Claims

1. A method of laser processing of a metallic material (WP), in particular for laser cutting, drilling or welding of said material, by means of a focused laser beam (B) having a predetermined transverse power distribution on at least one working plane (II) of the metallic material (WP), comprising the steps of:

   - providing a laser beam emitting source (10);
   - leading the laser beam (B) emitted by said emitting source (10) along a beam transport optical path to a working head (14) arranged in proximity to said metallic material (WP);
   - collimating the laser beam (B) along an optical axis of propagation incident on the metallic material (WP);
   - focusing said collimated laser beam (B) in an area of a working plane (II) of said metallic material (WP); and
   - conducting said focused laser beam (B) along a working path (T) on the metallic material (WP) comprising a succession of working areas (T1, R1, T2, R2, T3, H),

   the method comprising shaping the laser beam (B), wherein shaping the laser beam (B) comprises:

   - reflecting said collimated beam (B) by means of a deformable controlled surface reflecting element (200) having a reflecting surface with a continuous curvature including a plurality of independently movable reflection areas (200a-200r), and
   - controlling the arrangement of said reflection areas (200a-200r) to establish a predetermined transverse power distribution of the beam (B) on at least one working plane (II) of the metallic material (WP) as a function of the area of the current working plane (□) and/or the current direction of the working path (T) on the metallic material (WP)

   characterised in that the method further comprises the steps of:

   - delivering a flow of assist gas towards said area of the working plane (II) of the metallic material (WP) along an axis of the assist gas flow,
   - translating the axis of the assist gas flow relatively to a predetermined working path (T) on the metallic material (WP),
   - detecting the current position and/or the direction of the current translation of the axis of the assist gas flow,
   - controlling the arrangement of said reflection areas (200a-200r) to establish said predetermined transverse power distribution of the beam (B) in an area of the working plane (II) on the metallic material (WP) comprised in a predetermined neighborhood around the axis of the assist gas flow and within a delivering area (G1-G4) of said flow,
   - automatically adjusting the position of the optical axis of propagation of the laser beam (B) as a function of the detected current position and/or of the detected current translation direction of the axis of the assist gas flow.

2. The method according to any one of the preceding claims, wherein controlling the arrangement of said reflection areas (200a-200r) of the controlled surface reflecting element (200) comprises controlling a combination of moves of said areas (200a-200r) with respect to a reflecting reference flat surface.

3. The method according to claim 2, wherein controlling a combination of moves of said reflection areas (200a-200r) of the controlled surface reflecting element (200) comprises controlling the translation movement of said areas (200a-200r) along the optical axis of the reflecting element (200) and/or the rotation of said areas (200a-200r) to obtain an inclination with respect to the optical axis of the reflecting element (200).

4. The method according to claim 1, wherein the automatic adjustment of the position of the optical axis of propagation of the laser beam (B) as a function of the detected current position and/or of the detected current direction of translation of the axis of the assist gas flow is performed by reference to a predetermined adjustment pattern or program.

5. The method according to claim 1 or 4, wherein the position of the optical axis of propagation of the laser beam (B) is adjusted so as to be alternately in a front area and in a rear area with respect to the current position of the axis of the assist gas flow along the working path (T) during a cutting operation of the metallic material (WP).

6. The method according to claim 1 or 4, wherein the position of the optical axis of propagation of the laser beam (B) is adjusted so as to follow a circular path (S10, S11, S12, S13) around the current position of the axis of the assist gas flow during a drilling operation of the metallic material (WP).

7. The method according to any one of the preceding claims, comprising providing a deformable controlled surface reflecting element (200) having a reflecting surface with a continuous curvature including a plurality of independently movable reflection areas (200a-200r) by means of a corresponding plurality of movement modules which include a central area and a plurality of ranks of circular crown sectors concentric to said central area.

8. The method according to claim 7, wherein said ranks of concentric circular crown sectors are in number of 6, the circular crown sectors are in number of 8 for each rank, and the height of the circular crown sectors is increasing from the first to the third rank and from the fourth to the sixth rank in the radial direction towards the outside of the reflecting element, the height of the circular crown sectors of the fourth rank being intermediate between the height of the circular crown sectors of the first and second rank.

