

Title: HINGED DOOR WITH A HINGE PLATE

Description

5 The invention relates to a rotatably supported door with a hinge, comprising a stationary hinge portion, a leaf hinge portion pivotable about the stationary hinge portion and a rotating shaft passing through the stationary hinge portion and the leaf hinge portion.

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In order to affect the opening and closing behavior of a swing leaf door, usually door closers are utilized, which can be installed in the floor to be concealed, or they can be affixed visibly to a door transom. These door closers allow
15 for realizing an adjustable damping effect during the terminal position of the opening or closing action. However, the door closers may allow for functions such as hold-open or automatic closing. Usually the majority of these door closers is suitable for only opening the swing leaf door in
20 one direction. With double-action doors, particular measures are required to allow the door closer to function in both directions. In this case, a particular disadvantage is that, in particular with doors made from glass, the door closers are either visible, or they need to be expensively
25 disposed in the floor, because the floor needs to be pried open, in order to prepare the space for the door closer.

It is the object of the invention to provide a rotatably supported door with hinges, which does not present these disadvantages.

- 5 The invention solves the given problem with the teaching of claim 1. Further advantageous embodiment features of the invention are characterized by the dependent claims.

10 According to the technical teaching of claim 1, a swing leaf door is created, which is fastened to a wall, a casing or to a sidewall via a hinge. According to the invention, the door has a hinge including an opening or closing damping device, such as to be able to forego an expensive and possibly visible door closer. In this case, the door may be
15 fastened to a wall, a casing or the sidewall by means of a single hinge only. In this case, this single hinge supports the entire weight of the door and includes an integral opening or closing damping device.

20 According to an advantageous further development, the door has a hinge including a hold-open or closing function. This is why a latching device disposed at a casing and at a door closer can be foregone.

25 Advantageously, the door may be rotatably supported with one or more joint hinges. The hinge may be combined with another joint hinge such as to traditionally suspend the

door from two hinges. In this case, the joint hinge only has the function of supporting a portion of the door weight, whereas the hinge assumes the function of the opening and/or closing damping effect and/or the function of holding
5 the opening and/or closing position.

In case of two joint hinges, the door closer, if provided, may be replaced by the inventive hinge, wherein the latter may be disposed between the joint hinges.

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Another improvement is achieved if both the hinge and the functional hinge are configured as double-action hinges. This would allow for omitting a floor door closer having the double-action function. The difference between existing
15 double-action door hinges and the inventive combination is that the double-action function is damped and the door does not pivot back and forth beyond the zero position.

According to the invention, the opening and/or closing
20 damping device of the hinge is configured by means of at least one damper, which cooperates with the rotating shaft. The damper damps the rotational movement of the door by consuming the kinetic energy, wherein, in the preferred embodiment, the damper has a piston, which, within the
25 cylinder, moves a fluid or a gas between two pressure compartments. A very small and effective damper can be

thereby provided which, on account of its structural size, is easy to incorporate into the dimensions of a hinge.

A damping function, which depends on the opening angle of the door, respectively on the deflection of the damper at the axis, is achieved on account of the eccentric disposition of the damper at the rotating shaft. At a small door opening angle, the damping effect is light and almost not noticeable for the user. At an important opening angle of the door, the damping is correspondingly higher such that the door will not pivot back and forth beyond the zero position.

In an advantageous embodiment, one end of the damper may be disposed eccentrically and articulately at the rotating shaft and may be fastened with the other end at, respectively in the stationary hinge portion. On the one hand, the eccentric disposition of the damper at the rotating shaft allows to influence the torques and the damping paths, which in turn affects the damping effect. On the other hand, the amount of eccentricity determines the thickness of the hinge, which, from the aspect of design, should be limited.

The disposition of the one or more dampers within a damper cartridge allows for easy exchangeability of this structural component. Furthermore, graduated according to the desired damping effect, the damper cartridge may be

equipped with one or more dampers. The mechanic installer or final user has the advantage that neither special tools nor expert knowledge are required to exchange a damaged damper or to adapt the system to the given
5 circumstances with a higher damping effect. The manufacturer of the hinge has the advantage of inexpensive production, because a hinge, without requiring any structural modifications, can be equipped with different dampers, which makes the hinge usable for different door
10 widths and door weights. Only the damper needs to be adapted to the door size.

