

Claims

1. A fail-safe actuator (10) for moving a part (12) between two end positions, comprising:
- 5 a first drive (18),
- a first drive train (24) which can be set in motion by the first drive (18) which has a first output shaft (34) which transmits the movement of the actuator outwards in the direction of the part (12),
- a second drive (118),
- 10 a second drive train (26) which can be set in motion by the second drive (118) which has a second output shaft (38) which runs coaxially with the first output shaft (34),
- wherein the first and/or the second drive (18, 118) can be activated, selectively, in order to set the first and/or second output shaft (34, 38) in motion,
- 15 an energy storage device (16) which is coupled with the second drive train (26),
- at least one externally actuatable holding device (182) which ensures, selectively, that the energy stored in the energy storage device (16) remains in the energy storage device (16) or is released to the second drive train (26),
- a mechanical rotary entrainment device (40) between the second output shaft
- 20 (38) and the first output shaft (34) which is configured such that it
- permits a rotation of the first output shaft (34) relative to the second output shaft (38) by at least one angle of rotation which is associated with the distance between the end positions if the energy storage device (16) is not released and if the drive moves the first output shaft (34) between the end
- 25 positions and
- provides a rotary entrainment of the first output shaft (34) by the second output shaft (38) with the energy storage device (16) released and the failed drive (18) in a first of the two end positions.

2. A fail-safe actuator (10) according to claim 1, wherein both drives (18, 118), the rotary entrainment device (40) and the at least one holding device (182) are configured and controllable in a coordinated manner such that, in a first state, the second drive (118) moves the second output shaft (38) in the direction of the second of the two end positions and energy is thereby introduced into the energy storage device (16), in particular wherein the first output shaft (34) is not thereby moved,

in a subsequent second state, the at least one holding device (182) holds the energy in the energy storage device (16) and the first drive (18) can move the part (12) between its end positions,

in a subsequent third state, in which both drives (18, 118) fail, the holding device (182) releases the energy in the energy storage device (16) and as a result the second output shaft (38) is moved in the direction of the first end position and a rotary entrainment of the first output shaft (34) in the direction of the first position is made possible.

3. A fail-safe actuator (10) according to claim 2, wherein in the first state, both drives (18, 118) drive and both output shafts (34, 38) move in the direction of the second of the two end positions and energy is thereby introduced into the energy storage device (16), or that, in the first state, on the first output shaft (34) being driven in the direction of the second of the two end positions by the first drive (18), with the second drive (118) inactive, with discharged energy storage device (16) and enabled holding device (182), the first output shaft (34) carries the second output shaft (38) with it.

4. A fail-safe actuator (10) according to any preceding claim, wherein the holding device (182) holds the second output shaft (38) in the second state and thus holds the energy storage device (16) in the state in which the energy remains in the energy storage device (16).

5. A fail-safe actuator (10) according to any preceding claim, wherein each drive train is assigned its own holding device (82, 182), wherein the holding device of the first drive train is activated if the part (12) is to be held in a position.

6. A fail-safe actuator (10) according to any preceding claim, wherein the energy storage device (16) is coupled directly or indirectly with the second output shaft and can be detached therefrom in a non-destructive manner.

5 7. A fail-safe actuator (10) according to claim 6, wherein the rotary entrainment device (40) is configured such that the second output shaft (38) can entrain the first output shaft (34) in opposite directions of rotation, wherein the direction of rotation is dependent on the direction of rotary effect of the energy storage device (16).

10 8. A fail-safe actuator (10) according to claim 7, wherein the energy storage device (16) can be coupled to the second output shaft (38) in two different positions, and in a first position ensures that the first output shaft (34) can be pressed into one end position and in a second position can be pressed into the opposite end position.

15 9. A fail-safe actuator (10) according to claim 8, wherein the first position differs from the second position in that the energy storage device (16) is inverted by 180° and is thus coupled to the second output shaft (38) on the rear side.

10. A fail-safe actuator (10) according to any preceding claim, wherein the first and the second output shaft (34, 38) are coupleable in the direction of rotation by means of stop surfaces (90, 92, 94, 96) which come into contact with one another.

20 11. A fail-safe actuator (10) according to claim 10, wherein the stop surfaces (90, 92, 94, 96) are formed on opposite end faces (42, 44) of the gear wheels (32, 36) or the output shafts (34, 38).

25 12. A fail-safe actuator (10) according to claim 10 or 11, wherein if stop surfaces (90, 94; 92, 96) of both the first and also the second drive train (24, 26) are in contact with one another, the stop surfaces which are not in contact with one another are distant from one another by at least 180°.

13. A fail-safe actuator (10) according to any preceding claim, wherein the energy storage device (16) comprises at least one elastic spring element.

30 14. A fail-safe actuator (10) according to claim 13, wherein several spring elements, in particular compression springs (66, 68, 70, 72), arranged symmetrically around the second output shaft are provided.

15. A fail-safe actuator (10) according to claim 14, wherein the compression springs (66, 68, 70, 72) are coupled mechanically to the second output shaft (38) in pairs by means of the same rack (64).

5 16. A fail-safe actuator (10) according to claim 15, wherein the second output shaft (38) is connected with the energy storage device (16) via a gear wheel (62) which in turn meshes with the gear teeth on the rack (64).

10 17. A fail-safe actuator (10) according to any of claims 13 to 16, wherein the energy storage device (16) is designed as a separate, externally closed assembly unit in which several spring elements are housed and which has a coupling point (60) with the second output shaft (38) which is accessible from opposite sides.

18. A fail-safe actuator (10) according to any preceding claim, wherein both drives (18, 118) can be operated as generators in order to brake a movement in at least one of the drive trains (24, 26), in particular to achieve a damping before reaching an end position.

15 19. An assembly unit with an actuator (10) according to any preceding claim and a part (12) moved by the actuator (10) which is in particular a valve flap or ventilation flap.