

Screwing tool, in particular screwdriver

The invention concerns a screwing tool according to the introductory part of claim 1.

A screwing tool for polygon socket screws is known from DE-A-3 206 494, wherein two polygon corners adjacent to each other are connected by two convexly shaped flank sections, forming a wedge in the central region of each flank. As the wedge is set back from a tangent applied to the convexly shaped flank sections, the area of force application is reduced, associated with the fact that only a reduced torque can be transmitted too.

It is the object of the invention to design a screwing tool of the kind in question in a manner for ease of manufacture in such a way that, in relationship to the size of the screwing tool, optimum torques can be transmitted.

This object is achieved in a generic screwing tool by the characteristics indicated in the characterising part of claim 1.

The subsidiary claims concern advantageous developments of the solution according to the invention.

As a result of such a design a screwing tool, in particular a screwdriver for polygon socket screws, in particular hexagon socket screws, of increased serviceability is provided. In relationship to the size of the screwing tool or its working end, optimum torques can be transmitted. This results from the fact that the convexly extending flank sections in the central region of each flank are separated from each other by a non-convexly extending intermediate section. Further, there is a set-back arrangement of the ends at the polygon corners of the convexly extending sections relative to the rectilinear extension of the two end points of the intermediate section. This means that, when the screwing tool is put into operation and a torque is applied, each flank with a convexly extending flank section and the non-convexly extending intermediate section or a partial length thereof





comes into contact with the corresponding hexagon socket face of the screw. With increasing torque, taking into account the deformation at the screw head, the result is a constantly increasing area of support, associated with the optimum transmission of a torque mentioned hereinbefore. On account of the constantly increasing area of support, a cam-out effect is also counteracted; this means that the screwing tool, in particular the screwdriver, remains with its working end engaged with the polygon socket of the screw. Owing to the set-back ends at the polygon corners, easy introduction of the working end into the polygon socket is made possible, even if the corners thereof are slightly rounded due to manufacturing tolerances. The effect is therefore always that the flanks with their convexly extending flank sections and the non-convexly directed intermediate sections come into contact with the polygon faces of the polygon socket. On account of the non-convexly extending intermediate section between the convex flank sections of each flank, obtuse-angled, almost 180° corners are formed, which in combination with the ends at the polygon corners e.g. from a hexagon make an octadecagon. The convexly extending flank sections are formed by curves which project beyond the connecting line between the corners of the intermediate sections and the ends at the polygon corners. It proves to be an advantage that the intermediate sections extend rectilinearly. This also accommodates easy production of the working end of the screwing tool. With regard to good torque transmission, it proves to be advantageous that each convexly extending flank section has more than twice the length of the intermediate section. With a screwdriver for hexagon socket screws, a ratio of 4:1 between flank section and intermediate section is recommended. Upward or downward deviations are possible. Furthermore it must be emphasised that the rectilinear intermediate section extends tangentially to the adjacent end region of the two convex flank sections. If occasion arises, the rectilinear





intermediate section can be formed by a groove filled with diamond particles. The working end is therefore further prevented from sliding out of the polygon socket. However, there is also the possibility of providing both the flank sections and the intermediate sections with a diamond particle coating. This can be done by adding a diamond powder in the region of about 15 μm to the electroplating bath. Together with the coating, a decrease in wear of the working end is obtained as well.

Below, a practical example of the invention is described with the aid of the drawings. They show:

- Fig. 1 a screwdriver for hexagon socket screws and a hexagon socket screw arranged coaxially therewith in elevation,
- Fig. 2 in a greatly enlarged view a cross-section through the screw head in the region of the hexagon socket,
- Fig. 3 also in a greatly enlarged view a cross-section through the working end of the screwdriver,
- Fig. 4 the cross-section through the screw head with the working end of the screwdriver inserted in the polygon socket thereof, during rotary entrainment thereof in the direction of the arrow, and
- Fig. 5 in a further enlarged view a detail of the contour of the working end of the screwdriver.

The screwdriver 1 shown in Fig. 1 has a handle 2 with a blade 2 embedded in the latter and non-rotatable relative to the handle. The blade 3 comprises a shank 4 of circular cylindrical cross-section which forms at the end a hexagonal bit 5. The latter forms the working end of the screwdriver 1 and is suitable for entering the hexagon socket 6 of the screw head 7 of a hexagon socket screw 8.

In detail, the hexagon socket 6 is composed of the rectilinearly extending hexagon socket faces 9 such that two hexagon socket faces meet at an edge 10. The distance between two parallel opposed hexagon socket faces 9 is the key size S.





Whereas there are rectilinear hexagon socket faces 9 on the screw 8, the polygon bit 5 has on each flank 11 two convexly extending flank sections 12 which are separated from each other in the central region of the flank 11 by a non-convexly extending intermediate section 13. Further, the ends 14 at the polygon corners of the convexly extending flank sections 12 are set back from the rectilinear extension 15 of the two end points 16 of the intermediate section 13, cf. in particular Fig. 5. The end points 16 in a certain respect form corner points owing to the adjoining convex flank sections 12, so that in the case of a hexagonal working end in connection with the ends 14 at the polygon corners an octadecagon is formed.

The connecting lines 17 between the end points 16 of the intermediate section 13 and the ends 14 at the polygon corners are overlapped by the convexly extending flank sections 12. Further it can be seen in Fig. 5 that the rectilinear intermediate section 13 extends tangentially to the adjacent end region of the two convex flank sections 12. The corresponding tangent 18 in this case forms with the connecting lines 17 an angle α of about 3.5° .

The length y of the convexly extending flank section has more than twice the length x of the intermediate section 13. In the practical example a ratio of about 4:1 between flank section 12 and intermediate section 13 is selected.

The distance between two parallel opposed flanks 11 of the hexagon bit 5 is the key size 51 which is adapted to that of the hexagon socket 6.

It is possible, as shown in dot and dash lines in Fig. 5, to provide in the region of the intermediate section 13 a channel 19 extending in the longitudinal direction of the shank for receiving diamond particles of which the outer surface forms the rectilinear intermediate section 13. It is however also possible to provide the working end itself with a diamond particle coating.

If the screw 8, as shown in Fig. 4, is to be entrained





in the direction of the arrow by means of the screwdriver 1, then first the hexagon bit 5 which forms the working end is to be introduced into the hexagon socket opening 6 of the screw head 7. Then the screwdriver 1 is to be turned in the direction of the arrow. A slight relative rotation by the angle β between hexagon socket screw 8 and hexagon bit 5 takes place here. Taking into account a certain deformation of the screw head 7, an area of support of large dimensions is formed between the hexagon socket faces 9 and the corresponding convex flank sections 12. In detail the appearance of this is that almost one flank section 12 of each flank 11 and also the intermediate section 13 or a major proportion of its length come into contact with the hexagon socket face 9, so that optimum torques can be transmitted. Owing to the deformation at the screw head there is an increase in the area of support with increasing torque transmission. Due to this large area of support, a cam-out effect is prevented as well, so that the working end of the screwdriver 1 remains connected in form-locking relationship to the hexagon socket screw 8 and does not jump out or slide out of the hexagon socket opening 6.

The characteristics of the invention disclosed in the above description, the drawings and the claims may be of significance for putting the invention into practice both individually and in any combination. The disclosure of the application hereby also includes in full the disclosure content of the associated/attached priority documents (copy of the earlier application).





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Claims

1. Screwing tool, in particular screwdriver (1) or screwdriver bit, for polygon socket screws, in particular hexagon socket screws (8), with flank sections (12) shaped convexly in the circumferential direction between the polygon corners, characterised in that the convexly extending flank sections (12) in the central region of each flank (11) are separated from each other by a non-convexly extending intermediate section (13) and the ends (14) at the polygon corners of the convexly extending flank sections (12) are set back from the rectilinear extension (15) of the two end points (16) of the intermediate section (13).
2. Screwing tool, in particular according to claim 1, characterised in that the intermediate sections (13) extend rectilinearly.
3. Screwing tool, in particular according to one or more of the preceding claims, characterised in that each convexly extending flank section (12) has more than twice the length (x) of the intermediate section (13).
4. Screwing tool, in particular according to one or more of the preceding claims, characterised in that the rectilinear intermediate section (13) extends tangentially to the adjacent end region of both convex flank sections (12).
5. Screwing tool according to one or more of the preceding claims, characterised in that both the convex flank sections (12) and the intermediate sections (13) are provided with a diamond particle coating.

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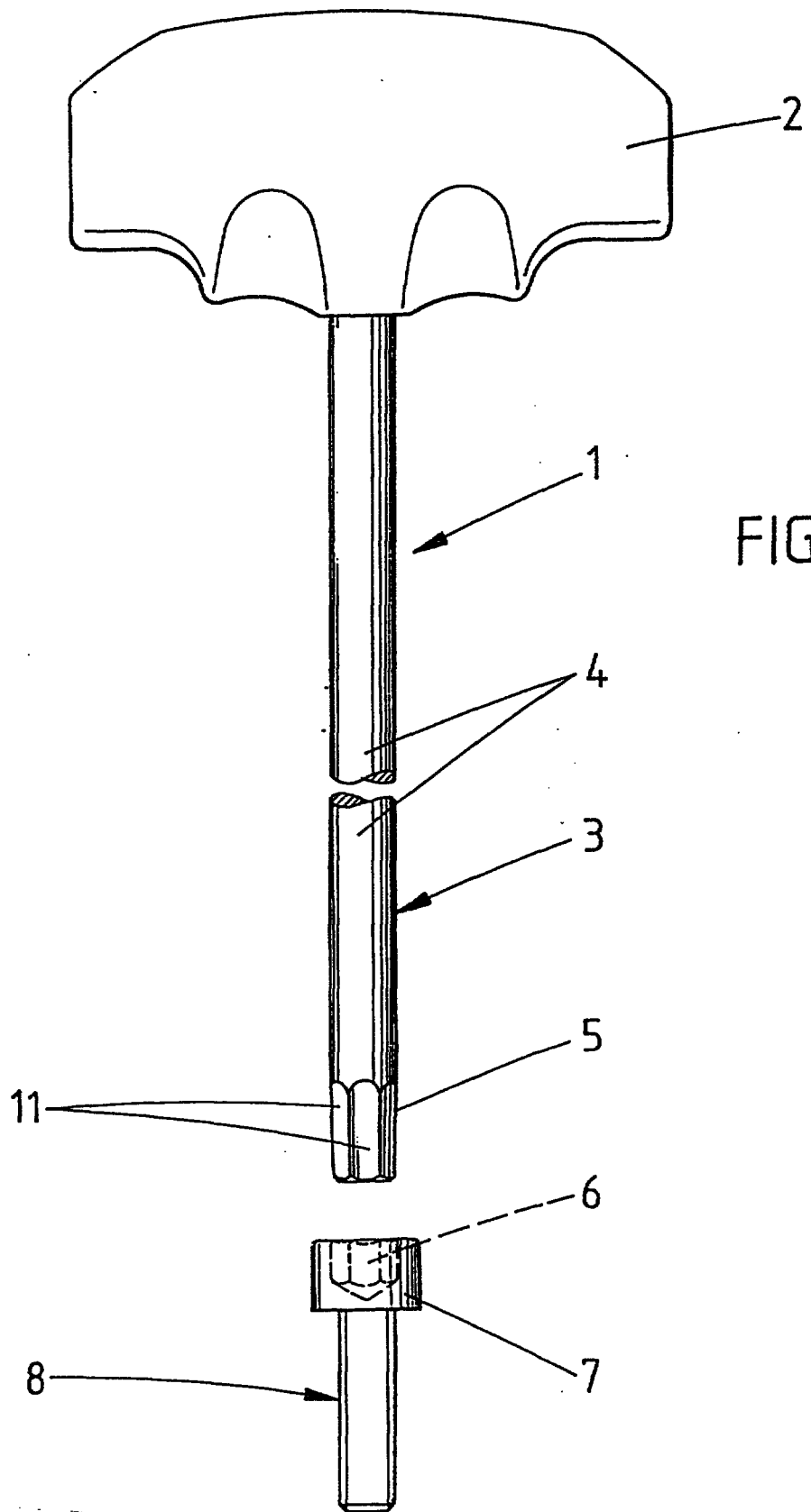




