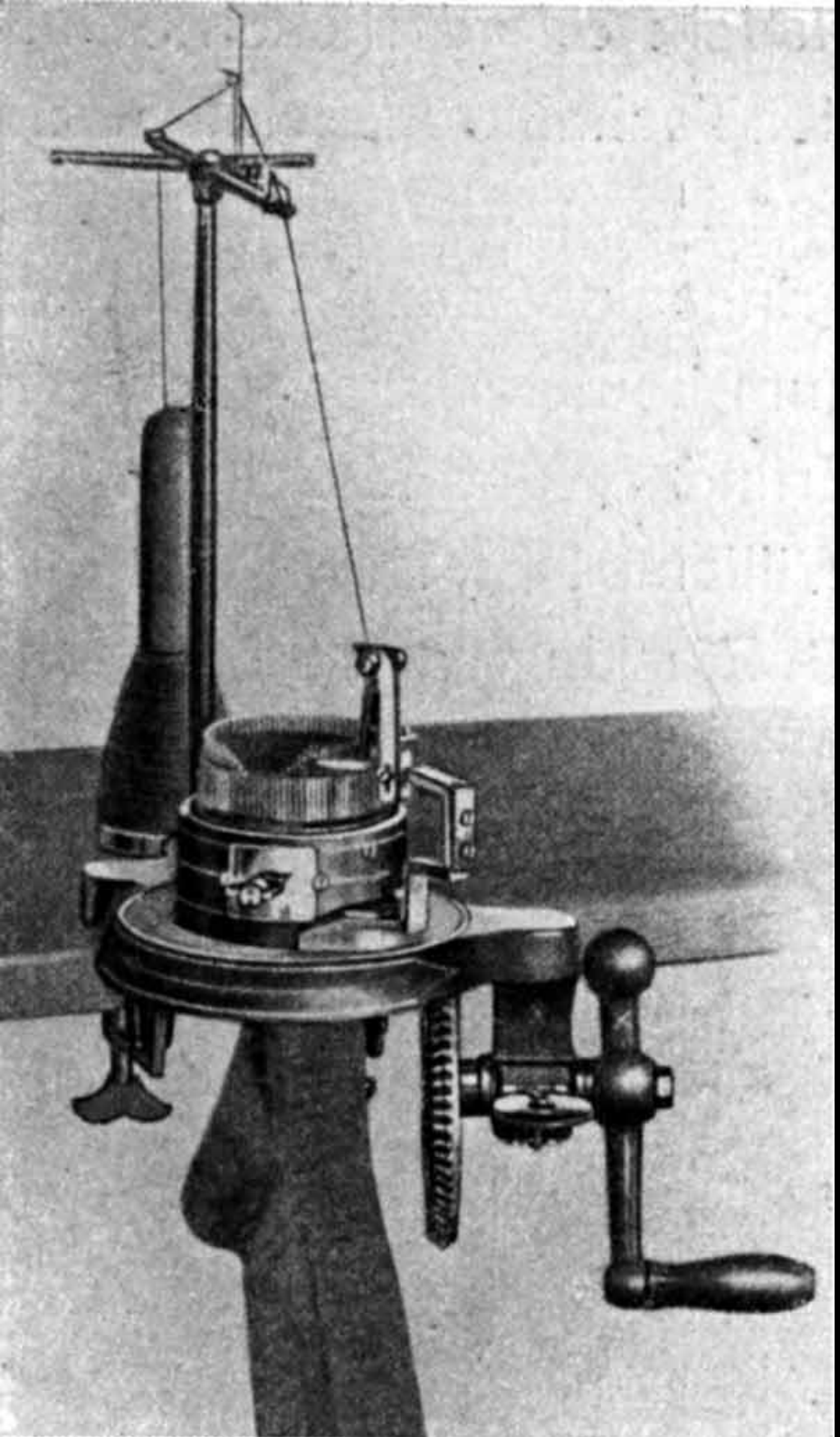
OPEN SOURCE HARDWARE
From Fibers to Fabrics

Varvara & Mar
www.var-mar.info

What about knitting and craft in general?

