

### *Safecracker Meets Safecracker*

I learned to pick locks from a guy named Leo Lavatelli. It turns out that picking ordinary tumbler locks--like Yale locks-- is easy. You try to turn the lock by putting a screwdriver in the hole (you have to push from the side in order to leave the hole open). It doesn't turn because there are some pins inside which have to be lifted to just the right height (by the key). Because it is not made perfectly, the lock is held more by one pin than the others. Now, if you push a little wire gadget-- maybe a paper clip with a slight bump at the end--and jiggle it back and forth inside the lock, you'll eventually push that one pin that's doing the most holding, up to the right height. The lock gives, just a little bit, so the first pin stays up--it's caught on the edge. Now most of the load is held by another pin, and you repeat the same random process for a few more minutes, until all the pins are pushed up.

What often happens is that the screwdriver will slip and you hear tic-tic-tic, and it makes you mad. There are little springs that push the pins back down when a key is removed, and you can hear them click when you let go of the screwdriver. (Sometimes you intentionally let go of the screwdriver to see if you're getting anywhere--you might be pushing the wrong way, for instance.) The process is something like Sisyphus: you're always falling back downhill.

It's a simple process, but practice helps a lot. You learn how hard to push on things--hard enough so the pins will stay up, but not so hard that they won't go up in the first place. What is not really appreciated by most people is that they're perpetually locking themselves in with locks everywhere, and it's not very hard to pick them.

When we started to work on the atomic bomb project at Los Alamos, everything was in such a hurry that it wasn't really ready. All the secrets of the project--everything about the atomic bomb-- were kept in filing cabinets which, if they had locks at all, were locked with padlocks which had maybe only three pins: they were as easy as pie to open.

To improve security the shop outfitted every filing cabinet with a long rod that went down through the handles of the drawers and that was fastened by a padlock.

Some guy said to me, "Look at this new thing the shop put on--can you open the cabinet now?"

I looked at the back of the cabinet and saw that the drawers didn't have a solid bottom. There was a slot with a wire rod in each one that held a slidable piece (which holds the papers up inside the drawer). I poked in from the back, slid the piece back, and began pulling the papers out through the slot. "Look!" I said. "I don't even have to pick the lock."

Los Alamos was a very cooperative place, and we felt it our responsibility to point out things that should be improved. I'd keep complaining that the stuff was unsafe, and although everybody *thought* it was safe because there were steel rods and padlocks, it didn't mean a damn thing.

To demonstrate that the locks meant nothing, whenever I wanted somebody's report and they weren't around, I'd just go in their office, open the filing cabinet, and take it out. When I was finished I would give it back to the guy: "Thanks for your report."

"Where'd you get it?"

"Out of your filing cabinet."

"But I *locked* it!"

"I *know* you locked it. The locks are no good."

Finally some filing cabinets came which had combination locks on them made by the Mosler Safe Company. They had three drawers. Pulling the top drawer out would release the other drawers by a catch. The top drawer was opened by turning a combination wheel to the left, right, and left for the combination, and then right to number ten, which would draw back a bolt inside. The whole filing cabinet could be locked by closing the bottom drawers first, then the top drawer, and spinning the combination wheel away from number ten, which pushed up the bolt.

These new filing cabinets were an immediate challenge, naturally. I love puzzles. One guy tries to make something to keep another guy out; there must be a way to beat it!

I had first to understand how the lock worked, so I took apart the one in my office. The way it worked is this: There are three discs on a single shaft, one behind the other; each has a notch in a different place. The idea is to line up the notches so that when you turn the wheel to ten, the little friction drive will draw the bolt down into the slot generated by the notches of the three discs.

Now, to turn the discs, there's a pin sticking out from the back of the combination wheel, and a pin sticking up from the first disc at the same radius. Within one turn of the combination wheel, you've picked up the first disc.

On the back of the first disc there's a pin at the same radius as a pin on the front of the second disc, so by the time you've spun the combination wheel around twice, you've picked up the second disc as well.

Keep turning the wheel, and a pin on the back of the second disc will catch a pin on the front of the third disc, which you now set into the proper position with the first number of the combination.

Now you have to turn the combination wheel the other way one full turn to catch the second disc from the other side, and then continue to the second number of the combination to set the second disc.

