Response Letter

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Dear EPO
This letter is in response to the communication under Art 94(3) and R 71(1) EPC. We enclose a set of amended claims to replace all claims currently on file, and request grant of the patent on the basis of these amended claims.

Amendments (Art 123(2) EPC)

Claim 1

Claim 1 has been ameded to incorporate the subject-matter of claim 6. Claim 6, which claims the serial reading function, is as filed dependent on claim 5, which claims the variant with consecutive magnets of different polarities. However, this amendment represents an allowable intermediate generalisation in accordance with GL H-V 3.2.1, because there is no structural or functional relationship between these features. The features of claim 6 permit a serial reading function to be performed, which allows fewer magnetic field detectors to be used, as explained in paragraphs [18]-[19] of the application. By contrast, the features of claim 5 allow magnets in neighboring disks to be placed closer together, thereby permitting minaturisation of the key, as explained by paragraph para [16] of the application. Paragraph [16] also explains that the use of consecutive magnets of different polarities is a "further variant", i.e. it is not essential.
Furthermore, , the overall disclosure justifies the generalising isolation of the features of claim 6 from claim 5 and their isolation into claim 1. This is stated explicitly in paragraph [20] of the application:
[020] All the methods and variants described above can of course be used independently or in combination according to the needs of the locking system. For instance, it is advantageous to combine the serial reading function together with a further variant having consecutive magnets of different polarities. This is however not necessary and both variant and serial reading function could be implemented independently of each other.
Hence, this amendment has basis in the application as filed and does not contravene Art 123(2) EPC.
Claim 1 has been placed into two-part form in relation to D3, first embodiment, which as discussed below is considered the closest prior art.

Claim 7

Claim 7 (now numbered claim 6) has been amended to incorporate the subject-matter of claim 11. Claim 11, which claims the serial reading function, is as filed dependent on claim 10, which claims the variant with magnets of differing strengths.
However, as with claim 1 this amendment also represents an allowable intermediate generalisation in accordance with GL H-V 3.2.1, because there is no structural or functional

relationship between the features of claim 10 and those of claim 11. The function of the features of claim 10 is given in para [024] of the application as filed, which explains that the use of different strengths makes it more difficult to illegally reproduce the keycard. This is not functionally linked with the function of the serial reading functionality provided by the features of claim 11.
Furthermore, the overall disclosure justifies the generalising isolation of the features of claim 11 from claim 10 and their isolation into claim 7. This is stated explicitly in paragraph [25] of the application:
[025] As a final variant, it is also possible to implement a serial reading function of the magnet combination as has been explained above in connection with the key of the first main embodiment. All the possibilities envisaged above for the second main embodiment can of course be used independently or together.
Hence, this amendment has basis in the application as filed and does not contravene Art 123(2) EPC.
Claim 7 has also been amended to recite "at least one magnetic field detector" rather than "at least one Hall effect transducer". This constitutes a broadening of a feature in an independent claim. However, this amendment has basis in accordance with Art 123(2) and GL H-V 3.1. Basis for this amendment may be found in para [10] of the application as filed, which explains that
"*It is furthermore noted that although the example described above uses a Hall-effect sensor to detect magnetic fields, it is also possible in the present invention to use any other suitable type of magnetic field sensor.*"
It is clear from this passage that the use of Hall effect transducers is not explained as essential in the application as filed (indeed, quite the opposite). Moreover, the skilled person would recognise that Hall effect transducers are not indespensible for the function of the invention in view of the objective technical problem discussed below. Finally, the skilled person would recognise that the replacement of Hall effect transducers with any other suitable magnetic field sensor would require no real modification of other features of the claim, other potentially than minor and conventional changes to the processing circuit connected to the sensors.

Claim 7 has been placed into two-part form in relation to D2, which as discussed below is considered the closest prior art.
Claim 11

Claim 11 has been amended to recite "~~substantially~~ differs in strength by at least 20%". Basis for this amendment may be found in paragraph [024], which recites "The expression "substantially different" should be understood in the present context as meaning that the magnetic field strengths differ by at least 20% in order that the transducer can reliably distinguish the different strengths"
Claims 6 and 11 have been deleted. Claims 2-5, and 8-10 are as previously presented, except

that their dependencies have been updated.

