

PATENT SPECIFICATION

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(54) LOCKING UNIT

(71) We, ISS SECURITAS AS, a Company organised under the Laws of Denmark, of Kornmarksvej 21-23, 2600 Glostrup, Denmark, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to a locking unit for example for a safe deposit box in which a manual key can be used to release a bolt or the like, but in which there is a safety latch which has to be released before the key can be used in that way.

10 According to the invention a locking unit is as claimed in any of the following claims.

An electro-magnet is arranged to be energised to release the latch and may allow the bolt to be operated by a key, and by having a permanent magnet movably mounted between pole pieces of its magnetic circuit, a permanent magnet engaging force is provided between the pole pieces and the permanent magnet even when the electro-magnet is de-energised, and that force can be used for engaging and holding engaged the latch. That is preferable to having a mechanical spring whose constant varies with fatigue as the lock is operated many times.

20 If the permanent magnet is a cylindrical member magnetised diametrically and rotatably mounted between arcuate pole pieces, there can be a constant very thin air gap between the magnet and bolt pieces in all positions of the permanent magnet so that the reluctance of the magnetic circuit of the electro-magnet can be kept low and the current consumption of the electro-magnet when energised can also be low. This has a particular advantage where there are a number of safe deposit boxes and a single electric circuit is energised to energise the electro-magnets of all the boxes.

30 The closing force provided by the permanent magnet can be increased by increasing the angular deflection between the diametrical pole piece axis of the permanent magnet and the centre line of the pole pieces.

The invention may be carried into practice in various ways, and 35 two embodiments will now be described by way of example with

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reference to the accompanying drawings in which;

FIGURE 1 is a diagram of a locking unit for a safe deposit box,

FIGURE 2 is a view of a part of the device of FIGURE 1 to an increased scale, and

5 FIGURE 3 is a diagram of an alternative embodiment.

In Figure 1 a lock 21 in the door of a safe deposit box can have its bolt 6 released by operation of a key 8 but only after a latch 2 has been released. The latch is normally engaged in a slot 22 in the bolt 6 and is released by energisation of an electro-magnet 1 by
10 closing of a switch (not shown).

The electro-magnet 1 is associated with a pair of opposed arcuate pole pieces 4 and 5 between which is rotatably mounted, a cylindrical permanent magnet 3 which carries the latch 2. The magnet 3 is magnetised diametrically with its poles as indicated in Figure 2
15 slightly angularly displaced from the centre line through the pole pieces 4 and 5 when the latch 2 is in the rest position in which it is engaged in the notch 22. The angular displacement of the poles from the central position may be only about 1 or 2 degrees, or a little more so that there is a magnetic force due to the poles
20 trying to align themselves with the pole pieces 4 and 5 which force tends to hold the latch 2 down in its notch 22. That is assisted by the weight of the latch 2.

When the electro-magnet 1 is energised the pole pieces 4 and 5 are magnetised with the same polarity as the permanent magnet poles near
25 to them so that magnetic repulsion tends to rotate the cylinder 3 in the sense to lift the latch 2 out of its notch 22 to enable the bolt 6 to be withdrawn by operation of the key 8. As soon as the bolt 6 has been withdrawn a pair of normally closed contacts (not shown) in the box 21 are opened to de-energise the electro-magnet 1.
30 Then the permanent magnet cylinder 3 tends to rotate back to its rest position with its poles in line with the pole pieces 4 and 5 so that the latch 2 extends across the end of the bolt 6. Then when the bolt is projected again by the key when the lock is to be re-engaged, an inclined portion 23 on the end face of the bolt 6
35 lifts the latch 2 sufficiently to let the bolt 6 be projected and the latch 2 slides along the top of the bolt until it comes over the notch 22 and drops into engagement with it.

The air gap between the magnetic components 3 and 4 and 5 might be between 0.1 and 0.5 mm so that the reluctance of the complete
40 magnetic circuit of the electro-magnet is very small and the current consumption necessary to magnetise the system is also low. The air gap and magnetic circuit reluctance are the same in all positions of rotation of the cylindrical permanent magnet 3. In one example, the current consumption of the electro-magnet is as little as 22.5 mA.

45 It will be observed that because the closing force of the latch 2 is provided by magnetic attraction its strength does not change with time as would be the case if the closing force was provided by a spring subject to fatigue.

In the modification shown in Figure 3, a mortise lock has a
50 slidable lock plate 10 which can only be moved to the right in the Figure after a latch 9 has been rotated about a bearing in a housing 25 in the direction indicated by the arrow 26. That movement is caused by energisation of an electro-magnet (not shown) similar to the electro-magnet 1 of Figures 1 and 2, with a
55 cylindrical rotor 3. When the electro-magnet is energised, a

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crank 7 on the rotor shaft 27 lifts a cranked end 28 of the latch 9 so that the latch no longer prevents movement of the plate 10 to the right.

There is an additional restriction on movement of the plate 5 provided by a rod 29 also mounted in a bearing in the housing 25 and spring loaded by a spring 31 against the end of the plate 10. That rod 29 has limited movement in the direction of the arrow 32, until it strikes a stop 33 mounted to turn about a pivot pin 34. Such pivotal movement of the stop 33 is normally prevented by a stop 10 rod 11 a part of which passes through a notch 35 in a lock cylinder 36. The lock cylinder 36 has to be turned by a key in one direction or the other to raise or lower the stop pin 11 to allow the stop 33 to turn in response to movement of the rod 29 to the right.