FIG.2

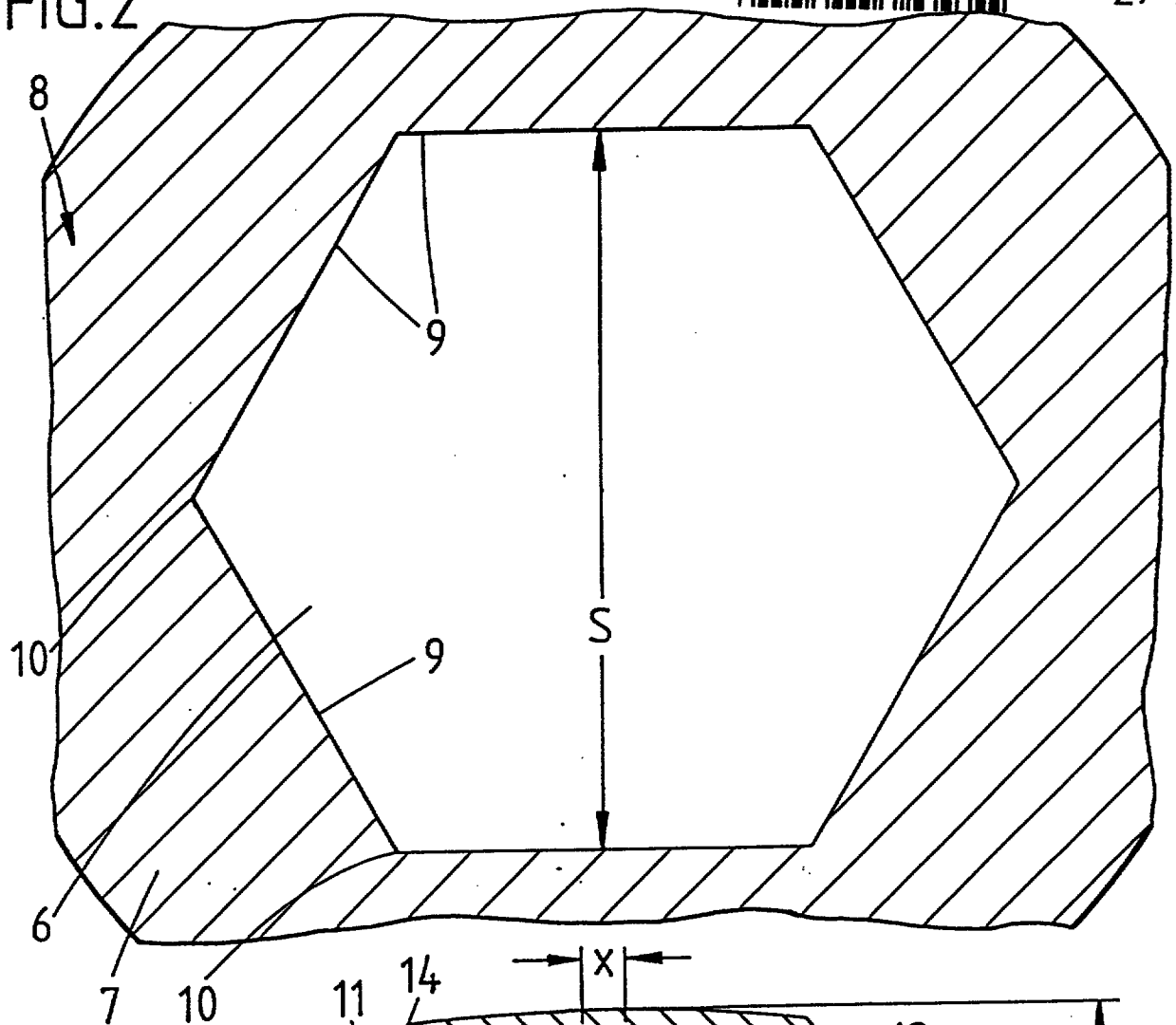
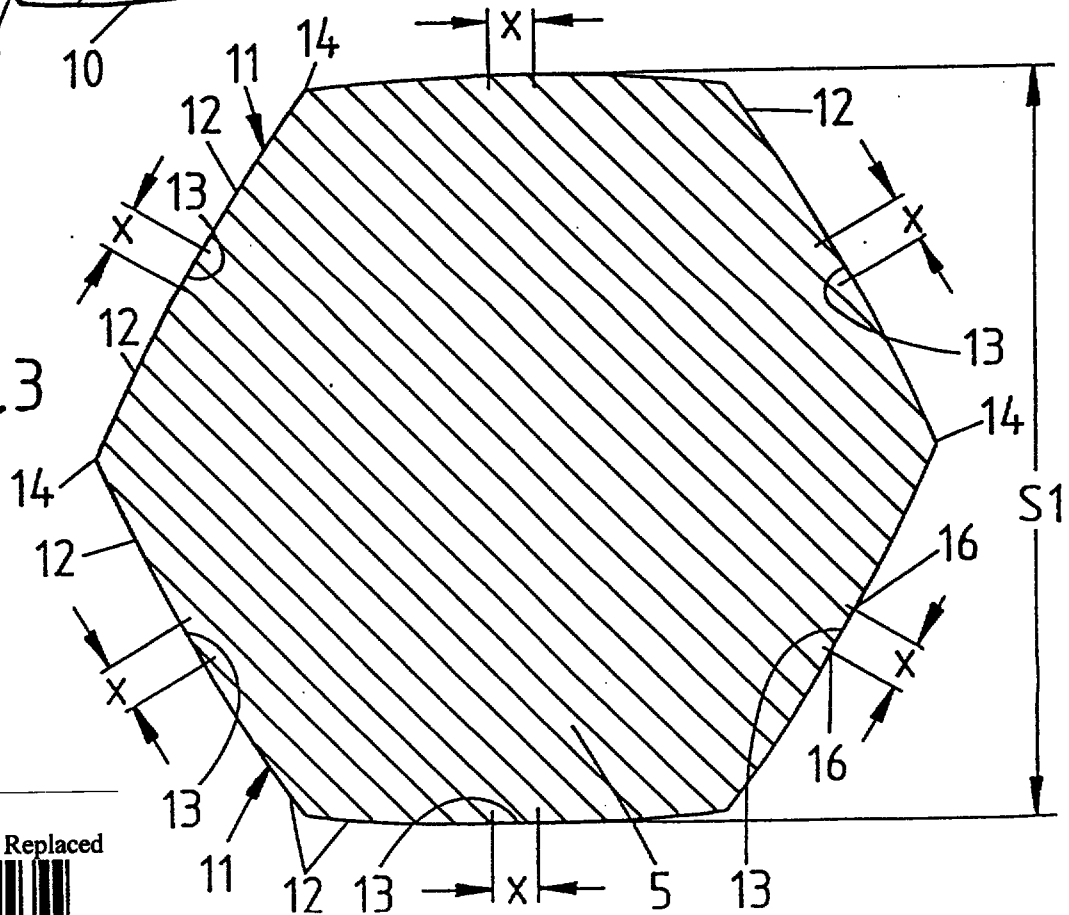
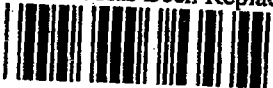


FIG.3



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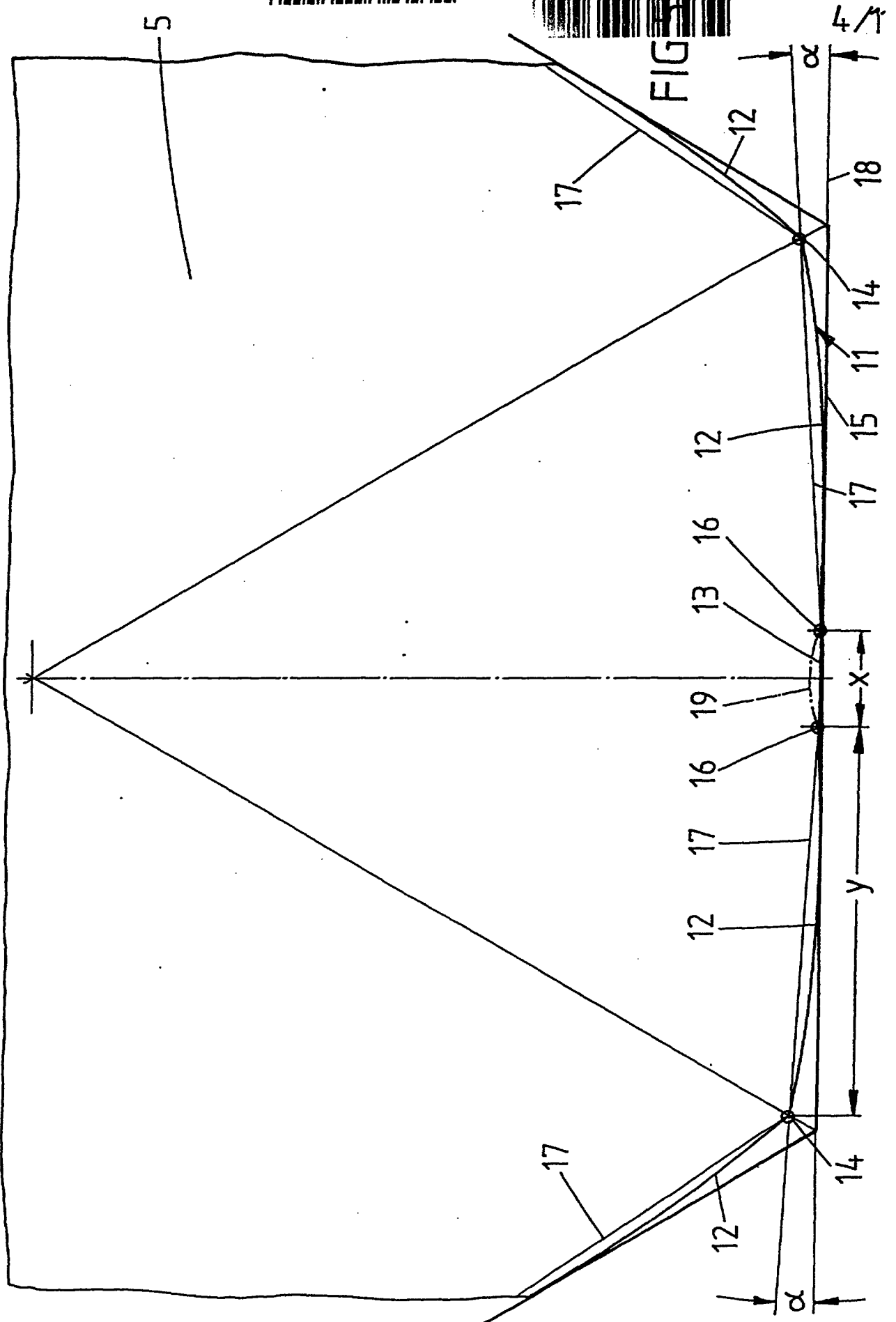