Again you reverse direction and set the first disc to its proper place. Now the notches are lined up, and by turning the wheel to ten, you open the cabinet.

Well, I struggled, and I couldn't get anywhere. I bought a couple of safecracker books, but they were all the same. In the beginning of the book there are some stories of the fantastic achievements of the safecracker, such as the woman caught in a meat refrigerator who is freezing to death, but the safecracker, hanging upside down, opens it in two minutes. Or there are some precious furs or gold bullion under water, down in the sea, and the safecracker dives down and opens the chest.

In the second part of the book, they tell you how to crack a safe. There are all kinds of ninny-pinny, dopey things, like "It might be a good idea to try a date for the combination, because lots of people like to use dates." Or "Think of the psychology of the owner of the safe, and what he might use for the combination." And "The secretary is often worried that she might forget the combination of the safe, so she might write it down in one of the following places--along the edge of her desk drawer, on a list of names and addresses . . . and so on.

They *did* tell me something sensible about how to open ordinary safes, and it's easy to understand. Ordinary safes have an extra handle, so if you push down on the handle while you're turning the combination wheel, things being unequal (as with locks), the force of the handle trying to push the bolt down into the notches (which are not lined up) is held up more by one disc than another. When the notch on that disc comes under the bolt, there's a tiny click that you can hear

with a stethoscope, or a slight decrease in friction that you can feel (you don't have to sandpaper your fingertips), and you know, "There's a number!"

You don't know whether it's the first, second, or third number, but you can get a pretty good idea of that by finding out how many times you have to turn the wheel the other way to hear the same click again. If it's a little less than once, it's the first disc; if it's a little less than twice, it's the second disc (you have to make a correction for the thickness of the pins).

This useful trick only works on ordinary safes, which have the extra handle, so I was stymied.

I tried all kinds of subsidiary tricks with the cabinets, such as finding out how to release the latches on the lower drawers, without opening the top drawer, by taking off a screw in front and poking around with a piece of hanger wire.

I tried spinning the combination wheel very rapidly and then going to ten, thus putting a little friction on, which I hoped would stop a disc at the right point in some manner. I tried all *kinds* of things. I was desperate.

I also did a certain amount of systematic study. For instance, a typical combination was 69-32-21. How far off could a number be when you're opening the safe? If the number was 69, would 68 work? Would 67 work? On the particular locks we had, the answer was yes for both, but 66 wouldn't work. You could be off by two in either direction. That meant you only had to try one out of five numbers, so you could try zero, five, ten, fifteen, and so on. With twenty such numbers on a wheel of 100, that was 8000 possibilities instead of the 1,000,000 you would get if you had to try every single number.

Now the question was, how long would it take me to try the 8000 combinations? Suppose I've got the first two numbers right of a combination I'm trying to get. Say the numbers are 69-32, but I don't know it--I've got them as 70-30. Now I can try the twenty possible third numbers without having to set up the first two numbers each time. Now let's suppose I have only the first number of the combination right. After trying the twenty numbers on the third disc, I move the second wheel only a little bit, and then do another twenty numbers on the third wheel.

I practiced all the time on my own safe so I could do this process as fast as I could and not get lost in my mind as to which number I was pushing and mess up the first number. Like a guy who practices sleight of hand, I got it down to an absolute rhythm so I could try the 400 possible back numbers in less than half an hour. That meant I could open a safe in a maximum of eight hours--with an average time of four hours.

There was another guy there at Los Alamos named Staley who was also interested in locks. We talked about it from time to time, but we weren't getting anywhere much. After I got this idea how to open a safe in an average time of four hours, I wanted to show Staley how to do it, so I went into a guy's office over in the computing department and asked, "Do you mind if I use your safe? I'd like to show Staley something."

Meanwhile some guys in the computing department came around and one of them said, "Hey, everybody; Feynman's gonna show Staley how to open a safe, ha, ha, ha!" I wasn't going to actually open the safe; I was just going to show Staley this way of quickly trying the back two numbers without losing your place and having to set up the first number again.