- Knitting is very old craft.
- The origins of knitting go back to 400-500BC

Source:
http://maryhanna.net/wp-content/uploads/2010/08/KnittingOldLady.jpg

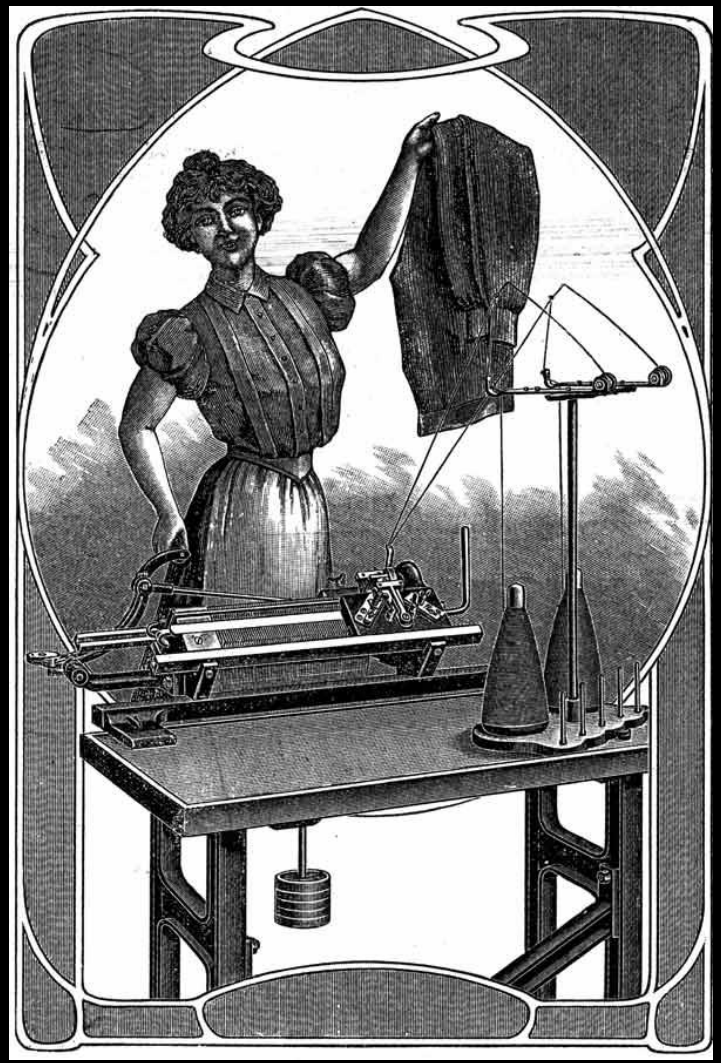


Circular knitting machine

Hand-powered circular knitting machine of the Chemnitz-Based "Strumpfmaschinenfabrik" (Stocking Machine Factory) for the production of stockings with toes and heels, 1880.

Source:
http://www.german-hosiery-museum.de/technik/07rundstrickmaschinen/Bild_rundstrick_02.htm

When did a knitting machine appear at home?



The first simple hand-powered flat-bed knitting Machines were constructed for home use by the cottage industry in 1890.

As well small-size factories were using these machines.

Source:
http://www.german-hosiery-museum.de/technik/06flachstrickmaschinen/Bild_flachstrick_06.htm

Brother knitting machines' models

MODEL	YEAR
KH-500	1955
KH-511	1960
KH-561	1964
KH-581	1966
KH-588	1969
KH-800	1971
KH-810	1973
KH-820	1974
KH-830	1976
KH-840	1978
KH-890	1979
KH-910	1976
KH-930	1980
KH-940	1988
KH-965	1992
KH-970	1996

Non punch-card machines

Punch-card machines

Electronic knitting machines

-> Although Brother knitting machines have been discontinued, they are still the ones that people have at home!
The two most popular knitting machine lines in the market, namely Brother and Silver Reed/Studio

