

AT: Welcome to the Infinite Women podcast. I'm your host, Allison Tyra and today I'm joined by Dr. Nina Baker, a historian of women in engineering, to tell us about British aeronautical engineer and motorcycle and sports car racer Beatrice Shilling. Now clearly, there's a lot to say about this incredible woman.

NB: Beatrice Shilling was born in 1909. Her father was a butcher, fairly prosperous. There were two older sisters and they all had good educations. So Beatrice was the baby and she was known as Baby until she went to school. When she didn't want to be called Beatrice, she insisted on being known as Bea. We'll hear about other names she was called but this was the name she went by normally was Bea. She went to a couple of different girls' high schools in the south of England as the family moved around. And when she was 12, she won a prize, Meccano, the metal kit for making machines and things out of little bits of metal. Meccano magazine ran a national competition for people to send in their designs for working machines of various kinds and she sent in presumably photos and a description of a working spinning wheel and she was one of the prize winners. This was in 1921. The prizes were quite lavish. She was by no means in the first, second or third prize. She was in the sort of other group and she got a Meccano set and a modern clockwork model railway set. So quite good prizes. She was very keen on everything to do with machines and she saved up her pocket money and when she was 14, she bought a two-stroke oil Enfield motorbike, which she used to run around on. She was able to take it to pieces while she was still a schoolgirl, put it back together again, clean it up, the whole thing.

So she was already a very adept practical engineer before she'd even left school and her parents were at a bit of a loss to know what to do with her because clearly nursing and secretary-ing wasn't going to suit. She said "I want to be an engineer." But they had no idea how that might happen, and by great good fortune the Women's Engineering Society, which was founded in 1919, 1926 they sent round an advertisement to girls' schools saying that one of their very well-respected members, Margaret Partridge had set up her own company building power stations and building power supply circuits for villages and large houses and she was looking for an apprentice. And Beatrice applied and was successful and of all the apprentices that Margaret Partridge took on, Beatrice was by a country mile the most successful. She took to it immediately, was a very hard worker, picked up all the technical detail very quickly. And was a great success, to such an extent that Margaret Partridge worked with the Women's Engineering Society to cobble together some money to support her to go to Manchester University to do a degree mechanical engineering and she and another woman, Sheila McGuffie, were the first two women to do mechanical engineering at Manchester University.

So she graduated from the Department of Electrical Engineering in 1932 and then did a Master's in mechanical engineering, and then a further year working for one of the professors whose interest was on two-stroke internal combustion engines. So she was developing her engineering knowledge.

And during this period, this is when she first started doing her racing. She bought a Norton 490 cc bike, pretty powerful bike and she raced this at Brooklands racetrack and in 1934 she got what was known as the Brooklands gold star, which was only awarded to those who had gone round a lap of Brooklands at least 100 miles an hour. This she did on only her second trip to Brooklands. Other people who had been going for years were still not getting their gold stars and she was very quickly moved out of the beginners' races and the ladies-only races into the general competition pool and was still beating the guys hands-down. She was absolutely fearless and she tinkered with this motorbike to make it go faster and was generally very successful. She had heard that one of the few places where women were getting jobs in engineering was the Royal Aircraft Establishment because quite a lot of links between Brooklands. Brooklands was also an aerodrome, a lot of racing fliers went there, so there was a lot of crossover of the people, the same kind of group of people. And after a lot of applying, she eventually started at the Royal Aircraft Establishment in 1936 and she was taken on as a technical author, which was absolutely not what she wanted to do but a toe in the door. She recognized that once she was there she could do something and she was a technical author, writing instructions on how various engines worked pilots instructions on how to pilot various types of airplanes and this kind of thing. But she hammered and hammered and hammered until she got moved across into one of the

mechanical engineering departments. She was transferred to the carburetor section in the engine department. Carburetors are all about fuel supply and fuel supply became her specialism more or less for the rest of her career. The first work she was doing was on something called the Royal Aircraft Establishment Carburetor. the RAE carburetor, which was intended to be for various Bristol radial aerial engines, for the Mercury engine, the Perseus engine. There was a design for one for the Hercules. And she was quickly promoted to assistant, too. Now it sounds very lowly, but actually many women never got above that and she got well above that over the years. So this was not too bad for a starting point. And it was while she was working on these carburetor designs that the Second World War came along.