I began. "Let's suppose that the first number is forty, and we're trying fifteen for the second number. We go back and forth, ten; back five more and forth, ten; and so on. Now we've tried all

the possible third numbers. Now we try twenty for the second number: we go back and forth, ten; back five more and forth, ten; back five more and forth, CLICK!" My jaw dropped: the first and second numbers happened to be right!

Nobody saw my expression because my back was towards them. Staley looked very surprised, but both of us caught on Very quickly as to what happened, so I pulled the top drawer out with a flourish and said, "And there you are!"

Staley said, "I see what you mean; it's a very good scheme"--and we walked out. Everybody was amazed. It was complete luck. Now I *really* had a reputation for opening safes.

It took me about a year and a half to get that far (of course, I was working on the bomb, too!) but I figured that I had the safes beaten, in the sense that if there was a real difficulty--if somebody was lost, or dead, and nobody else knew the combination but the stuff in the filing cabinet was needed--I could open it. After reading what preposterous things the safecrackers claimed, I thought that was a rather respectable accomplishment.

We had no entertainment there at Los Alamos, and we had to amuse ourselves somehow, so fiddling with the Mosler lock on my filing cabinet was one of my entertainments. One day I made an interesting observation: When the lock is opened and the drawer has been pulled out and the wheel is left on ten (which is what people do when they've opened their filing cabinet and are taking papers out of it), the bolt is still down. Now what does that mean, the bolt is still down? It means the bolt is in the slot made by the three discs, which are still properly lined up. Ahhhh!

Now, if I turn the wheel away from ten a little bit, the bolt comes up; if I immediately go back to ten, the bolt goes back down again, because I haven't yet disturbed the slot. If I keep going away from ten in steps of five, at some point the bolt won't go back down when I go back to ten: the slot has just been disturbed. The number just before, which still let the bolt go down, is the last number of the combination!

I realized that I could do the same thing to find the second number: As soon as I know the last number, I can turn the wheel around the other way and again, in lumps of five, push the second disc bit by bit until the bolt doesn't go down. The number just before would be the second number.

If I were very patient I would be able to pick up all three numbers that way, but the amount of work involved in picking up the first number of the combination by this elaborate scheme would be much more than just trying the twenty possible first numbers with the other two numbers that you already know, when the filing cabinet is closed.

I practiced and I practiced until I could get the last two numbers off an open filing cabinet, hardly looking at the dial. Then, when I'd be in some guy's office discussing some physics problem, I'd lean against his opened filing cabinet, and just like a guy who's jiggling keys absent-mindedly while he's talking, I'd just wobble the dial back and forth, back and forth. Sometimes I'd put my finger on the bolt so I wouldn't have to look to see if it's coming up. In this way I picked off the last two numbers of various filing cabinets. When I got back to my office I would write the two numbers down on a piece of paper that I kept inside the lock of my filing cabinet. I took the lock apart each time to get the paper--I thought that was a very safe place for them.

After a while my reputation began to sail, because things like this would happen: Somebody would say, "Hey, Feynman! Christy's out of town and we need a document from his safe--can you open it?"

If it was a safe I knew I didn't have the last two numbers of, I would simply say, "I'm sorry, but I can't do it now; I've got this work that I have to do." Otherwise, I would say, "Yeah, hut I gotta get my tools." I didn't need any tools, but I'd go back to my office, open my filing cabinet, and look at my little piece of paper: "Christy--35, 60." Then I'd get a screwdriver and go over to Christy's office and close the door behind me. Obviously not everybody is supposed to be allowed to know how to do this!

I'd be in there alone and I'd open the safe in a few minutes. All I had to do was try the first number at most twenty times, then sit around, reading a magazine or something, for fifteen or twenty minutes. There was no use trying to make it look too easy; somebody would figure out there was a trick to it! After a while I'd open the door and say, "It's open."

People thought I was opening the safes from scratch. Now I could maintain the idea, which began with that accident with Staley, that I could open safes cold. Nobody figured out that I was picking the last two numbers off their safes, even though--perhaps because--I was doing it *all* the time, like a card sharp walking around all the time with a deck of cards,

I often went to Oak Ridge to check up on the safety of the uranium plant. Everything was always in a hurry because it was wartime, and one time I had to go there Ofl a weekend. It was Sunday, and we were in this fella's office--a general, a head or a vice president of some company, a couple of other big muck-a-mucks, and me. We were gathered together to discuss a report that was in the fella's safe--a secret safe--. when suddenly he realized that he didn't know the combination. His secretary was the only one who knew it, so he called her home and it turned out she had gone on a picnic up in the hills.

