Abstract: The present invention relates to a storage (1) for storing bicycles (10), comprising multiple, adjacent, vertically extending bicycle storage columns (2), that comprise bicycle storage spaces (5) situated above each other, wherein these bicycle storage spaces (5) each comprise an enclosure (6) that is suitable for protecting a stored bicycle (10), wherein these columns (2) at least comprise an overground part (3) and a protective casing for protecting the overground part (3) of the bicycle storage columns (2), wherein the bicycle storage columns (2) are accessible through an access opening (11) in the casing, and a transportation system to move the bicycle storage spaces (5) from a first level of a column (2) to a second level of the same column (2), or a further column (2), characterized in that multiple of these overground column parts (3) are simultaneously accessible through multiple access openings (11) in the casing for placing a bicycle (10) in a bicycle storage space (5), or taking a bicycle (10) out therefrom.
Storage for storing bicycles

The present invention relates to a storage for storing bicycles, comprising multiple, adjacent, vertically extending bicycle storage columns, that comprise bicycle storage spaces situated above each other, wherein these bicycle storage spaces each comprise an enclosure that is suitable for protecting a stored bicycle, wherein these columns at least comprise an overground part and a protective casing for protecting the overground part of the bicycle storage columns, wherein the bicycle storage columns are accessible through an access opening in the casing, and a transportation system to move the bicycle storage spaces from a first level of a column to a second level of the same column, or a further column.

In the publication WO2010/114080 an underground storage for bicycles is described. This known bicycle storage has an underground, vertically extending cylindrical storage shaft, wherein an elevator system, that is also vertical, extends along the central axis of the cylindrical storage shaft. The bicycles are automatically stored underground in a radial fashion, between the elevator system and the inner wall of the storage shaft, in multiple storage layers. Overground, the elevator system has a single entry for placing a bicycle in the elevator system for storage in the underground storage shaft, or for taking out the bicycle from that bicycle storage shaft.

A disadvantage of the known bicycle storage is, however, that there is merely one overground entry for storing or for taking out a bicycle from the underground bicycle storage. Especially during busy moments, such as during rush hour, or, when at a train station a large group of people leave a train that has just arrived, that single entry is not sufficient to provide this group of people quick access to their bicycle. Additionally, this also holds for storing the bicycle, wherein that single entry is not sufficient for allowing people to store their bicycle in a short time span.

A further disadvantage of the known bicycle storage is that the storage mechanism comes into direct contact with the bicycle, which is cumbersome and prone to malfunction.

An object of the invention is to provide a storage for the underground storage of bicycles that allows a relatively large group of people to store their bicycle in the underground storage, or to take it out there from, simultaneously. A further object of the invention is to prevent the carrying out of direct mechanical actions on the bicycle.
Hereto the bicycle storage according to the invention is characterized in that multiple of these overground column parts are simultaneously accessible through multiple access openings in the casing for placing a bicycle in a bicycle storage space, or taking a bicycle out there from.

By using multiple overground bicycle storage columns, that are simultaneously accessible through multiple access openings in the casing, it is achieved that a relatively large group of people can simultaneously utilize the underground storage facility. By providing bicycle storage spaces that furthermore comprise a sealable enclosure, actions relating to transportation can be carried out on the bicycle storage space and not on the bicycle itself. Furthermore, the use of individually sealable enclosures allow a user to store further items, such as baggage, in the enclosure and thus use it as a locker. Preferably, use is made of a single transportation system for accessing all the bicycle storage columns in a casing.

An embodiment relates to a storage, wherein at least one of the bicycle storage columns also comprises an underground part, situated below ground level, for storing bicycles. Thus, in areas wherein little space is available, a storage having a relatively large storing capacity can still be realized.

An embodiment relates to a storage, wherein the transportation system comprises two adjacent bicycle storage columns, that are part of a pater noster elevator system. Such an elevator system provides a continuous inflow and outflow of bicycle storage spaces, such that the accessibility of the storage is further increased. Preferably, the time of operation or the speed of the elevator system can be adjusted by means of adjustment means suitable therefor. To facilitate storage and removal of the bicycle from the concerned bicycle storage space, the elevator system is preferably to be halted temporarily.