9. A machine for laser processing of a metallic material, in particular for laser cutting, drilling or welding of said material, by means of a focused laser beam (B) having a predetermined transverse power distribution on at least one working plane (II) of the metallic material (WP), comprising:

- a laser beam emitting source (10);
- means (12a, 12b, 12c; 12d) for leading the laser beam (B) emitted by said emitting source (10) along a beam transport optical path to a working head (14) arranged in proximity of said metallic material (WP);
- optical means (120) for collimating the laser beam (B) along an optical axis of propagation incident on the metallic material (WP);
- optical means (16; 140) for focusing said collimated laser beam (B) in an area of a working plane (II) of said metallic material (WP),
wherein at least said focusing optical means (16; 140) of said collimated laser beam (B) are carried by said working head (14) at a controlled distance from said metallic material (WP);
- means for adjusting the distance between said working head (14) and said metallic material (WP), adapted to conduct said focused laser beam (B) along a working path (T) on the metallic material (WP) comprising a succession of working areas (T1, R1, T2, R2, T3, H),
- optical means (180) for shaping the laser beam (B) including a deformable controlled surface reflecting element (200) having a reflecting surface with a continuous curvature including a plurality of independently movable reflection areas (200a-200r), adapted to reflect said collimated laser beam (B), the arrangement of said reflection areas (200a-200r) being adapted to establish a predetermined transverse power distribution of the beam (B) on at least one working plane (II) of the metallic material (WP); and
- electronic processing and control means (ECU, CM1, CM2, CM3) arranged to control the arrangement of said reflection areas (200a-200r) to establish a predetermined transverse power distribution of the beam (B) on at least one working plane (II) of the metallic material (WP) as a function of the area of the current working plane (II) and/or the current direction of the working path (T) on the metallic material (WP),

characterised in that it comprises a nozzle (18) for delivering a flow of assist gas towards the working area on the material (WP), and
in that said electronic processing and control means (ECU, CM1, CM2, CM3) are further arranged for:

- detecting the current position and/or the direction of the current translation of the axis of the assist gas flow,
- translating the axis of the assist gas flow relatively to a predetermined working path (T) on the metallic material (WP),
- automatically adjusting the position of the optical axis of propagation of the laser beam (B) as a function of the detected current position and/or of the detected current translation direction of the axis of the assist gas flow.

10. Computer program comprising one or more code modules for performing a method of shaping a laser beam (B) when the program is executed by electronic processing and control means (ECU, CM1, CM2, CM3) in a machine for laser processing of a metallic material (WP),
wherein said machine comprises: optical means (180) for shaping the laser beam (B) including a deformable controlled surface reflecting element (200) having a reflecting surface with a continuous curvature including a plurality of independently movable reflection areas (200a-200r), adapted to reflect a collimated laser beam (B), the arrangement of said reflection areas (200a-200r) being adapted to establish a predetermined transverse power distribution of the beam (B) on at least one working plane (II) of the metallic material (WP); and electronic processing and control means (ECU, CM1, CM2, CM3) arranged for controlling the arrangement of said reflection areas (200a-200r) to establish a predetermined transverse power distribution of the beam (B) on at least one working plane (II) of the metallic material (WP) as a function of the area of the current working plane (II) and/or the current direction of the working path (T) on the metallic material (WP),
characterised in that said method of shaping a laser beam (B) comprises controlling the arrangement of said reflection areas (200a-200r) to establish said predetermined transverse power distribution of the beam (B) in an area of the working plane (Π) on the metallic material (WP) comprised in a predetermined neighborhood around the axis of the assist gas flow and within a delivering area (G1, G2, G3, G4) of said flow, and automatically adjusting the position of the optical axis of propagation of the laser beam (B) as a function of the detected current position and/or of the detected current translation direction of the axis of the assist gas flow.