Now it didn't come out of nowhere and the country had been preparing for this war for a couple of years before it actually broke out, so that's why they were working on all these fighter plane engines already. The Spitfire already existed. It wasn't invented at the beginning of the war. It was already in trial. But the trials they were doing before they were on active service were nothing like what happens when you actually get into battle. And the first thing that happened when they got into aerial combat with the Germans was that they realized that both the Hurricane and the Spitfire, which had the same Rolls-Royce Merlin engines, were struggling because the Messerschmitts that they were up against were faster and could dive very effectively. And the Spitfire and the Hurricane couldn't, and the reason for this was that they discovered that when they dived, the engine would putt-putt-putt and cut out. And when they tried to pull up out of the dive it still wouldn't start. There were two things going on here. It's quite complicated to explain when you can't see something, when you're only listening to me talking. But the problem was that the carburetor is a little chamber in which air and fuel are mixed to the right proportion for the internal combustion, the explosion that takes place in the cylinder. And what they hadn't reckoned on was all this diving that was going on at high speed, because what happened was in a dive, the float in the carburetor would move to the top and cut off the access to the fuel. And so there wouldn't be enough fuel going into the cylinder. And then because it has moved to the top and all the fuel was suddenly at the top, the fuel then push it down again and flood the engine. And if you've ever flooded a petrol engine you will understand that it's then very difficult to restart. And so the pilots were having a lot of trouble with this. And this problem was given to Beatrice to sort out. And it emerged that her skill was not just practical. She had really absorbed a lot of physical principles when she was at university, was able to understand what was going on with the gravity situation inside the carburetor. And there were a number of problems that they had to solve. They had to stop the fuel surging up, they had to make sure that the fuel outlets at the bottom of the carburetor had access to fuel, and they had to deal with the problem of the float being forced down by the fuel and flooding in the engine.

She looked at this and she developed a cross between a washer and a tiny funnel and it was called the RAE restrictor, very simple to make and very simple to install in the carburetor, very cheap. And for this work she was promoted to senior technical officer and she became head of that section. And in 1941, she presented the RAE restrictor to the people who had made the original carburetor, which was made by a company called SU. So the SU carburetors, which were fitted in the Rolls-Royce engines. So she gave a presentation to SU and to Rolls-Royce about what the problem was, what the solution was, was this little kind of washer thing. And for a while, until they could find a more permanent solution, she was going round different airfields on her motorbike with a pocketful of these things, teaching the RAF technicians how to retrofit these into the Merlin engines on the airfield, but this wasn't a permanent solution. This was very much a sort of bodge and fix it to hold the place. A year later, she'd come up with a new design for the carburetor for fixing to the Merlin engines. Some of them were back-fitted, some of them were done at the factory by this point. And this involved quite a lot of changes to the interior of the carburetor, so that the fuel was limited in its ability to flow during dives. Eventually the Merlin engines ended up with injection carburetors, which is what the Messerschmitts had had all along. And one of the things that she needed in order to get to this point was a test platform so that she could test the carburetors on the ground before they went up into an airplane. She built one of these. And she started being asked to test other people's carburetors. The Americans sent over one, something called the US Bendix-Stromberg carburetor and she identified the problems they had with theirs particularly at high altitude, and

suggested modification for that. The RAE restrictor that she'd invented for the Merlin engines had a rather rude name. It was known as Tilly's orifice. Now I have to say "Tilly" was never her nickname to her face. It was a behind-her-back kind of name for her, because that was not the name she went by. But Tilly's orifice was what it was colloquially known by. And so this new invention for the American carburetor was a completely different design. It was known as Tilly's pepper pot because it had lots of holes in it.

So she'd been working on fuel supply and that was her clear area of expertise. Come 1944 and the V bombers were arriving. And one of the problems was that the V bombers came so quickly, you didn't have enough time to do anything about them. So what they wanted to do was have an airplane that was fast enough to catch them up and shoot them down in the air because shooting them down from the ordinary anti-aircraft guns wasn't working. And after a lot of research, Beatrice developed a way of boosting the power for a plane called the Mustang, so it was fast enough to be able to catch the V bombers and shoot them down. And at this point she was promoted to principal technical officer and her role was as experimental supervisor for this kind of work. Her RAE carburetor design was handed over to commercial company Hobson's, the manufacturer and it continued to be in use, made by a variety of engines, not just Rolls-Royce, but Bristol engines as well for many years long after the Second World War ended. So it was it was a solid design.