=> Knitting machine is a 1st personal manufacturing tool at home

Industrial yarn spinning machine

1905

2013

Industrial drawing frame machine

1908

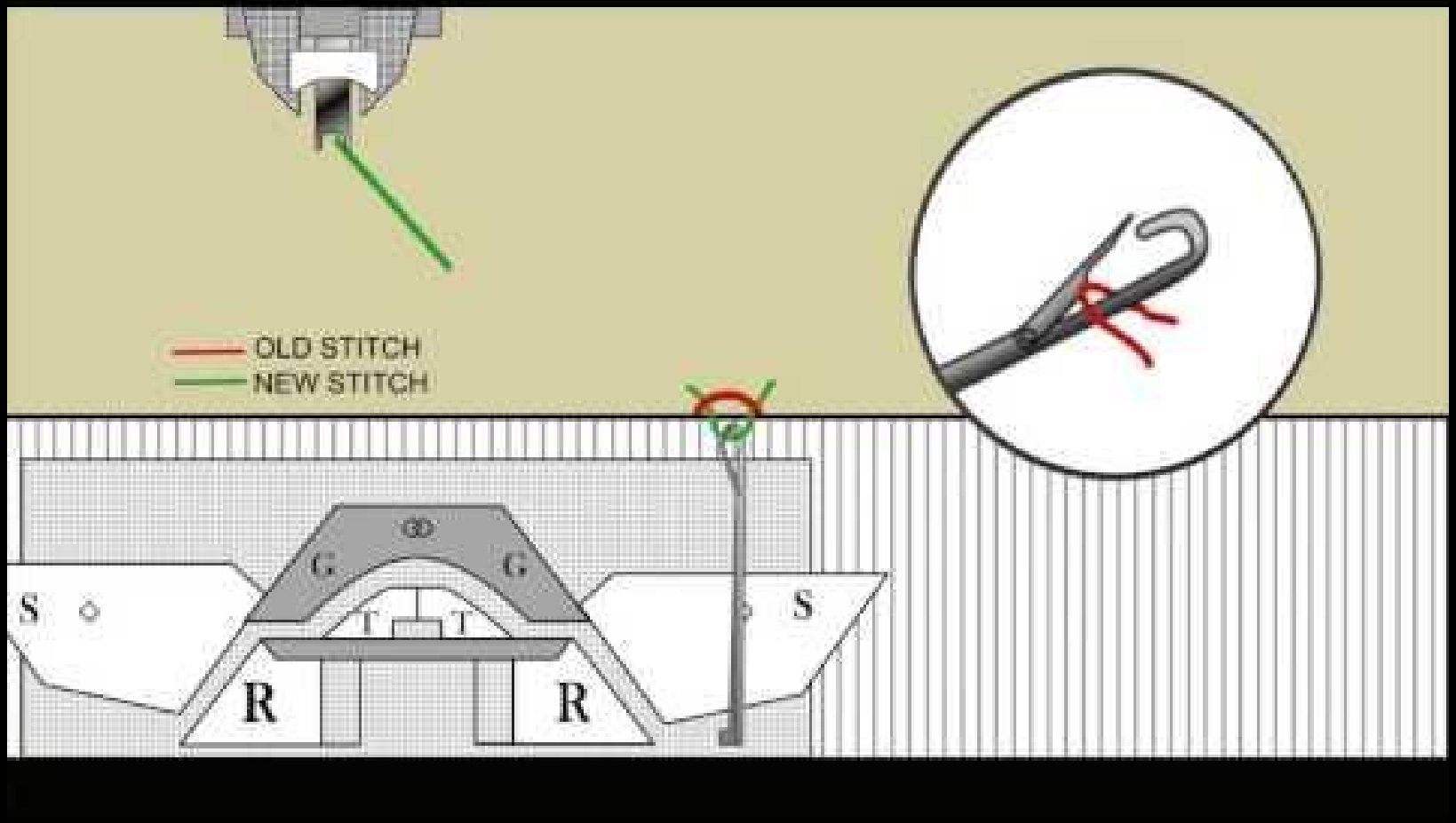
2013

Sewing in the factories

1930

2013

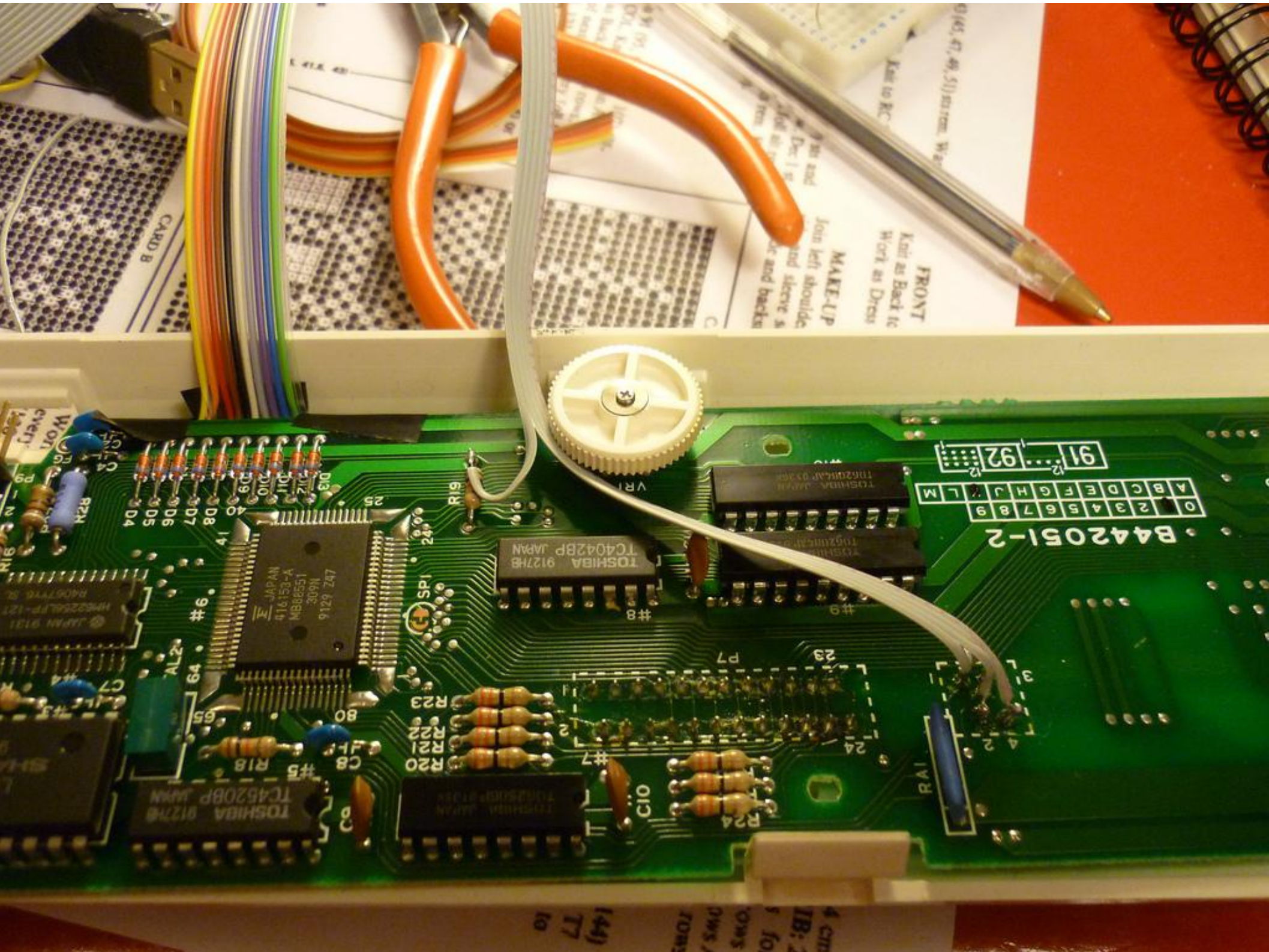
Knitting



Source: https://www.youtube.com/watch?v=NGLsnhnR7UU

Hacking KH930

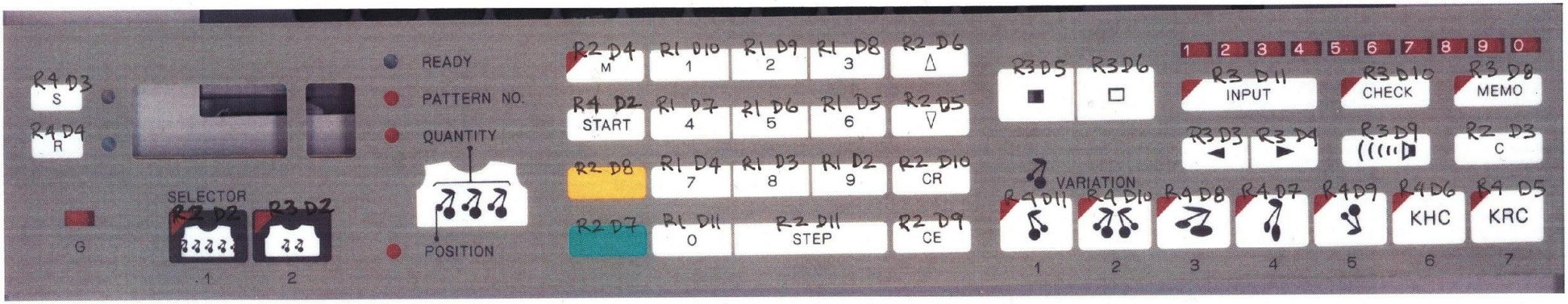
The hack of Becky Stern from MAKE magazine
Floppy emulation script in Python by by Steve Conklin


B4205I-2
TOSHIBA 9127HB
TC4042BP JAPAN
TOSHIBA 9127HB
TC4520BP JAPAN
MB86551
SPI

Physical hack

- Inspired by Travis Goodspeed and Fabienne Serriere

Button Matrix Encoding KH-930 Knitting Machine



on the board rows are in 4 pin ribbon cable, on mainboard denoted on P8 as 1,2,3,4.