A further embodiment relates to a storage wherein one or more bicycle storage spaces are provided with a charging point for electrical bicycles. When storing the bicycle in an accessible bicycle storage space, such a bicycle can be immediately connected to a charging point present in the bicycle storage space, such that, when the bicycle is removed from that storage at a later time, it has a fully charged battery.

Another embodiment relates to a storage wherein one or more bicycle storage spaces are provided with identification means for identifying the person desiring to store his bicycle in the bicycle storage space, or to remove it therefrom. Especially
during rush hour, the speed of accessing a stored bicycle can be increased and improper
access to the bicycle storage space is prevented.

A further advantageous embodiment relates to a storage wherein the overground parts of the bicycle storage columns at all times comprise at least one empty bicycle storage space. In this way, a person desiring to store his or her bicycle has quick access to an empty bicycle storage space.

In addition thereto, one or more bicycle storage spaces can be provided with a presence sensor for determining the presence of a bicycle in those one or more bicycle storage spaces. In this way, it can be determined relatively easily if the bicycle storage space concerned is already occupied, which facilitates efficient use of the bicycle storage space.

Preferably, the bicycle storage spaces are provided with supporting means for supporting a bicycle in the bicycle storage space.

It is also advantageous to provide guiding means for guiding the bicycle into and out of the bicycle storage space.

Another embodiment relates to a storage, wherein the casing comprises the overground column parts as well the underground column parts of multiple adjacent bicycle storage columns. Thus a single casing can be used to protect both the overground as well as the underground column parts, for instance against severe weather conditions in case of the overground parts, or ground water in case of the underground column parts.

Another embodiment relates to a storage, wherein an upper wall of the casing is constructed to serve as a platform of a train station or subway station. In this manner use of space in cramped areas, such as at a train station, subway station, bus station, or similar transportation facility is further optimized. The major part of the storage will then be arranged underground.

Another embodiment relates to a storage, wherein the transportation system to move the bicycle storage spaces from the first level to the second level is suspended from an upper wall, such as a ceiling, of the casing. Especially when using the storage mainly as an underground storage, and the ceiling or upper wall of the casing is close to ground level, maintenance of the transportation system is simplified due to better accessibility.
Another embodiment relates to a storage, wherein the transportation system, instead of a paternoster elevator system, comprises a vertically movable platform for transporting a bicycle storage space from the first level to the second level. Such a system is mechanically reliable and allows for relatively long maintenance intervals.

Another embodiment relates to a storage, wherein the vertically movable platform is configured for transporting at least two horizontally adjacent bicycle storage spaces at the same time. Thus, storage speed and access speed is greatly increased.

Another embodiment relates to a storage, wherein the access opening comprises an indicator indicating the availability of a bicycle storage space in the respective bicycle storage column. Thus, a user can quickly see whether the access opening can be used for storing a bicycle.

Another embodiment relates to a storage, wherein the indicator comprises a light emitting device that emits green light when a bicycle storage space in the respective bicycle storage column is available and red light when no bicycle storage space is available in the respective bicycle storage column. Due to the use of red and green colors a user will quickly and intuitively recognize the availability of an access opening for storing his or her bicycle. Preferably, a LED is used as the light emitting device.

Another embodiment relates to a storage, wherein the storage is arranged in a previously unoccupied, unused or deserted building. Thus, such buildings are put to good use again, instead of being merely destined for deterioration or destruction.

Another embodiment relates to a storage, wherein the access opening is configured to be operated by means of a software program on a smart phone. Thus, a user can easily access the access opening, for instance by means of a software program in the form of a so-called 'app'.

Another embodiment relates to a storage, wherein the ratio between the amount of bicycle storage spaces in a casing and the amount of access openings in the casing lies between 20:1 and 5:1, preferably lies between 15:1 and 5:1, most preferably is around 10:1. The inventor has had the inventive insight that the best balance between simultaneous accessibility and storage capacity in a casing is achieved by using the above ratios.