FIG. 6

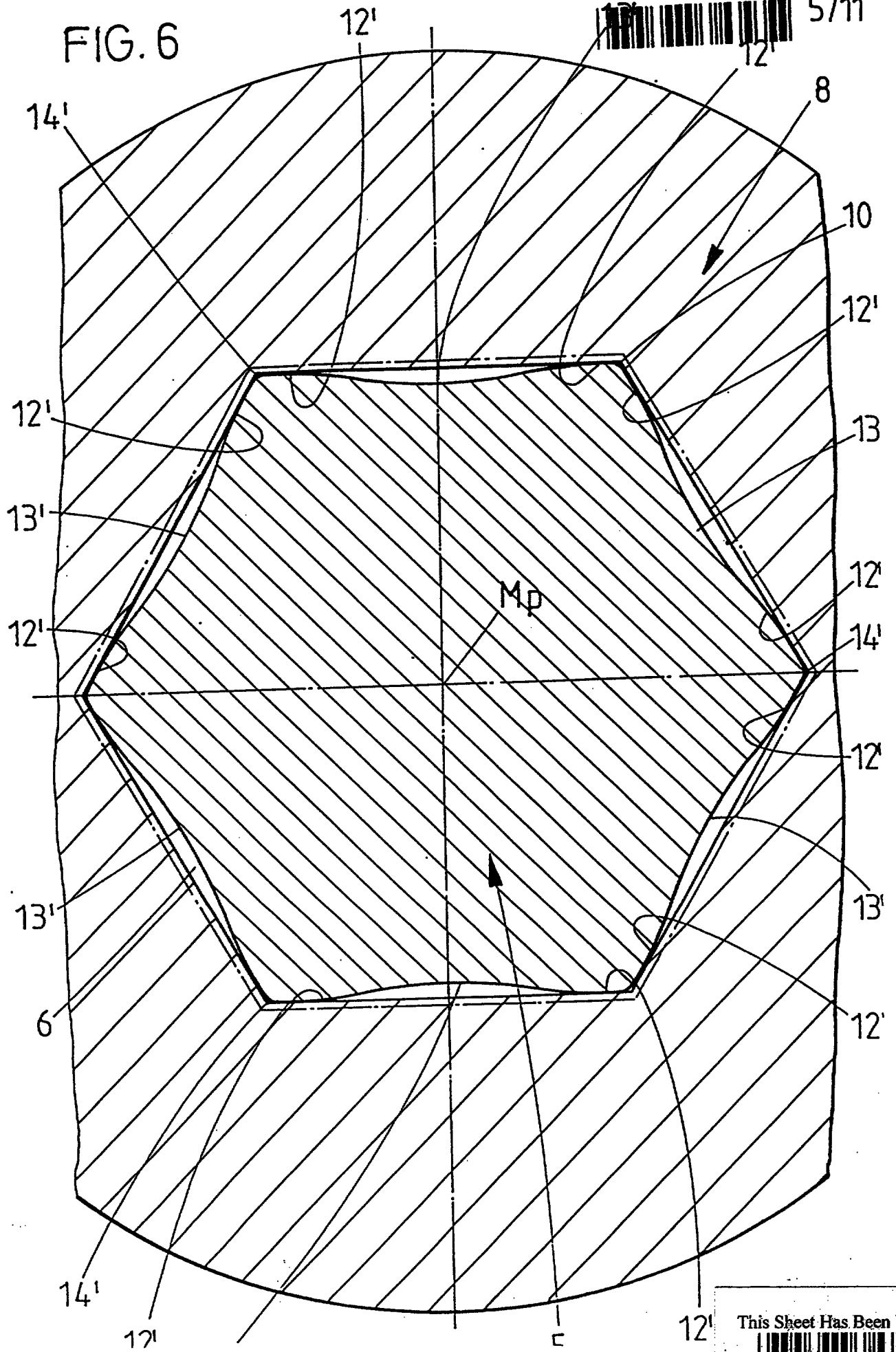
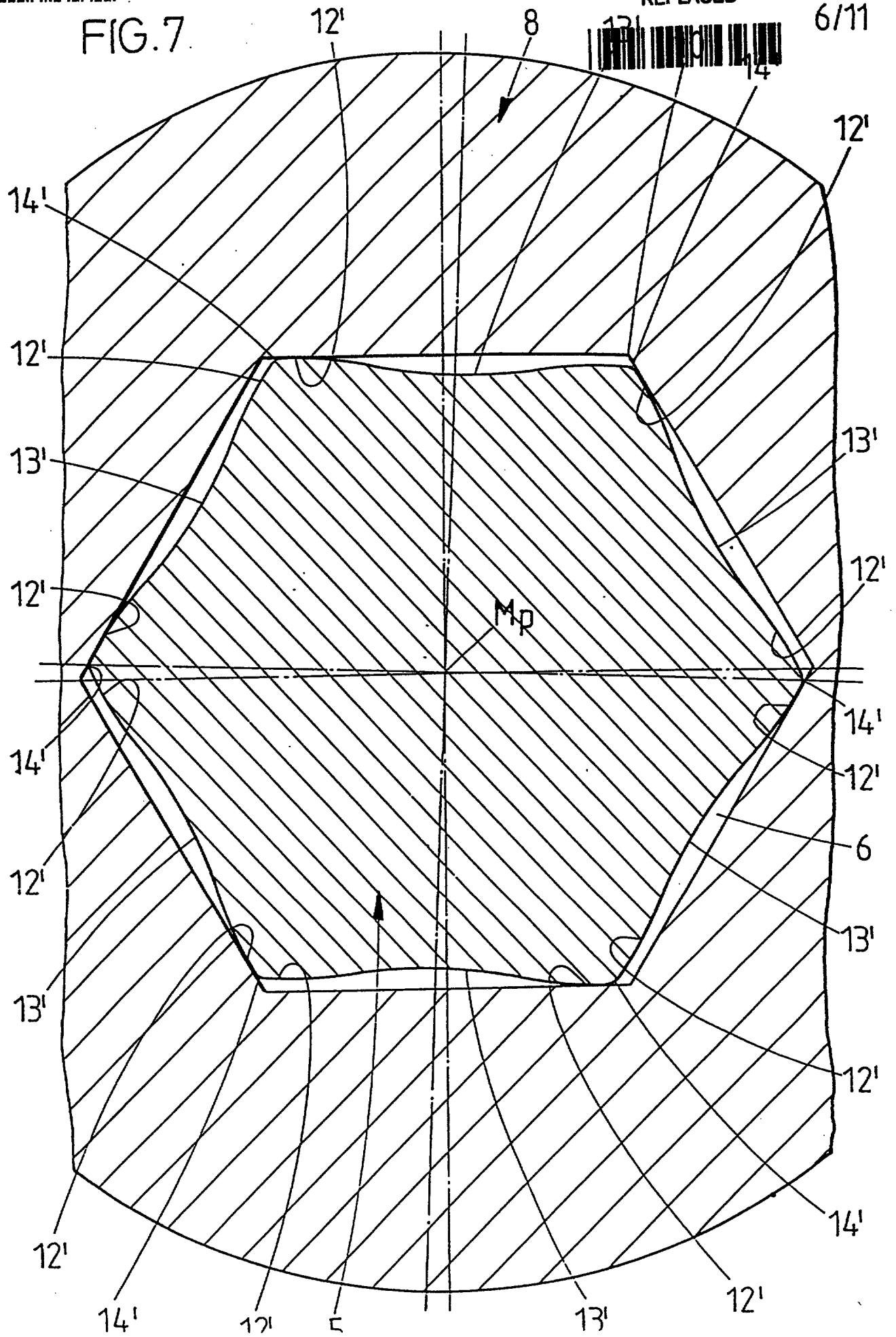


FIG. 7.



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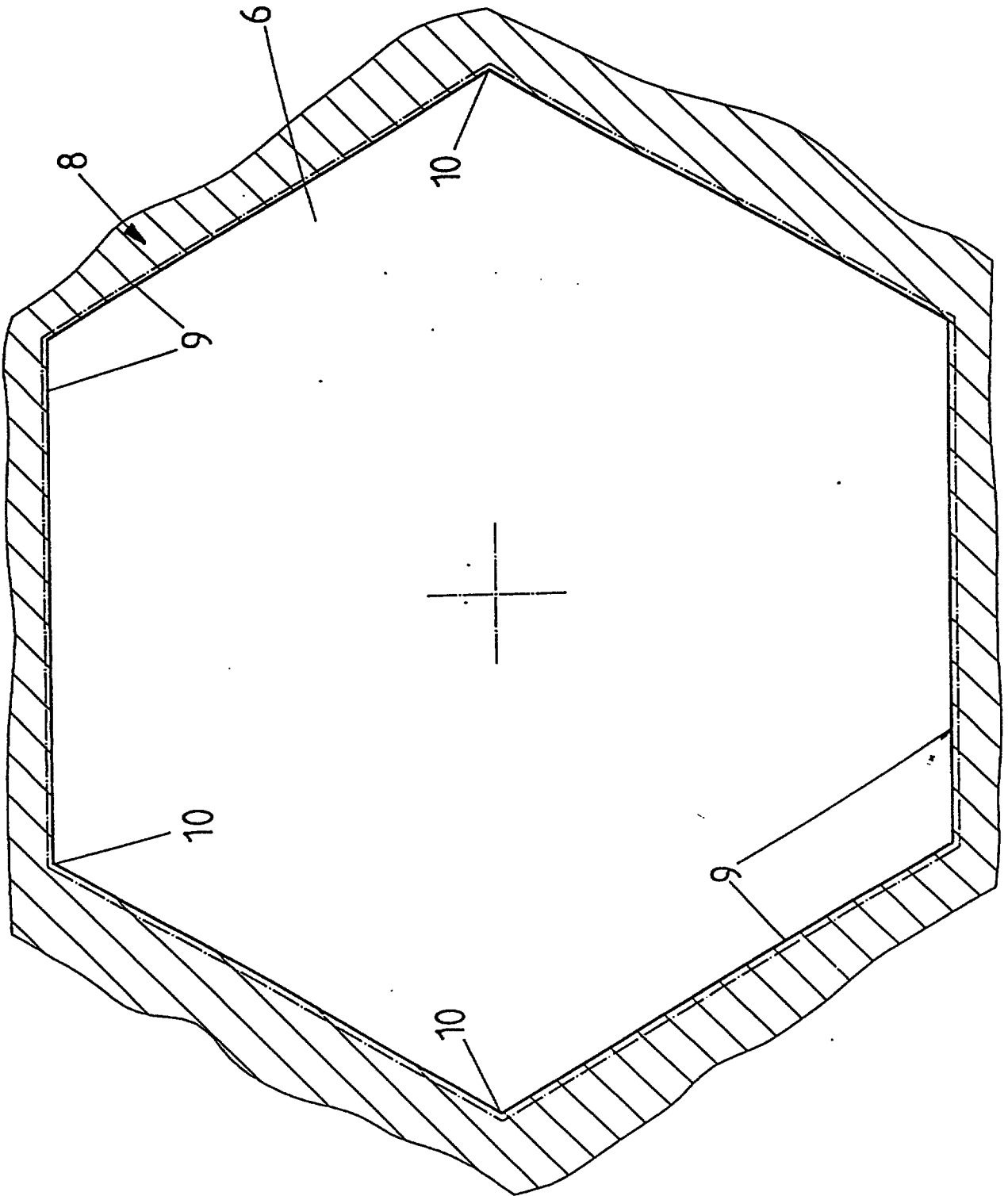


FIG. 8

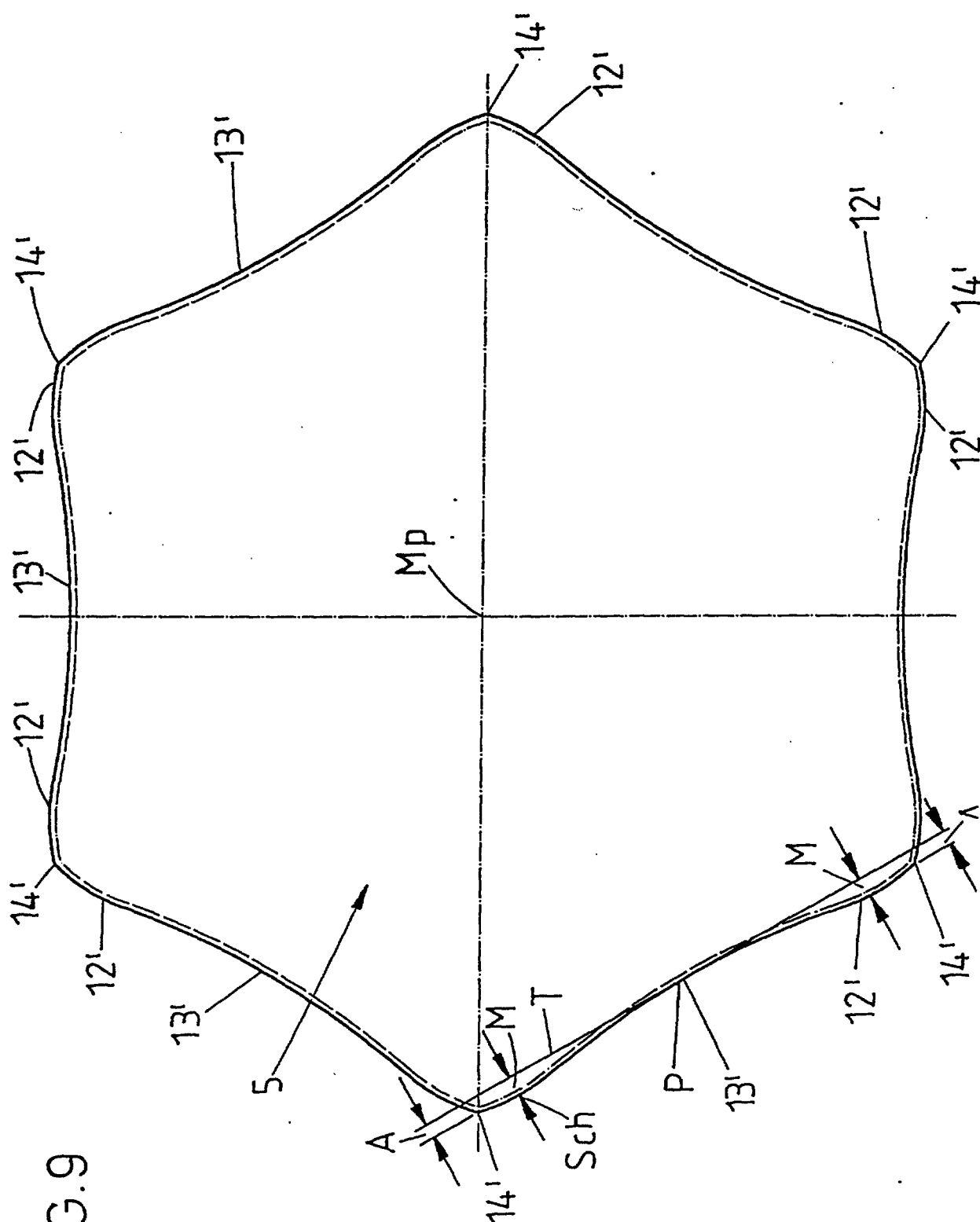
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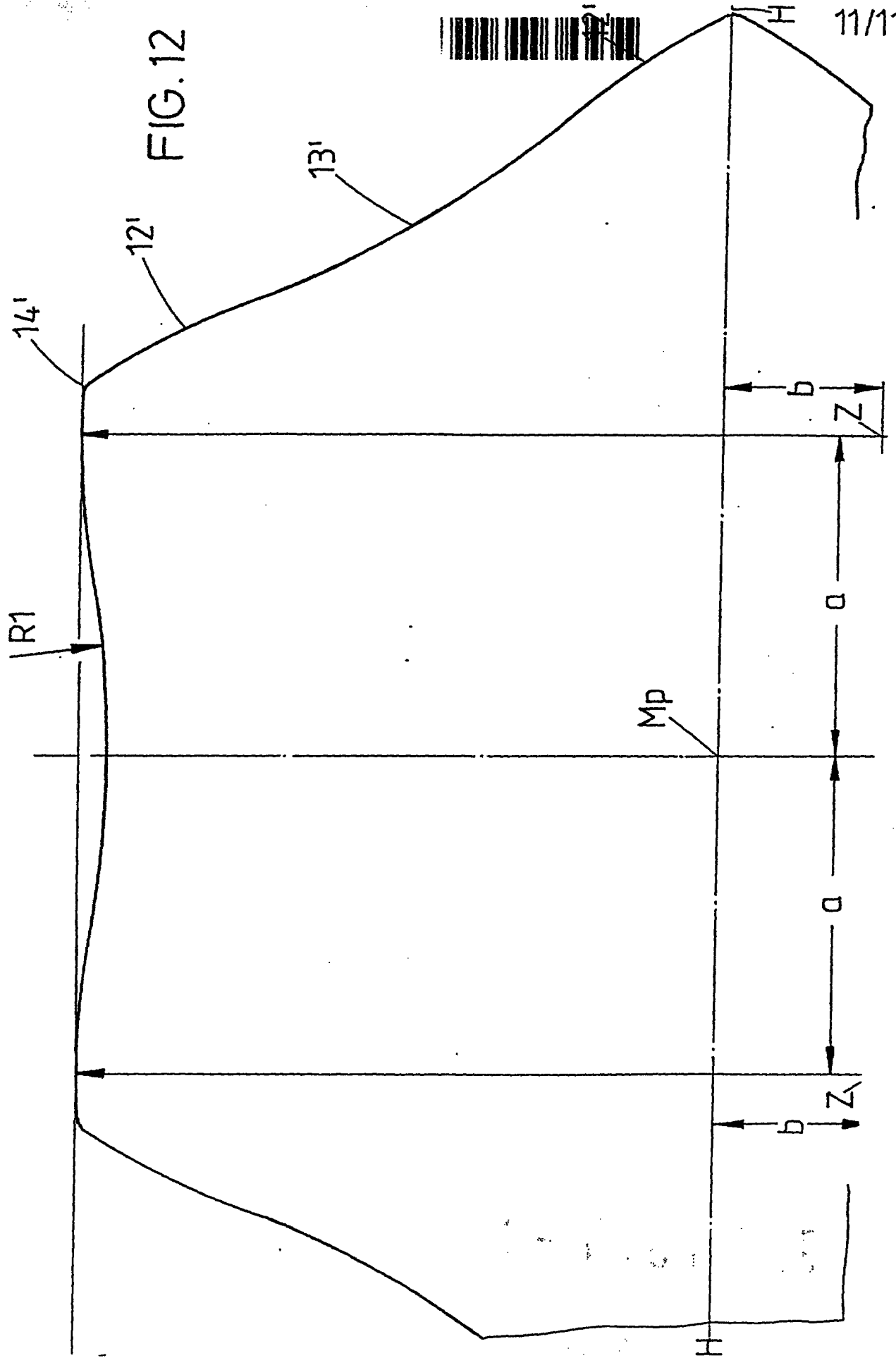
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ABSTRACT

