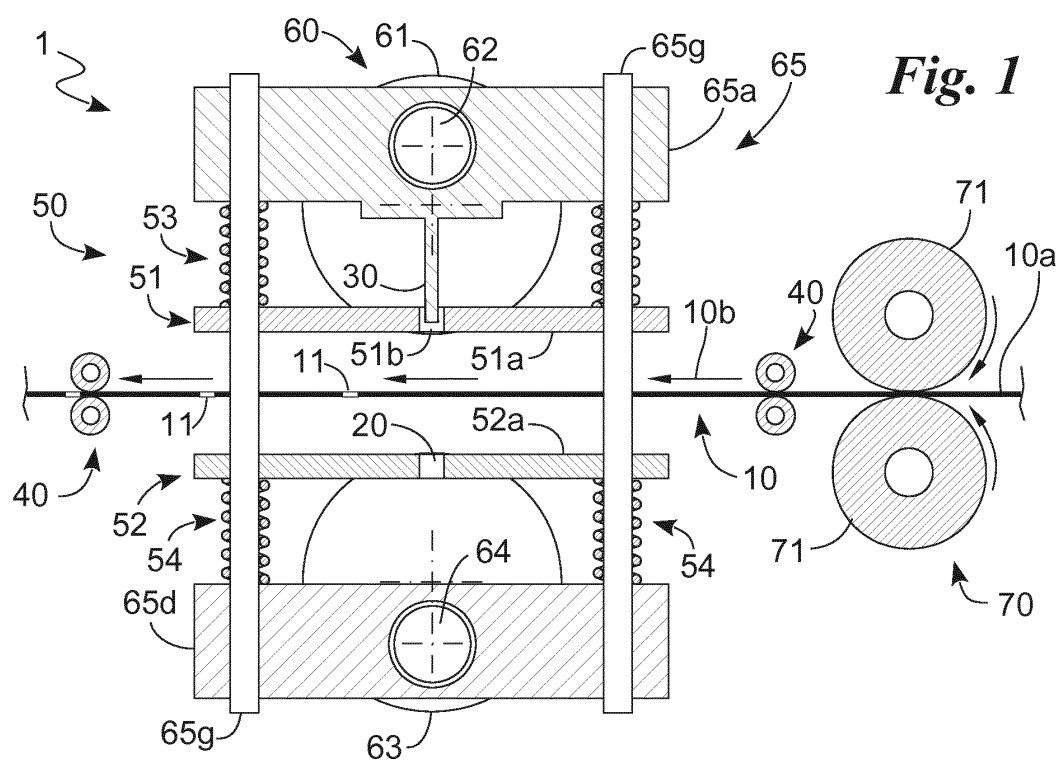
8. Shearing method according to one or more of the previous claims, in which said movement system (60) moves said die (20) and comprises a supplementary rotating body (63) defining a supplementary rotation axis (63a); and a supplementary cam (62) positioned between said die (20) and said supplementary rotating body (63) so as to define for said die (20) a translation along a trajectory at least partially circular (60b) with respect to said supplementary rotation axis (63a). 10 15
9. Shearing method according to the previous claim, wherein in said feed step said eccentric movement of at least one out of said punch (30) and said die (20) pushes said bodies (51, 52) making said band (10) advance. 20
10. Shearing method according to the previous claim, wherein said movement system (60) comprises a guide (65) suitable to be associated to said punch (30) and said die (20) preventing a rotation of said punch (30) and of said die (20) relative to said band (10). 25
11. Shearing method according to one or more of the claims 6 - 10, wherein said moving body (51) is weakly constrained to said punch (30) so as to translate in relation to said punch (30) in a direction substantially transversal to said lying surface (10a). 30 35