In a general sense, the use of the mentioned bicycle storage spaces, especially a bicycle storage space embodied as a box or container, offers the advantage of making handling during storage easier and therefore less prone to malfunction.
Embodiments of a bicycle storage according to the invention will be described in detail with reference to the accompanying drawings, by way of non-limiting example. In the drawings:

Figure 1 schematically shows a perspective view of an embodiment of the bicycle storage according to the invention,

Figure 2 shows a front view of the overground parts of an exemplary embodiment of the bicycle storage,

Figure 3 shows a schematic cross-section in side view of a further embodiment of the bicycle storage,

Figure 4 shows a schematic cross-section in side view of a bicycle storage wherein a pater noster elevator system is used,

Figures 5a and 5b show a schematic cross-section in side view and top view, respectively, of an exemplary embodiment of a bicycle storage space, such as suitable for the bicycle storage,

Figure 6 shows an embodiment of the storage incorporated in the construction of a train station 14, and

Figure 7 shows a top view of a possible arrangement of bicycle storage spaces in a casing.

Figure 1 schematically shows a bicycle storage 1 having multiple adjacent bicycle storage columns 2. Each column 2 comprises multiple bicycle storage spaces 5. In figure 1 each column 2 comprises, by means of example, six bicycle storage spaces 5 situated above each other in the Z-direction as shown. In the exemplary embodiment a row of eleven columns 2 is arranged in the X-direction as shown. In the Y-direction as shown four columns 2 are provided, by means of example. The bicycle storage spaces 5 each have an enclosure 6, that can be individually sealable, in the form of an elongated box which protects the bicycle storage space 5 against, for instance, rain. The box-shaped bicycle storage spaces 5 extend substantially in the Y-direction in this example. The box-shaped bicycle storage spaces 5 can furthermore be provided with sealing means (not shown) in order to make one, or both, ends of a bicycle storage space 5 sealable and are provided with means for supporting the bicycle in the bicycle storage space 5. Besides, the bicycle storage spaces 5 are provided with means for guiding the bicycle into and out of the bicycle storage space 5. The enclosure 6 of such a box-
shaped bicycle storage space 5 can, by means of example, when viewed in the Y-
direction, have a height of 1.35 m, a width of 0.85 m and a depth of 2 m.

The bicycle storage columns 2 have an overground part 3 and an underground
part 4. The underground part 4 primarily serves the purpose of storing bicycles. The
distinction between the overground part 4 and the underground part 3, i.e. ground level,
is indicated by reference numeral 8. The underground part 4 is protected by a casing 7,
in this example made of concrete. This casing 7 protects the underground part of the
bicycle storage columns 2 against, for instance, ground water. The overground part 3
provides access to the respective bicycle storage column 2, but can also be used for
storing bicycles if desired. The casing 7 can also comprise the overground parts 3. A
single casing 7 may be formed comprising a group of adjacent, if not all, of the bicycle
storage columns 2, comprising the overground parts 3 as well as the underground parts
4, if applicable. The dimensions of the casing 7 are schematically indicated by Lb (length), Bb (width), Hbl (height) and can for example amount to 14 m, 9 m and 7 m.

Empty bicycle storage spaces 5 can be accessed by, for example, providing an access
opening, such as a door, in the overground part of the casing 7 at the position of the
respective empty bicycle storage space 5.

Because of the fact that the bicycle storage columns 2 as shown are simultaneously accessible from the overground by multiple access opening, a relatively
large group of people can have access to the bicycle storage spaces 5 in the columns 2
simultaneously. The overground parts 3 of the bicycle storage columns 2 as shown each
have two bicycle storage spaces 5 situated above each other, such that if desired also
the overground parts 3 can be used for storing bicycles. The bicycle storage 1 can
furthermore be provided with identification means (not shown) for allowing quick
identification of somebody desiring access to the bicycle column 2. Two or more
adjacent bicycle storage columns 2 can optionally be part of a pater noster elevator
system (not shown), which further improves efficient operation of the bicycle storage 1.
Besides, an individual bicycle storage space 5 can be provided with a charging point for
electrical bicycles, such that such a bicycle can be charged during storage.

