The Drumm Geminy shield

My name is Han Fey and as a collector of high security locks, I am interested in the techniques behind the security that they afford. With locks intended for extraordinary usage, these high security features are often not clearly visible.

I take pleasure in disassembling locks and from that, learning their internal workings. I have at the moment about 2100 different locks from all over the world.

In this article, I will discuss the security features and the technology of the Drumm Geminy shield. Klaus Drumm, a 57 year old German, is the creator of this locking system. During his working period at BASF in Ludwigshafen he became interested in security. He is now quite busy with developing, analysing and improving security products. Aside from that, Klaus is also an inventor with at least 160 Patents to his credit. I have met Klaus Drumm on several occasions, and I can easily say that he is a very pleasant and friendly person. But relevant to this article, I particularly enjoy his willingness to talk openly and freely about locking / security techniques as well as their countermeasures. I have learned a lot from him.

I call his Geminy shield a High Security lock as it can withstand most hostile attacks with a great deal of success. More about that later.

The technologies that I write about in this article are based upon my observations from working with parts of my collection. Please be advised I disclaim liability for any errors within this article's content. However, I have done my best to record it as accurately as possible. For errors and suggested corrections, see the end of the document for my contact details.

The Geminy slogan is:
There is a difference between "feeling secure"and "being secure"
Geminy is the difference

Keyway (10-pin)

Frontview Geminy shield, Close, Keyway and Open

Introduction of the Geminy shield

About 15 years ago Klaus Drumm had the idea that the small surface in front of a cylinder was not big enough to provide for an effective Shield against differing modern burglar attacks. He wanted a solution for this. With this idea in mind, he came to the conclusion that a cylinder shield out of steel which could withstand several attacks could be the solution. His thinking was that such a shield would protect the cylinder against intensive hostile attacks from the outside, such as drilling, sawing and beating it with a hammer. Drumm's strategy is that the main two contributors to creating a highly secure locking system, involve increasing both the time it would take, as well as the amount of noise that would be created, should any attempt be undertaken in order to defeat a lock like his shield. Research in Germany indicates that these two factors play a very significant role in reducing the incidence of burglary. This data indicates that typically, after 4 to 5 minutes without success, a burglar tends to move on.

The steel Drumm Geminy shield is located in front of the lock's cylinder. Its 7mm thick hardened steel plate which is located in front of the lock's cylinder, acts as a first line of defense against all known break-in techniques. When this lock is installed on a door, the cylinder is not visible. This is because the cylinder is totally shielded as you could see in the pictures before. Should a criminal succeed in overcoming this barrier, he or she would as in the case of conventional security fittings, still have to deal with the lock's cylinder.

The product line of Geminy is currently the world market leader in protective fittings mounted on machines with either considerable quantities of cash or of items of a relatively high resale value. Specifically, this includes railroad ticket machines, charge collecting machines, automatic teller machines and cigarette vending machines. The Geminy shield also is widely deployed within prison facilities as well as psychiatric clinics. Pay telephones which are located in remote areas are also good candidates for being fitted with the Geminy shield. With regards to railroad usage of the Geminy, the German railroad system currently uses more than 10,000 of these locks. And in the Netherlands, you can also find these locks on all of the Dutch railroad's ticket machines.

There are nowadays more manufacturers who employ the usage of covers to protect cylinders against vandalism etc, but the Drumm shield was in my opinion one of the first. Of particular interest is that this lock is a 100% mechanical system. Where as other shielded locks that compete, they typically employ the usage of either magnets or electronics.

The three way protection

This Drumm Geminy shield protects your cylinder against drilling / pulling, lock picking and vandalism. And by vandalism I mean to say, it protects against the insertion of glue, wooden stick of a match, dirt, sand etc. which can be inserted in the keyway of a lock's cylinder and could potentially, impede the unlocking process. The locking mechanism in the shield itself is protected by a self-cleaning feature. The manufacturer supplies a Teflon spray which protects the lock for 3 months against super glue and other agents that somebody could insert in the keyway. The shield also is secure against lock picking, due to the specially shaped pins used in this lock. More about that later….