So we've now got to almost the end of the Second World War and the V bombers and the V bombs were of course rockets. And famously Von Braun, who designed them for Hitler and all the rocket engineers in Germany, they were miles and miles ahead of anything we had on that front in Britain or America, which is why at the end of the war, both Britain and America recruited these rocket scientists and some of their kit for their post-war work. And that was the kind of work that she then moved into. And in a way I feel, yes, the work she did in the war was very significant but some of the work she did after the war, hardly anybody knows about because everybody's got so besotted with this jokey name of Tilly's orifice. and the work on iconic Spitfire and Hurricane, which they don't usually mention, that they don't really ever get to the point where they find out what else she did.

So after the war there was a lot of work to try and catch up with what the Germans were doing. There are two things, the rockets and the very fast supersonic planes. And some of the work that Beatrice did was to do with that and some of it was to do with rockets. So she designed, built, commissioned a high-altitude test plant. So this was a way of testing things on the ground that were intended to be used at very high altitude thin air, less oxygen, all these kinds of things, very cold very often. And she was testing a lot of top-secret equipment, some of which had been brought over from Germany. So, not to put too fine a point on it, but at the end of the war as the Allied forces were moving across Germany with the advancing troops even before VE-Day, with the advancing troops were sent teams of scientists and industrialists to Hoover up as much of the technology and the technologists and the knowledge as they could. It was considered the legitimate spoils of war reparation. Now the Americans were able to offer better working conditions, so they got a lot of the stars. But the Royal Aircraft Establishment picked up a lot of people and a lot of stuff, including some of their biggest ever wind tunnels. So she was testing equipment that had come from Germany for a couple of years after the war and she was starting to work on experimental rocket fuels. Now basically if internal combustion is an explosion inside a cylinder, a rocket is an explosion that you've tied something onto the top of. So these fuels are really scary. Now, I'm no chemist, but a very well known one at the time that she worked with quite a lot, something called hydrazine hydrate. Highly explosive. I have no idea really what it is. But basically they were trying to control an explosion, which is what a rocket is. It's a controlled explosion with something on the top of it. So in 1947, she was supervising the design of power units for the supersonic development work and she was designing scale model rocket engines. And they were usually made by Vickers, which was a big armaments company, Vickers Armstrong. But Shilling's team were working on the design of the engines and the fuel supply for these things.

All this work got her OBE, Officer of the Order of the British Empire in 1948. I think she was quietly pleased but it was the fashion to be quite dismissive in those days. In fact, famously OBE was often said to stand for "other buggers efforts." But in her case absolutely not, because she had done a lot of stuff largely on her own. But as

part of a team, but it was her engineering prowess that came up with solutions. So the other thing she was working on, so we're just coming into the Cold War era in the 1950s. She's working on something called ramjets, which are very peculiar things where you launch something with a rocket and when it's going fast enough, there is a way of using that speed to make it carry on even after the rocket fuel husk has died away and that's called a ramjet. But you have to launch them at over 1,000 miles an hour. And one of the things that she had to do was to design tests launching structures first at first they were launching them off airplanes. They were flying airplanes with these things tied to the bottom over the Scilly Isles and then launching the rocket. Because whatever happened you didn't know, it all fell in the sea. So then they designed these rigs for launching them on land. A lot of this was done at the coast where, you couldn't do this at Farnborough because you'd be launching it over people's heads. Farnborough is quite a built-up area. So she was doing quite well, and she worked on what was known as the boil-off rig, which is part of the fuel system for a thing called the Blue Street rocket, which was Britain's last independent effort to have its own space program. And these were rockets that were being designed and built in Britain and then shipped out to Woomera and launched there. And sometime you must do a podcast about the Woomera women because they're really interesting too, the women who worked there. And that's where they were test launched from. The knowledge that came out of this period was, in the end, used much more for missiles than it ever was to the space program as far as Britain was concerned.

Towards the end of her career, she was working on a whole variety of things, cabin pressure for very high-altitude craft. She was working on braking systems and braking surfaces. So one of the things, the faster an airplane goes the more distance it needs to land when it comes back, and she was working on figuring out the surfaces the best surfaces for getting things to brake very quickly. And interestingly in the light of the much later shuttle program, NASA came over to see what she was working on and she went over there to work with them. And in fact one of the very few occasions when she was allowed to publish work she'd been working on because nearly everything she ever did was top secret defense work. She was allowed to publish a paper about this in a journal, which was really very unusual because most of what she was doing, she wasn't allowed to do. She was born in 1909, so in 1969, she was 60 and had to retire, that was the civil service rule, women retired at 60 without the option. And she and her husband spent most of their retirement really working on and racing their little car. They had a Lagonda which they used to race. And that's a very quick roundup of Beatrice Shilling's professional work.