While all this was going on, I asked, "Do you mind if I fiddle with the safe?"

"Ha, ha, ha--not at all!" So I went over to the safe and started to fool around.

They began to discuss how they could get a car to try to find the secretary, and the guy was getting more and more embarrassed because he had all these people waiting and he was such a jackass he didn't know how to open his own safe. Everybody was all tense and getting mad at him, when CLICK!--the safe opened.

In 10 minutes I had opened the safe that contained all the secret documents about the plant. They were astonished. The safes were apparently not very safe. It was a terrible shock: All this "eyes only" stuff, top secret, locked in this wonderful secret safe, and this guy opens it in ten minutes!

Of course I was able to open the safe because of my perpetual habit of taking the last two numbers off. While in Oak Ridge the month before, I was in the same office when the safe was open and I took the numbers off in an absentminded way--I was always practicing my obsession. Although I hadn't written them down, I was able to vaguely remember what they were. First I tried 40-15, then 15-40, but neither of those worked. Then I tried 10-45 with all the first numbers, and it opened.

A similar thing happened on another weekend when I was visiting Oak Ridge. I had written a report that had to be OKed by a colonel, and it was in his safe. Everybody else keeps documents in filing cabinets like the ones at Los Alamos, but he was a colonel, so he had a much fancier, two-door safe with big handles that pull four ¾-inch-thick steel bolts from the frame. The great brass doors swung open and he took out my report to read.

Not having had an opportunity to see any really *good* safes, I said to him, "Would you mind, while you're reading my report, if I looked at your safe?"

"Go right ahead," he said, convinced that there was nothing I could do. I looked at the back of one of the solid brass doors, and I discovered that the combination wheel was connected to a little lock that looked exactly the same as the little unit that was on my filing cabinet at Los Alamos. Same company, same little bolt, except that when the bolt came down, the big handles on the safe could then move some rods sideways, and with a hunch of levers you could pull back all those 3/4-inch steel rods. The whole lever system, it appeared, depends on the same little bolt that locks filing cabinets.

Just for the sake of professional perfection, to make *sure* it was the same, I took the two numbers off the same way I did with the filing cabinet safes.

Meanwhile, he was reading the report. When he'd finished he said, "All right, it's fine." He put the report in the safe, grabbed the big handles, and swung the great brass doors together. It sounds so good when they close, but I know it's all psychological, because it's nothing but the same damn lock.

I couldn't help but needle him a little bit (I always had a thing about military guys, in such wonderful uniforms) so I said, "The way you close that safe, I get the idea that you think things are safe in there."

"Of course."

"The only reason you think they're safe in there is because *civilians* call it a 'safe.'" (I put the word "civilians" in there to make it sound as if he'd been had by civilians.)

He got very angry. "What do you mean--it's not safe?"

"A good safecracker could open it in thirty minutes."

"Can *you* open it in thirty minutes?"

"I said a *good* safecracker. It would take me about forty-five."

"Well!" he said. "My wife is waiting at home for me with supper, but I'm gonna stay here and watch you, and you're gonna sit down there and work on that damn thing for forty-five minutes and *not* open it!" He sat down in his big leather chair, put his feet up on his desk, and read.

With complete confidence I picked up a chair, carried it over to the safe and sat down in front of it. I began to turn the wheel at random, just to make some action.

After about five minutes, which is quite a long time when you're just sitting and waiting, he lost some patience: "Well, are you making any progress?"

"With a thing like this, you either open it or you don't."

I figured one or two more minutes would be about time, so I began to work in earnest and two minutes later, CLINK-- it opened.

The colonel's jaw dropped and his eyes bugged out.

"Colonel," I said, in a serious tone, "let me tell you something about these locks: When the door to the safe or the top drawer of the filing cabinet is left open, it's very easy for someone to get the combination. That's what I did while you were reading my report, just to demonstrate the danger.

You should insist that everybody keep their filing cabinet drawers locked while they're working, because when they're open, they're very, very vulnerable."