Drumm logo with in the front the special Teflon spray

The key

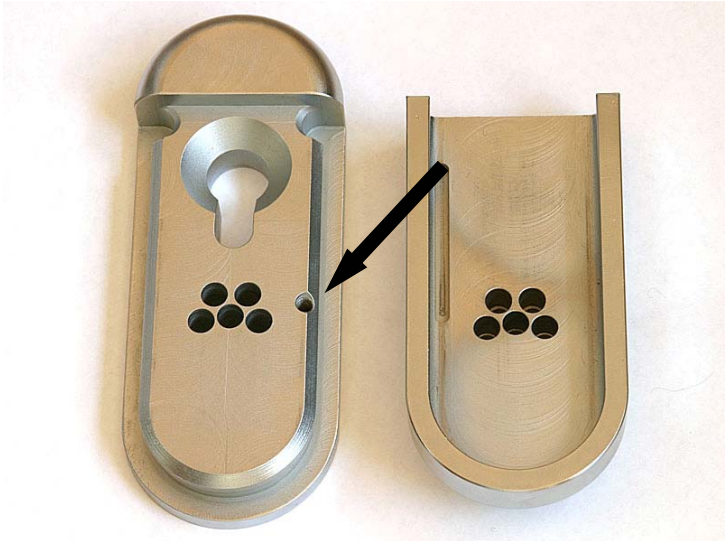
The standard key has 5 positions, were a “key pin” can be mounted. There are 10 different key pins. And every key pin has two different heights which control the pins in the lock. The system can therefore be called a pin in pin system much like the Mul-T-Lock system. On the picture below you can see some keys with different keypins. In Germany they call this key a Pfannenschluessel, this means something like a frying pan key.

Some Geminy keys

Note: The max. key pin height is 6 mm, the manufacturer did this to make the total key not thicker than 11 mm, in order to avoid problems in the pocket of your trousers. There are 100.000 theoretical key combinations, with 5 key pins on the key. The manufacturer claims that each individual key is unique. Additional copies of a key are available only with a security card.

How the lock works

You can see that the lock consists of two simple sliding parts**.** I call the part that is fixed on the door the “Body”, and the part that moves upwards and down, the “Sliding front”. This Sliding front covers the cylinder when this hardware is locked. The 10 pins in the corresponding 5 holes prevent the Sliding front from being moved. If the pins are pushed in properly by the key, a shear line is created, (all the pins are on the same height as the Sliding front) and you can now move the Sliding front downwards to open the lock.



The “Body” and the “Sliding front”

Note: The preceding picture shows this lock’s 5 chambers for the pins as well as a small hole in the body (see arrow) which is intended to prevent the “Sliding front” from coming off. This specific lock contains 46 parts. Furthermore, in each chamber there are 8 parts.

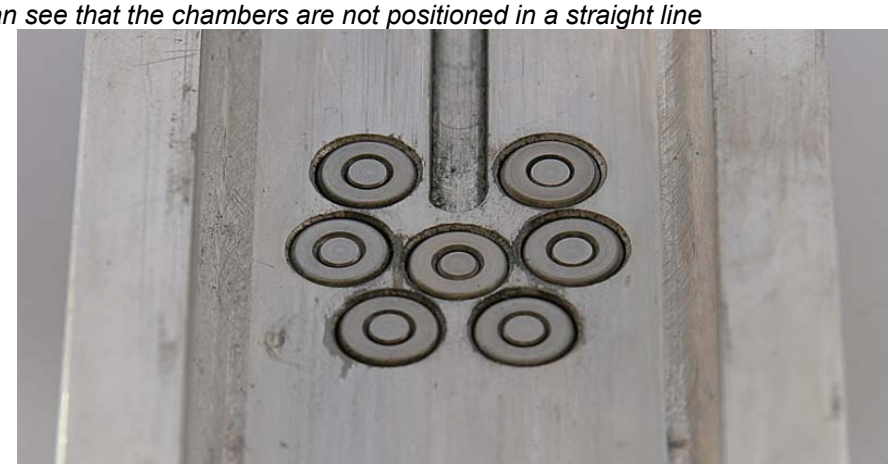
To open the lock

To open the lock, you place the key with the key pins downwards on the “keyway” and push it down. The pins are now set and it is now possible to make a sliding movement. Because the pins in the lock are pushed in properly by the key, you can now move the slider downwards. The lock is now open and you can remove the key. The cylinder has become visible. To close the lock, there are two possibilities according to the specific model of the Geminy Shield. One version requires the installation of the key in order to slide the front back into position. The second version can also be closed without the usage of its key. In the pictures below you can see the back of the “Sliding front”, with some different keys in it. Of course, normally the pins in the body (top pins) block the Sliding front from sliding.