Figure 2 shows a front view of the overground parts of another embodiment of
the bicycle storage 1, wherein the bicycle storage spaces 5, which are grouped in
groups of six horizontally adjacent bicycle storage spaces 5, accessible from the
overground, are simultaneously accessible to the persons 9, as shown, with bicycle via
access openings in the form of doors 11. By the way, the bicycle is indicated by reference numeral 10.

Figure 3 shows a schematic cross-section in side view of a further embodiment of the bicycle storage 1. Between the two bicycle storage columns 2 a vertical transport part is situated serving the purpose of moving bicycle storage spaces 5 between the overground parts 3 and the underground parts 4 of the bicycle storage columns 2. The transport part can for example comprise a cable elevator. The dimensions, as shown, H1 (in this embodiment being the height of the access building as shown) and Hb2 (in this embodiment being the height of the casing 7 as shown) can by means of example amount to respectively 3.6 m and 8.75 m.

Figure 4 shows a schematic cross-section in side view of a bicycle storage 1, wherein use is made of a pater noster elevator system. It can be seen that above ground level 8, in the overground parts 3, time and time again an empty bicycle storage space 5 is accessible to the person 9 with bicycle. In this exemplary embodiment the height of the access building amounts to 3.9 m. Of course, other elevator systems are conceivable (such as the one shown in figure 6).

Figures 5a and 5b show a schematic cross-section, respectively, in side view and top view of an exemplary embodiment of a bicycle storage space 5 such as applicable in the bicycle storage 1. The height Hf of such a bicycle storage space 5 for example amounts to 1350 mm, but may vary. The length Lf and width Bf of the bicycle storage space 5 in this exemplary embodiment amount to respectively 2000 mm and 850 mm. These lengths may also vary.

Figure 6 shows an embodiment of the storage 1 incorporated in the construction of a train station 14. Advantageously, an upper wall 12 of the casing 7 therein is used as a platform 15. The storage of bicycles mainly happens underground, in the underground parts 4. An elevator system 13 is suspended from the upper wall 12 comprising a vertically movable platform or tray for moving bikes from a first storage level to a second storage level. Furthermore, the elevator system 13 is preferably capable of moving in a horizontal direction, i.e. in the direction perpendicular to the plane of the paper, along for instance guide rails or tracks. Advantageously, the storage 1 can also be incorporated in a deserted building, as to put it to good use again.

Figure 7 shows a top view of a possible arrangement of bicycle storage spaces 5 in a casing 7. For example, per casing 7 and per layer or level, two times nine opposing
bicycle storage spaces 5 can be used. The elevator system then is arranged between the opposing bicycle storage spaces 5 (not shown). The platform of the elevator system can be configured to be capable of moving multiple horizontally adjacent bicycle storage spaces 5 at the same time from the first level to the second level, such as two, three or more.

Thus, the invention has been described by reference to the embodiments discussed above. It will be recognized that these embodiments are susceptible to various modifications and alternative forms well known to those of skill in the art without departing from the spirit and scope of the invention. Accordingly, although specific embodiments have been described, these are examples only and are not limiting upon the scope of the invention.
List of reference numerals

1. Underground bicycle storage
2. Bicycle storage column
3. Overground part of bicycle storage column
4. Underground part of bicycle storage column
5. Bicycle storage space
6. Enclosure of bicycle storage space
7. Protective casing
8. Ground level
9. Person with bicycle
10. Bicycle
11. Access door
12. Casing upper wall
13. Elevator system
14. Train station
15. Platform
Claims

1. Storage (1) for storing bicycles, comprising multiple, adjacent, vertically extending bicycle storage columns (2), that comprise bicycle storage spaces (5) situated above each other, wherein these bicycle storage spaces (5) each comprise an enclosure (6) that is suitable for protecting a stored bicycle, wherein these columns (2) at least comprise an overground part (3) and a protective casing (7) for protecting the overground part (3) of the bicycle storage columns (2), wherein the bicycle storage columns (2) are accessible through an access opening in the casing (7), and a transportation system to move the bicycle storage spaces (5) from a first level of a column (2) to a second level of the same column (2), or a further column (2), characterized in that multiple of these overground column parts (3) are simultaneously accessible through multiple access openings (11) in the casing (7) for placing a bicycle in a bicycle storage space (5), or taking a bicycle out there from.