Unity (Art 82 EPC)

The communication suggested that claims 5 and 10 on file are not unified. We submit that the amended claims are unitary in accordance with Art 82 EPC and R 44 EPC. In particular, the amended claims all share a special technical technical feature making a contribution over the prior art, in accordance with R44(1).

Amended independent claims 1 and 6 have both been amended to recite that the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key/keycard is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors. As will be shown below in relation to novelty and inventive step, this feature is novel over each of D1-D3 and provides a technical effect supporting an inventive step. Hence, this feature is a "special technical feature" in the sense of R44(1). Since all amended claims are dependent either on claim 1 or claim 6, all claims share this special technical feature and are unified as a single inventive concept in accordance with Art 82 EPC.

While no objection under R43(2) has been raised, it is noted for completeness that the independent claims satisfy the requirements of R43(2) because they are a plurality of interrelated products in accordance with R43(2)(a).

Clarity (Art 84 EPC)

We submit that the amended claims are clear and concise asr required by Art 84 EPC.

The term "substantially" in claim 10 was objected to as being vague and undefined. This term has been replaced by a clear and objective statement of "at least 20%".

The inconsistency between claims 7 and 11 in terms of "Hall effect transducer" and "magnetic field detector" has been resolved by amending claim 7 (now numbered claim 6) to also use the language "magnetic field detector", thereby making this claim consistent with claim 11 (now numbered claim 10).

Novelty (Art 54 EPC)

The amended claims are novel over each of the prior art documents D1-D3.

Claim 1

D1 discloses an elongate key comprising one (or more, D1 para [03]) magnets and a magnetic field detector for sensing the magnet. However, unlike amended claim 1 D1 does not disclose that there are fewer magnetic field detectors than magnets. Instead, D1 para [03] states that where there are several magnets, "Several detectors are then used in correspondence with these magnets", suggesting that there is at least one detector per magnet. Nor does D1 disclose that the the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic fielddetectors. D1 para [03] instead

discloses that each of the detectors sends respective signals to the processing circuit for validation, i.e. parallel reading rather than serial reading. In addition, D1 does not disclose a plurality of magnets spaced axially apart. Rather, D3 merely suggests arranging magnets "about the axis", i.e. circumferentially apart, in different recesses.

D2 discloses a keycard including magnets, rather than an elongate key as recited by amended claim 1. In addition, D2 does not disclose that there are fewer magnetic field detectors than magnets. In fact, D2 discloses that there is a magnetic sensor 14 for each recess in the keycard (D2[03]), and also that the recesses may or may not contain a magnet (D2[02]). Hence, D2 actually discloses that there may be the same or fewer magnets than magnetic sensors, but not vice-versa. In addition, D2 does not disclose that the the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic fielddetectors. D2 para [03] instead discloses that each of the magnetic sensors generates a signal and passes the signal to a processing circuit 15, which generates a code corresponding to the polarity or absence of a magnet in each recess of the keycard. I.e. as with D1, D2 discloses parallel reading of the magnets rather than serial reading.

D3 discloses, in a first embodiment, a contactless pushbutton 1, and in a second embodiment, a rotary switch. Neither of these embodiments anticipate amended claim 1. In the first embodiment, paragraph [4] of D3 mentions that:

"In another alternative embodiment (not shown in the figures), it is also possible to use several transducers 15 and one magnet along the axis 8 so that the transducers can detect several positions of the push-button. Similarly, it is possible to use several magnets and one transducer along the axis 8. Such alternative arrangements make it possible to detect whether the push-button is in an open position, a closed position or any intermediate position"

While this paragraph mentions that there may be fewer transducers (i.e. one) than magnets (i.e. several), it does not directly and unambiguously disclose that the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors. Instead, the transducer simply detects which magnet is closest, allowing the circuit to determine the position of the push-button. It is not necessary to serially read the magnets as they go past the transducer in order to perform this function, merely to read whichever magnet is closest and discard any previous information.

The second embodiment of D3 also does not disclose that the the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors. The second embodiment of D3 features more magnets (7) than detectors (3), as shown in Figs 2 and 3 of D3. However, as with the first embodiment the intention is only to read the final position of the rotary switch. Paragraph [08] of D3 states that "the new position of the disc 100 (and therefore of the rotary switch) can be determined by the microprocessor 25 based on the combination of signals detected." Since the position of the switch is determined solely by the combination of magnets sensed by the transducers, it is serial

reading of magnets as they pass by one of the transducers is unnecessary. Hence, D1 does not explicitly or implicitly teach the features of amended claim 1. Furthermore, the magnets in the second embodiment of D3 are not spaced axially apart in the housing as claimed, but rather disposed circumferentially apart on one distal end of the rotary switch.

