Claims

1. Method for warping the machine bed (5) of a punching press to compensate at least partially a bending caused by the punching force during punching operation, wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish,

characterised in that forces acting transverse to the punching force direction are introduced into the machine bed (5) or are created within the machine bed (5) for warping the machine bed (5) in the direction towards the press ram (2) such that the machine bed (5) is warped stronger in the area adjacent to the aperture (6b) than in the areas adjacent to the longitudinal sides.

2. Method according to claim 1, wherein the machine bed (3) with tie-rods (19) extending in its longitudinal direction is set under compressive stress in its lower area for warping the same in the direction towards the press ram (2).

3. Method according to claim 2, wherein the tie-rods (19) are arranged such that they cross the machine bed (5) in its lower area.

4. Method according to one of the claims 2 to 3, wherein on both sides of the aperture (6b) of the machine bed (5), in particular symmetrical to both sides of the aperture (6b), in each case a tie-rod (19) is arranged such that the tie-rod (6b) in each case has a smaller distance to the aperture (6b) than to the respective longitudinal side of the machine bed (5).

5. Method according to one of the preceding claims, wherein a temperature gradient is produced within the machine bed (5) or a supporting structure (4, 5, 11) for the lower tool parts built with the machine bed (5), by means of which the machine bed (5) warps in the direction towards the press ram (2).

6. Method according to claim 5, wherein the temperature gradient is produced by heating the machine bed (5) in the area of its side facing the press ram (2).

7. Method according to claim 6, wherein the machine bed (5) near to the boundaries of the aperture (6b) is heated stronger than near to the longitudinal sides.

8. Method according to one of the claim 5 to 7, wherein the temperature gradient is produced by cooling the machine bed (5) in the area of its side facing away from the press ram (2).

9. Method according to claim 8, wherein the machine bed is near to the boundaries of the aperture is cooled stronger than near to the longitudinal sides.

10. Method according to one of the claim 5 to 9, wherein flow channels (10a-19f) arranged within the machine bed (5) are flown through by a heated or cooled gaseous or liquid medium (8) for producing the temperature gradient.

11. Method according to claim 10, wherein heated lubricating oil (8) of a lubricating oil circuit of the press is passed through the flow channels (10a-10f).

12. Method according to one of the claim 5 to 11, wherein electricalheating elements arranged within the machine bed are charged with electric current for producing the temperature gradient.

13. Method according to one of the claim 5 to 12, wherein a clamping plate arranged on the machine bed is present which is heated for warping the machine bed in the direction towards the press ram as a consequence of a heating of it by the clamping plate on its side facing the ram and/or for warping the machine bed in the direction towards the press ram as a consequence of an introduction of shear forces produced by a thermal expansion

of the clamping plate into the side of the machine bed facing the ram.

14. Method according to one of the claim 5 to 11, wherein a clamping plate (4) arranged on the machine bed (5) is present and a heating device (11) arranged between the machine bed (5) and the clamping plate (4), which is heated for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of heating it by the heating device (11) on its side facing the ram (2) and/or for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of a heating of the clamping plate (4) by the heating device (11) and by an introduction of shear forces produced by a thermal expansion of the clamping plate (4) into the side of the machine bed (5) facing the ram (2).

15. Method according to one of the preceding claims, wherein the warp of the machine bed is adjusted depending on parameters of the punching process, in particular depending on a calculated or measured maximal punching force, and in particular, wherein the warp is adjusted during the intended operation of the press.

16. Punching press, in particular for performing the method according to one of the preceding claims, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by an introduction of forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

and wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) for warping the machine bed (5) are designed such that

the machine bed (5) warps stronger in the area adjacent to the aperture (6b) than in the areas adjacent to the longitudinal sides of the machine bed (5).

17. Punching press according to claim 16, wherein the means (12-19) for warping the machine bed comprise tie-rods (19) extending in longitudinal direction of the machine bed, by means of which the machine bed (5) can be set under compressive stress in its lower area for warping the machine bed (5) in the direction towards the press ram (2).

18. Punching press according to claim 17, wherein the tie-rods (19) crosses the machine bed (5) in its lower part.

19. Punching press according to one of the claim 17 to 18, wherein on both sides of the aperture (6b) of the machine bed (5) in each case a tie-rod (19) is arranged such that in each case the tie-rod has a smaller distance to the aperture (6b) than to the respective longitudinal side of the machine bed (5).

20. Punching press according to claim 19, wherein the both tie-rods (19) are arranged symmetrically to both sides of the aperture (6b).