It is particularly advantageous, if the damper cartridge has an abutment which cooperates with the rotating shaft. This
15 arrangement has the advantage of not having to fasten each damper individually, despite the fact it is incorporated into a damper cartridge, to the rotating shaft in an expensive manner. In this case, the abutment may cooperate with a cam which is disposed on the rotating
20 shaft. The required eccentricity, and thereby the torque respectively the damping path, are again adjusted via the cam.

The abutment may present a flat, convex or concave
25 abutment surface, wherein the configuration of the abutment surface may in turn increase or reduce the eccentricity. An additional variable is thus available by

means of the configuration of the abutment surface, in order to combine a single hinge with different dampers, respectively damper cartridges for different applications.

- 5 In a preferred embodiment, the dampers are configured as closing dampers, which absorb the kinetic energy upon compression. A counter-force needs to be applied for this purpose such that the abutment is permanently pressed against the cam. In this case, an inexpensive option is to
- 10 equip the damper cartridge with a compression spring, which presses the abutment against the cam. It is thereby assured that the abutment and the cam are in permanent contact.
- 15 For creating a double-action door hinge, in an advantageous embodiment it is provided the hold-open function and the hold-closed function are generated by a latching device disposed at the rotating shaft. The latching device offers the possibility to maintain the door in
- 20 predetermined positions such that the door does not swing back and forth, for example under wind load. It is likewise possible to keep the door open for example at an opening angle of 90°, without a potential closing function always conveying the door into the zero position or closed position.

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An inexpensive structural configuration of the invention provides that the latching device is configured by a cam

with a depression, which cam is disposed at the rotating shaft and the depression cooperates with a force-loaded roller. This embodiment offers the advantage of being able to utilize inexpensive standardized structural components.

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The disposition of the opening and closing damping device above and/or below the latching device at the rotating shaft allows for a compact structural design of the hinge.

- 10 Another improvement is achieved if an overload protection is disposed at the abutment. Damage or destruction of the dampers is thereby avoided. In a preferred embodiment, the overload protection is configured as a leaf-spring, which deforms under too important forces.

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In the following, further advantages and embodiments of the invention will be explained in detail based on several diagrammatically illustrated embodiments. In this case, the same reference numerals are utilized for the same structural components.

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In the drawings:

Figure 1: shows a door with hinges,

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Figure 2: shows a perspective illustration of the joint hinge,

Figure 3: shows a sectional illustration of the joint hinge according to a first embodiment,

5 Figure 4: shows a partially sectional illustration of the joint hinge according to a first embodiment,

Figure 5: shows a perspective view of a second embodiment,

10 Figure 6: shows a perspective view of a second embodiment,

Figure 7: shows a sectional illustration of the second embodiment,

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Figure 8: shows a perspective view of a damper cartridge,

20 Figure 9: shows another embodiment of a damper cartridge,

Figure 10: shows another embodiment of a joint hinge,

Figure 11: shows a detailed illustration of an abutment.

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Figure 1 illustrates a door 11, which, by means of a hinge 1, is disposed at a wall 12. In this case, the door 11 may be

attached to the wall 12, a casing or a sidewall exclusively by a single hinge 1. As an alternative, the door 11 may be rotatably supported at a joint hinge 10 and at a hinge 1.

5 Another alternative is given if an existing door closer is to be replaced by a hinge 1. In this case, the door 11 is rotatably supported at two already existing joint hinges 10, between which the hinge 1 is disposed.

10 Furthermore, the door 11 may be configured as a double-action door such that the joint hinges 10 and the hinge 1 are configured as well as double-action door hinges. However, the door 11 may be fastened to a wall 12, a casing or a sidewall by means of two functional hinges 1.

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Utilizing the invention, in particular with a glass door, allows for a transparent design of an all glass door system, which cannot be accomplished with conventional door closers.

20 According to Figure 2, the joint hinge 1 has a stationary hinge portion, identified here as a bearing block 20, and has a leaf hinge portion 2. An attaching plate 21, by means of which the joint hinge 1 is attached to a non-illustrated wall or wall structure, is attached to the bearing block 20.

25 Instead of the bearing block 20, the joint hinge 1 may have another hinge strap to be attached to a glass pane or to a wall element.