SCREWING TOOL, IN PARTICULAR SCREWDRIVER

The invention concerns a screwing tool, in particular screwdriver (1) or screwdriver bit, for polygon socket screws (8), with flank sections (12) shaped convexly in the circumferential direction; to optimise force transmission, the flank sections (12/12') in the central region of each flank (11) are cut off from each other by a non-convexly extending intermediate section (13/13').

(Key figure 10)



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Screwing tool, in particular screwdriver

The invention concerns a screwing tool according to the introductory part of claim 1.

A screwing tool for polygon socket screws is known from DE-A-3 206 494, wherein two polygon corners adjacent to each other are connected by two convexly shaped flank sections, forming a wedge in the central region of each flank. As the wedge is set back from a tangent applied to the convexly shaped flank sections, the area of force application is reduced, associated with the fact that only a reduced torque can be transmitted too. The wedge weakens above all due to its notch effect the transmitting stability of the screwing tool.

It is the object of the invention to design a screwing tool of the kind in question in a manner for ease of manufacture in such a way that, in relationship to the size of the screwing tool, optimum torques can be transmitted.

This object is achieved in a generic screwing tool by the characteristics indicated in the characterising part of claim 1.

The subsidiary claims concern advantageous developments of the solution according to the invention.

As a result of such a design a screwing tool, in particular a screwdriver for polygon socket screws, in particular hexagon socket screws, of increased serviceability is provided. In relationship to the size of the screwing tool or its working end, optimum torques can be transmitted with low wear. This results from the fact that the convexly extending flank sections in the central region of each flank are separated from each other by a non-convexly extending intermediate section. Further, there is a special arrangement of the ends at the polygon corners of the convexly extending sections relative to the rectilinear extension of the two end points of the intermediate section or the tangent thereto. This means that, when the screwing tool is put into operation and a torque is applied, each

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flank with a convexly extending flank section and the non-convexly extending intermediate section or a partial length thereof comes into contact with the corresponding hexagon socket face of the screw. There are optimum leverages for the ranges of force application. With increasing torque, taking into account the deformation at the screw head, the result is a constantly increasing area of support, associated with the optimum transmission of a torque mentioned hereinbefore. On account of the constantly increasing area of support, a cam-out effect is also counteracted; this means that the screwing tool, in particular the screwdriver, remains with its working end engaged with the polygon socket of the screw. Owing to the set-back ends at the polygon corners, easy introduction of the working end into the polygon socket is made possible, even if the corners thereof are slightly rounded due to manufacturing tolerances. The effect is therefore always that the flanks with their convexly extending flank sections and the non-convexly directed intermediate sections come into contact with the polygon faces of the polygon socket. On account of the non-convexly extending or even concave intermediate section between the convex flank sections of each flank, obtuse-angled, almost 180° corners are formed, which in combination with the ends at the polygon corners e.g. from a hexagon make an octadecagon. The convexly extending flank sections are formed by curves which project beyond the connecting line between the corners of the intermediate sections and the ends at the polygon corners. It proves to be an advantage that the intermediate sections extend rectilinearly. This also accommodates easy production of the working end of the screwing tool. With regard to good torque transmission, it proves to be advantageous that each convexly extending flank section has more than twice the length of the intermediate section. With a screwdriver for hexagon socket screws, a ratio of 4:1 between flank section and intermediate section is recommended. Upward or downward

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deviations are possible. Furthermore it must be emphasised that the rectilinear intermediate section extends tangentially to the adjacent end region of the two convex flank sections. With a concave intermediate section, more or less the same length of all curve sections is advantageous. If occasion arises, the intermediate section can be formed by a groove filled with diamond particles. The working end is therefore further prevented from sliding out of the polygon socket. However, there is also the possibility of providing both the flank sections and the intermediate sections with a diamond particle coating. This can be done by adding a diamond powder in the region of about 15 μm to the electroplating bath. Together with the coating, a decrease in wear of the working end is obtained as well.

Below, a practical example of the invention is described with the aid of the drawings. They show:

- Fig. 1 a screwdriver for hexagon socket screws and a hexagon socket screw arranged coaxially therewith in elevation,
- Fig. 2 in a greatly enlarged view a cross-section through the screw head in the region of the hexagon socket,
- Fig. 3 also in a greatly enlarged view a cross-section through the working end of the screwdriver,
- Fig. 4 the cross-section through the screw head with the working end of the screwdriver inserted in the polygon socket thereof, during rotary entrainment thereof in the direction of the arrow,
- Fig. 5 in a further enlarged view a detail of the contour of the working end of the screwdriver,
- Fig. 6 in a greatly enlarged view the cross-section through the screw head with the working end of the screwdriver of a modified embodiment inserted in the polygon socket thereof,
- Fig. 7 the view as in Fig. 6 in the rotary entrainment loading position,

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- Fig. 8 an enlarged view of the min./max. tolerances of the polygon socket of a screw, key size 6,
Fig. 9 the same view as in Fig. 8 but relating to the working end (cross-section) of the modified embodiment according to Fig. 6,
Figs. 10 and 11 an enlarged view as in Fig. 7, taking into account the (permitted) manufacturing tolerances of Figs. 8 and 9, with key size 6, and
Fig. 12 in an enlarged view a part-section contour view to illustrate the pull of the centres of the curves.

The screwdriver 1 shown in Fig. 1 has a handle 2 with a blade 2 embedded in the latter and non-rotatable relative to the handle. The blade 3 comprises a shank 4 of circular cylindrical cross-section which forms at the end a hexagonal bit 5. The latter forms the working end of the screwdriver 1 and is suitable for entering the hexagon socket 6 of the screw head 7 of a hexagon socket screw 8.

In detail, the hexagon socket 6 is composed of the rectilinearly extending hexagon socket faces 9 such that two hexagon socket faces meet at an edge 10. The distance between two parallel opposed hexagon socket faces 9 is the key size S.

Whereas there are rectilinear hexagon socket faces 9 on the screw 8, the polygon bit 5 has on each flank 11 two convexly extending flank sections 12 which are separated from each other in the central region of the flank 11 by a non-convexly extending intermediate section 13. Further, the ends 14 at the polygon corners of the convexly extending flank sections 12 are set back from the rectilinear extension 15 of the two end points 16 of the intermediate section 13, cf. in particular Fig. 5. The end points 16 in a certain respect form corner points owing to the adjoining convex flank sections 12, so that in the case of a hexagonal working end in connection with the ends 14 at the polygon corners an octadecagon is formed.

The connecting lines 17 between the end points 16 of

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the intermediate section 13 and the ends 14 at the polygon corners are overlapped by the convexly extending flank sections 12. Further it can be seen in Fig. 5 that the rectilinear intermediate section 13 extends tangentially to the adjacent end region of the two convex flank sections 12. The corresponding tangent 18 in this case forms with the connecting lines 17 an angle α of about 3.5° .

The length y of the convexly extending flank section 11 is twice the length x of the intermediate section 13. In the practical example a ratio of about 4:1 between flank section 12 and intermediate section 13 is selected.

The distance between two parallel opposed flanks 11 of the hexagon bit 5 is the key size 51 which is adapted to that of the hexagon socket 6.

It is possible, as shown in dot and dash lines in Fig. 5, to provide in the region of the intermediate section 13 a channel 19 extending in the longitudinal direction of the shank for receiving diamond particles of which the outer surface forms the rectilinear intermediate section 13. It is however also possible to provide the working end itself with a diamond particle coating.

If the screw 8, as shown in Fig. 4, is to be entrained in the direction of the arrow by means of the screwdriver 1, then first the hexagon bit 5 which forms the working end is to be introduced into the hexagon socket opening 6 of the screw head 7. Then the screwdriver 1 is to be turned in the direction of the arrow. A slight relative rotation by the angle β between hexagon socket screw 8 and hexagon bit 5 takes place here. Taking into account a certain deformation of the screw head 7, an area of support of large dimensions is formed between the hexagon socket faces 9 and the corresponding convex flank sections 12. In detail the appearance of this is that almost one flank section 12 of each flank 11 and also the intermediate section 13 or a major proportion of its length come into contact with the hexagon socket face 9, so that optimum torques can be transmitted. Owing to the deformation at

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the screw head there is an increase in the area of support with increasing torque transmission. Due to this large area of support, a cam-out effect is prevented as well, so that the working end of the screwdriver 1 remains connected in form-locking relationship to the hexagon socket screw 8 and does not jump out or slide out of the hexagon socket opening 6.

Figs. 6-12 show a modified embodiment. Here, the non-convexly extending section 13' is concavely shaped. On either side thereof are located the convexly extending flank sections 12'.

The ends 14' at the polygon corners are located - including any tolerances permitted according to DIN - at a normal distance A (see Fig. 9) from the tangent T, applied to the lowest point P of the convex region. This distance A is smaller than the normal distance M which the apex Sch has from this tangent T. Figs. 10 and 11 show that even in case of random (unfavourable) addition of the tolerances this embodiment still in an optimum manner represents the advantage that cutting edge contact is avoided, but above all that the region of load transmission is located at maximum possible leverage from the polygon centre Mp.

The centres Z (see Fig. 12) of the convexly extending flank sections 12' are located at a distance a from the polygon centre Mp and beyond the respective cross-section bisecting line H-H, the latter by the amount b which is roughly half the amount a.

The amount a roughly corresponds to 1/4 of the length of the cross-section bisecting line H-H.

The characteristics of the invention disclosed in the above description, the drawings and the claims may be of significance for putting the invention into practice both individually and in any combination. All the characteristics disclosed are essential to the invention. The disclosure of the application hereby also includes in full the disclosure content of the associated/attached priority documents (copy of the earlier application).

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Claims

1. Screwing tool, in particular screwdriver (1) or screwdriver bit, for polygon socket screws, in particular hexagon socket screws (8), with flank sections (12) shaped convexly in the circumferential direction between the polygon corners, characterised in that the convexly extending flank sections (12/12') in the central region of each flank (11) are separated from each other by a non-convexly extending intermediate section (13/13').
2. Screwing tool according to claim 1 or in particular according thereto, characterised in that the ends (14) at the polygon corners of the convexly extending flank sections (12) are set back from the rectilinear extension (15) of the two end points (16) of the intermediate section (13).
3. Screwing tool according to claim 1 or in particular according thereto, characterised in that the intermediate sections (13) extend rectilinearly.
4. Screwing tool according to one or more of the preceding claims or in particular according thereto, characterised in that the rectilinear intermediate section (13) extends tangentially to the adjacent end region of both convex flank sections (12).
5. Screwing tool according to one or more of the preceding claims or in particular according thereto, characterised in that both the convex flank sections (12/12') and the intermediate sections (13/13') are provided with a diamond particle coating.
6. Screwing tool according to one or more of the preceding claims or in particular according thereto, characterised in that the intermediate section (13') extends concavely.