AT: So I want to go back to the sexism, unfortunately, because as you mentioned, even the nickname Tilly which anybody who's cottoned on to the fact that her name was not Matilda might be saying "hey, where did that come from?" And my understanding is that it's short for "utilitarian," like it was an insult to her appearance in the first place.

NB: Well, I've never seen any evidence, but I've heard that too. So there's no better explanation. And yes, she was not somebody who valued her appearance at all.

AT: And that's not why she was there! She wasn't there to look pretty. She was there to fix airplanes.

NB: Well, quite. In the pictures in the book, apart from when she's on her motorbike, she is seen in dresses and skirts. But in the book, he says that her usual clothing for work every day was a corduroy trouser suit, probably a man's suit cut down. She was very small. But then if I look at pictures of other women of that period, they lived through the Depression, when there was no money. They lived through the war when clothing was rationed. After the war, clothing was still in really short supply and these were women who were interested in their work. These were mostly not women who were interested in clothing. None of them looked all that much more of a fashion plate than she did, to be honest.

AT: And of course, nobody's applying those same standards to the men. (NB: No.) In an episode that I did about Ruby Payne-Scott who's a who was a radio astronomer here in Australia. We talked about how the dress code at CSIR where she worked was that, "oh the women have to wear skirts." And she just straight-up said, "this is ridiculous. I'm climbing up on ladders installing aerials and things. I'm wearing pants." So this idea that "oh she didn't take care of her appearance" is such a...

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NB: Well, it's a thing of its period because if we think about, yes women in the war for their work, were wearing boiler suits and trousers, WREN boat crew wore trousers. The WRENS who were air mechanics wore boiler suits. The women in the in the WRAF who were mechanics, they wore boiler suits. The women who were in the army mending tanks, they wore boiler suits. But it was still considered rather risque to wear trousers socially. My mother was of that generation, slightly younger, my mother was born in '23. But she told me that people did wear trousers but it was considered rather racy to wear trousers socially. So I can kind of see it. The other thing you have to accept about Beatrice and she rose to principal technical officer, which is pretty high. She didn't become a director but then Farnborough had a very flat hierarchy. There were only four directors. So of all the brilliant men who started there, most of them never became directors either. She headed up her own teams from quite an early point and apparently worked well with the teams, got on well with them, I imagine was able to go down and have a pint or two at the pub with them and be absolutely fine. I've only met one person who worked directly for her and he was there as a very young engineering graduate at the end of the war. And he said she was a very, very tough taskmaster. She expected perfection out of the box and she would have words to say if you couldn't meet up to that. And other women there were the same. A woman called Frances Bradfield absolutely had a very high standard of what she expected from report writing. And Beatrice didn't like writing reports, but she expected everybody's reports to be absolutely spot-on accurate without mistakes. So, she was not an easy person.

But we think of barriers - were there barriers against where she might have got to? I'm not so sure because to be a director of a whole section, let alone director of the whole place, there's a certain amount of politicking that's always required when you get to those levels of management and she wasn't that kind of person. She could never hold her tongue and everybody knew this. And some could work with it and some couldn't. She worked for people that really were desperate to get rid of her, but they never actually did. She was there until her 60th birthday. And I think it's an indication of how valued she was, that she continued to be there in her own name despite having married her husband, George Naylor, who worked there as well, although he went away to the RAF during the war. She wouldn't marry him until he got his Brooklands Gold Star, which he eventually did. But everybody knew they were married because they were both working at the place. But she never went by her married name and the marriage bar was quietly forgotten about, almost like Don't Ask Don't Tell, but it wasn't quite like that. I think it was more or less, "for God's sake don't anybody tell the minister at the Treasury." But there were other women in other parts of the civil service for whom this was also the case - if you had really desirable skills, they would turn a blind eye to the marriage bar. So I'm not convinced that she was really battling a gender barrier all that terribly unsuccessfully.

AT: Well, it's interesting when you mentioned, she could go for a drink at the pub with them because my understanding, there were all these little annoyances and bigger ones, like you mentioned the marriage bar, which for anyone who doesn't know is basically you get fired or you can't hold certain positions if you're a married woman.