Shear line in back of Sliding front in locked position

Note: This picture is from the 14-pin version of this lock

Note: You can see that the chambers are not positioned in a straight line



Shear line in back of Sliding front with correct key

Shear line in back of Sliding front with false key

You can see that the Sliding front is effectively blocked against sliding. In the picture below, you can see a blank for a 5 key pin and two 14-pin keys.

A blank and two 14 pin keys

Note: The key blank is shown staged, awaiting the insertion of key pins

Something about the key pins

There are 3 different heights possible for the outer diameter pins and 5 different heights for the inner pins. This adds up to 10 different key pins. You can find the coding and length of these pins in the table below.

Pin number	Height outer diameter [mm]	Height inner diameter*
11	1	1
12	1	2
13	1	3
14	1	4
21	2	1
22	2	2
23	2	3
31	3	1
32	3	2
33	3	3

* referenced is the outer diameter, the tip is x mm higher as the outer diameter.

Some key pins in detail (code 11,13,14,21,22,32,31)

If you have a close look at some of these key pins, you can see that there are pins with three different heights. This is part of their new production process. The keys are made by pressing the key pins into the holes in the frying pan key. Because the outer diameter, where the press pushes on, can have three differing heights, the manufacturer developed a technique to produce these keys more efficiently. He made an extra outer diameter (see arrow). When the key pins are pressed into the frying pan key, this special outer diameter ledge is used. This “extra” diameter provides for a means of indexing the depth of each individual pin’s penetration.

Note that in the new series of this lock there are three different heights in the key pin, this way you can recognize that you have a lock from a new series.

The pins in the lock

The pins on the left (marked with an arrow) are the pins in the Body. These pins you can compare with the top pins, or the pins in the housing. These pins also have differing lengths. The reason for that is to offer protection against someone measuring the length of the pins to determine which specific configuration pin is in the lock. When I first attempted to pick a Geminy shield lock, the first method that I tried was to attempt pushing the pins in as deep as possible in order to measure their relative depths. This should be an indication of the length of a pin in the Sliding front. Because of the variation in length of the pins in the Body part, this was not possible.

The pins in the red oval on the right, represent the pins which are in the Sliding front and which are responsible for the differing key configurations. As you can see, they have different lengths. You can compare these pins with the Bottom pins or the pins in the plug.

The pins in the Body ***The pins in the Sliding front.***

The pins in the lock.

Note: The number 1591 stands for the key number.

Master key version

The Geminy shield does not come in master key version. The reason for this is according to the manufacturer, that the lock could become instable. A master key function must be arranged by the cylinder located on the door itself. Drumm's thinking is that the Geminy shield is intended primarily as a means of securing additional protection.

The Combination key

A Geminy shield key can be combined with a cylinder key, to form the Geminy Combination key.

Combination key

The 14-pin version

For extra high security features the manufacturer developed a 14-pin version. The manufacturer thought 15 years ago when he released this lock, that in a few years, people could potentially, manipulate the lock. This is the reason that he developed this later, 14-pin version. Very few of this model have been made, as the 10-pin locks have proven very secure. So secure, that the 14-pin version has for the most part, not been required.

10-pins keyway and 14-pins keyway

Note: That the pins are vertically not in line, this is done to let the Sliding front not block if you push it back in the locking position.

The working of the mushroom pins

When I first saw this lock, I initially thought it would be quite vulnerable, as all the pins are visible. Also, the pins are not positioned in a straight line in a “typical” narrow keyway, as is the case with most “ordinary” pin-tumbler locks. If you were to attempt to pick this lock, you would likely put tension on the Sliding front by hand, or perhaps by means of inserting a screwdriver into the gap between these two parts. The 10 pins in the normal lock get stuck then, just like with an ordinary pin-tumbler cylinder.

By now pushing in the pins with a stick you can try to pick the lock, because you feel the pins set.