Thus the plate 10 can be pushed in only after the key has been 15 used to turn the lock cylinder 36, and the electro-magnet has been energised to lift the latch 9. After the electro-magnet has been de-energised, the crank 7 returns to its normal position shown in Figure 3 by operation of the permanent magnet 3, and the latch 9 which rides over the face of the plate 10 while the plate is moved 20 to the right drops back into its latching position shown in Figure 3 after the plate 10 has been returned to its left-hand or locking position.

WHAT WE CLAIM IS:-

1. A locking unit for safe deposit boxes comprising an electro- 25 magnet and a locking latch engaging a bolt when in a locking position, the locking latch being releasable to allow the bolt to be operated when the electromagnet is energised, whereby the electro-magnet controls the locking latch via a movably mounted permanent magnet, the north-south direction of which is slightly angularly 30 out of alignment with the line of maximum magnetic force between the pole pieces of the electro-magnet, the poles of the permanent magnet being generally adjacent, when in the locked position, those poles of the electro-magnet which assume like polarity when energised, the permanent magnet being adapted to disengage and release the locking 35 latch when the electro-magnet is energised due to a magnetic repulsion between the pole pieces of the electro-magnet, and the adjacent poles of the permanent magnet, the locking latch returning to the locking position when the electro-magnet is de-energised due to a magnetic attraction between the poles of the permanent magnet 40 and the pole pieces of the electro-magnet, when this is not energised.

2. A locking unit as claimed in Claim 1, in which the permanent magnet is cylindrical along its entire periphery.

3. A locking unit as claimed in Claim 1 or 2, in which the north- 45 south direction of the permanent magnet in the latching position is about 1 or 2 degrees out of alignment with the line of maximum magnetic force between the pole pieces of the electro-magnet.

4. A locking unit as claimed in Claim 2 or Claim 3 in which the 50 permanent magnet is magnetised diametrically and rotatably mounted within an opposed pair of arcuate pole pieces of the electro-magnet.



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crank 7 on the rotor shaft 27 lifts a cranked end 28 of the latch 9 so that the latch no longer prevents movement of the plate 10 to the right.

There is an additional restriction on movement of the plate 5 provided by a rod 29 also mounted in a bearing in the housing 25 and spring loaded by a spring 31 against the end of the plate 10. That rod 29 has limited movement in the direction of the arrow 32, until it strikes a stop 33 mounted to turn about a pivot pin 34. Such pivotal movement of the stop 33 is normally prevented by a stop 10 rod 11 a part of which passes through a notch 35 in a lock cylinder 36. The lock cylinder 36 has to be turned by a key in one direction or the other to raise or lower the stop pin 11 to allow the stop 33 to turn in response to movement of the rod 29 to the right.

Thus the plate 10 can be pushed in only after the key has been 15 used to turn the lock cylinder 36, and the electro-magnet has been energised to lift the latch 9. After the electro-magnet has been de-energised, the crank 7 returns to its normal position shown in Figure 3 by operation of the permanent magnet 3, and the latch 9 which rides over the face of the plate 10 while the plate is moved 20 to the right drops back into its latching position shown in Figure 3 after the plate 10 has been returned to its left-hand or locking position.

WHAT WE CLAIM IS:-

1. A locking unit for safe deposit boxes comprising an electro- 25 magnet and a locking latch engaging a bolt when in a locking position, the locking latch being releasable to allow the bolt to be operated when the electromagnet is energised, whereby the electro-magnet controls the locking latch via a movably mounted permanent magnet, the north-south direction of which is slightly angularly 30 out of alignment with the line of maximum magnetic force between the pole pieces of the electro-magnet, the poles of the permanent magnet being generally adjacent, when in the locked position, those poles of the electro-magnet which assume like polarity when energised, the permanent magnet being adapted to disengage and release the locking 35 latch when the electro-magnet is energised due to a magnetic repulsion between the pole pieces of the electro-magnet, and the adjacent poles of the permanent magnet, the locking latch returning to the locking position when the electro-magnet is de-energised due to a magnetic attraction between the poles of the permanent magnet 40 and the pole pieces of the electro-magnet, when this is not energised.

2. A locking unit as claimed in Claim 1, in which the permanent magnet is cylindrical along its entire periphery.

3. A locking unit as claimed in Claim 1 or 2, in which the north- 45 south direction of the permanent magnet in the latching position is about 1 or 2 degrees out of alignment with the line of maximum magnetic force between the pole pieces of the electro-magnet.

4. A locking unit as claimed in Claim 2 or Claim 3 in which the permanent magnet is magnetised diametrically and rotatably mounted 50 within an opposed pair of arcuate pole pieces of the electro-magnet.

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5. A locking unit as claimed in any of the preceding Claims in which the air gap between the permanent magnet and the pole pieces is between 0.1 and 0.5 mm.

6. A locking unit as claimed in any of the preceding Claims in which the bolt is arranged when operated to de-energise the electro-magnet.

7. A locking unit as claimed in any of the preceding Claims including means for operating the bolt by use of a key.

8. A locking unit constructed and arranged substantially as herein specifically described with reference to Figures 1 and 2, or Figure 3 of the accompanying drawings.

Agents for the Applicants
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