Claim 6

Amended claim 6 is also novel over each of D1-D3.

Like amended claim 1, amended claim 6 also recites that there are fewer magnetic field detectors than magnets and that the processing circuit is configured to implement a serial reading of said detectors' electric signals as the keycard (in the case of claim 6, rather than the key) is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors. Amended claim 6 is therefore novel over each of D1-D3 for the same reasons as amended claim 1.

In addition, while D2 does disclose a keycard in accordance with amended claim 6, D1 and D3 do not. In D1, the key is an elongate key rather than a keycard. In D3, the "key" is either a push-button (in the first embodiment) or a rotary switch (in the second embodiment). Other embodiments are mentioned, such as a lever or key-operated rotary switch, but there is no direct and unambiguous disclosure in D3 of anything which could be called a keycard.

The remaining claims all depend directly or indirectly from one of the claims discussed above. Therefore, they too are novel for the same reasons (GL F-IV 3.4)

Inventive Step

The claimed invention provides an inventive step in accordance with Art 56 EPC as demonstrated by following the problem-and-solution approach set out in EPO GL G-VII.

Claim 1

Purpose

The purpose of claim 1 is to provide a locking system, specifically to provide a locking system with a serial reading functionality which allows the complexity and cost of the system to be reduced.

Closest Prior Art

The closest prior art is taken to be one of the embodiments of D3, because per T606/89 and GL G-VII 5.1, it is that combination of featyures which, disclosed in a single reference, constitute the most promising starting point for a obvious development leading to the claimed invention.

D3 is directed towards a similar purpose of providing a switching device which can be used to stop/lock a vehicle or apparatus (D3[01]), i.e. a locking system. D3 is therefore within the same technical field as claim 1 and directed towards a broadly similar purpose. D1 and D2 are also directed towards locking systems, i.e. they are also in the same technical field.

D2 cannot be considered the closest prior art for amended claim 1 because it is directed

towards a keycard system, rather than a system involving an elongate key.
Between D3 and D1, D3 requires the minimum of structural and functional modifications to arrive at the claimed invention (per T606/89). In particular, the embodiment mentioned in D3 para [04] in which there are several magnets arranged along the axis 8 and a single transducer would require the fewest structural modifications, because the transducer and processor 25 could conceivably be modified to provide a serial reading functionality. By contrast, D1 does not disclose arranging magnets axially apart and therefore there is no way to modify D1 to perform serial reading without significant modifications to the design of the key and opening.
Differences

The difference between amended claim 1 and this embodiment of D3 is that D3 does not disclose that the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors.
The technical effect of this difference is explained by paragraphs [17]-[19] of the application as filed. By spacing the magnets axially along the elongate key, the magnetic field detector can be a configured to detect the presence of the magnets which are downstream along that row, as well as their polarity, while the key is being introduced into the passage. This produces a series of electrical signals which are analysed by the processing circuit and compared with the expected series corresponding to the lock system. As a result, it is not necessary to use other magnetic field detectors along the same row and so the number of magnetic field detectors in the locking system can be reduced.
Magnetic field detectors are more expensive and complex to manufacture than permanent magnets, because each magnetic field detector is an electric or electronic component whereas the permanent magnets may simply be a piece of ferrous material. In addition, each magnetic field detector must be electrically connected to the electronic circuit means, which must be powerful and fast enough to read all magnetic field detectors connected to it simaltaneously. By contrast, the series of electrical signals received in serial reading will arrive at intervals spaced significantly apart in time (when measured at even simple electronic clock speeds). By using a serial reading system, the complexity of manufacturing the components for the locking system and assembling them together is reduced. The processing demands on the electronic circuit means may also be reduced, allowing a simpler processor to be used.
Hence, the objective technical problem may be formulated as how to modify the system of D3 to provide a simpler and easier to manufacture locking system. This objective technical problem is clearly supported by paragraphs [17]-[19] of the application as filed.
Task of the skilled person

Starting from D3 as the closest prior art, it would not be obvious for the skilled persn to solve the objective technical problem and arrive at the claimed invention, even in view of the other prior art documents.