"Yeah! I see what you mean! That's very interesting!" We were on the same side after that.

The next time I went to Oak Ridge, all the secretaries and people who knew who I was were telling me, "Don't come through here! Don't come through here!"

The colonel had sent a note around to everyone in the plant which said, "During his last visit, was Mr. Feynman at any time in your office, near your office, or walking through your office?" Some people answered yes; others said no. The ones who said yes got another note: "Please change the combination of your safe."

That was his solution: *I* was the danger. So they all had to change their combinations on account of me. It's a pain in the neck to change a combination and remember the new one, so they were all mad at me and didn't want me to come near them: they might have to change their combination once again. Of course, their filing cabinets were still left open while they were working!

A library at Los Alamos held all of the documents we had ever worked on: It was a solid, concrete room with a big, beautiful door which had a metal wheel that turns--like a safe-deposit vault. During the war I had tried to look at it closely. I knew the girl who was the librarian, and I begged her to let me play with it a little bit. I was fascinated by it: it was the biggest lock I ever saw! I discovered that I could never use my method of picking off the last two numbers to get in. In fact, while turning the knob while the door was open, I made the lock close, so it was sticking out, and they couldn't close the door again until the girl came and opened the lock again. That was the end of my fiddling around with that lock. I didn't have time to figure out how it worked; it was much beyond my capacity.

During the summer after the war I had some documents to write and work to finish up, so I went back to Los Alamos from Cornell, where I had taught during the year. In the middle of my work I had to refer to a document that I had written before but couldn't remember, and it was down in the library.

I went down to get the document, and there was a soldier walking back and forth, with a gun. It was a Saturday, and after the war the library was closed on Saturdays.

Then I remembered what a good friend of mine, Frederic de Hoffman, had done. He was in the Declassification Section. After the war the army was thinking of declassifying some documents, and he had to go back and forth to the library so much--look at this document, look at that document, check this, check that--that he was going nuts! So he had a copy of every document--all the secrets to the atomic bomb--in nine filing cabinets in his office.

I went down to his office, and the lights were on. It looked as if whoever was there--perhaps his secretary--had just stepped out for a few minutes, so I waited. While I was waiting I started to fiddle around with the combination wheel on one of the filing cabinets. (By the way, I didn't have the last two numbers for de Hoffman's safes; they were put in after the war, after I had left.)

I started to play with one of the combination wheels and began to think about the safecracker books. I thought to myself, "I've never been much impressed by the tricks described in those books, so I've never tried them, but let's see if we can open de Hoffman's safe by following the book."

First trick, the secretary: she's afraid she's going to forget the combination, so she writes it down somewhere. I started to look in some of the places mentioned in the book. The desk drawer was

locked, but it was an ordinary lock like Leo Lavatelli taught me how to open--*ping!* I look along the edge: nothing.

Then I looked through the secretary's papers. I found a sheet of paper that all the secretaries had, with the Greek letters carefully made--so they could recognize them in mathematical formulas--and named. And there, carelessly written along the top of the paper, was  $\pi = 3.14159$ . Now, that's six digits, and why does a secretary have to know the numerical value of  $\pi$ ? It was obvious; there was no other reason!

I went over to the filing cabinets and tried the first one: 31-41-59. It didn't open. Then I tried 59-41-31. That didn't work either. Then 95-14-13. Backwards, forwards, upside down, turn it this way, turn it that--nothing!

I closed the desk drawer and started to walk out the door, when I thought of the safecracker books again: Next, try the psychology method. I said to myself, "Freddy de Hoffman is *just* the kind of guy to use a mathematical constant for a safe combination."

I went back to the first filing cabinet and tried 27-18-28-- CLICK! It opened! (The mathematical constant second in importance to  $\pi$  is the base of natural logarithms,  $e:2.71828 \dots$ ) There were nine filing cabinets, and I had opened the first one, but the document I wanted was in another one--they were in alphabetical order by author. I tried the second filing cabinet: 27-18-28---CLICK! It opened with the same combination. I thought, "This is *wonderful!* I've opened the secrets to the atomic bomb, but if I'm ever going to tell this story, I've got to make sure that all the combinations are really the same!" Some of the filing cabinets were in the next room, so I tried 27-18-28 on one of them, and it opened. Now I'd opened three safes--all the same.