The leaf hinge portion 2 comprises at least a first clamping plate 3 and a second clamping plate 4, which hold a non-illustrated door panel or a glass door in a clamping manner by means of fastening means 5. Sealing and/or damping plates 6 are disposed between the clamping plates 3, 4 and a glass pane, in order to enclose the door leaf, made from wood or glass, in the gentlest manner. Decorative covering elements 29 may be disposed on both sides of the bearing block 20. A gap 55 is located between the bearing block 20 and the clamping plates 3, 4, so that the structural components do not contact each other when operating the door. In order to avoid injuries, the frontal side of the bearing block 20, which is oriented towards the gap 55, is rounded.

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As illustrated in Figure 3 and Figure 4, a rotating shaft 7 is attached in a torque-proof manner to the first clamping plate 3. In this case, the rotating shaft 7 forms the axis of rotation or pivoting axis of the joint hinge 1. In this case, the rotating shaft 7 is attached with journals 7a to the first clamping plate 3 and is fixed in a torque-proof manner by means of fastening means, for example hammer-tightened rivets or screws. The rotating shaft 7 is fixed and supported in the bearing block 20 via the closures 9. When opening the door, the leaf hinge portion 2 rotates together with the rotating shaft 7 about the rotating shaft 7, wherein the bearing block 7 is affixed to a wall, a casing or a stationary

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lateral panel. A damper 22 comprises at least one piston 23 and a cylinder 24, wherein one end of the piston 23 is articulately and eccentrically fastened to the rotating shaft 7 via a pin 8. The other end of the piston 23 plunges into the
5 cylinder 24. The end of the cylinder 24 is likewise articulately fastened to or in the damper reception 25. The damper reception 25 is fastened in the bearing block 20, respectively to the attaching plate 21 by means of a closure 27. When rotating the rotating shaft 7, the eccentrically
10 supported pin 8 pivots about the axis of rotation of the hinge 1, such that the piston 23 moves out of the cylinder 24 and the damper 22 rotates out of the longitudinal axis, i.e. the zero position of the joint hinge X-X.

15 The damper 22 may be equipped with an opening and/or damping function, which effects a speed reduction in one of the terminal positions. However, the damper 22 may be equipped with an opening or closing control, whereby the door is always moved back from the opening position into
20 the closed position or which realizes a hold-open function. For this purpose and depending on the application case, the damper 22 may be provided with an air or oil damping device, may have an eddy-current brake or a hysteresis brake.

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In a preferred embodiment, the dampers 22 are configured as closing dampers such that the door is damped, when

being moved into the zero position, respectively when being closed. For this purpose, the dampers 22 are conceived in that, when the piston 23 moves out of the cylinder 24, only a minor force needs to be applied so that
5 the user can easily open the door.

When closing the door, the pistons 23 move back into the cylinder 24 and produce an important force such that the door is damped in the zero position, respectively when
10 being closed. It is thereby guaranteed that a normal door, which travels against an abutment or a seal, will not be damaged. A double-action door is thereby prevented from opening at great momentum in the opposite direction and to swing back and forth. In this preferred embodiment, the
15 dampers 22 are filled with a fluid or with gas which, when the damper is actuated, is moved back and forth between two pressure compartments. When utilizing valves or particularly configured seals, it is achieved that in only one direction – in this case when pulling the piston 23 out of the
20 cylinder 24 – the fluid or the gas is displaced at low resistance between the pressure compartments, whereas a large resistance is generated in the other direction.

Each rotation or actuation of the door about the rotating
25 shaft 7 of the hinge 1 results in this case in an outstroke of the piston 23 out of the cylinder 24, wherein the damper 22, on account of the eccentric disposition at the rotating

shaft 7, moves out of the longitudinal axis X-X. In this embodiment, two dampers 22 are disposed vertically above each other in the bearing block 20. However, only one damper 22 or, depending on the available space, several dampers 22 may be disposed therein. As an alternative, the dampers 22 may be disposed next to each other; however, the hinge 1 would become thicker.

In this embodiment, the hinge is configured as a double-action door hinge, in which the door 11 may be opened in both directions. An arbitrary mechanical opening limitation at the rotating shaft 7 may protect the dampers 22 from being damaged. This hinge 1 may be utilized as a normal hinge for doors with an abutment, wherein, even for this application case, a mechanical opening limitation may be provided.