D3 alone

As previously discussed, D3 does not disclose that the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors. Nor is there any teaching in D3 to modify the system of D3 to implement serial reading. Serial reading is not mentioned in any other embodiment of D3. Nor would serial reading offer any advantages for the system of D3, since as previously discussed serial reading is unneccessary for performing the task of measuring the position of the push-button. Furthermore, there is no suggestion that serial reading is a technique forming part of the CGK of the skilled person. Therefore, the skilled person would not even conceive of modifying D3 in order to perform serial reading.

Nor is reducing the number of magnetic field detectors in D3 disclosed as providing any advantages. D3 paragraph [04] explains that there may be more several magnets and one transducer, or similarly, that there may be multiple transducers and one magnet. These are presented as equally valid alternatives for detecting the position of the push-button. Hence, D3 provides no teaching that reducing the number of magnetic field detectors is any more or less desirable than reducing the number of magnets.

D3 in view of D1

D1 does not remedy the deficiencies of D3. D1 also does not mention serial reading as a possible technique. Moreover, D1 suggests in D1[03] that security may be improved by increasing the number of magnets and using different polarities, and using a corresponding detector to measure each magnet. D1 therefore actually teaches away from the claimed invention, by teaching that a corresponding magnetic field detector is required for each magnet.

D3 in view of D2

D2 also does not remedy the deficiencies of D3. Firstly, D2 relates to keycards, which have an entirely different design to the elongate "key" elements of D3. The skilled person would likely therefore conclude that D2 and D3 were technically incompatible, and would not even consider combining them.

Even if the skilled person were to consider D2 and D3 together, D2 also does not disclose serially reading the magnets. In fact, as previously discussed D2 suggests that the number of magnetic field detectors should be equal to the number of magnets, or preferably greater than the number of magnets so that some recesses in the keycard may be empty (which increases the number of permutations). Hence, D2 also actually teaches away from the claimed invention.

Hence, claim 1 as amended provides an inventive step.

Claim 6

Technical purpose

The purpose of claim 6 is to provide and access system using a portable keycard.
Closest Prior Art

The closest prior art is taken to be D2, which like claim 6 is also directed towards a keycard access system using a portable keycard.
Neither D1 or D3 are directed towards keycard access sytsems, so they cannot be considered to be within the same technical field as claim 6 or directed towards he same technical purpose. In fact, D3 does not even disclose a portable key of any kind, since the key is retained within the housing.
Differences

As discussed above, amended claim 6 differs from D2 in that amended claim 6 recites that there are fewer magnetic field detectors than magnets and that the processing circuit is configured to implement a serial reading of said detectors' electric signals as the keycard (in the case of claim 6, rather than the key) is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors.
Technical Effect and OTP

The distinguishing features of claim 6 in relation to D2 are substantially the same as the distinguishing features of claim 1 in relation to D3, and additionally D2 also does not disclose that there are fewer magnetic field detectors than magnets. Hence the technical effect of claim 6 is also substantially the same, with the addition that there are fewer complex magnetic field components and hence manufcacuring and assembly complexity is even further reduced.
Hence, the objective technical problem may be formulated as how to modify the system of D2 to provide a simpler and easier to manufacture access system. This objective technical problem is clearly supported by paragraphs [17]-[19] of the application as filed.
Task of the skilled person

Starting from D2 as the closest prior art, it would not be obvious for the skilled persn to solve the objective technical problem and arrive at the claimed invention, even in view of the other prior art documents.
Task of the skilled person

Starting from D2 alone

As discussed above, D2 does not disclose or teach serially reading the magnets. Furthermore, there is no suggestion that serial reading is a technique forming part of the CGK of the skilled person. Therefore, the skilled person would not even conceive of modifying D3 in order to

perform serial reading.
In fact, as previously discussed D2 suggests that the number of magnetic field detectors should be equal to the number of magnets, or preferably greater than the number of magnets so that some recesses in the keycard may be empty (which increases the number of permutations). Hence, D2 also actually teaches away from the claimed invention.
Combination of D2 and D1

D1 does not remedy the deficiencies of D2. Firstly, D1 is not directed towards keycard access systems, so the skilled person would likely not even consider D1 in view of D2.
Even if the skilled person were to consider D1 and D2 together, D1 also does not disclose serial reading and therefore cannot provide the missing feature. Like D2, D1 also suggests that the number of magnets and the number of magnetic field detectors should be equal, i.e. teaching away from the claimed invention of claim 6.
Combination of D2 and D3