I thought to myself, "Now *I* could write a safecracker book that would beat every one, because at the beginning I would tell how I opened safes whose contents were bigger and more valuable than what any safecracker anywhere had opened--except for a life, of course--but compared to the furs or the gold bullion, I have them all beat: I opened the safes which contained all the secrets to the atomic bomb: the schedules for the production of the plutonium, the purification procedures, how much material is needed, how the bomb works, how the neutrons are generated, what the design is, the dimensions--the entire information that was known at Los Alamos: *the whole shmeer!*"

I went back to the second filing cabinet and took out the document I wanted. Then I took a red grease pencil and a piece of yellow paper that was lying around in the office and wrote, "I borrowed document no. LA4312--Feynman the safecracker." I put the note on top of the papers in the filing cabinet and closed it.

Then I went to the first one I had opened and wrote another note: "This one was no harder to open than the other one--Wise Guy" and shut the cabinet.

Then in the other cabinet, in the other room, I wrote, "When the combinations are all the same, one is no harder to open than another--Same Guy" and I shut that one. I went back to my office and wrote my report.

That evening I went to the cafeteria and ate supper. There was Freddy de Hoffman. He said he was going over to his office to work, so just for fun I went with him.

He started to work, and soon he went into the other room to open one of the filing cabinets in there--something I hadn't counted on--and he happened to open the filing cabinet I had put the third

note in, first. He opened the drawer, and he saw this foreign object in there--this bright yellow paper with something scrawled on it in bright red crayon.

I had read in books that when somebody is afraid, his face gets sallow, but I had never seen it before. Well, it's absolutely true. His face turned a gray, yellow green--it was really frightening to see. He picked up the paper, and his hand was shaking. "L-l-look at this!" he said, trembling.

The note said, "When the combinations are all the same, one is no harder to open than another--Same Guy."

"What does it mean?" I said.

"All the c-c-combinations of my safes are the s-s-same!" he stammered.

"That ain't such a good idea."

"I-I know that n-now!" he said, completely shaken.

Another effect of the blood draining from the face must be that the brain doesn't work right. "He signed who it was! He signed who it was!" he said.

"What?" (I hadn't put my name on that one.)

"Yes," he said, "it's the *same* guy who's been trying to get into Building Omega!"

All during the war, and even after, there were these perpetual rumors: "Somebody's been trying to get into Building Omega!" You see, during the war they were doing experiments for the bomb in which they wanted to get enough material together for the chain reaction to just get started. They would drop one piece of material *through* another, and when it went through, the reaction would start and they'd measure how many neutrons they got. The piece would fall through so fast that nothing should build up and explode. Enough of a reaction would begin, however, so they could tell that things were really starting correctly, that the rates were right, and everything was going according to prediction--a *very* dangerous experiment!

Naturally, they were not doing this experiment in the middle of Los Alamos, but off several miles, in a canyon several mesas over, all isolated. This Building Omega had its own fence around it with guard towers. In the middle of the night when everything's quiet, some rabbit comes out of the brush and smashes against the fence and makes a noise. The guard shoots. The lieutenant in charge comes around. What's the guard going to say--that it was only a rabbit? No. "Somebody's been trying to get into Building Omega and I scared him off!"

So de Hoffman was pale and shaking, and he didn't realize there was a flaw in his logic: it was not clear that the same guy who'd been trying to get into Building Omega was the same guy who was standing next to him.

He asked me what to do.

"Well, see if any documents are missing."

"It looks all right," he said. "I don't see any missing."

I tried to steer him to the filing cabinet I took my document out of. "Well, uh, if all the combinations are the same, perhaps he's taken something from another drawer."

"Right!" he said, and he went back into his office and opened the first filing cabinet and found the second note I wrote: "This one was no harder than the other one--Wise Guy."

By that time it didn't make any difference whether it was "Same Guy" or "Wise Guy": It was completely clear to him that it was the guy who was trying to get into Building Omega. So to convince him to open the filing cabinet with my first note in it was particularly difficult, and I don't remember how I talked him into it.

He started to open it, so I began to walk down the hall, because I was a little bit afraid that when he found out who did it to him, I was going to get my throat cut!