21. Punching press according to one of the claims 16 to 20, wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for producing a temperature gradient within the machine bed (5) or a supporting structure (4, 5; 4, 5, 11) for the lower tool parts built with the machine bed (5) in order to produce forces acting transverse to the punching force direction for warping the machine bed in the direction towards the press ram.

22. Punching press according to claim 21, wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for heating the machine bed (5) in the area of its side facing the press ram (2).

23. Punching press according to claim 22, wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed to heat the machine bed (5) in the area of its side facing the press ram (2) stronger near to the boundaries of the aperture (6b) than near to the longitudinal sides.

24. Punching press according to one of the claims 21 to 23, wherein the means for warping the machine bed are designed to cool the machine bed in the area of its side facing away from the press ram.

25. Punching press according to claim 24, wherein the means for warping the machine bed are designed to cool the machine bed in the area of its side facing away from the press ram stronger near to the boundaries of the aperture than near to the longitudinal sides.

26. Punching press according to one of the claims 21 to 25, wherein the means (8, 9a, 9c, 10a-10f) for warping the machine bed (5) comprise flow channels (10a-10f) arranged within the machine bed (5), which can be flown through during the intended operation of the press by a heated or cooled gaseous or liquid medium (8) for generating the temperature gradient.

27. Punching press according to claim 26, wherein the press comprises a lubricating oil circuit and the means for warping the machine bed comprise arrangements, by means of which heated lubricating oil of the lubricating oil circuit can be passed through the flow channels (10a-10f) during the intended operation of the press.

28. Punching press according to one of the claim 21 to 27, wherein the means for warping the machine bed comprise electrical heating elements arranged within the machine bed, which can be charged by electric current during the intended operation of the press for producing the temperature gradient.

29. Punching press according to one of the claims 26 to 28, wherein on both sides of the aperture of the machine bed in each case one or more flow channels and/or electrical heating elements are arranged within the machine bed such that, per side, the sum of the distances of the flow channels and/or the heating elements to the aperture is smaller than the sum of the distances of the flow channels and/or heating elements to the respective longitudinal sides of the machine bed.

30. Punching press according to claim 29, wherein the flow channels and/or the heating elements are arranged symmetrically to both sides of the aperture.

31. Punching press according to one of the claim 21 to 30, wherein a clamping plate arranged on the machine bed is present which can be heated by the means for warping the machine bed during the intended operation of the press for producing the temperature gradient by heating the machine bed on its side facing the ram by the clamping plate.

32. Punching press according to one of the claims 21 to 31, wherein a clamping plate (4) arranged on the machine bed (5) is present which can be heated by the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) during the intended operation of the press and which is connected with the machine bed (5) such that it can transfer shear forces to the machine bed (5) for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of an introduction of shear forces produced by a thermal expansion of the clamping plate (4) into the side of the machine bed facing the press ram (2).

33. Punching press according to claim 32, wherein a thermal insulation layer is available between the clamping plate and the machine bed for reducing a heat transfer from the clamping plate to the machine bed.

34. Punching press according to claim 33, wherein the thermal insulation layer is present in the areas, which adjoin the longitudinal sides of the clamping plate or of the machine bed, respectively, between the clamping plate and the machine bed and in the areas, which adjoin the aperture, a layer between the clamping plate and the machine bed is present which has an essentially better thermal conductivity for promoting a heat transfer from the clamping plate to the machine bed in these areas.

35. Punching press according to one of the claims 31 to 34, wherein the clamping plate can be heated by the means for warping the machine bed during the intended operation of the press such that it is warmer in the areas, which adjoin the aperture, than in the areas, which adjoin the longitudinal sides.

36. Punching press according to one of the claims 21 to 35, wherein a clamping plate (4) arranged on the machine bed (5) is present and wherein the means (10a-10l, 11) for warping the machine bed (5) comprise a heating device (11) arranged between the machine bed (5) and the clamping plate (4), which can be operated during the intended operation of the press for warping the machine bed (5) as a consequence of a heating of it on its side facing the ram (2).

37. Punching press according to one of the claims 21 to 36, wherein a clamping plate (4) arranged on the machine bed (5) is present, which is connected with the machine bed (5) such that it can transfer shear forces to the machine bed (5), and wherein the means (10a-10l, 11) for warping the machine bed (5) comprise a heating device (11) arranged between the machine bed (5) and the clamping plate (4), which can be operated during the intended operation of the press for warping the machine bed (5) in the direction towards the press ram (2)

as a consequence of an introduction of shear forces produced by a thermal expansion of the clamping plate (4) into the side of the machine bed (5) facing the ram (2).