The combination of D2 with D3 has already been discussed in relation to claim 1 and shown not to lead obviously to the claimed invention. The same reasoning applies in relation to claim 6.
The remaining claims all depend directly or indirectly from one of the claims discussed above. Therefore, they too are inventive for the same reasons (GL F-IV 3.4)
Conclusion

We submit that the objections raised in the communication have been dealt with and the application is now in order for allowance. The description will be brought into conformity with the claims in due course if the Examiner agrees.
As a prrecaution, we request oral proceedings if refusal of the application is contemplated.
Yours faithfully,
M Mend-AterAuthorised Representative
Enclosed: Amended claims 1-9

AMENDED CLAIMS

1. A locking system (50) comprising:
an elongated key (10) extending along a key axis and having a plurality of permanent magnets (15) spaced axially apart in a predetermined magnet arrangement;
a housing (30) defining a passage (34) complementary to said key and extending along an insertion axis of said key;
one or a plurality of magnetic field detectors (37, 37') spaced axially apart in said housing relative to said insertion axis in a detector arrangement positioned in relation to said magnet arrangement, each of said one or plurality of detectors being configured to change state on

juxtaposition with a magnet and to generate one or several electrical signals in accordance therewith;
an actuatable latch; and
electronic circuit means connected to said latch and said one or plurality of detectors for actuating said latch based on the one or several electrical signals generated by the one or plurality of magnetic field detectors, wherein there are fewer magnetic field detectors than magnets**characterised in that**
wherein the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors.
2. A locking system according to claim 1 wherein the elongated key has a circular-shaped section.
3. A locking system according to claim 1 wherein the elongated key has a square-, T-, hexagon- or any other polygon-shaped section.

4. A locking system according to claim 2 or 3 wherein the elongated key further comprises a plurality of radially outwardly open recesses (16) to position and attach the permanent magnets.
5. A locking system according to any of claims 1 to 4 wherein the locking system comprises at least two magnetic field detectors and two corresponding consecutive magnets positioned along the insertion axis, the magnetic fields of said magnets as sensed by corresponding magnetic field detectors differing in polarity.
~~6. A locking system according to claim 5 wherein there are fewer magnetic field detectors than magnets and wherein the electronic circuit means are configured to implement a serial reading of said detectors' electric signals as the key is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors.~~

~~7~~. 6. An access system (150) comprising:
a portable keycard (110) having a plurality of permanent magnets (120) embedded therein, said magnets being located at predetermined locations within said keycard;
a housing (140) having an external surface and an interior chamber, said interior chamber including a channel which is sized and shaped to receive according to an insertion direction said keycard to a fully inserted position;
a sensing circuit disposed within said interior chamber, said sensing circuit including at least one magnetic field detector ~~Hall-effect transducer~~ (162a-162f) positioned adjacent to said channel, each of said at least one magnetic field detector ~~Hall-effect transducer~~ being configured to change state on juxtaposition with a magnet and to generate one or several output signals in accordance therewith;
an actuatable latch; and
a processing circuit disposed within said interior chamber, said processing circuit being

electrically connected to said sensing circuit and said processing circuit actuating said latch in response to said one or several output signals, **characterised in that**
wherein there are fewer magnetic field detectors than magnets, and wherein the processing circuit is configured to implement a serial reading of said detectors' electric signals as the keycard is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors.
~~8.~~ 7. An access system according to claim 6 ~~7~~ wherein the keycard comprises a top section and a bottom section sized and shaped to mate and be attached to each other.

~~9.~~ 8. An access system according to claim ~~8~~ 7 wherein the top and/or bottom section further comprise(s) a plurality of recesses to position and attach the permanent magnets.
~~10.~~ 9. An access system according to any of claims 6 ~~7~~ to 8 ~~9~~ wherein the magnetic field of at least one of the plurality of magnets ~~substantially~~ differs in strength by at least 20% from another of the
plurality of magnets.

~~11. An access system according to claim 10 wherein there are fewer magnetic field detectors than magnets and wherein the processing circuit is configured to implement a serial reading of said detectors' electric signals as the keycard is being inserted into the housing and a plurality of magnets pass in proximity to one of the magnetic field detectors.~~