Sure enough, he came running down the hall after me, but instead of being angry, he practically put his arms around me because he was so completely relieved that this terrible burden of the atomic secrets being stolen was only me doing mischief.

A few days later de Hoffman told me that he needed something from Kerst's safe. Donald Kerst had gone back to Illinois and was hard to reach. "If you can open all *my* safes using the psychological method," de Hoffman said (I had told him how I did it), "maybe you could open Kerst's safe that way."

By now the story had gotten around, so several people came to watch this fantastic process where I was going to open Kerst's safe--cold. There was no need for me to be alone. I didn't have the last two numbers to Kerst's safe, and to use the psychology method I needed people around who knew Kerst.

We all went over to Kerst's office and I checked the drawers for clues; there was nothing. Then I asked them, "What kind of a combination would Kerst use--a mathematical constant?"

"Oh, no!" de Hoffman said. "Kerst would do something very simple."

I tried 10-20-30, 20-40-60, 60-40-20, 30-20-10. Nothing.

Then I said, "Do you think he would use a date?"

"Yeah!" they said. "He's just the kind of guy to use a date."

We tried various dates: 8-6-45, when the bomb went off; 86-19-45; this date; that date; when the project started. Nothing worked.

By this time most of the people had drifted off. They didn't have the patience to watch me do this, but the only way to solve such a thing is patience!

Then I decided to try everything from around 1900 until now. That sounds like a lot, but it's not: the first number is a month, one through twelve, and I can try that using only three numbers: ten, five, and zero. The second number is a day, from one to thirty-one, which I can try with six numbers. The third number is the year, which was only forty-seven numbers at that time, which I could try with nine numbers. So the 8000 combinations had been reduced to 162, something I could try in fifteen or twenty minutes.

Unfortunately I started with the high end of the numbers for the months, because when I finally opened it, the combination was 0-5-35.

I turned to de Hoffman. "What happened to Kerst around January 5, 1935?"

"His daughter was born in 1936," de Hoffman said. "It must be her birthday."

Now I had opened two safes cold. I was getting good. Now I was professional.

That same summer after the war, the guy from the property section was trying to take back some of the things the government had bought, to sell again as surplus. One of the things was a Captain's safe. We all knew about this safe. The Captain, when he arrived during the war, decided that the filing cabinets weren't safe enough for the secrets he was going to get, so he had to have a special safe.

The Captain's office was on the second floor of one of the flimsy wooden buildings that we all had our offices in, and the safe he ordered was a heavy steel safe. The workmen had to put down platforms of wood and use special jacks to get it up the steps. Since there wasn't much amusement, we all watched this big safe being moved up to his office with great effort, and we all made jokes about what kind of secrets he was going to keep in there. Some fella said we oughta put our stuff in his safe, and let him put his stuff in ours. So everyone knew about this safe.

The property section man wanted it for surplus, but first it had to be emptied, and the only people who knew the combination were the Captain, who was in Bikini, and Alvarez, who'd forgotten it. The man asked me to open it.

I went up to his old office and said to the secretary, "Why don't you phone the Captain and ask him the combination?"

"I don't want to bother him," she said.

"Well, you're gonna bother *me* for maybe eight hours. I won't do it unless you make an attempt to call him."

"OK, OK!" she said. She picked up the telephone and I went into the other room to look at the safe. There it was, that huge, steel safe, and its doors were wide open.

I went back to the secretary. "It's open."

"Marvelous!" she said, as she put down the phone.

"No," I said, "it was *already* open."

"Oh! I guess the property section was able to open it after all."

I went down to the man in the property section. "I went up to the safe and it was already open."

"Oh, yeah," he said; "I'm sorry I didn't tell you. I sent our regular locksmith up there to drill it, but before he drilled it he tried to open it, and he opened it."

So! First information: Los Alamos now has a regular locksmith. Second information: This man knows how to drill safes, something I know nothing about. Third information: He can open a safe cold--in a few minutes. This is a *real* professional, a *real* source of information. This guy I have to meet.

I found out he was a locksmith they had hired after the war (when they weren't as concerned about security) to take care of such things. It turned out that he didn't have enough work to do opening safes, so he also repaired the Marchant calculators we had used. During the war I repaired those things all the time--so I had a way to meet him.