38. Punching press according to one of the claims 36 to 37, wherein the heating device (11) arranged between the machine bed (5) and the clamping plate (4) is designed such that with it the areas of the machine bed (5) or of the clamping plate (4), respectively, which adjoin the aperture (6b) are heated stronger than the areas of the machine bed (5) or of the clamping plate (4), respectively, which adjoin the longitudinal sides.

39. Punching press according to one of the claims 16 to 38, wherein the means for warping the machine bed are built adjustable, in particular during the intended operation of the press for enabling a specific adjustment of the warp of the machine bed.

40. Punching press according to one of the claims 16 to 39, wherein the punching press comprises a press control, by means of which the warp of the machine bed, in particular automatically, is adjustable depending on parameters of the punching process, in particular depending on a calculated or measured maximal punching force, and in particular adjustable during the intended operation of the press

Claims

1. Method for warping the machine bed (5) of a punching press to compensate at least partially a bending caused by the punching force during punching operation, wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish,

characterised in that forces acting transverse to the punching force direction are introduced into the machine bed (5) or are created within the machine bed (5) for warping the machine bed (5) in the direction towards the press ram (2) such that the machine bed (5) is warped stronger in the area adjacent to the aperture (6b) than in the areas adjacent to the longitudinal sides.

2. Method according to claim 1, wherein the machine bed (3) with tie-rods (19) extending in its longitudinal direction is set under compressive stress in its lower area for warping the same in the direction towards the press ram (2).

3. Method according to claim 2, wherein the tie-rods (19) are arranged such that they cross the machine bed (5) in its lower area.

4. Method according to one of the claims 2 to 3, wherein on both sides of the aperture (6b) of the machine bed (5), in particular symmetrical to both sides of the aperture (6b), in each case a tie-rod (19) is arranged such that the tie-rod (6b) in each case has a smaller distance to the aperture (6b) than to the respective longitudinal side of the machine bed (5).

5. Method according to one of the preceding claims, wherein a temperature gradient is produced within the machine bed (5) or a supporting structure (4, 5, 11) for the lower tool parts built with the machine bed (5), by means of which the machine bed (5) warps in the direction towards the press ram (2).

6. Method according to claim 5, wherein the temperature gradient is produced by heating the machine bed (5) in the area of its side facing the press ram (2).

7. Method according to claim 6, wherein the machine bed (5) near to the boundaries of the aperture (6b) is heated stronger than near to the longitudinal sides.

8. Method according to one of the claim 5 to 7, wherein the temperature gradient is produced by cooling the machine bed (5) in the area of its side facing away from the press ram (2).

9. Method according to claim 8, wherein the machine bed is near to the boundaries of the aperture is cooled stronger than near to the longitudinal sides.

10. Method according to one of the claim 5 to 9, wherein flow channels (10a-19f) arranged within the machine bed (5) are flown through by a heated or cooled gaseous or liquid medium (8) for producing the temperature gradient.

11. Method according to claim 10, wherein heated lubricating oil (8) of a lubricating oil circuit of the press is passed through the flow channels (10a-10f).

12. Method according to one of the claim 5 to 11, wherein electricalheating elements arranged within the machine bed are charged with electric current for producing the temperature gradient.

13. Method according to one of the claim 5 to 12, wherein a clamping plate arranged on the machine bed is present which is heated for warping the machine bed in the direction towards the press ram as a consequence of a heating of it by the clamping plate on its side facing the ram and/or for warping the machine bed in the direction towards the press ram as a consequence of an introduction of shear forces produced by a thermal expansion

of the clamping plate into the side of the machine bed facing the ram.

14. Method according to one of the claims 5 to 11, wherein a clamping plate (4) arranged on the machine bed (5) is present and a heating device (11) arranged between the machine bed (5) and the clamping plate (4), which is heated for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of a heating of it by the heating device (11) on its side facing the ram (2) and/or for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of a heating of the clamping plate (4) by the heating device (11) and by an introduction of shear forces produced by a thermal expansion of the clamping plate (4) into the side of the machine bed (5) facing the ram (2).

15. Method according to one of the preceding claims, wherein the warp of the machine bed is adjusted depending on parameters of the punching process, in particular depending on a calculated or measured maximal punching force, and in particular, wherein the warp is adjusted during the intended operation of the press.