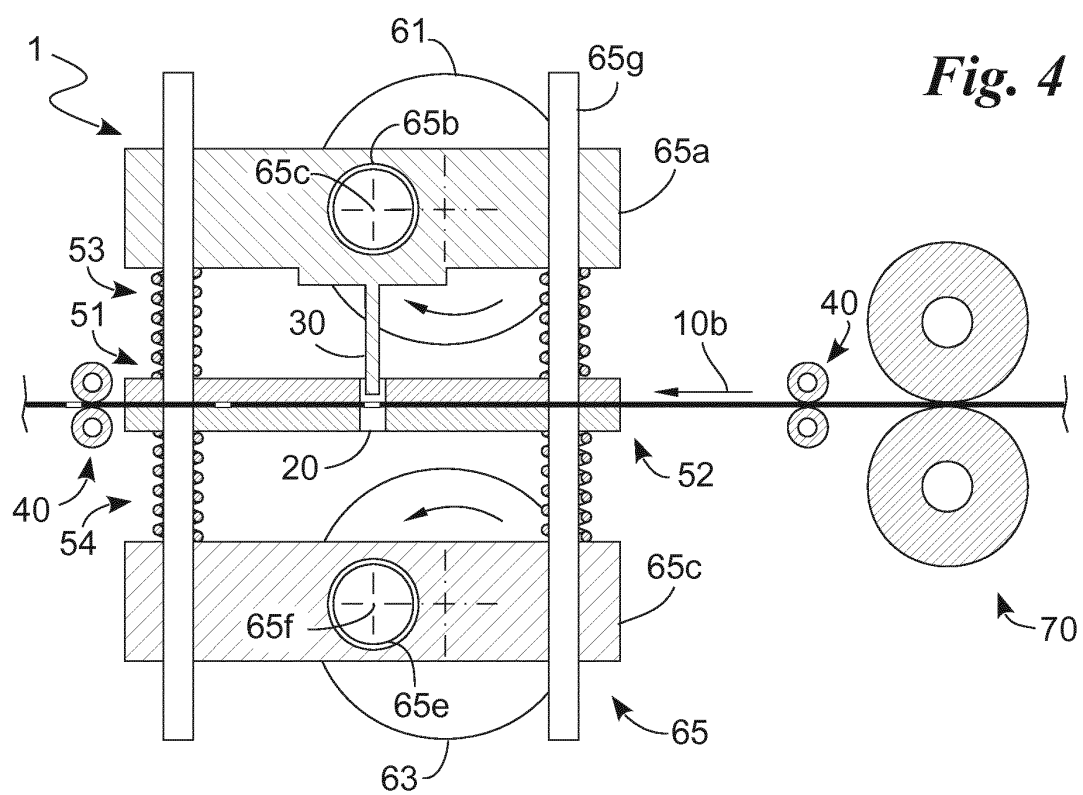
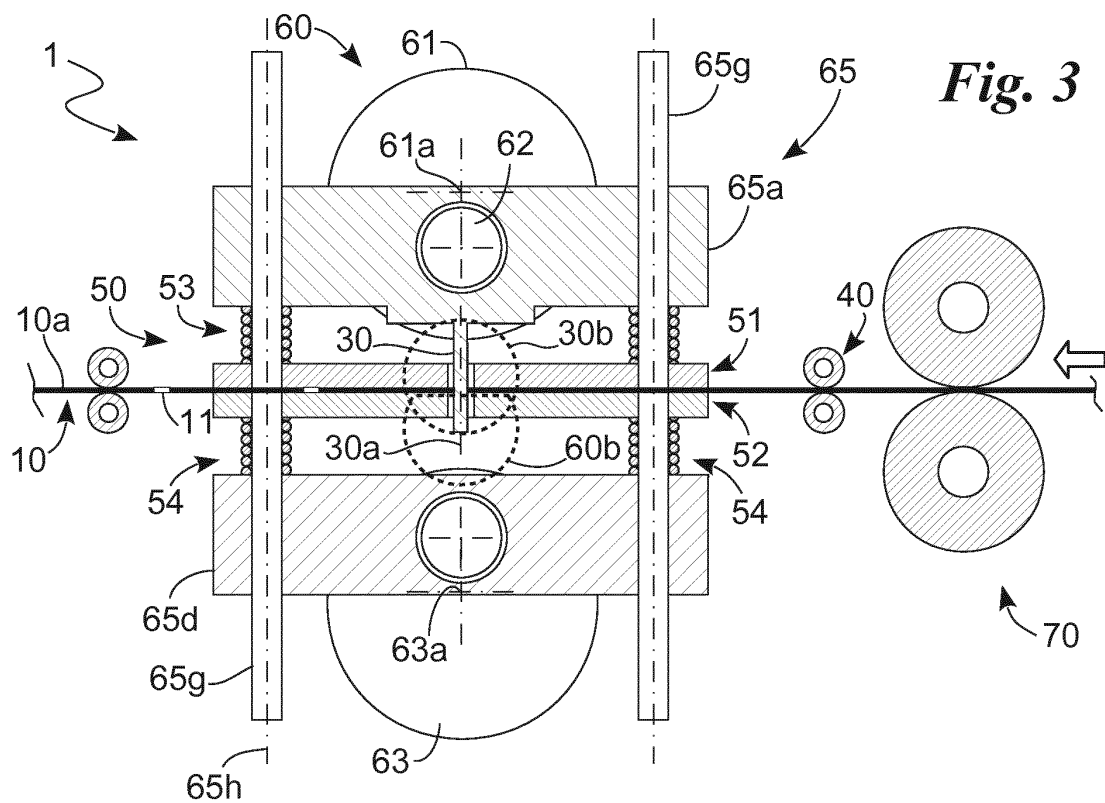
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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 6742

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 August 2014	Examiner Pieracci, Andrea
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EP 14 16 6742

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18-08-2014

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REFERENCES CITED IN THE DESCRIPTION

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