Now I have never been surreptitious or tricky about meeting somebody; I just go right up and introduce myself. But in this case it was so important to meet this man, and I knew that before he would tell me any of his secrets on how to open safes, I would have to prove myself.

I found out where his room was--in the basement of the theoretical physics section, where I worked--and I knew he worked in the evening, when the machines weren't being used. So, at first I would walk past his door on my way to my office in the evening. That's all; I'd just walk past.

A few nights later, just a "Hi." After a while, when he saw it was the same guy walking past, he'd say "Hi," or "Good evening."

A few weeks of this slow process and I see he's working on the Marchant calculators. I say nothing about them; it isn't time yet.

We gradually say a little more: "Hi! I see you're working pretty hard!"

"Yeah, pretty hard"--that kind of stuff.

Finally, a breakthrough: he invites me for soup. It's going very good now. Every evening we have soup together. Now I begin to talk a little bit about the adding machines, and he tells me he has a problem. He's been trying to put a succession of spring-loaded wheels back onto a shaft, and he doesn't have the right tool, or something; he's been working on it for a week. I tell him that I used to work on those machines during the war, and "I'll tell you what: you just leave the machine out tonight, and I'll have a look at it tomorrow."

"OK," he says, because he's desperate.

The next day I looked at the damn thing and tried to load it by holding all the wheels in my hand. It kept snapping back. I thought to myself, "If he's been trying the same thing for a week, and I'm trying it and can't do it, it ain't the way to *do* it!" I stopped and looked at it very carefully, and I noticed that each wheel had a little hole--just a little hole. Then it dawned on me: I sprung the first one; then I put a piece of wire through the little hole. Then I sprung the second one and put the wire through it. Then the next one, the next one--like putting beads on a string--and I strung the whole thing the first time I tried it, got it all in line, pulled the wire out, and everything was OK.

That night I showed him the little hole and how I did it, and from then on we talked a lot about machines; we got to be good friends. Now, in his office there were a lot of little cubbyholes that contained locks half taken apart, and pieces from safes, too. Oh, they were beautiful! But I still didn't say a word about locks and safes.

Finally, I figured the day was coming, so I decided to put out a little bit of bait about safes: I'd tell him the only thing worth a damn that I knew about them--that you can take the last two numbers off while it's open. "Hey!" I said, looking over at the cubbyholes. "I see you're working on Mosler safes."

"Yeah."

"You know, these locks are weak. If they're open, you can take the last two numbers off..

"You can?" he said, finally showing some interest.

"Yeah."

"Show me how," he said. I showed him how to do it, and he turned to me. "What's your name?" All this time we had never exchanged names.

"Dick Feynman," I said.

"God! You're Feynman!" he said in awe. "The great safecracker! I've heard about you; I've wanted to meet you for so long! I want to learn how to crack a safe from you."

"What do you mean? You know how to open safes cold."

"I don't."

"Listen, I heard about the Captain's safe, and I've been working pretty hard all this time because *I* wanted to meet *you*. And you tell me you don't know how to open a safe cold."

"That's right."

"Well you must know how to drill a safe."

"I don't know how to do that either."

"WHAT?" I exclaimed. "The guy in the property section said you picked up your tools and went up to drill the Captain's safe."

"Suppose you had a job as a locksmith," he said, "and a guy comes down and asks you to drill a safe. What would you do?"

"Well," I replied, "I'd make a fancy thing of putting my tools together, pick them up and take them to the safe. Then I'd put my drill up against the safe somewhere at random and I'd go vvvvvvvvvvv, so I'd save my job."

"That's exactly what I was going to do."

"But you opened it! You must know how to crack safes."

"Oh, yeah. I knew that the locks come from the factory set at 25-0-25 or 50-25-50, so I thought, 'Who knows; maybe the guy didn't bother to change the combination,' and the second one worked."

So I *did* learn something from him--that he cracked safes by the same miraculous methods that I did. But even funnier was that this big shot Captain had to have a super, super safe, and had people go to all that trouble to hoist the thing up into his office, and he didn't even bother to set the combination.

I went from office to office in my building, trying those two factory combinations, and I opened about one safe in five.