

Title: Door operator, in particular swing door operator

Description

The invention relates to a door operator, in particular to a
5 swing door operator according to the generic part of patent
claim 1.

Such a door operator is known from DE 295 21 068 U1. An
overhead door closer with a slide rail linkage is known from
DE 40 38 720 C2, which has a cam drive unit allowing for
10 an optimum door moment curve and a comfortable
operation. In principle this overhead door closer would
therefore be suitable as door operator as well; however,
experiments conducted during the course of the invention
have shown that applying oil pressure to the drive unit
15 results in a very unfavourable transformation of the
hydraulic pressure in the resulting movement of
stroke/rotation and repeated stroke. Since about 75% of
the output capacity to be applied is required for tensioning
the spring force accumulator of such a door closer,
20 whereas only about 25% of the output capacity needs to be
delivered by the system for accelerating the door. As it is
furthermore desirable to keep the narrow structural shape
of such a door closer for door operators as well, the
dimensions of the structural components cannot be
25 adapted to the extremely high loads. Thus, although

functionally and technically advantageous, the known overhead door closer is not suitable as a door operator.

Another swing door operator is known from DE 197 56 496 C2. This swing door operator has an electromechanical drive unit, which is provided with a drive motor and a gear and with a subsequent power transmission unit for the connected door. The power transmission unit has a spindle with a spindle nut partially overlapping the former, which spindle is non-positively and positively connected to a toothed rack. Although this swing door operator can be installed concealed, the door moment curve is not as optimal as with the above described door closers having the cam technology.

Therefore, it is the object of the present invention to provide a door operator of the species indicated in the generic part of patent claim 1, which can be installed completely concealed within the door profile or frame profile, and does not require any special constructions of the door system.

This problem is solved by the features of patent claim 1.

On account of its compact structure, the inventive door operator allows for a concealed installation within a door profile or a frame profile and thus allows for total integration with the door system.

Particularly the installation in common narrow door profiles is possible.

As an advantage, neither special door profiles nor any special constructions, which would interfere with the design of the door system, are necessary. Another advantage results from an economical mounting combined with a wide applicability and moreover, it is possible to retrofit existing door systems with the inventive door operator. Another advantage results from the fact that, with the inventive door operator, a direct introduction of power for tensioning a spring force accumulator is possible. Thus the possibility is given of avoiding unnecessarily loading the mechanical structural components, and a reduction of the required operating pressure can be achieved, because larger effective piston areas are provided. As the hydraulic pump of the inventive door operator is in hydraulic connection with a separate pressure compartment, which is associated directly to the spring force accumulator, a direct pressure application and thus a direct introduction of power into the spring force accumulator is the result, whereby the pre-tensioning of the spring force accumulator is completely or at least partially achieved. By this measure the disadvantages explained at the beginning are completely eliminated, because unnecessary losses are avoided.

The inventive door operator further achieves avoiding unnecessary stress on structural components, load on

bearings, and any loss on account of friction or loss of efficiency. On account of a separate pressure compartment associated to the spring force accumulator, the effective piston areas for tensioning the spring force accumulator and thus for generating a higher driving torque are further increased and, moreover, the required system pressure is thus considerably reduced and the stroke volume is increased. As a consequence, the control response is improved and the overall hydraulic system is less sensitive, whereby a more precise control of the door operator can be realized.

It can thus be achieved that the torque required at the output shaft for opening the doors can be generated by means of a cam arrangement, while the spring tensioning work is simultaneously generated in the separate pressure compartment.

Through providing the pressure compartment, associated to the spring force accumulator, and a preferably provided specific hydraulic control, such as through the use of a solenoid valve, further hydraulic functions such as hydraulic hold-open or hydraulic closing sequence control are made possible.

Furthermore, it is possible to realize a hydraulic opening damping and to use differently built drive units.

Advantageous further developments of the invention are the subject matter of the dependent claims.

Further details, features and advantages of the invention will become apparent from the following description of
5 exemplary embodiments, reference being made to the drawings, in which:

Figure 1: shows a diagrammatically slightly simplified basic illustration of an embodiment of an inventive door operator,

10 Figure 2: shows a top view on the door operator according to Figure 1.

Figure 1 shows an inventive door operator 1, which in particular can be executed as a swing door operator. The door operator 1 has a drive unit 2, which, via an output
15 shaft 9, can be coupled to a door not illustrated in Figure 1, for example via a lever 26 and a slide channel with a sliding member. The drive unit 2 is disposed in a housing 13.

Furthermore, the door operator 1 has a motor 3, as well as
20 a spring force accumulator 4 disposed in the housing 13, which accumulator is coupled to the motor 3 and to the drive unit 2.