The rotating shaft 7 may be configured as one part or multipart. In this embodiment, the rotating shaft 7 is configured as one part, wherein the rotating shaft 7 has depressions for receiving the pistons 23. Figure 4 reveals again the gap 55 between the clamping plates 3, 4 and the bearing block 20. The rounded frontal edge of the bearing block 20 helps minimize the risk of squeezing and pinching.

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In the second embodiment according to the Figures 5, 6 and 7, a latching device is combined with the above

described damping device. A latching device in a double-action door hinge has the function of keeping the door in a predetermined opening position, e.g. at a 90° door opening angle and/or to reliably close the door and to position it in the zero position. For this purpose, the latching device has at least one cam 30, which is disposed on the rotating shaft 7 and has a counter-pressure device, for example in the shape of a roller 33, which is pressed against the cam 30 by means of a spring 36. In this embodiment, the cam 30 cooperates with a roller 33, wherein, when operating the hinge 1, the surfaces of the cam 30 and of the roller 33 roll on each other. A depression 31 is disposed in the cam 30, which depression is able to receive, at least partially, a segment of the circle of the roller 33. Furthermore, one more or several more recesses 32, which likewise cooperate with the roller 33, may be disposed on the circumference of the cam 30.

The cam 30 may be configured with the rotating shaft 7 as one part or multipart. In this embodiment, the cam 30 is configured with the rotating shaft 7 as one part, wherein the cam 30 is integrally connected to the rotating shaft 7.

The roller 33 is rotatably supported at a roller piston 34 by means of a non-illustrated bolt. The roller piston 34 in turn is disposed to be movable in axial direction in an adjusting cylinder 35. A force is acting against the roller piston 34 in

axial direction such as to press the roller 33 against the cam 30. The force may be applied by a spring 36 or hydraulically or pneumatically. In this embodiment, the roller piston 34 is configured as a pot on one side, into
5 which the spring 36 engages, at least partially, and is guided therein. In this case, the spring 36 is supported at a closure 27, which is disposed at or in the attaching plate 21 and is attached thereto.

10 In the zero position of the door, the roller 33 is located in the depression 31 of the cam 30. As the bearing block 20 is attached to a wall via the attaching plate 21, the clamping plates 3, 4 rotate together with the door about the rotating shaft 7 of the hinge 1, when opening the door. As the
15 rotating shaft 7 is disposed in a torque-proof manner within the first clamping plate 3 via the attaching means 9, the rotating shaft 7 rotates within the bearing block 20, wherein the cam 30, with its surface, rolls on the surface of the rotatably disposed roller 33. In this case, the roller 33,
20 together with the roller piston 34, is pressed against the spring 36 and leaves the depression 31 during this rotary movement. Another recess 32 may be disposed at a 90° angle with regard to the depression 31, such that the door stops at this intermediate position. This one and also
25 several latching recesses 32 may be disposed and distributed in an arbitrary number on the cam 30, depending on the intermediate positions, in which the door

is supposed to stay open. If the door is closed with momentum, the rotating shaft 7 rotates with the cam 30, until the roller 30 reaches the depression 31 again. In this case, depending on size of the spring force, the cam 30
5 with the depression 31 swings back and forth several times, wherein, in this case, the roller 33 passes the depression 31 of the cam 30, until the momentum of the spring force and of the damper 22 is more important than the remaining torque of the door.

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The one or more dampers 22 according to this second embodiment is/are essentially disposed in a damper cartridge 41, which has an abutment 42 with an abutment surface 43, wherein the abutment surface 43 cooperates
15 with a cam 40. In this embodiment, respectively one damper cartridge is disposed above and one below the latching device. However, depending on the application case, it may be possible that only one damper cartridge be disposed next to the latching device. Also the disposition of
20 the damper cartridges 41 at the rotating shaft 7 may be arbitrary. The damper cartridge 41 may receive at least one or several dampers 22, wherein, in a preferred embodiment, the cylinders 24 of the dampers are coated with or encased in plastic material. An abutment 42 is
25 connected to the pistons 23 of the dampers 22. The abutment may have a flat, convex or concave abutment surface 43, which cooperates with the surface of the cam

40. In this case, the geometry of the abutment surface 43 depends on the desired damping effect. As the dampers 22 function as closing dampers, the abutment 42 needs to be pressed against the cam 40 against the damping force.