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7. Screwing tool according to one or more of the preceding claims or in particular according thereto, characterised in that the length (X') of the concave intermediate section (13') more or less corresponds to the length of the convexly extending region (12').

8. Screwing tool according to one or more of the preceding claims or in particular according thereto, characterised in that the polygon ends (14) of the convexly extending regions are a shorter normal distance (A) away from the tangent (T) applied to the lowest point (P) of the concave region than the apex (Sch) is from this tangent (T).

9. Screwing tool according to one or more of the preceding claims or in particular according thereto, characterised in that the distance a is approximately half the distance Mp-H extending from the polygon centre Mp to the associated polygon end (14').

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ABSTRACT

SCREWING TOOL, IN PARTICULAR SCREWDRIVER

The invention concerns a screwing tool, in particular screwdriver (1) or screwdriver bit, for polygon socket screws (8), with flank sections (12) shaped convexly in the circumferential direction; to optimise force transmission, the flank sections (12/12') in the central region of each flank (11) are cut off from each other by a non-convexly extending intermediate section (13/13').

(Key figure 10)

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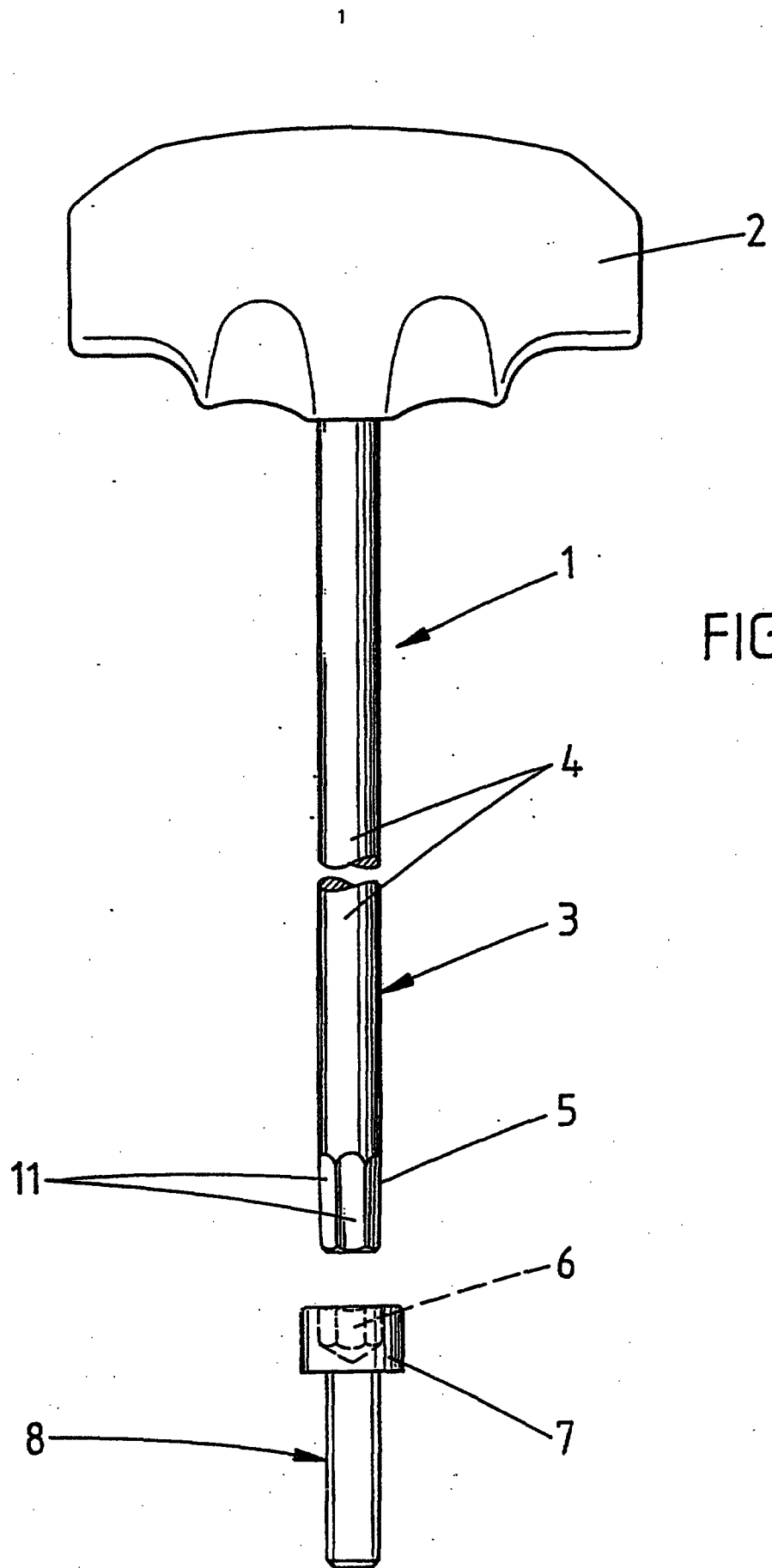


FIG.1

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FIG.2

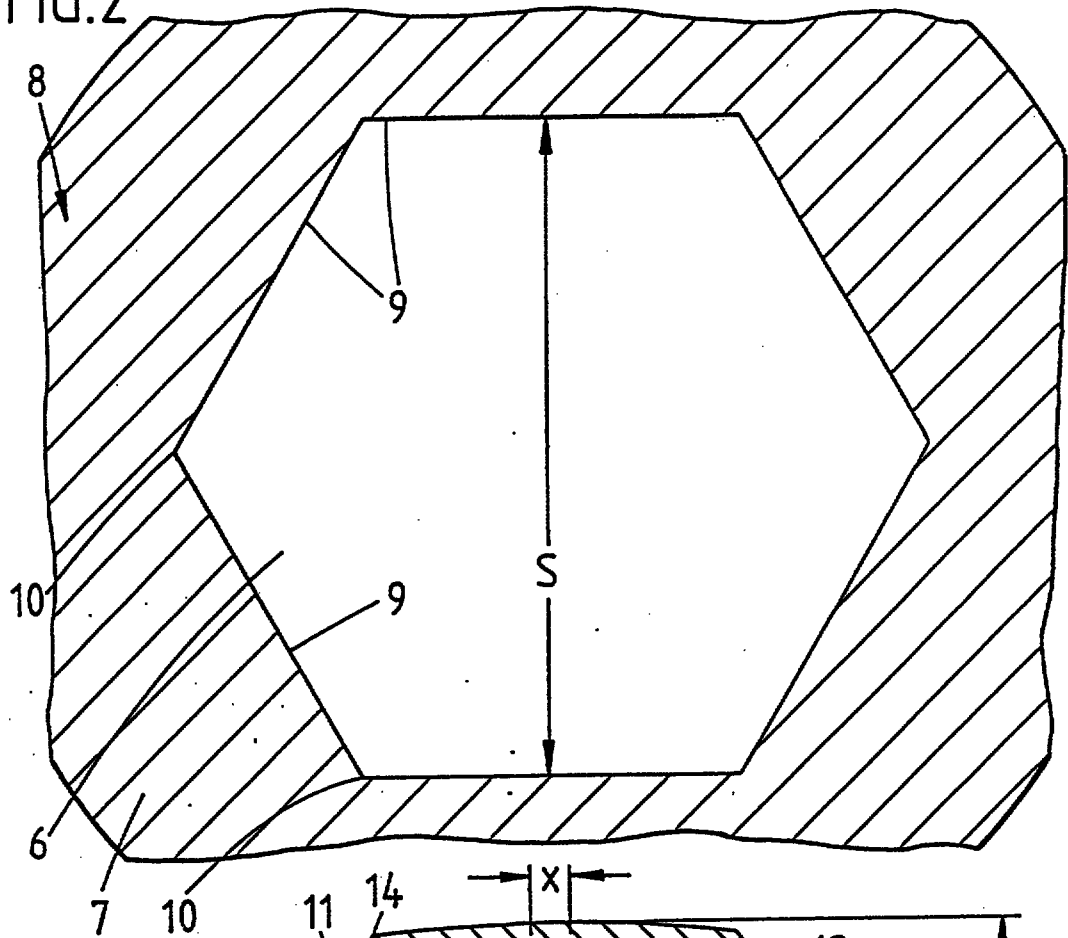
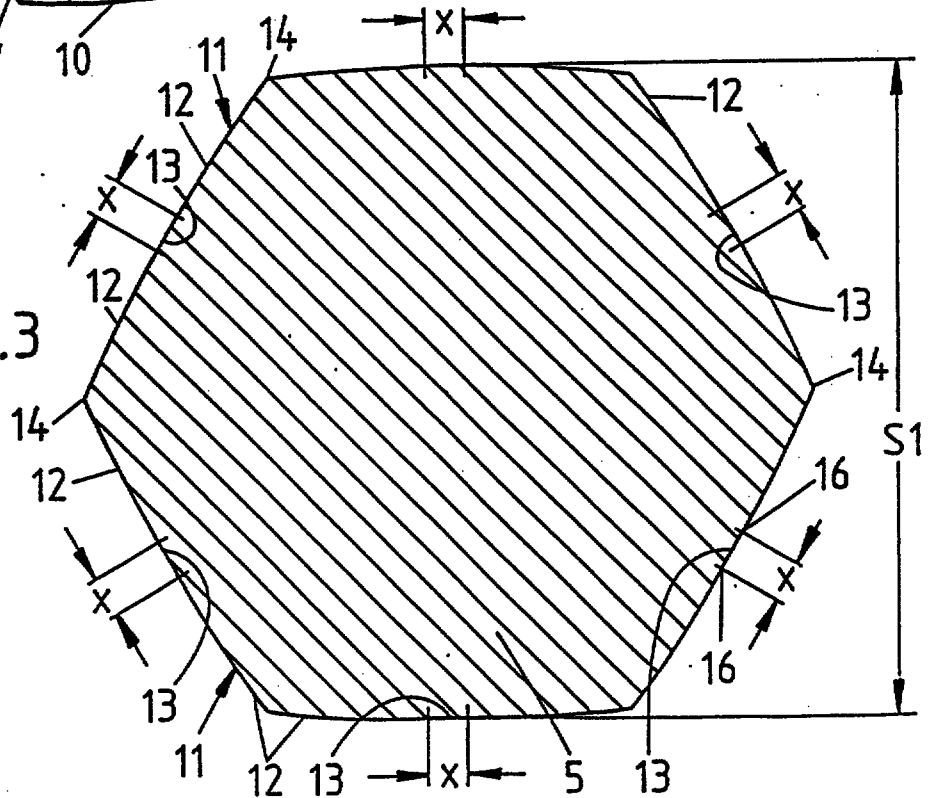