NB: Well, it was rich, they referred to it as "so-and-so is retiring to get married." We think of retiring as an old-age thing, but people were referred to as, "oh, Miss So-and-So is retiring to get married."

AT: Like being forced into retirement because you got pregnant, for example.

NB: Well that was an absolute, people who had babies were expected to vanish for a few years.

AT: But the reason I mentioned the drink at the pub is my opinion is there's things like women weren't allowed to enter the RAE senior mess like club and dining hall. There was a law prohibiting women from working at night. There was an RAE chief engineer who wouldn't allow women to enter the building, just stories like that.

29:10

NB: Well, these old farts, I think he would have been given short shrift because if the work required a woman to be in there. Somebody would have told him actually suck it up. As regards the mess on the site, I think it was during the Second World War that they were told, "You've got to admit women" and it was suggested to Beatrice that she would be an appropriate first member, but it wasn't her kind of place. It was too formal. She would rather be down the pub with the boys. And there's a lovely picture in the book of her team, down the pub with the boys after their first successful ramjet launch. So, I wouldn't have thought that that kind of thing would have bothered her.

But you mentioned women not being allowed to work at night. Well, this wasn't the situation at the RAE but going way back into her apprenticeship days when she was still a teenager and working for Margaret Partridge. So Margaret Partridge was a woman who had set up her own business to build power stations and wire up small villages, small estates, large country houses with lighting. This is during the mid-1920s at a time when by no means everywhere had electricity. Lots of rural areas, towns had electric lighting in most homes, but rural areas didn't. My father, a middle-class man brought up in a house in Essex in the countryside, a house where they could afford to have a couple of servants - no electricity. So this was very common. So Margaret Partridge set up this business and her idea was that she would take on an apprentice. Together, they would build this power station. They would wire up the the the local village or wherever it was and then, it could take a couple years, the apprentice would be left behind to run the power station and Margaret would move on to another one with another apprentice. And now as it turned out, Beatrice was the only one where this really worked because the others either weren't up for the hard work or hadn't the mechanical aptitude or whatever. But Beatrice absolutely had and of course when you need a power station to be working for electric light, it needs to be working at night. So she was work supervising power station overnight. The problem was that there was an international regulation called the Washington Convention, which forbade women from working overnight. And they got taken to court and so the Women's Engineering Society took this up as a cause celebre and, Margaret Partridge, Beatrice Shilling, Dorothy Rowbotham who was another woman in this company, the woman who ran the Women's Engineering Society, Caroline Haslett, and a couple of others. They campaigned on this for years and eventually got it partly overturned so that women in a professional supervisory capacity could work overnight. I think this was a leftover from some of the worst excesses of Victorian exploitation of women at work. This is supposed to be in the women's own interest. Eventually, the the rule was completely overturned, but Beatrice was part of this group that got caught by the problem and then solved the problem. So she was aware of the issues of women in unusual places, but in my impression, it's not something that got in her way.

AT: So she's one of these people who's just so brilliant and assertive that she's able to sort of just bypass these restrictions.

NB: I think she was a force of nature, she was so focused on her work and what what interested her. So I've just been watching *For All Mankind*. And if you look at some of the women engineers and that, they're like that. All they're interested in is their work and everything else can go hang. And I think she was a bit like that - perfectly capable of having a heterosexual successful marriage, no children by their own choice. They decided that there was a choice because children cost money. So they did a sort of a cost-benefit analysis: "if we have a child, we can't afford to continue racing and we want to continue racing. So we're not going to have any children." (AT: That's fair.) Well, we all make our priorities and those were hers.

AT: Well, actually let's talk about that because Beatrice and George really as I understand it got into racing cars as sort of a team after World War II. Is that correct?

NB: Yeah, they bought a beautiful thing called a Lagonda Rapier, which is a gorgeous little two-seater coupe with with a drop hood, gorgeous lines. They stripped it back to practically nothing and when you look at it racing, you hardly believe it's the same thing. So they stripped it down almost to the chassis and the engine with a seat and they raced that quite successfully for some years. But racing isn't cheap. But yeah, they enjoyed tinkering. And they both enjoyed speed.

AT: It is funny when when you think about how she's described as, even in 2011, a review of a biography of her was like, "oh she looked pretty awful. She looked like a frumpy old British housewife." And it's just sort of funny when you think about, that's how this man even in 2011 is perceiving a photo of her, as she was out here racing bikes and cars.