5 This is accomplished by means of one or more springs 45, which press the abutment surface 43 against the surface of the cam 40. When closing the door, the roller 33 of the latching device latches with the depression 31 of the cam 30. So that the door does not swing back and forth all the
10 time until the kinetic energy of the door is consumed, the one or more dampers dampen the rotational movement of the door in such a way that the roller 33 of the latching device can not leave the depression 31 of the cam 30. The door therefore remains in the zero position.

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The disposition of the dampers 22 in a damper cartridge 41 is illustrated again in Figure 8. In this embodiment three dampers 22 are illustrated together with their pistons 23 and cylinders 24, which are inserted into a damper
20 cartridge 41. The connection between the abutment 42 and the dampers 22 is realized via pins 8. Springs 45, which allow the pistons 23 to travel out of the cylinders 24, are disposed between the abutment 42 and the damper cartridge 41. In this embodiment, an overload protection 44
25 is disposed at the frontal side on the abutment 42, the abutment surface 43 thereof cooperating with the cam 40. The overload protection 44 prevents the dampers 22 from

being destroyed should the door 11 be operated at too high a force. The overload protection 44 is configured in this embodiment as a leaf spring, which deforms when being overloaded.

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The disposition of the dampers 22 in a damper cartridge 41 is advantageous in that the dampers can be exchanged as a module without requiring major mounting and adjusting work. Furthermore, the damper cartridges 41 may be
10 combined according to door sizes and weights, wherein for example only one damper cartridge 41 with two dampers 22 is utilized for a small door, and a damper cartridge 41 with four dampers 22 is utilized for a large door. The hinge may thus be variably equipped for a plurality of differently
15 dimensioned doors having different weights, and moreover no skilled personnel is required.

Another embodiment of a disposition of the dampers 22 in a damper cartridge 41 is illustrated in Figure 9. This
20 embodiment shows three dampers 22 with their pistons 23 and cylinders 24 which are inserted into a damper cartridge 41. In this case again, the connection between the abutment 42 and the dampers 22 is realized via pins 8. Springs 45, which allow the pistons 23 to travel out of the
25 cylinders 24, are disposed between the abutment 42 and the damper cartridge 41. Sliders 48, which ensure low friction guidance, are disposed laterally at the abutment 42.

In this embodiment, the overload protection 44 is disposed behind the cylinder 24 between a deflector plate 46 and a closure 47. This embodiment shows an overload protection made from plastic material which deforms elastically. The
5 cylinders 24, with their bottom, bear against the deflector plate 46. The closure 47 closes the damper cartridge 41. The abutment 42 mounted with the dampers 22 combined in the damper cartridge 41 results in a complete damper magazine 49, which, in different configurations, can be
10 inserted into a hinge 1.

The hinge 1 according to Figure 10 is pivoted by 90° to the side such that the frontal side of an angular bearing block 20 becomes visible. Once the cover cap 29 is removed,
15 which in this embodiment encloses the bearing block in a U-shape on three sides, a cover 51 can be dismounted, behind which the at least one damper insert 50 is visible. This damper insert 50 is configured as an opening for inserting, respectively for removing a complete damper
20 magazine 49. Thus, the hinge can be equipped with different dampers by a few manipulations such that an exchange of damaged dampers or an adaptation to different requirements is possible without any skilled personnel.

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As the bearing block 20 has an angular contour in this embodiment, the risk of injury is given during a rotational

movement if for example a finger gets into the gap 55 between the bearing block 20 and the leaf hinge portion 2. In order to cover the gap 55, the gap 55 is covered by an abutment 52, which according to Figure 11 essentially consists of a support 53 and a buffer 54. The buffer 54 has an acute angle made from elastic material and is disposed with its tip oriented towards the bearing block 20. The gap 55 is thereby closed such as to avoid reaching into it. The geometrical configuration of the buffer 54 and its elastic behavior result in a visually completely closed hinge surface. In this case, the abutment 52 may consist of a composite material, wherein the support 53 may consist of hard material such as plastic material or metal, and the buffer 54 of soft material, such a rubber or plastic material.

