CLAIMS

1. Screw elements (10, 10') for multi-shaft screw machines with paired co-directionally rotating screw shafts (W, W'), these screw elements being fully wiping in pairs and screw shafts that are made up of these screw elements having two or more screw flights, the screw elements having screw profiles (11, 11') being able to be represented over the entire cross section by respective profile curves, characterized in that each profile curve (11, 11') has at least one kink location (K, K') along it that lies within an outer radius (RA, RA') of the profile curve, the ratio of a radius of curvature of the screw profile to the outer radius of the profile curve being 0.05 to 0.95 at a point P_A which cleans the barrel, the point P_A being the only point in a profile portion in a segment of 90° that lies on a circle around a point of rotation C with the outer radius RA.

2. The screw elements (10, 10') as claimed in claim 1, each profile curve being a continuous, closed, convex curve, which is also continuously differentiable apart from the at least one kink location (K, K').

3. The screw elements (10, 10') as claimed in claim 2, the profile (11) of one of the screw elements (10) of a pair of screw elements being formed by a curve $\vec{p}$ and the profile (11') of another screw element (10') of a pair of screw elements being formed from the curve $\vec{q}$ according to the following relationship (1):

$$\vec{q} = \vec{p} + a \cdot \vec{n}(\vec{p}) + \vec{a} \qquad (1),$$

where

- the curve $\vec{p}$ has at each point a radius of curvature ρ that is less than or equal to a centerline distance a between the screw elements (10, 10'),

- for each point of the curve $\vec{p}$ within a continuously differentiable portion there exists a normalized normal vector $\vec{n}(\vec{p})$ with the length 1, which at a respective point is perpendicular to the tangent to the curve $\vec{p}$ and points towards the center point of curvature belonging to the respective point of the curve $\vec{p}$,

- $\vec{a}$ is a vector which leads in the direction from the point of rotation (C) of the profile being a generating profile (11) to the point of rotation (C') of the profile being a generated profile (11') and has a length a.

4. The screw elements (10, 10') as claimed in one of claims 1 to 3, each screw profile or each profile curve (11, 11') being made up of a number of arcs of a circle (1-5), wherein the tangential lines at the intersection point of the respective arcs (1-5) are at an angle (θ) of between 90° and 180°, preferably between 140° and 180°, to one another at the at least one kink location (K, K').

5. The screw elements (10, 10') as claimed in one of claims 1 to 4, each screw profile or each profile curve (11, 11') allowing itself to be subdivided into profile portions, which can be transferred into one another by point or axis mirroring.

6. The screw elements (10, 10') as claimed in claim 5, each profile portion being made up of a number of arcs of a circle (1-5), the number of arcs (1-5) that form one of the profile portions being preferably 2 to 8, particularly preferably 3 to 6.

7. The screw elements (10, 10') as claimed in claim 5 or claim 6, one of the profile portions extending between a point (P_A, P_A'), which lies on the outer radius (RA, RA') of the profile (11, 11'), and a point (P_I, P_I'), which lies on the core radius (RI, RI') of the profile (11, 11'), and comprising the at least one kink location (K, K').

8. The screw elements (10, 10') as claimed in claim 5 or claim 6, each profile portion comprising a continuously differentiable curve between two kink locations (K, K').

9. The screw elements (10, 10') as claimed in one of claims 1 to 8, the ratio of a radius of curvature of the screw profile to the outer radius of the profile curve being 0.2 to 0.8, preferably 0.3 to 0.7, particularly preferably 0.35 to 0.65, preferably at the point P_A which cleans the barrel.

10. A method for producing screw elements (10, 10') for multi-shaft screw machines with paired co-directionally rotating screw shafts, these screw elements being fully wiping in pairs and screw shafts that are made up of these screw elements having two or more screw flights, for producing the screw profile (11, 11') a profile curve

being created in a plane perpendicular to the axis of rotation (C, C'), which profile curve has at least one kink location (K, K') or a location of discontinuity in the slope of the curve along it, this location (K, K') lying within an outer radius (RA, RA') of the profile curve, the ratio of a radius of curvature of the screw profile to the outer radius of the profile being 0.05 to 0.95 at a point PA which cleans the barrel, the point PA being the only point in a profile portion in a segment of 90° that lies on a circle around a point of rotation C with the outer radius RA.

11. A method for producing screw elements (10, 10') for multi-shaft screw machines with paired co-directionally rotating screw shafts, these screw elements being fully wiping in pairs and screw shafts that are made up of these screw elements having two or more screw flights, characterized in that, in a first step for producing the screw profiles (11, 11'), a profile curve is created in a plane perpendicular to the axis of rotation (C, C'), which profile curve has at least one kink location (K, K') or a location of discontinuity in the slope of the curve along it, this location (K, K') lying within an outer radius (RA, RA') of the profile curve, the ratio of a radius of curvature of the screw profile to the outer radius of the profile curve being 0.05 to 0.95 at a point P_A which cleans the barrel, the point P_A being the only point in a profile portion in a segment of 90° that lies on a circle around a point of rotation C with the outer radius RA, and in a second step clearances are introduced.

12. The use of screw elements (10, 10') as claimed in one of claims 1 to 9 or produced as claimed in claim 10 or 11 in a screw machine.

13. The use as claimed in claim 12, the screw elements (10, 10') cleaning in pairs with a constant gap over their entire circumference, or the screw elements (10, 10') cleaning in pairs with a gap that is not constant over the entire circumference.

14. A screw machine, in particular an extruder, with paired co-directionally rotating screw shafts (W, W'), the screw shafts having screw elements (10, 10') as claimed in one of claims 1 to 9 or produced as claimed in claim 10 or 11.

15. A method for extruding plastic compositions, characterized in that screw elements as claimed in one of claims 1 to 9 or produced as claimed in claim 13 or 14 or a screw machine as claimed in claim 14 are used.