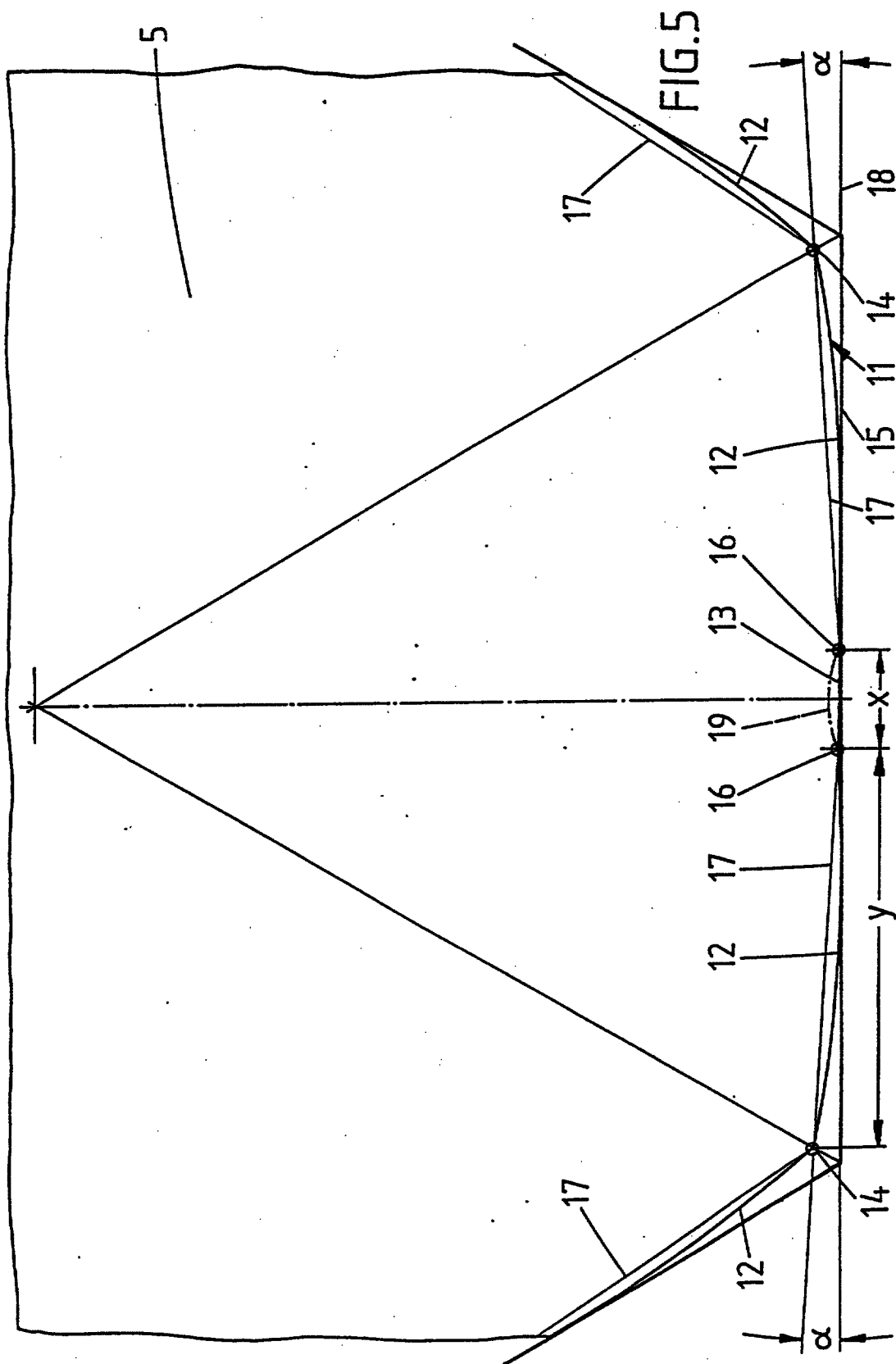
FIG.3



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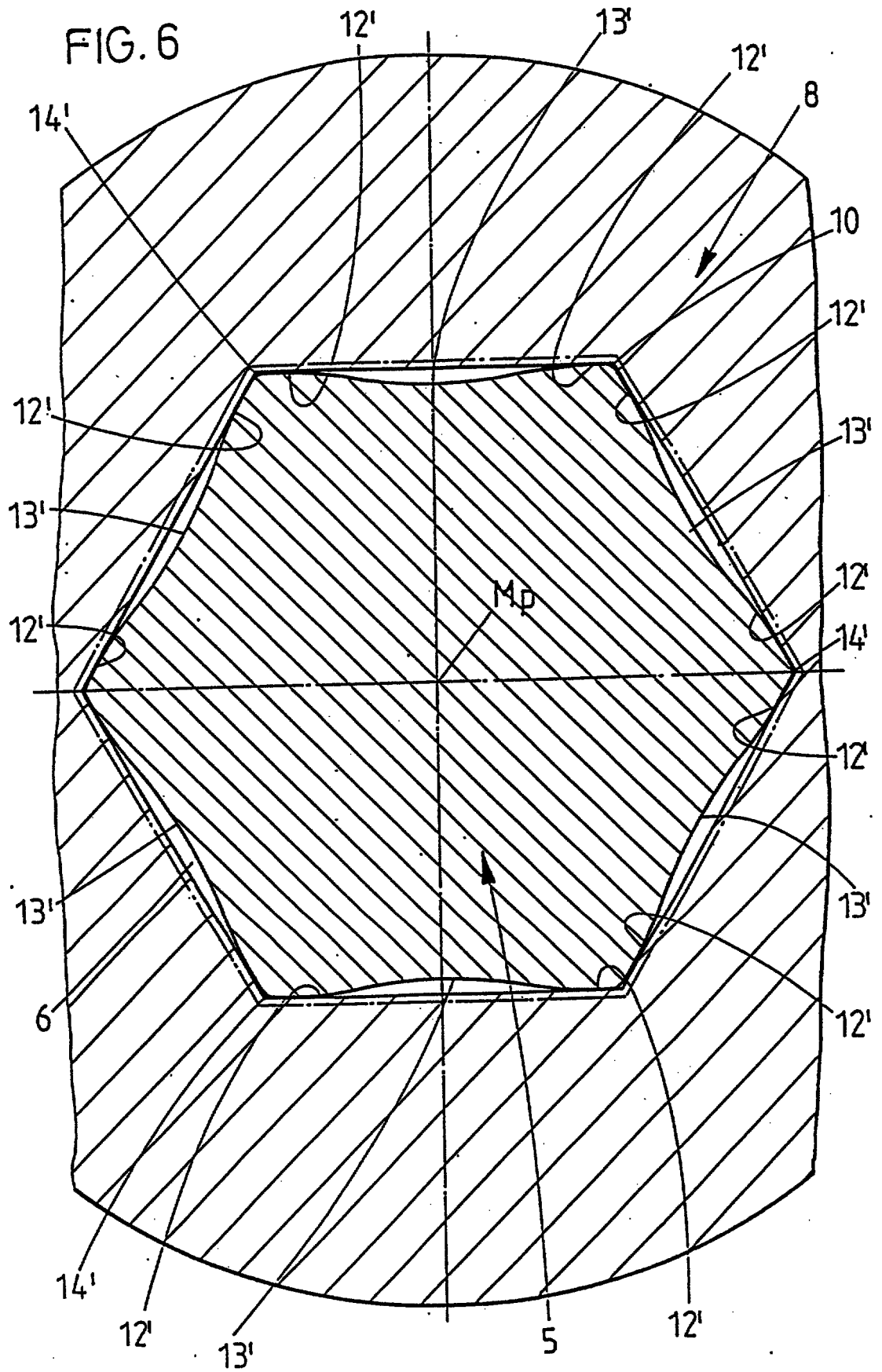
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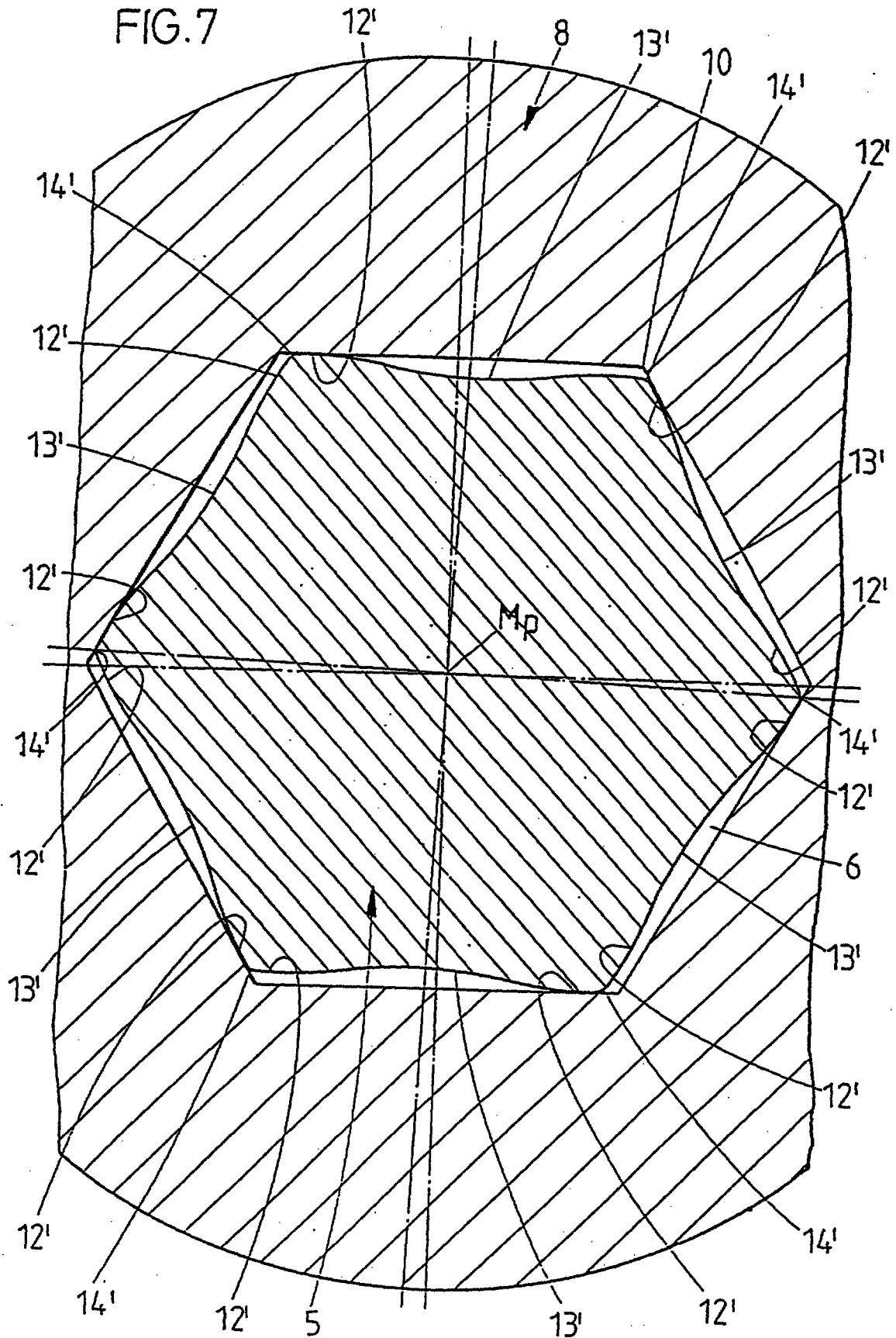
FIG. 6



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FIG. 7



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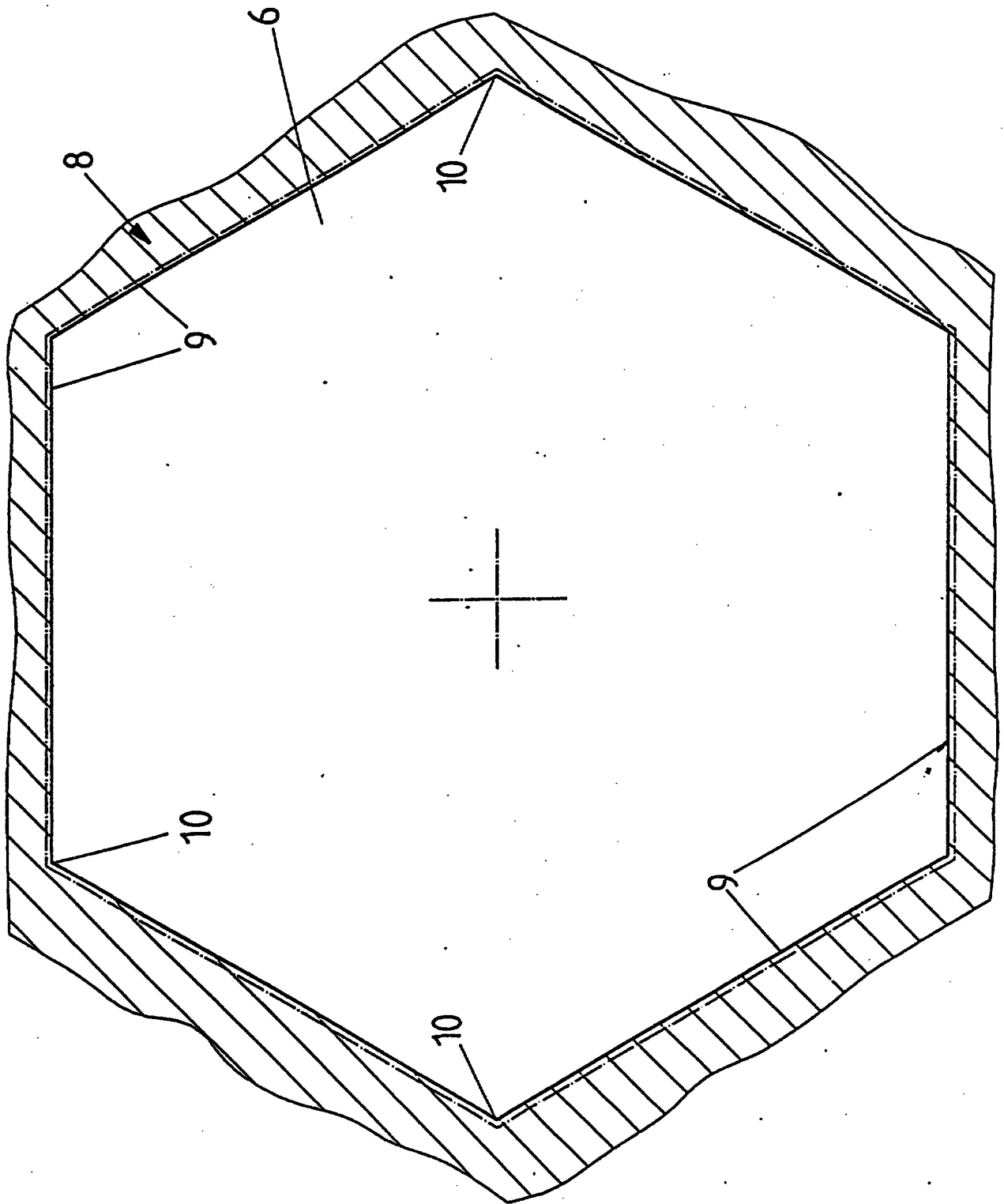