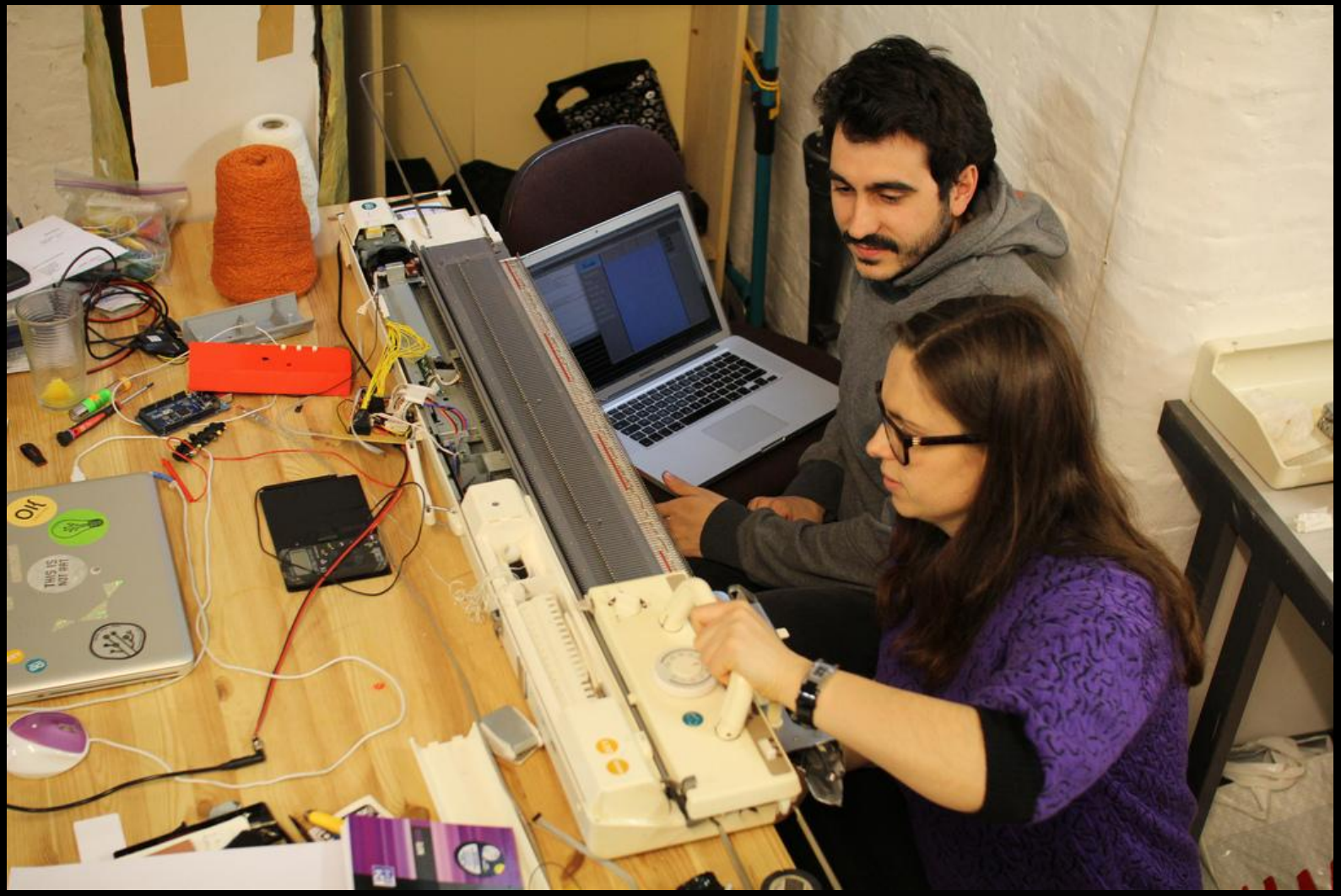
On the board columns are diodes D2 – D11 on mainboard, and pins 7–16 on large ribbon cable between boards.