Indeed the first generation of this lock was easy pick-able. This because there were no special shaped pins in the lock which prevented the lock from being picked. The manufacturer however added some very clever “tricks” in newer versions in order to prevent this. He created a special kind of mushroom pin as you can see in the picture below. In Germany they call these special pins, “Hantelstifte”

Mushroom pins

Note: The three different lengths of the pins. This variation is intended to make it impossible to determine which specific pin configuration has been installed in a Geminy shield, thus likely frustrating an attempted picking attack.

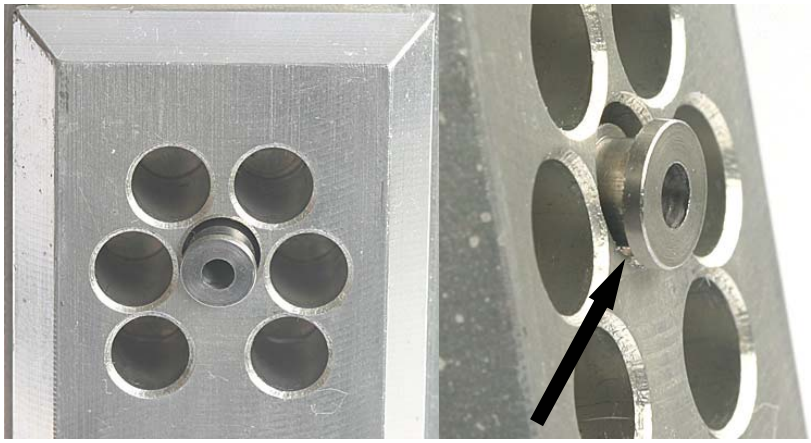
This mushroom pin is very sneaky, and prevents the lock from being picked easily. There are two or three of these pins in every lock, located at random positions.

Mushroom (top)pin and ordinary(top)pin

If you have a close look at the mushroom pin, you will notice that the top of this pin has the normal diameter of the chamber, just like the normal pin has this diameter over the full length. The mushroom pin has an undercut which provides for a section with a smaller diameter. This trick makes it possible that the pin can tilt in the chamber as you can see in the following picture.

Because the mushroom pin is tilted (see next picture), you can move the sliding front a little bit downwards. Because the normal pins can be set easily, you do not feel resistance. At this point, you will get the false impression that you are succeeding in picking open the lock.

However, at this point, the second security feature of the mushroom pin has just been activated. The wider upper diameter of the mushroom pin hooks on the top of the body. (see arrow).This pin blocks the movement of the sliding front, besides that is this pin fixed in the chamber. So the edge on top of this mushroom hooks on the top of the chamber in the body and you cannot at this point, push in this pin further because it’s blocked.



"Sloppy" mushroom pin in blocking position

If you want to push down this mushroom pin, you must release the slider upwards and you can push in the mushroom pin. If you however release the slider, the other pins jump back in their locking position.

It's a very strange feeling trying to pick this lock, I played with it some hours, but I have not succeeded (yet) in lock picking it, but then again I am a lockcollector, not a lockpicker.

I had also tried to shim this lock with a thin steel plate, in order to prevent the pins from jumping back, but this also did not work with this lock.

I will also point out that the Geminy shield is a secondary line of defense, intended to shroud the primary lock cylinder. Therefore should a burglar succeed in compromising the shield, he or she would still have to contend with the primary lock cylinder that it covers. The usage of a high security cylinder is recommended in this installation.

Protection against drilling

The lock also offers protection against grinding, drilling, because of Drumm's All-Steel principle, (the consistent use of hardened steels throughout), the Geminy steel protective fitting with its integrated lock presents virtually no weak spots for a criminal attempting to remove it by force. The all steel principle makes this lock extremely resistant to drilling and sawing. The steel pins in the lock are designed so that if you should try to drill out the pins, the pins start rotating. Thus, you cannot get a good grip on these pins.