FIG. 8

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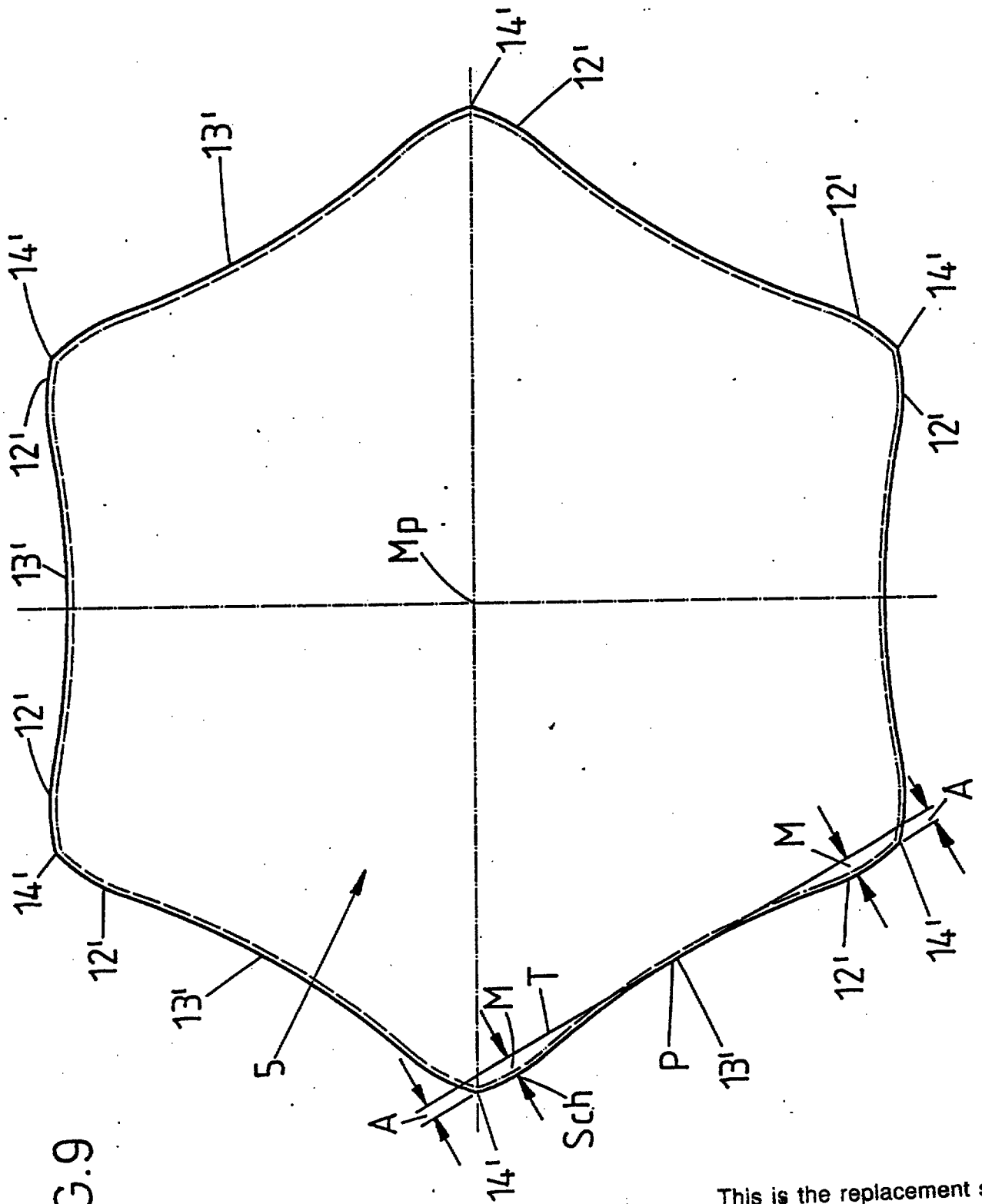


FIG. 9

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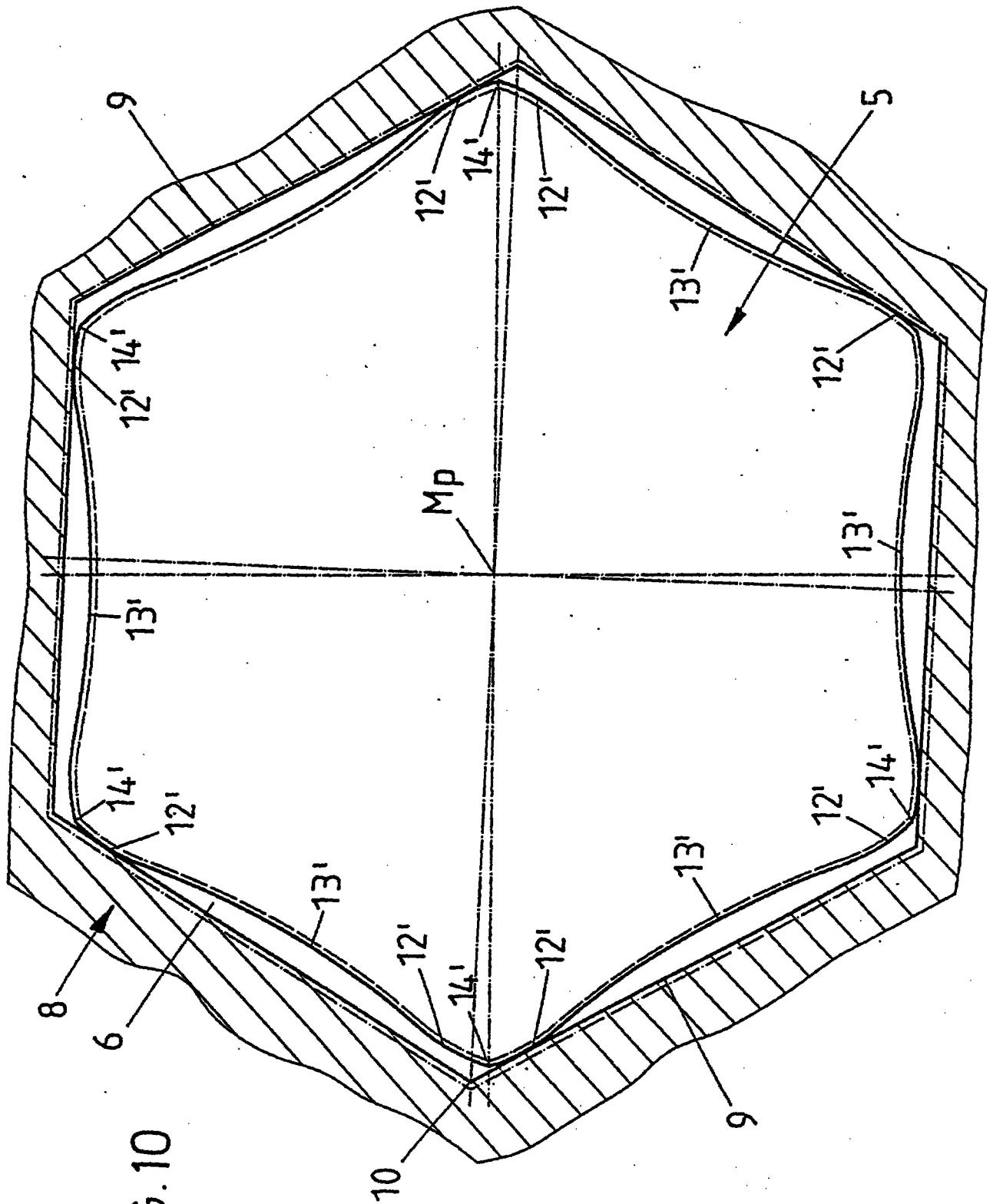


FIG. 10

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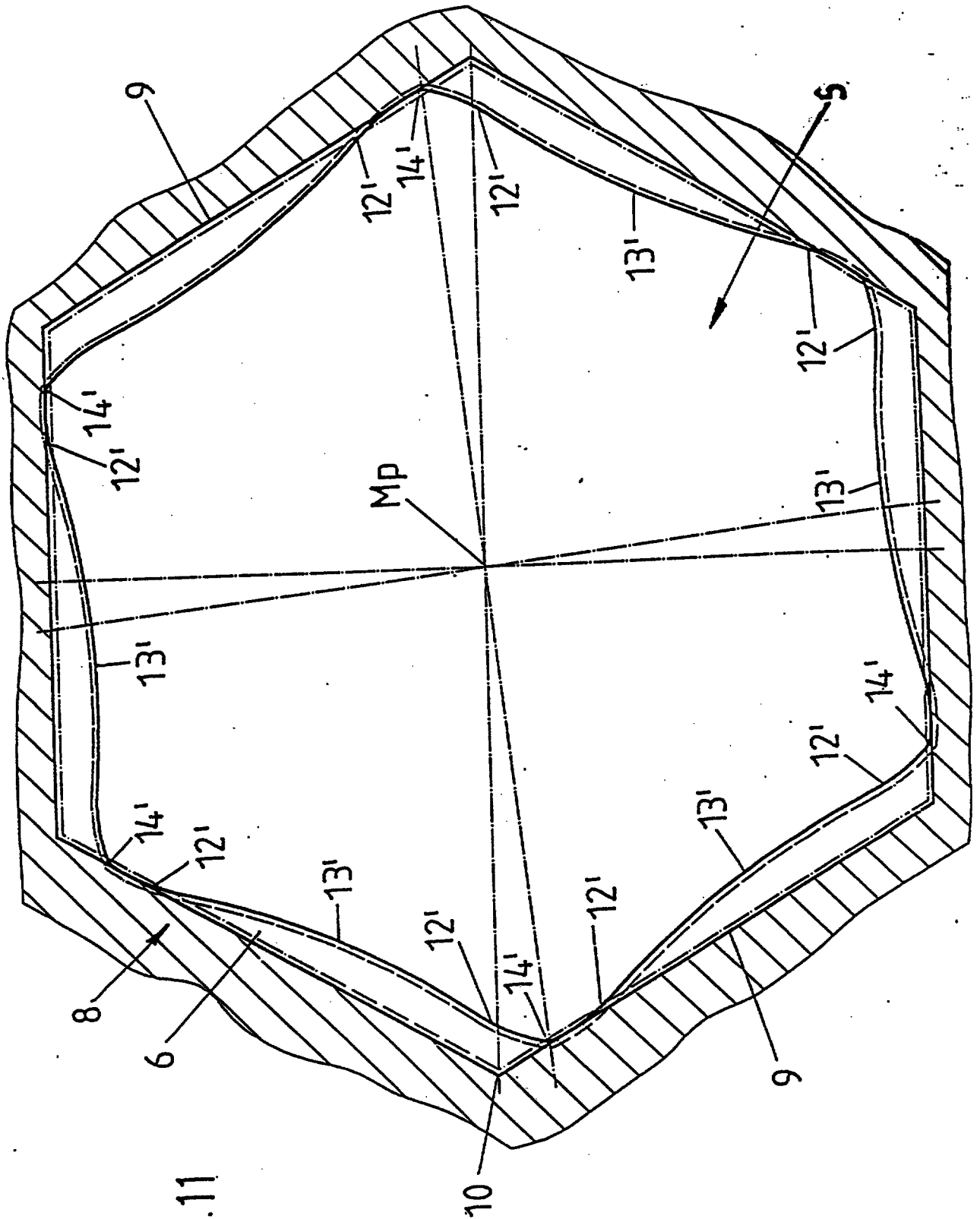
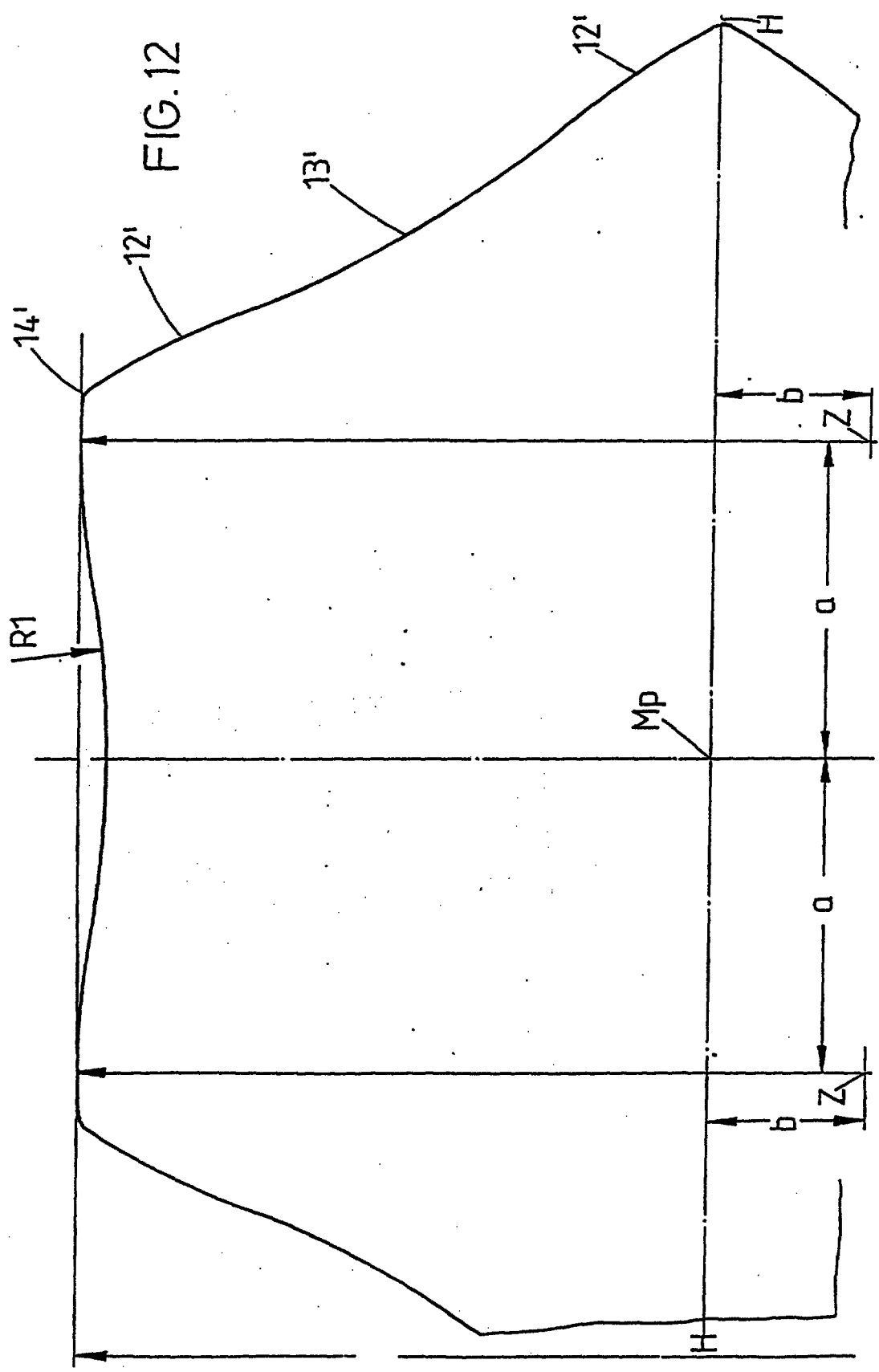


FIG. 11

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Screwing tool, in particular screwdriver

The invention concerns a polygon screwing tool, in particular screwdriver or screwdriver bit for polygon socket screws, in particular hexagon socket screws, with flanks of identical construction in the circumferential direction. Screwing tools of this kind are known in the state of the art under the trade name of INBUS.