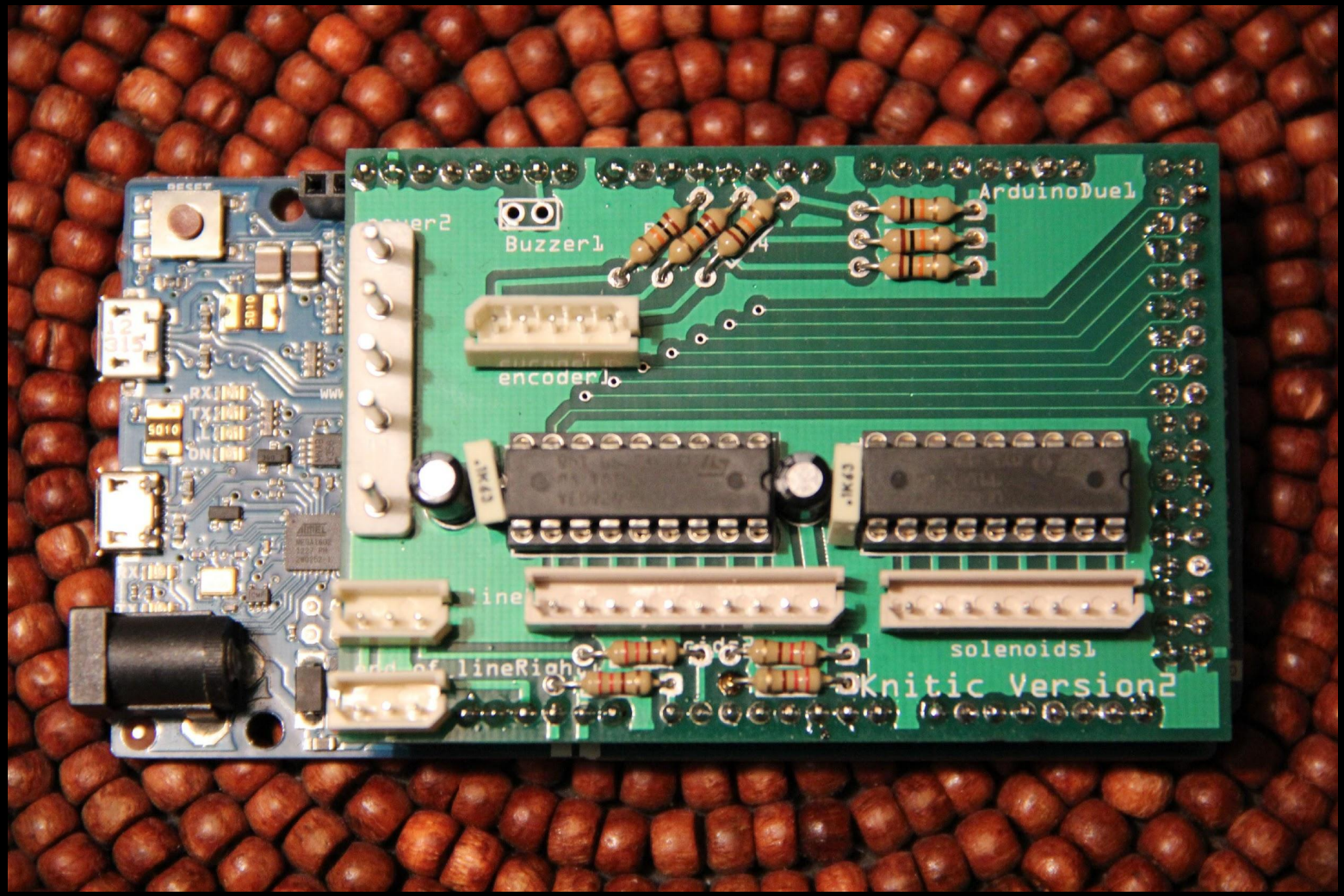
rows	
0	R1
1	R2
2	R3
3	R4

columns	
0	D2
1	D3
2	D4
3	D5
4	D6
5	D7
6	D8
7	D9
8	D10
9	D11

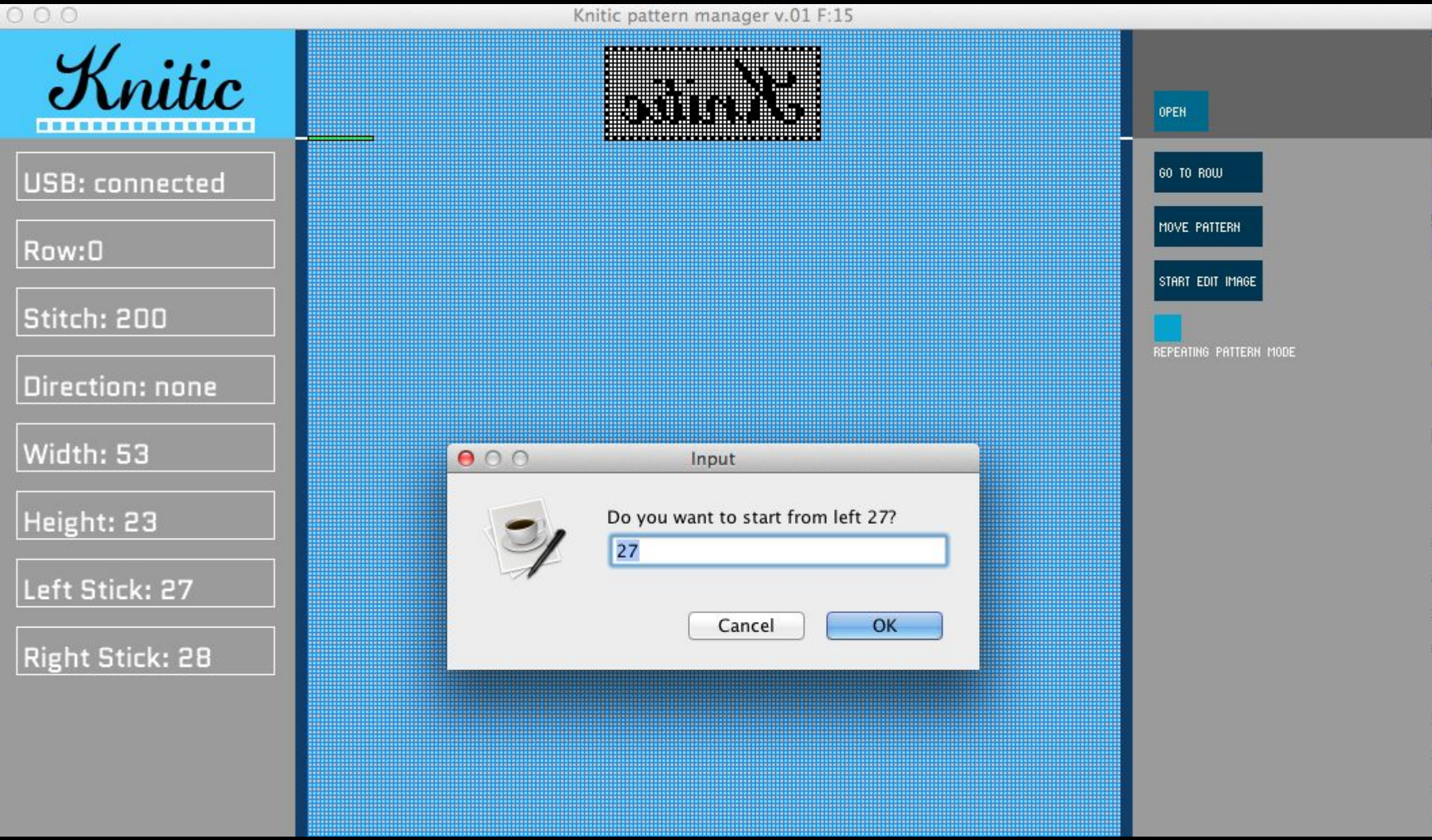
unused: R3D7

Knitic – open source knitting machine



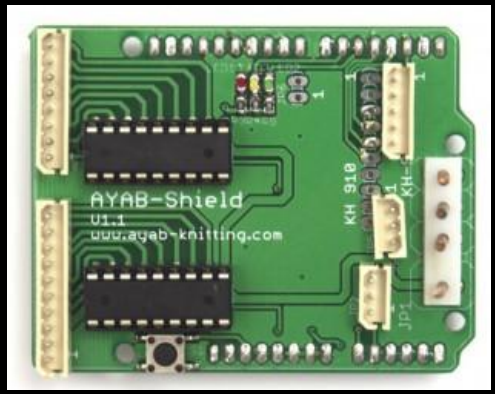


https://github.com/mcanet/knitic

