CLAIMS

1. A method of producing a 3D article by additive manufacture, wherein the method includes the steps of:

forming a meltpool in an already-existing part of the article, and moving the meltpool relative thereto;

feeding a directed feedstock into the moving meltpool to deposit and fuse a layer of material on the already-existing part; and

repeating the forming and moving and feeding steps to build up successive layers of material, and thereby produce the 3D article; and

wherein, in performance of the forming and moving step:

a first energy source is directed onto the already-existing part, the first energy source impinging at a first region which moves with and leads the meltpool, whereby the first energy source initiates the formation of the meltpool;

a second energy source is directed onto the already-existing part, the second energy source impinging at a second region which moves with and follows the first region, whereby the second energy source grows the lateral width of the meltpool before or after the feedstock is fed therein; and

the energy profile of the impinging energy of the second energy source is weighted to opposite lateral sides of the meltpool.

2. The method of claim 1, wherein the first energy source is a plasma transferred arc.

3. The method of claim 1 or 2, wherein the second energy source is one or more lasers.

4. The method of any preceding claim, wherein the energy profile and/or the power of the impinging energy of the second energy source is adjusted to vary the lateral growth of the meltpool.

5. A method of producing a 3D article by additive manufacture, wherein the method includes the steps of:

forming a meltpool in an already-existing part of the article, and moving the meltpool relative thereto;

feeding a directed feedstock into the moving meltpool to deposit and fuse a layer of material on the already-existing part; and

repeating the forming and moving and feeding steps to build up successive layers of material, and thereby produce the 3D article; and

wherein, in performance of the forming and moving step:

a first energy source is directed onto the already-existing part, the first energy source impinging at a first region which moves with and leads the meltpool, whereby the first energy source initiates the formation of the meltpool;

a second energy source is directed onto the already-existing part, the second energy source impinging at a second region which moves with and follows the first region, whereby the second energy source grows the lateral width of the meltpool before or after the feedstock is fed therein; and

the energy profile and/or the power of the impinging energy of the second energy source is adjusted to vary the lateral growth of the meltpool.

6. The method of any preceding claim, wherein the feedstock is a wire or tape feedstock.

7. The method of any preceding claim which includes the further step of:

impinging a third energy source onto the directed feedstock to melt the feedstock as it is fed into the moving meltpool.

8. A method of producing a 3D article by additive manufacture, wherein the method includes the steps of:

forming a meltpool in an already-existing part of the article, and moving the meltpool relative thereto;

feeding a directed feedstock into the moving meltpool to deposit and fuse a layer of material on the already-existing part; and

repeating the forming and moving and feeding steps to build up successive layers of material, and thereby produce the 3D article; and

wherein, in performance of the forming and moving step:

a first energy source is directed onto the already-existing part, the first energy source impinging at a first region which moves with and leads the meltpool, whereby the first energy source initiates the formation of the meltpool; and

a second energy source is directed onto the already-existing part, the second energy source impinging at a second region which moves with and follows the first region, whereby the second energy source grows the lateral width of the meltpool before or after the feedstock is fed therein; and

wherein the method includes the further step of:

impinging a third energy source onto the directed feedstock to melt the feedstock as it is fed into the moving meltpool.

9. The method of claim 7 or 8, wherein the third energy source is one or more lasers.

10. The method of any of claims 7 to 9, wherein the energy profile of the impinging energy of the third energy source is adjusted to compensate for changes in the shape, size and/or feed rate of the feedstock.

11. The method of any of claims 7 to 10, wherein the power of the third energy source is adjusted to compensate for changes in the feed rate of the feedstock.

12. The method of any preceding claim, further including the step of preheating the feedstock.

13. A system for producing a 3D article by additive manufacture, the system being configured for a meltpool to be formed in an already-existing part of the article, and moved relative thereto, for a directed feedstock to be fed into the moving meltpool to deposit and fuse a layer of material on the already-existing part, and for the forming and moving and feeding to be repeated to build up successive layers of material, and thereby produce the 3D article, the system comprising:

a first energy source configured to be directed onto the already-existing part;

a second energy source configured to be directed onto the already-existing part;

a feedstock directing arrangement; and

a computer controller adapted to control movement of the first energy source, the second energy source and the feedstock directing arrangement relative to the already-existing part such that: the first energy source impinges at a first region which moves with and leads the meltpool whereby the first energy source initiates the formation of the meltpool, the second energy source impinges at a second region which moves with and follows the first region to grow the lateral width of the meltpool before or after receipt of the directed feedstock into the moving meltpool, and the directed feedstock is fed into the moving meltpool;

wherein the system is configured for the energy profile of the impinging energy of the second energy source to be weighted to opposite lateral sides of the meltpool.

14. The system of claim 13, wherein the computer controller is further adapted to adjust the energy profile and/or the power of the impinging energy of the second energy source to vary the growth of the meltpool.

15. A system for producing a 3D article by additive manufacture, the system being configured for a meltpool to be formed in an already-existing part of the article, and moved relative thereto, for a directed feedstock to be fed into the moving meltpool to deposit and fuse a layer of material on the already-existing part, and for the forming and moving and feeding to be repeated to build up successive layers of material, and thereby produce the 3D article, the system comprising:

a first energy source configured to be directed onto the already-existing part;

a second energy source configured to be directed onto the already-existing part;

a feedstock directing arrangement; and

a computer controller adapted to control movement of the first energy source, the second energy source and the feedstock directing arrangement relative to the already-existing part such that: the first energy source impinges at a first region which moves with and leads the meltpool whereby the first energy source initiates the formation of the meltpool, the second energy source impinges at a second region which moves with and follows the first region to grow the lateral width of the meltpool before or after receipt of the directed feedstock into the moving meltpool, and the directed feedstock is fed into the moving meltpool;

wherein the computer controller is further adapted to adjust the energy profile and/or the power of the impinging energy of the second energy source to vary the growth of the meltpool.

16. The system of any of claims 13 to 16, wherein the system further comprises a third energy source, and wherein the computer controller is further adapted to control movement of the third energy source relative to the already-existing part such that the third energy source impinges the directed feedstock to melt the feedstock as it is fed into the moving meltpool.

17. A system for producing a 3D article by additive manufacture, the system being configured for a meltpool to be formed in an already-existing part of the article, and moved relative thereto, for a directed feedstock to be fed into the moving meltpool to deposit and fuse a layer of material on the already-existing part, and for the forming and moving and feeding to be repeated to build up successive layers of material, and thereby produce the 3D article, the system comprising:

a first energy source configured to be directed onto the already-existing part;

a second energy source configured to be directed onto the already-existing part;

a feedstock directing arrangement;

a computer controller adapted to control movement of the first energy source, the second energy source and the feedstock directing arrangement relative to the already-existing part such that: the first energy source impinges at a first region which moves with and leads the meltpool whereby the first energy source initiates the formation of the meltpool, the second energy source impinges at a second region which moves with and follows the first region to grow the lateral width of the meltpool before or after receipt of the directed feedstock into the moving meltpool, and the directed feedstock is fed into the moving meltpool; and

a third energy source;

wherein the computer controller is further adapted to control movement of the third energy source relative to the already-existing part such that the third energy source impinges the directed feedstock to melt the feedstock as it is fed into the moving meltpool.

18. The system of claim 16 or 17, wherein the computer controller is further adapted to adjust the energy profile of the impinging energy of the third energy source to compensate for changes in the shape and/or size of the feedstock.