Also known in the state of the art are polygon screwing tools which are designed with flanks specially adapted to the internal socket shape, for example from US patent 4 338 835.

A polygon screwing tool for polygon socket screws is known from DE-A-3 206 494, wherein two polygon corners adjacent to each other are connected by two convexly shaped flank sections, forming a wedge in the central region of each flank. The two flanks adjoining each other are separated from each other by a linear apex of the wedge. As the wedge is set back from a tangent applied to the convexly shaped flank sections, the area of force application is reduced, associated with the fact that only a reduced torque can be transmitted too. The wedge weakens above all due to its notch effect the transmitting stability of the screwing tool. In the region of the wedge, the convexly extending flanks adjoining each other form a central section in the form of a telephoto lens with tapering bottom.

It is the object of the invention to design a screwing tool of the kind in question in a manner for ease of manufacture in such a way that, in relationship to the size of the screwing tool, optimum torques can be transmitted.

This object is achieved in a generic screwing tool by the characteristics indicated in claim 1.

The subsidiary claims concern advantageous developments of the solution according to the invention.

As a result of such a design a screwing tool, in particular a screwdriver for polygon socket screws, in

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particular hexagon socket screws, of increased serviceability is provided. In relationship to the size of the screwing tool or its working end, optimum torques can be transmitted with low wear. This results from the fact that the convexly extending flank sections in the central region of each flank are separated from each other by a non-convexly extending intermediate section. Further, there is a special arrangement of the ends at the polygon corners of the convexly extending sections relative to the rectilinear extension of the two end points of the intermediate section or the tangent thereto. This means that, when the screwing tool is put into operation and a torque is applied, each flank with a convexly extending flank section and the non-convexly extending intermediate section or a partial length thereof comes into contact with the corresponding hexagon socket face of the screw. There are optimum leverages for the ranges of force application. With increasing torque, taking into account the deformation at the screw head, the result is a constantly increasing area of support, associated with the optimum transmission of a torque mentioned hereinbefore. On account of the constantly increasing area of support, a cam-out effect is also counteracted; this means that the screwing tool, in particular the screwdriver, remains with its working end engaged with the polygon socket of the screw. Owing to the set-back ends at the polygon corners, easy introduction of the working end into the polygon socket is made possible, even if the corners thereof are slightly rounded due to manufacturing tolerances. The effect is therefore always that the flanks with their convexly extending flank sections and the non-convexly directed intermediate sections come into contact with the polygon faces of the polygon socket. On account of the non-convexly extending or even concave intermediate section between the convex

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flank sections of each flank, obtuse-angled, almost 180° corners are formed, which in combination with the ends at the polygon corners e.g. from a hexagon make an octadecagon. The convexly extending flank sections are formed by curves which project beyond the connecting line between the corners of the intermediate sections and the ends at the polygon corners. It proves to be an advantage that the intermediate sections extend rectilinearly. This also accommodates easy production of the working end of the screwing tool. With regard to good torque transmission, it proves to be advantageous that each convexly extending flank section has more than twice the length of the intermediate section. With a screwdriver for hexagon socket screws, a ratio of 4:1 between flank section and intermediate section is recommended. Upward or downward deviations are possible. Furthermore it must be emphasised that the rectilinear intermediate section extends tangentially to the adjacent end region of the two convex flank sections. With a concave intermediate section, more or less the same length of all curve sections is advantageous. If occasion arises, the intermediate section can be formed by a groove filled with diamond particles. The working end is therefore further prevented from sliding out of the polygon socket. However, there is also the possibility of providing both the flank sections and the intermediate sections with a diamond particle coating. This can be done by adding a diamond powder in the region of about $15\text{ }\mu\text{m}$ to the electroplating bath. Together with the coating, a decrease in wear of the working end is obtained as well.

Below, a practical example of the invention is described with the aid of the drawings. They show:

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- Fig. 1 a screwdriver for hexagon socket screws and a hexagon socket screw arranged coaxially therewith in elevation,
- Fig. 2 in a greatly enlarged view a cross-section through the screw head in the region of the hexagon socket,
- Fig. 3 also in a greatly enlarged view a cross-section through the working end of the screwdriver,
- Fig. 4 the cross-section through the screw head with the working end of the screwdriver inserted in the polygon socket thereof, during rotary entrainment thereof in the direction of the arrow,
- Fig. 5 in a further enlarged view a detail of the contour of the working end of the screwdriver,
- Fig. 6 in a greatly enlarged view the cross-section through the screw head with the working end of the screwdriver of a modified embodiment inserted in the polygon socket thereof,
- Fig. 7 the view as in Fig. 6 in the rotary entrainment loading position,
- Fig. 8 an enlarged view of the min./max. tolerances of the polygon socket of a screw, key size 6,
- Fig. 9 the same view as in Fig. 8 but relating to the working end (cross-section) of the modified embodiment according to Fig. 6,
- Figs. 10 and 11 an enlarged view as in Fig. 7, taking into account the (permitted) manufacturing tolerances of Figs. 8 and 9, with key size 6, and
- Fig. 12 in an enlarged view a part-section contour view to illustrate the pull of the centres of the curves.

The screwdriver 1 shown in Fig. 1 has a handle 2 with a blade 2 embedded in the latter and non-rotatable relative to the handle. The blade 3 comprises a shank 4 of circular cylindrical cross-section which forms at the end a

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hexagonal bit 5. The latter forms the working end of the screwdriver 1 and is suitable for entering the hexagon socket 6 of the screw head 7 of a hexagon socket screw 8.

In detail, the hexagon socket 6 is composed of the rectilinearly extending hexagon socket faces 9 such that two hexagon socket faces meet at an edge 10. The distance between two parallel opposed hexagon socket faces 9 is the key size S.

Whereas there are rectilinear hexagon socket faces 9 on the screw 8, the polygon bit 5 has on each flank 11 two convexly extending flank sections 12 which are separated from each other in the central region of the flank 11 by a non-convexly extending intermediate section 13. Further, the ends 14 at the polygon corners of the convexly extending flank sections 12 are set back from the rectilinear extension 15 of the two end points 16 of the intermediate section 13, cf. in particular Fig. 5. The end points 16 in a certain respect form corner points owing to the adjoining convex flank sections 12, so that in the case of a hexagonal working end in connection with the ends 14 at the polygon corners an octadecagon is formed.

The connecting lines 17 between the end points 16 of the intermediate section 13 and the ends 14 at the polygon corners are overlapped by the convexly extending flank sections 12. Further it can be seen in Fig. 5 that the rectilinear intermediate section 13 extends tangentially to the adjacent end region of the two convex flank sections 12. The corresponding tangent 18 in this case forms with the connecting lines 17 an angle α of about 3.5° .

The length y of the convexly extending flank section 11 is twice the length x of the intermediate section 13. In the practical example a ratio of about 4:1 between flank section 12 and intermediate section 13 is selected.

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The distance between two parallel opposed flanks 11 of the hexagon bit 5 is the key size 51 which is adapted to that of the hexagon socket 6.

It is possible, as shown in dot and dash lines in Fig. 5, to provide in the region of the intermediate section 13 a channel 19 extending in the longitudinal direction of the shank for receiving diamond particles of which the outer surface forms the rectilinear intermediate section 13. It is however also possible to provide the working end itself with a diamond particle coating.

If the screw 8, as shown in Fig. 4, is to be entrained in the direction of the arrow by means of the screwdriver 1, then first the hexagon bit 5 which forms the working end is to be introduced into the hexagon socket opening 6 of the screw head 7. Then the screwdriver 1 is to be turned in the direction of the arrow. A slight relative rotation by the angle β between hexagon socket screw 8 and hexagon bit 5 takes place here. Taking into account a certain deformation of the screw head 7, an area of support of large dimensions is formed between the hexagon socket faces 9 and the corresponding convex flank sections 12. In detail the appearance of this is that almost one flank section 12 of each flank 11 and also the intermediate section 13 or a major proportion of its length come into contact with the hexagon socket face 9, so that optimum torques can be transmitted. Owing to the deformation at the screw head there is an increase in the area of support with increasing torque transmission. Due to this large area of support, a cam-out effect is prevented as well, so that the working end of the screwdriver 1 remains connected in form-locking relationship to the hexagon socket screw 8 and does not jump out or slide out of the hexagon socket opening 6.

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Figs. 6-12 show a modified embodiment. Here, the non-convexly extending section 13' is concavely shaped. On either side thereof are located the convexly extending flank sections 12'.

The ends 14' at the polygon corners are located - including any tolerances permitted according to DIN - at a normal distance A (see Fig. 9) from the tangent T, applied to the lowest point P of the convex region. This distance A is smaller than the normal distance M which the apex Sch has from this tangent T. Figs. 10 and 11 show that even in case of random (unfavourable) addition of the tolerances this embodiment still in an optimum manner represents the advantage that cutting edge contact is avoided, but above all that the region of load transmission is located at maximum possible leverage from the polygon centre M_p .

The centres Z (see Fig. 12) of the convexly extending flank sections 12' are located at a distance a from the polygon centre M_p and beyond the respective cross-section bisecting line H-H, the latter by the amount b which is roughly half the amount a.

The amount a roughly corresponds to 1/4 of the length of the cross-section bisecting line H-H.

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Claims

1. Polygon screwing tool, in particular screwdriver (1) or screwdriver bit, for polygon socket screws, in particular hexagon socket screws (8), with flanks (11) of identical construction in the circumferential direction, wherein
 - a) each flank comprises two convexly extending flank sections (12/12');
 - b) the lines of convex curvature of two adjacent flanks (11) intersect with each other, forming in each case a polygon corner (14);
 - c) in the central region of each flank (11) is provided a non-convexly extending intermediate section (13/13');
 - d) the intermediate section extends rectilinearly or concavely;
 - e) the intermediate section separates the two flank sections (12/12') at a distance from each other.
2. Screwing tool according to claim 1, characterised in that the ends (14) at the polygon corners of the convexly extending flank sections (12) are set back from the rectilinear extension (15) of the two end points (16) of the intermediate section (13).
3. Screwing tool according to claim 1, characterised in that the rectilinear intermediate section (13) extends tangentially to the adjacent end region of both convex flank sections (12).
4. Screwing tool according to one or more of the preceding claims, characterised in that both the convex flank sections (12/12') and the intermediate sections (13/13') are provided with a diamond particle coating.

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5. Screwing tool according to claim 1, characterised in that the length (X') of the concave intermediate section (13') more or less corresponds to the length of the convexly extending region (12').

6. Screwing tool according to one or more of the preceding claims, characterised in that the polygon ends (14) of the convexly extending regions are a shorter normal distance (A) away from the tangent (T) applied to the lowest point (P) of the concave region than the apex (Sch) is from this tangent (T).

7. Screwing tool according to one or more of the preceding claims, characterised in that the distance is approximately half the distance (Mp-H) extending from the polygon centre (Mp) to the associated polygon end (14').

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10ABSTRACT

SCREWING TOOL, IN PARTICULAR SCREWDRIVER

The invention concerns a screwing tool, in particular screwdriver (1) or screwdriver bit, for polygon socket screws (8), with flank sections (12) shaped convexly in the circumferential direction; to optimise force transmission, the flank sections (12/12') in the central region of each flank (11) are cut off from each other by a non-convexly extending intermediate section (13/13').

(Key figure 10)