NB: Well, whatever you think she looked like in a photo, a photo doesn't tell you anything about what person is like and I'll show you her husband. This was her husband, he was quite (AT: He was hot.) Yeah, I would say so! He could have probably had anybody, so it wasn't that she was so frumpy she couldn't get a man, because she got I would say, as you say, a pretty hot guy and she was one of the few there who did marry. Some of the the women who started a bit later, the women who started during the war, some of those married, but most of the women who started at Royal Aircraft Establishment before the Second World War, I think she was about the only senior one that married. Perhaps people just looked different in those days.

AT: But also this idea that a woman's main attribute that you should be concerned about is how she looks. Never mind her brilliance or her daring or her driving or anything like that. "Oh, no, she looks frumpy."

NB: I think the difficulty is we're looking at these photos and comparing them to women on TikTok today. It's like comparing chalk, cheese and a dinosaur It's just not the same thing. You can't, because you don't know, you're not speaking to her even as we are and getting some animation out of them. You're not hearing them being enthusiastic about their enthusiasm. People come across very differently when when they were speaking to them when you're face-to-face and you see their faces light up. Just totally different. Fortunately she was valued for her other attributes, she had this, okay, not easy career and the letters that this book includes between her and her husband, about the difficulty she was having was such and such a boss and such and such a situation. It wasn't easy, but she didn't give up. The book is called *Negative Gravity: A Life of Beatrice Shilling* by Matthew Freudenberg. This is the only biography that I'm aware of. But this was written by somebody who had access to her family's archives. This is the only book the only authoritative book about her.

AT: In the context of her legacy, so there's the book that you've mentioned. But when we're talking about, Tilly was an insult, right? This isn't a nickname that she liked or chose for herself or anything like that. But that's what's on her blue plaque. And there was a one-act play written by a woman called *Tilly and the Spitfires*. And for anyone who's not familiar with blue plaques, these are an official historical marker that you'll see all over the UK saying, this famous person, this was their childhood home or where they lived as an adult or their office. So this is a very official thing that is meant to commemorate someone and even that says Tilly.

NB: I think people like to think that they they have some kind of inside knowledge by using this, "Oh, I know enough about this woman to use her nickname." the fact that she never had it used to her face, either they don't know it or they choose to ignore it, but I think it's false personally. So when she retired in 1969, over 200 people came to her retirement presentation. And so I'm reading from the book, "her choice of retirement gift was a trio of Canaletto prints, which was in marked contrast to the set of taps and dyes - engineering tools -

which had been given to her on her marriage to George Naylor. And as well as the Canaletto, she was given a magnificent retirement scroll.” I would love to see this. “Artistically illustrated, it bore the signature of over 200 colleagues and well-wishers and closed with two quotations: ‘Happy the man who void of cares and strife in silken or in leather purse retains a spent splendid shilling.’” And this is a quote from somebody called John Phillips in the 17th century. So this is saying somebody, “no matter what you've got if you've got a splendid shilling” - as in Beatrice - “you're in a good place.” And the other one was anonymous and this refers to the transition of British currency from the old pound shillings and pence to the decimal coinage. And the quote is, “the shilling will shortly disappear from our currency and its value will no doubt increase compared with the five new pence piece replacing it.” So, quite humorous but still pertinent people valued her they thought warmly of her despite everything.

AT: That's interesting when you were saying earlier about how people didn't like her, this is one of the things that was said about her. And I'm wondering how much of that is just this idea that women have this higher bar for likeability, (NB: Absolutely.) compared to behavior that would not even be commented on in a man.

NB: Yeah, absolutely. It's a bit like when a man is bold and a woman is pushy. Just words, but my word, they carry a load of meaning. I'm sure you're right because I'm sure that the Royal Aircraft Establishment was absolutely full of people who we would now regard as autistic-ish, people who were absolutely obsessed with certain things, socially appalling and very hard to get along with. And perhaps it was more normal for men in engineering fields and people everybody was used to working with old so-and-so, don't go and talk to him before 12 noon because he's grumpy. And a grumpy guy, you just get used to. A grumpy woman, not so much.