2. Storage (1) according to claim 1, wherein at least one of the bicycle storage columns (2) also comprises an underground part (4), situated below ground level (8), for storing bicycles.

3. Storage (1) according to claim 1 or 2, wherein the transportation system comprises two adjacent bicycle storage columns (2), that are part of a pater noster elevator system.

4. Storage (1) according to any of the preceding claims, wherein one or more bicycle storage spaces (5) are provided with a charging point for electrical bicycles.

5. Storage (1) according to any of the preceding claims, wherein one or more bicycle storage spaces (5) are provided with identification means for identifying the person desiring to store his bicycle in the bicycle storage space (5), or to remove it there from.
6. Storage (1) according to any of the preceding claims, wherein the overground parts (3) of the bicycle storage columns (2) at all times comprise at least one empty bicycle storage space (5).

7. Storage (1) according to any of the preceding claims, wherein one or more bicycle storage spaces (5) are provided with a presence sensor for determining the presence of a bicycle in those one or more bicycle storage spaces (5).

8. Storage (1) according to any of the preceding claims, wherein the bicycle storage spaces (5) are provided with supporting means for supporting a bicycle in the bicycle storage space (5).

9. Storage (1) according to any of the preceding claims, wherein the bicycle storage spaces (5) are provided with guiding means for guiding the bicycle into and out of the bicycle storage space (5).

10. Storage (1) according to any of the claims 2-9, wherein the casing (7) comprises the overground column parts (3) as well the underground column parts (4) of multiple adjacent bicycle storage columns (2).

11. Storage (1) according to claim 10, wherein an upper wall (12) of the casing (7) is constructed to serve as a platform (15) of a train station (14), subway station, bus station or similar transportation facility.

12. Storage (1) according to any of the preceding claims, wherein the transportation system to move the bicycle storage spaces (5) from the first level to the second level is suspended from an upper wall (12) of the casing (7).

13. Storage (1) according to claim 12, wherein the transportation system, instead of a pater noster elevator system, comprises a vertically movable platform (13) for transporting a bicycle storage space (5) from the first level to the second level.
14. Storage (1) according to claim 13, wherein the vertically movable platform is configured for transporting at least two horizontally adjacent bicycle storage spaces (5) at the same time.

15. Storage (1) according to any of the preceding claims, wherein the access opening (11) comprises an indicator indicating the availability of a bicycle storage space (5) in the respective bicycle storage column (2).

16. Storage (1) according to claim 15, wherein the indicator comprises a light emitting device that emits green light when a bicycle storage space (5) in the respective bicycle storage column (2) is available and red light when no bicycle storage space (5) is available in the respective bicycle storage column (2).

17. Storage (1) according to any of the preceding claims, wherein the storage (1) is arranged in a previously unoccupied, unused or deserted building.

18. Storage (1) according to any of the preceding claims, wherein the access opening (11) is configured to be operated by means of a software program on a smart phone.

19. Storage (1) according to any of the preceding claims, wherein the ratio between the amount of bicycle storage spaces (5) in a casing (7) and the amount of access openings in the casing (7) lies between 20:1 and 5:1, preferably lies between 15:1 and 5:1, most preferably is around 10:1.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. B62H3/00 EO4H6/00 E04H6/14 E04H6/18

ADD.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B62H E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X Further documents are listed in the continuation of Box C. X See patent family annex.

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Date of the actual completion of the international search
17 October 2013

Date of mailing of the international search report
24/10/2013

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NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

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