16. Punching press for performing the method according to claim 1, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by an introduction of forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) for warp-

ing the machine bed (5) are designed such that they warp the machine bed (5) stronger in the area adjacent to the aperture (6b) than in the areas adjacent to the longitudinal sides of the machine bed (5),

and wherein the means (12-19) for warping the machine bed comprise tie-rods (19) extending in longitudinal direction of the machine bed, by means of which the machine bed (5) can be set under compressive stress in its lower area for warping the machine bed (5) in the direction towards the press ram (2).

17. Punching press according to claim 16, wherein the tie-rods (19) cross the machine bed (5) in its lower area.

18. Punching press according to one of the claims 16 to 17, wherein on both sides of the aperture (6b) of the machine bed (5) in each case a tie-rod (19) is arranged such that in each case the tie-rod (19) has a smaller distance to the aperture (6b) than to the respective longitudinal side of the machine bed (5).

19. Punching press according to claim 18, wherein the both tie-rods (19) are arranged symmetrically to both sides of the aperture (6b).

20. Punching press for performing the method according to claim 1, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by introducing forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) for warping the machine bed (5) are designed such that they warp

the machine bed (5) in the area adjacent to the aperture (6b) stronger than in the areas adjacent to the longitudinal sides of the machine bed (5),

wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for producing a temperature gradient within the machine bed (5) or a supporting structure (4, 5; 4, 5, 11) for the lower tool parts built with the machine bed (5), respectively, in order to produce the forces acting transverse to the punching force direction for warping the machine bed in the direction towards the press ram,

wherein the means (8, 9a, 9c, 10a-10f) for warping the machine bed (5) comprise flow channels (10a-10f) arranged within the machine bed (5), which can be flown through by a heated or cooled gaseous or liquid medium (8) during the intended operation of the press for producing the temperature gradient

and wherein the press comprises a lubricating oil circuit and the means for warping the machine bed comprise arrangements, by means of which heated lubricating oil of the lubricating oil circuit can be passed through the flow channels (10a-10f) during the intended operation of the press.

21. Punching press according to claim 20, wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for heating the machine bed (5) in the area of its side facing the press ram (2).

22. Punching press according to claim 21, wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed to heat the machine bed (5) in the area of its side facing the press ram (2) stronger near to the boundaries of the aperture (6b) than near to its longitudinal sides.

23. Punching press according to one of the claims 20 to 22, wherein the means for warping the ma-

chine bed are designed to cool the machine bed in the area of its side facing away from the press ram.

24. Punching press according to claim 23, wherein the means for warping the machine bed are designed to cool the machine bed in the area of its side facing away from the press ram stronger near to the boundaries of the aperture than near to its longitudinal sides.

25. Punching press according to one of the claim 20 to 24, wherein the means for warping the machine bed comprise electrical heating elements arranged within the machine bed, which can be charged by electric current during the intended operation of the press for producing the temperature gradient.

26. Punching press according to one of the claims 20 to 25, wherein on both sides of the aperture of the machine bed in each case one or more flow channels and/or electrical heating elements are arranged within the machine bed such that, per side, the sum of the distances of the flow channels and/or the heating elements to the aperture is smaller than the sum of the distances of the flow channels and/or heating elements to the respective longitudinal sides of the machine bed.

27. Punching press according to claim 26, wherein the flow channels and/or the heating elements are arranged symmetrically to both sides of the aperture.

28. Punching press for performing the method according to claim 1, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by introducing forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) for warping the machine bed (5) are designed such that they warp the machine bed (5) in the area adjacent to the aperture (6b) stronger than in the areas adjacent to the longitudinal sides of the machine bed (5),

wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for the production of a temperature gradient within the machine bed (5) or a supporting structure (4, 5; 4, 5, 11) for the lower tool parts built with the machine bed (5), respectively, in order to produce the forces acting transverse to the punching force direction for warping the machine bed in the direction towards the press ram, and

wherein a clamping plate arranged on the machine bed is present which can be heated by the means for warping the machine bed during the intended operation of the press for producing the temperature gradient by heating the machine bed on its side facing the ram by the clamping plate.

29. Punching press for performing the method according to claim 1, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by introducing forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) for warping the machine bed (5) are designed such that they warp

the machine bed (5) in the area adjacent to the aperture (6b) stronger than in the areas adjacent to the longitudinal sides of the machine bed (5),

wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for the production of a temperature gradient within the machine bed (5) or a supporting structure (4, 5; 4, 5, 11) for the lower tool parts built with the machine bed (5), respectively, in order to produce the forces acting transverse to the punching force direction for warping the machine bed in the direction towards the press ram,

and wherein a clamping plate (4) arranged on the machine bed (5) is present which can be heated by the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) during the intended operation of the press and which is connected with the machine bed (5) such that it can transfer shear forces to the machine bed (5) for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of an introduction of shear forces produced by a thermal expansion of the clamping plate (4) into the side of the machine bed facing the press ram (2).