AT: I am autistic and have a previous episode on women and autism and one of the things that we talk about is the reason that girls are less likely to, one of many reasons girls are less likely to be identified as autistic is that there is so much more social pressure for us to mask, to behave, (NB: To be social, in fact.) Exactly and an interesting connection as well is as we were talking about the Tilly thing, which I don't think I'm ever gonna get over frankly. One of the correlations there, is you were saying people like to feel like they have this familiarity with someone, they like to feel like they have that connection, but it's often used as a way to undermine women and it made me think of (NB: Infantilize somebody.). Yeah, exactly and I believe it was Watson was the one who was worse, of Watson and Crick. Watson, when he wrote about their discovery, which was basically Rosalind Franklin's work being handed over to them without her knowledge or consent and then “oh *they* discovered DNA.” But when Watson was writing about this, not only was he commenting on Franklin's appearance, he also referred to her as Rosie, which was a nickname that she did not like, and he also suggested that she was autistic, which a lot of people viewed as like “oh, how dare you say that!” And I'm just like, “that one may actually be true.” Like he was a jackass, but (NB: That's plausible, yeah, yeah.) But that fact that he's using Rosie again, not just annoy her but to sort of assert power over her to say, “oh, you can't stop me from using this nickname. And so it's just interesting when we look at the nicknames that are applied to women without their consent

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NB: Well, the other thing is if we go back, in Watson, Crick and Franklin's time as well, but if we go back into the the Second World War and before that, men who'd been to privately funded school, to public schools and and the like, boarding schools, without exception they referred to equals by their surname: “oh, morning, Smith, morning, Jones. It'd be very rare for them to refer to each other by their first names. Women did this to a certain extent. But it was much more common that the man was was addressing a woman by her first name and the men were addressing each other by their surnames and there was a certain level of, even if they were a similar formal rank in the civil service, of formality versus informality for the woman. My own parents referred to each other by their surname. I found it very peculiar. And in fact when I went to do my PhD at Liverpool, I

was surprised to hear my supervisor, who was actually my age because I was a mature student, talking to a colleague and saying so-and-so by his surname and said, “you don't talk like that to anybody here. Why do you talk to him like that?” And it was, “oh, well, I knew him when we were students and everybody referred to each other by their surname.” Oh, really? But I had forgotten that about Rosalind Franklin, but yes, I think it was a way of threatened men reducing the woman to the level of a secretary. Because you could refer to a secretary by her first name, especially if she was unmarried, because she was absolutely an underling with no power whatsoever.

AT: But you also see this, it's an issue even today with media for example referring to politicians, and they'll call the woman by her first name and the man by his last name. But even as someone who has seen shows like *Upstairs Downstairs* and *Downton Abbey*, the housekeeper or the butler would have the the honor of being Mr. or Mrs. And I think that was a thing where even if the housekeeper wasn't married she was, Mrs. was an honorific. But it was a sign of status - anyone under them was known by their first name. And so this whole first name last name thing, I think has a lot of different avenues that we could go down.

NB: Oh yeah. The British class culture is absolutely riven with this sort of stuff. And I don't know, maybe people addressed her as Shilling, underlings would have had to call her Miss Shilling. I doubt if anybody called her Ma'am. (AT: Can't call her Mrs. because we're not acknowledging that she's married.) I think she went by Miss Shilling throughout, which was rare in those days And perhaps, I don't even know if we know from the letters how her husband...

AT: It would be hilarious if he called her Shilling. Did they meet through work? (NB: Yeah) So if she was commonly known as Shilling, it might be.

NB: She's addressing him as “George dear.” Beatrixie! Here we are, 1943, “Beatrixie, darling.” But that's a very intimate thing. And certainly nobody else is going to be allowed to say that.

AT: I mentioned earlier that you're a historian of women in engineering more broadly. So what is it that made you say, “oh, we have to talk about Beatrice Shilling?”

NB: Well, I'm afraid it's because she's rather an obvious person. She is really well known and there are other women who are nearly as well known, particularly in British engineering. But if anybody can come up with the name of a woman engineer other than Ada Lovelace, it's probably gonna be her. So we can come back and revisit some of the other people who are also very interesting but perhaps less well-known still. But I thought you wouldn't want to leave out somebody obvious, as it were And she did such a lot. It wasn't easy at any given time, but she moved from somebody who was just a schoolgirl, wiring up houses to getting a degree, going to the Royal Aircraft Establishment, getting a Brooklands Gold Star, getting married and still carrying on at the Royal Aircraft Establishment and doing all this work on airplanes and rockets and stuff. It's a very full story.

AT: Join us next time on the Infinite Women podcast and remember well-behaved women rarely make history.