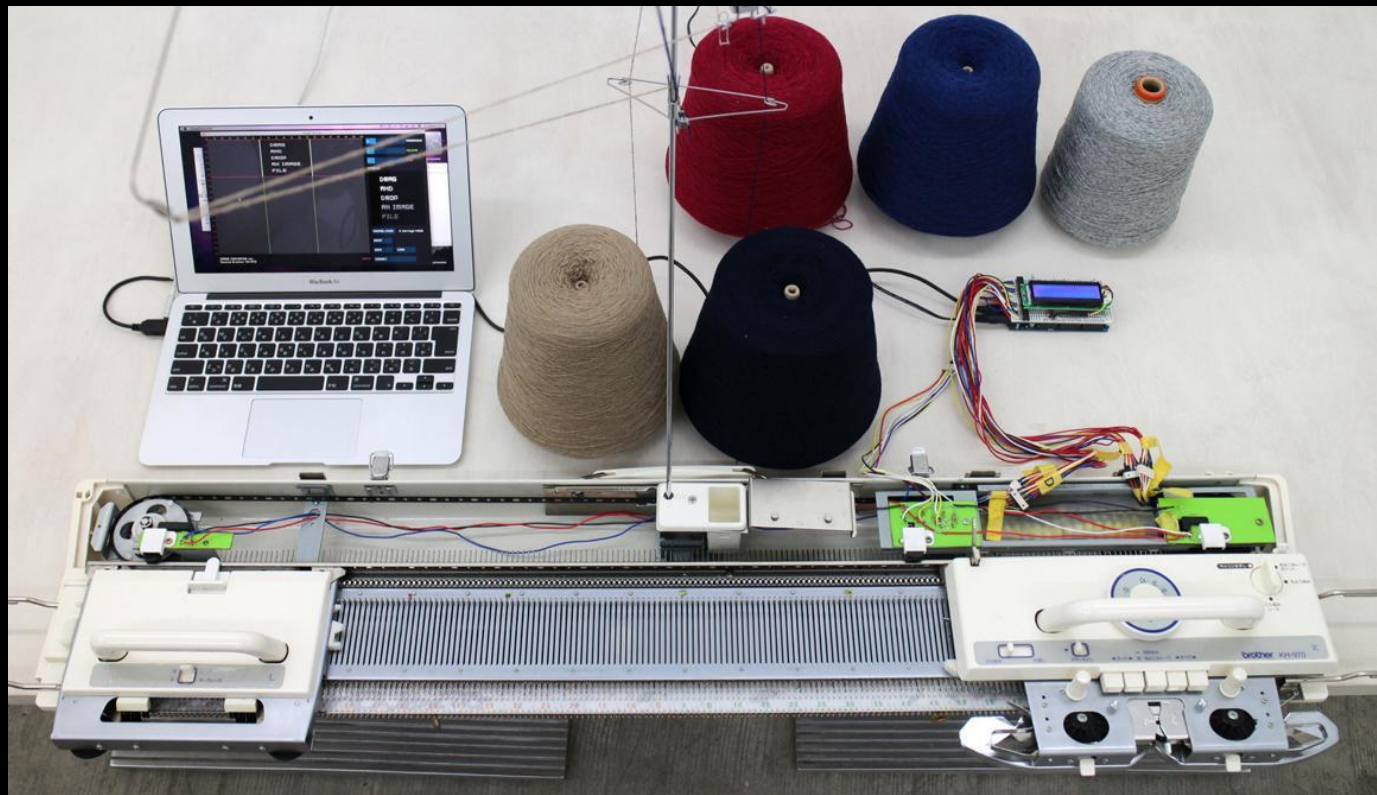

Knitic pattern manager v.01 F:15
Knitic
USB: connected
Row:0
Stitch: 200
Direction: none
Width: 53
Height: 23
Left Stick: 27
Right Stick: 28
OPEN
GO TO ROW
MOVE PATTERN
START EDIT IMAGE
REPEATING PATTERN MODE
Input
Do you want to start from left 27?
27
Cancel
OK