30. Punching press according to claim 29, wherein a thermal insulation layer is present between the clamping plate and the machine bed for reducing a heat transfer from the clamping plate to the machine bed.

31. Punching press according to claim 30, wherein the thermal insulation layer is present in the areas, which adjoin the longitudinal sides of the clamping plate or of the machine bed, respectively, between the clamping plate and the machine bed and in the areas, which adjoin the aperture, a layer between the clamping plate and the machine bed is present which has an essentially better thermal conductivity for promoting a heat transfer from the clamping plate to the machine bed in these areas.

32. Punching press according to one of the claims 28 to 31, wherein the clamping plate can be heated by the means for warping the machine bed during the intended operation of the press such that it is warmer in the areas which adjoin the aperture than in the areas which adjoin the longitudinal sides.

33. Punching press for performing the method according to claim 1, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by introducing forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are designed for warping the machine bed (5) such that they warp the machine bed (5) in the area adjacent to the aperture (6b) stronger than in the areas adjacent to the longitudinal sides of the machine bed (5),

wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for the production of a temperature gradient within the machine bed (5) or a supporting structure (4, 5; 4, 5, 11) for the lower tool parts built with the machine bed (5), respectively, in order to produce the forces acting transverse to the punching force direction for warping the machine bed in the direction towards the press ram,

and wherein a clamping plate (4) arranged on the machine bed (5) is present and wherein the means (10a-10l, 11) for warping the machine bed (5) comprise a heating device (11) arranged between the machine bed (5) and the clamping plate (4), which can be operated during

the intended operation of the press for warping the machine bed (5) as a consequence of a heating of it on its side facing the ram (2).

34. Punching press for performing the method according to claim 1, with a machine bed (5) and with a press ram (2) working against the machine bed (5),

wherein means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) are present for warping the machine bed (5) in the direction towards the press ram (5) by introducing forces acting transverse to the punching force direction into the machine bed (5) and/or by producing forces acting transverse to the punching force direction within the machine bed (5),

wherein the machine bed (5) has an aperture (6b) for carrying away punching parts and rubbish and the means (8, 9a, 9c, 10a-10f; 10a-10l, 11; 12-19) for warping the machine bed (5) are designed such that they warp the machine bed (5) in the area adjacent to the aperture (6b) stronger than in the areas adjacent to the longitudinal sides of the machine bed (5),

wherein the means (8, 9a, 9c, 10a-10f; 10a-10l, 11) for warping the machine bed (5) are designed for the production of a temperature gradient within the machine bed (5) or a supporting structure (4, 5; 4, 5, 11) for the lower tool parts built with the machine bed (5), respectively, in order to produce the forces acting transverse to the punching force direction for warping the machine bed in the direction towards the press ram, and

wherein a clamping plate (4) arranged on the machine bed (5) is present, which is connected with the machine bed (5) such that it can transfer shear forces to the machine bed (5), and wherein the means (10a-10l, 11) for warping the machine bed (5) comprise a heating device (11) arranged between the machine bed (5) and the clamping plate (4), which can be operated during the intended

operation of the press for warping the machine bed (5) in the direction towards the press ram (2) as a consequence of an introduction of shear forces produced by a thermal expansion of the clamping plate (4) into the side of the machine bed (5) facing the ram (2).

35. Punching press according to one of the claims 33 to 34, wherein the heating device (11) arranged between the machine bed (5) and the clamping plate (4) is designed such that with it the areas of the machine bed (5) or of the clamping plate (4), respectively, which adjoin the aperture (6b) can be heated stronger than the areas of the machine bed (5) or of the clamping plate (4), respectively, which adjoin their longitudinal sides.

36. Punching press according to one of the claims 16 to 35, wherein the means for warping the machine bed are built adjustable, in particular during the intended operation of the press, for enabling a specific adjustment of the warp of the machine bed.

37. Punching press according to one of the claims 16 to 36, wherein the punching press comprises a press control, by means of which the warp of the machine bed, in particular automatically, is adjustable depending on parameters of the punching process, in particular depending on a calculated or measured maximal punching force, and in particular is adjustable during the intended operation of the press.