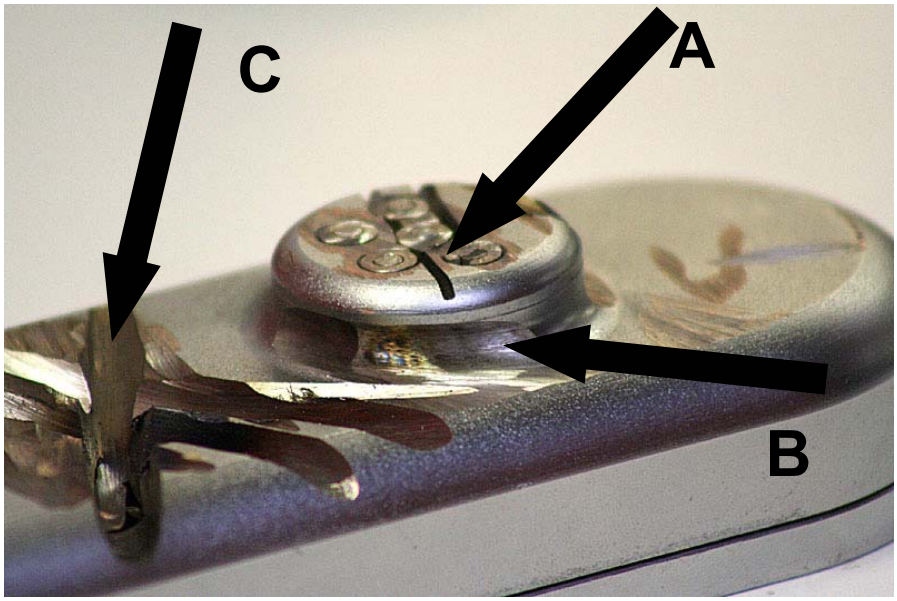
In the pictures below, you can see what happened to a lock which came back to the Drumm factory from the field. It appears to have been attacked by burglars with a grinder. The lock withstood this assault without problems. It is estimated that they were busy with this "project" for about 45 minutes, judging by viewing the degree of damage withstood.

When looking at the next 2 pictures, it is my assumption that this attack was attempted using a battery powered grinder. This attack probably ended when the grinder's batteries ran out. The sliding front of the Geminy shield is made from tool steel, which is hardened to 64 Rockwell. In comparison, high speed drills and files are typically hardened to 62 Rockwell, and thus are ineffective.

The English railway has also tested this lock for periods of one hour with a number of different attacks such as a hammer, saw, grinder, chisel, etc. The lock withstood the multiple threat attack of 60 minutes without problem.

With grinder attacked Geminy shield (picture 1)

Note: It took the burglars 45 minutes to achieve what you see in this picture. During the grinding attack, some pins were pushed down. However, when the burglars removed the grinder, the pins jumped back up to full extension again. I wish to say that I did not see this lock in person, but rather have only been privy to this picture. I expect that the original key still fitted, as no critical elements were damaged.



Attacked Geminy shield (picture 2)

Note: The three ways of attacking that this shield suffered:
A, Attack to the pins in the front keyway.
Note: the pins were pushed in by the grinder and then jumped back after the grinder was removed.
B, Attack to the keyway from aside
Note: the pins started rotating as soon as the grinder makes contact with the pins.
C, Attack to the surface of the shield

I am told that during the 15 years this model of lock was in service installed on differing automatic cash containing machines, there have been no successful attempts in opening this lock by force or by other means. There only have been reported cases where the whole machine that the Drumm shield was installed upon, was stolen.

My favourite

The aforementioned locks are correctly used on steel doors for industrial / commercial usage. For civilian usage, they developed the Geminy Exclusive series, which can be used for normal house doors.

I have a demo lock from the civilian version with a steel Abloy Protec in it. I currently have a Protec lock installed upon my door. As of yet, the Geminy shield not (yet). I very much like the shield's all steel construction in combination with the all steel construction of the Abloy Hard cylinder.

Geminy Exclusive series for domestic household use.

Note: That the cylinder is exposed only halfway, this means that the cylinder is triple protected against pulling =>
1. steel bridge in cylinder
2 steel screw in cylinder
3. the Geminy shield which holds the cylinder

Closing comments

So far this article about the Geminy high security shield. I personally find that this lock has similarities in development and success with the American Tufloc. The Tufloc also has a special design and is one of a kind. Maybe the Tufloc is something for the next time?

You can download this file with the next link "www.toool.nl/drumm-geminy.pdf" where you can see the pictures in this article more clearly and in color. If you have a question or discovered not correct things in this article, you can contact me at: han.fey@12move.nl.

More info about the Geminy shield you can find on the website of the manufacturer www.drummsecurity.com.

More info about the Geminy shield for the American market you can find on my website www.hanfeylocktechnologies.com.

I want to thank Jeffrey Sachs (USA) for editing this article.

I hope you have enjoyed reading this article.

Han Fey
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