CLAIMS

1. An optical effect layer (x10; OEL) comprising a radiation cured coating composition comprising non-spherical oblate magnetic or magnetizable pigment particles, said non-spherical oblate magnetic or magnetizable pigment particles being oriented according to an orientation pattern,
wherein the orientation pattern is circularly symmetric around a center of rotation,
wherein the non-spherical oblate magnetic or magnetizable pigment particles at at least two, preferably four, distinct locations x_i along any selected diameter of the OEL have an average zenithal deflection angle φ' at location x_i and an average azimuth angle θ with respect to the selected diameter at the same location x_i that satisfy the condition $|\varphi' \sin(\theta)| \geq 10°$, preferably $|\varphi' \sin(\theta)| \geq 15°$,

and said optical effect layer providing an optical impression of at least one circularly moving spot or at least one comet-shaped spot rotating around said center of rotation upon tilting said OEL.

2. The optical effect layer according to claim 1, wherein at least a part of the plurality of non-spherical oblate magnetic or magnetizable particles is constituted by non-spherical oblate optically variable magnetic or magnetizable pigment particles.

3. The optical effect layer according to claim 2, wherein the optically variable magnetic or magnetizable pigments are selected from the group consisting of magnetic thin-film interference pigments, magnetic cholesteric liquid crystal pigments and mixtures thereof.

4. The optical effect layer according to any preceding claim, wherein the radiation cured coating composition is a UV-Vis radiation cured coating composition.

5. A use of the optical effect layer (OEL) recited in any one of claims 1 to 4 for the protection of a security document against counterfeiting, fraud or illegal reproduction or for a decorative application.

6. A security document or a decorative element or object comprising one or more optical effect layer (OEL) recited in any one of claims 1 to 4.

7. A printing apparatus for producing on a substrate the optical effect layer (OEL) recited in any one of claims 1 to 4, wherein the non-spherical oblate magnetic or magnetizable pigment particles are oriented with the magnetic field from at least one spinning magnetic assembly (x00) comprised in the apparatus, the spinning magnetic assembly (x00) having an axis of spinning, wherein the surface of the substrate provided with the OEL is substantially perpendicular to the axis of spinning of the magnet assembly (x00), and comprising at least a) first magnetic-field generating device (x30) and b) a second magnetic-field generating device (x40), wherein said first magnetic-field generating device (x30) and said second magnetic-field generating device (x40) have mutually skew magnetic axes, wherein said first magnetic-field generating device (x30) has its

magnetic axis substantially perpendicular to the axis of spinning and said second magnetic-field generating device (x40) has its magnetic axis substantially perpendicular to the axis of spinning and wherein the projection of the magnetic axis of the first magnetic-field generating device (x30) and the projection of the magnetic axis of the second magnetic-field generating device (x40) along the axis of spinning onto a plane perpendicular to the axis of spinning form an angle (Ω) either in the range from 5° to 175° or in the range from -5° to -175°, preferably in the range from 15° to 165° or in the range from -15° to -165°,

and wherein

a) the first magnetic-field generating device (x30) comprises

a bar dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning, or

two or more bar dipole magnets, each of said two or more bar dipole magnets having its North-South magnetic axis substantially perpendicular to the axis of spinning and all of said two or more bar dipole magnets having a same magnetic field direction, or

a loop-shaped, preferably a ring-shaped, dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning, or

a disc-shaped dipole magnet being nested inside a loop-shaped, preferably a ring-shaped, dipole magnet, each of the disc-shaped dipole magnet and the loop-shaped, preferably ring-shaped, dipole magnets having their North-South magnetic axis substantially perpendicular to the axis of spinning and having a same magnetic field direction, or

two or more nested loop-shaped, preferably two or more nested ring-shaped, dipole magnets, each of said two or more nested loop-shaped, preferably two or more nested ring-shaped, dipole magnets, having its North-South magnetic axis substantially perpendicular to the axis of spinning and all of said two or more nested ring-shaped magnets having a same magnetic field direction; and wherein

b) the second magnetic-field generating device (x40) comprises

a disc-shaped dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning, or

a loop-shaped, preferably a ring-shaped, dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning, or

a bar dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning.

8. The apparatus according to claim 7,

wherein the first magnetic-field generating device (x30) comprises a loop-shaped, preferably a ring-shaped, dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning and the second magnetic-field generating device (x40) comprises a disc-shaped dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning; or

wherein the first magnetic-field generating device (x30) comprises a loop-shaped, preferably a ring-shaped, dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning and the second magnetic-field generating device (x40) comprises a loop-shaped, preferably a ring-shaped, dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning; or

wherein the first magnetic-field generating device (x30) comprises a bar dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning and the second magnetic-field generating device (x40) comprises a disc-shaped dipole magnet having its North-South magnetic axis perpendicular to the axis of spinning; or

wherein the first magnetic-field generating device (x30) comprises a two or more bar dipole magnets, each of said two or more bar dipole magnets having its North-South magnetic axis substantially perpendicular to the axis of spinning and all of said two or more bar dipole magnets having a same magnetic field direction and the second magnetic-field generating device (x40) comprises a disc-shaped dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning; or

wherein the first magnetic-field generating device (x30) comprises a disc-shaped dipole magnet being nested inside a loop-shaped, preferably a ring-shaped, dipole magnet, each of the disc-shaped dipole magnet and the loop-shaped, preferably a ring-shaped, dipole magnet having their North-South magnetic axis substantially perpendicular to the axis of spinning and having a same magnetic field direction and the second magnetic-field generating device (x40) comprises a disc-shaped dipole magnet having its North-South magnetic axis substantially perpendicular to the axis of spinning; or

wherein the first magnetic-field generating device (x30) comprises two or more nested ring-shaped magnets, each of said two or more nested ring-shaped magnets having its North-South magnetic axis substantially perpendicular to the axis of spinning and all of said two or more nested ring-shaped magnets having a same magnetic field direction and the second magnetic-field generating device (x40) comprises a disc-shaped dipole magnet having its North-South magnetic axis perpendicular to the axis of spinning.

9. The apparatus according to any one of claims 7 or 8 further comprising a rotating magnetic cylinder or a flatbed printing unit, wherein the at least one spinning magnetic assembly (x00) is comprised in the rotating magnetic cylinder or the flatbed printing unit.

10. A process for producing the optical effect layer (OEL) (x10) recited in any one of claims 1 to 4 on a substrate (x20), said process comprising the steps of:

i) applying on a substrate (x20) surface a radiation curable coating composition comprising non-spherical oblate magnetic or magnetizable pigment particles, said radiation curable coating composition being in a first state;

ii) exposing the radiation curable coating composition to a magnetic field of the printing apparatus recited in any one of claims 7 to 9 so as to orient at least a part of the non-spherical oblate

magnetic or magnetizable pigment particles; and

iii) at least partially curing the radiation curable coating composition of step ii) to a second state so as to fix the non-spherical oblate magnetic or magnetizable pigment particles in their adopted positions and orientations.

11. The process according to claim 10, wherein step iii) is carried out by UV-Vis light radiation curing.

12. The process according to claim 10 or 11, wherein step iii) is carried out partially simultaneously with the step ii).