List of Reference Numerals

	1	hinge
	2	leaf hinge portion
5	3	first clamping plate
	4	second clamping plate
	5	fastening means
	6	sealing and/or damping plates
	7	rotating shaft
10	7a	tenon
	8	pin
	9	closure
	10	joint hinge
	11	door
15	12	wall
	20	bearing block
	21	attaching plate
	22	damper
20	23	piston
	24	cylinder
	25	damper reception
	27	closure
	29	cover cap
25		
	30	cam
	31	depression
	32	recess
	33	roller
30	34	roller piston
	35	adjusting cylinder

	36	spring
	40	cam
	41	damper cartridge
5	42	abutment
	43	abutment surface
	44	overload protection
	45	return spring
	46	deflector plate
10	47	closure
	48	damper magazine
	50	damper insert
	51	cover
15	52	abutment
	53	support
	54	buffer
	55	gap
20	X-X	longitudinal axis of the joint hinge

Patent claims

1. A rotatably supported door (11) including a hinge (1) comprising a stationary hinge portion, a leaf hinge portion (2) which is pivotable about the stationary hinge portion, and a rotating shaft (7) passing through the stationary hinge portion and the leaf hinge portion (2), **characterized in that** the rotating shaft (7) cooperates with an opening and/or closing damping device.
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2. The rotatably supported door (11) according to claim 1, **characterized in that** the hinge has a hold-open and/or hold-closed function.
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3. The rotatably supported door (11) according to claim 1, **characterized in that** the door (11) is rotatably supported with one or more joint hinges (10).
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4. The rotatably supported door (11) according to claim 1 to 3, **characterized in that** the hinges (1, 10) are configured as double-action hinges.
- 25 5. A hinge for a rotatably supported door (11) according to claim 1, comprising a stationary hinge portion, a leaf hinge portion (2) which is

pivotable about the stationary hinge portion, and a rotating shaft (7) passing through the stationary hinge portion and the leaf hinge portion (2), **characterized in that** the rotating shaft (7) cooperates with an opening and/or closing damping device.

6. The hinge for a rotatably supported door (11) according to claim 5, **characterized in that** the opening and/or closing damping device is configured by at least one damper (22) which cooperates with the rotating shaft (7).

7. The hinge for a rotatably supported door (11) according to claim 6, **characterized in that** the damper (22) has a piston (23), which, within a cylinder (24), moves a fluid or a gas between two pressure compartments.

8. The hinge for a rotatably supported door (11) according to claim 6, **characterized in that** the damper (22) is disposed eccentrically at the rotating shaft (7).

9. The hinge for a rotatably supported door (11) according to claim 8, **characterized in that** one end of the damper (22) is disposed eccentrically

and articulately at the rotating shaft (7) and the other end is articulately attached to the stationary hinge respectively therein.

5 10. The hinge for a rotatably supported door (11) according to claim 6, **characterized in that** the one or more dampers (22) is/are disposed within a damper cartridge (41).

10 11. The hinge for a rotatably supported door (11) according to claim 10, **characterized in that** the damper cartridge (41) has an abutment (42), which cooperates with the rotating shaft (7).

15 12. The hinge for a rotatably supported door (11) according to claim 11, **characterized in that** the abutment (42) cooperates with a cam (40), which is disposed on the rotating shaft (7).

20 13. The hinge for a rotatably supported door (11) according to claim 12, **characterized in that** the abutment (42) has a flat, convex or concave abutment surface (43).

25 14. The hinge for a rotatably supported door (11) according to claim 12, **characterized in that** the abutment (42) is pressed against the cam (40).

15. The hinge for a rotatably supported door (11) according to claim 5, **characterized in that** the hold-open function and the hold-closed function are generated by a latching device disposed at the rotating shaft (7).
16. The hinge for a rotatably supported door (11) according to claim 15, **characterized in that** the latching device is configured by a cam (30) with a depression (31), which cam is disposed at the rotating shaft (7) and cooperates with a force-loaded roller (33).
17. The hinge for a rotatably supported door (11) according to claim 15, **characterized in that** the opening damping device and the closing damping device are disposed above and/or below the latching device at the rotating shaft (7).
18. The hinge for a rotatably supported door (11) according to claim 11, **characterized in that** an overload protection (44) is disposed at the abutment (42).
19. The hinge for a rotatably supported door (11) according to claim 18, characterized in that the

overload protection (44) is configured as a leaf spring or as a plastic material component.