As revealed in Figures 1 and 2, the motor 3 is in driving connection with a hydraulic pump 5. In the illustrated

embodiment, the motor 3 and the hydraulic pump 5 are disposed at the housing 13; however, they might be distinctly flange-mounted to or integral with the housing 13. The motor 3, via the hydraulic pump 5 and a first hydraulic line 22', is in hydraulic connection with a pressure compartment 7, which is associated to the spring force accumulator 4. The first hydraulic line 22' may be provided with a throttle 22. Via a second hydraulic line 23, the motor 3 and the pump 5 are in hydraulic connection with a hydraulic compartment 6, wherein a compression spring 12 is disposed, and which compartment serves as a reservoir volume.

In the embodiment illustrated in Figures 1 and 2, the drive unit 2 is formed as a cam drive. This cam drive has a cam disc 8, which is disposed on the output shaft 9. The cam disc 8 cooperates with two force transmission rollers 10 and 11, which are disposed on both sides of the output shaft 9 on a cam plate assembly 18 and bear on different cam paths of the cam disc 8. Through rotating the output shaft 9, the compression spring 12 is tensioned, because the cam plate assembly 18, via a piston rod 19, passes through an internal compartment of a separating wall 24 and is attached to a spring tensioning piston 17. As the force transmission rollers, which, in this embodiment, are aligned towards the centre of the axis of the door operator

1, are secured to the cam plate assembly 18, the distance between them remains constant.

As revealed in Figure 1, a spring tensioning piston 17, which directly introduces the power for tensioning the compression spring 12 into the latter, is disposed in the pressure compartment 7. The spring tensioning piston 17 is connected to the cam plate assembly 18 via a piston rod 19, whereby, when applying pressure in the pressure compartment 7, a subsequent introduction of power into the piston rod 19 is also realized, which is guided into a reception compartment 21 passing through a joint 20. The joint 20 is disposed in a separating wall 24 between the pressure compartment 7 and the reception compartment 21.

Figure 1 shows furthermore that in the exemplary embodiment, one end 14 of the spring 12, via a spring force adjusting device 25, bears indirectly against a housing wall 15 of the housing 13, whereas the other end 16 thereof bears against the spring tensioning piston 17.

As revealed in Figures 1 and 2, the result is the extremely compact design explained at the beginning, which allows for a completely concealed installation in door profiles or frame profiles.

List of References

	1	door operator
	2	drive unit
	3	motor
5	4	spring force accumulator
	5	hydraulic pump
	6	hydraulic compartment
	7	pressure compartment
	8	cam disc
10	9	output shaft
	10	force transmission rollers
	11	force transmission rollers
	12	compression spring
	13	housing
15	14	end
	15	housing wall
	16	end
	17	spring tensioning piston
	18	cam plate assembly
20	19	piston rod
	20	joint
	21	reception compartment
	22	throttle
	22'	first hydraulic line
25	23	second hydraulic line
	24	separating wall
	25	spring force adjusting device

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26 lever

Patent claims

1. A door operator (1), in particular a swing door operator,
- with a drive unit (2), which can be coupled to a door via an output shaft (9) and is disposed in a housing (13);
 - with a motor (3) being in driving connection with the drive unit (2), and
 - with a spring force accumulator (4), which is disposed in the housing (13) and is coupled to the motor (3) and the drive unit (2);
- characterized by
- a hydraulic pump (5), which is in driving connection with the motor (3) and is in hydraulic connection with a hydraulic compartment (6), representing a reservoir volume, and with a separate, sealed pressure compartment (7), which is associated to the spring force accumulator (4).
2. A door operator according to claim 1, characterized in that the drive unit (2) is formed as a cam drive, which has a cam disc (8), which is disposed on the output shaft (9), and two force

transmission rollers (10, 11), which are disposed on both sides of the output shaft (9) and bear on cam paths of the cam disc (8).

3. A door operator according to claim 1 or 2,
5 characterized in that the spring force accumulator (4) has a compression spring (12), which, with one end (14), bears against a housing wall (15) or against a spring force adjusting device (25) and with the other end (16) against a spring tensioning
10 piston (17).
4. A door operator according to one of the preceding claims 1 to 3, characterized in that the pressure compartment (7) associated to the spring force accumulator (4) is disposed adjacent the spring
15 tensioning piston (17) and is sealed by means of a separating wall (24) with a joint (20) with regard to a reception compartment (21) of the drive unit (2).
5. A door operator according to any of the claims 2
20 to 4, characterized in that the force transmission rollers (10, 11) are disposed in a cam plate assembly (18), which is connected to the spring tensioning piston (17) via a piston rod (19).

6. A door operator according to claim 5, characterized in that the piston rod (19) passes through the joint (20).
- 5 7. A door operator according to any of the claims 1 to 6, characterized in that the pump (5) is connected to the pressure compartment (7) via a throttle (22) disposed in a line.
- 10 8. A door operator according to any of the preceding claims 1 to 7, characterized in that the motor (3) is formed as an alternating current or direct current micro-motor.