Oiko-nomic Threads is an installation for an algorithmically controlled knitting machine and open data.
http://afroditipsarra.com/index.php?/on-going/oiko-nomic-threads/

Ayab provide an alternative way to control the famous Brother KH-9xx range of knitting machines using a computer.
http://ayab-knitting.com

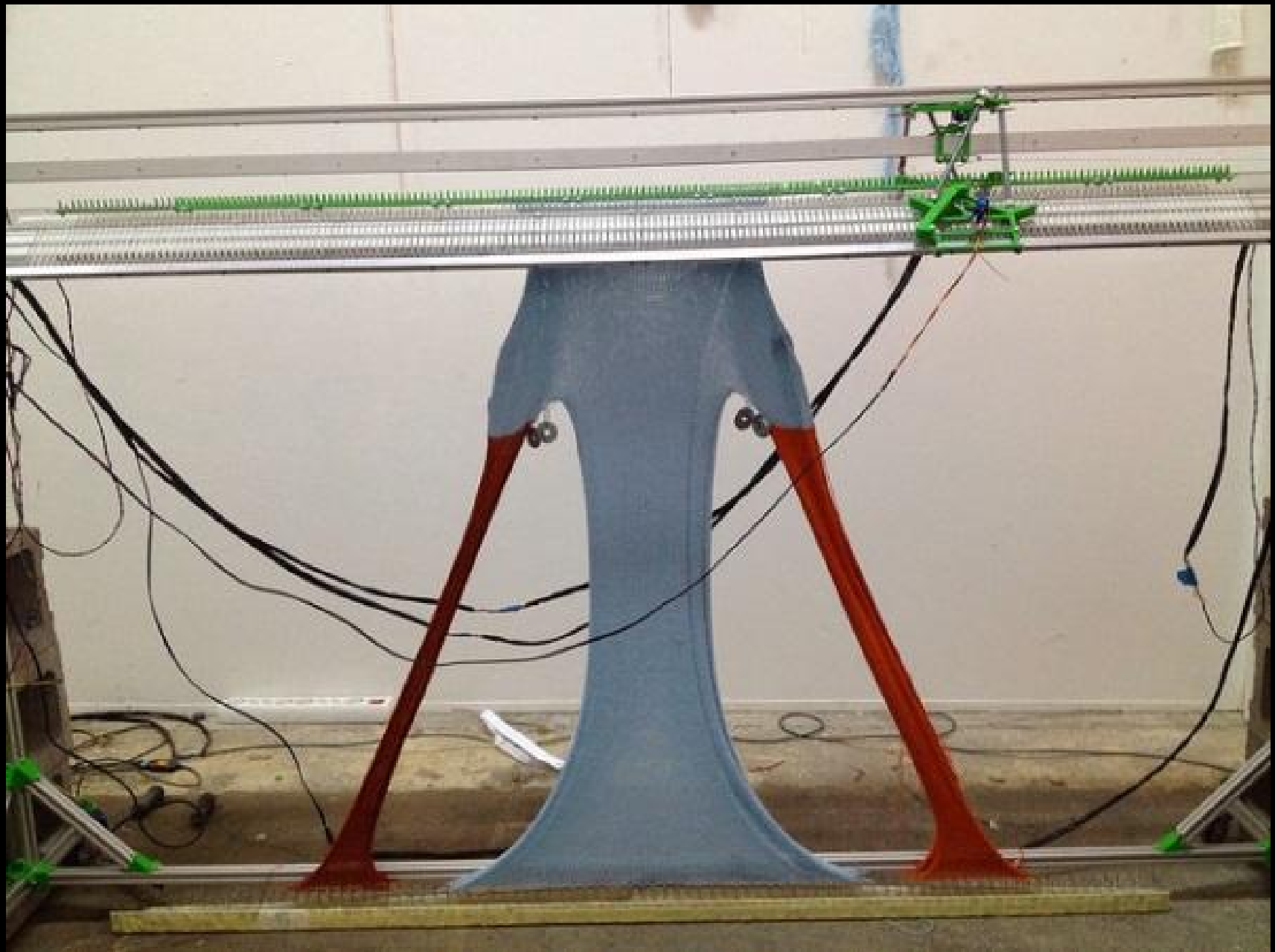


Glitchknit The project is largely divided into two parts. The first is hacking the knitting machine, exposing an environment where anyone can output the image as a knit, and the second is to make a glitch knit using the hacked knitting machine.
http://glitchknit.jp



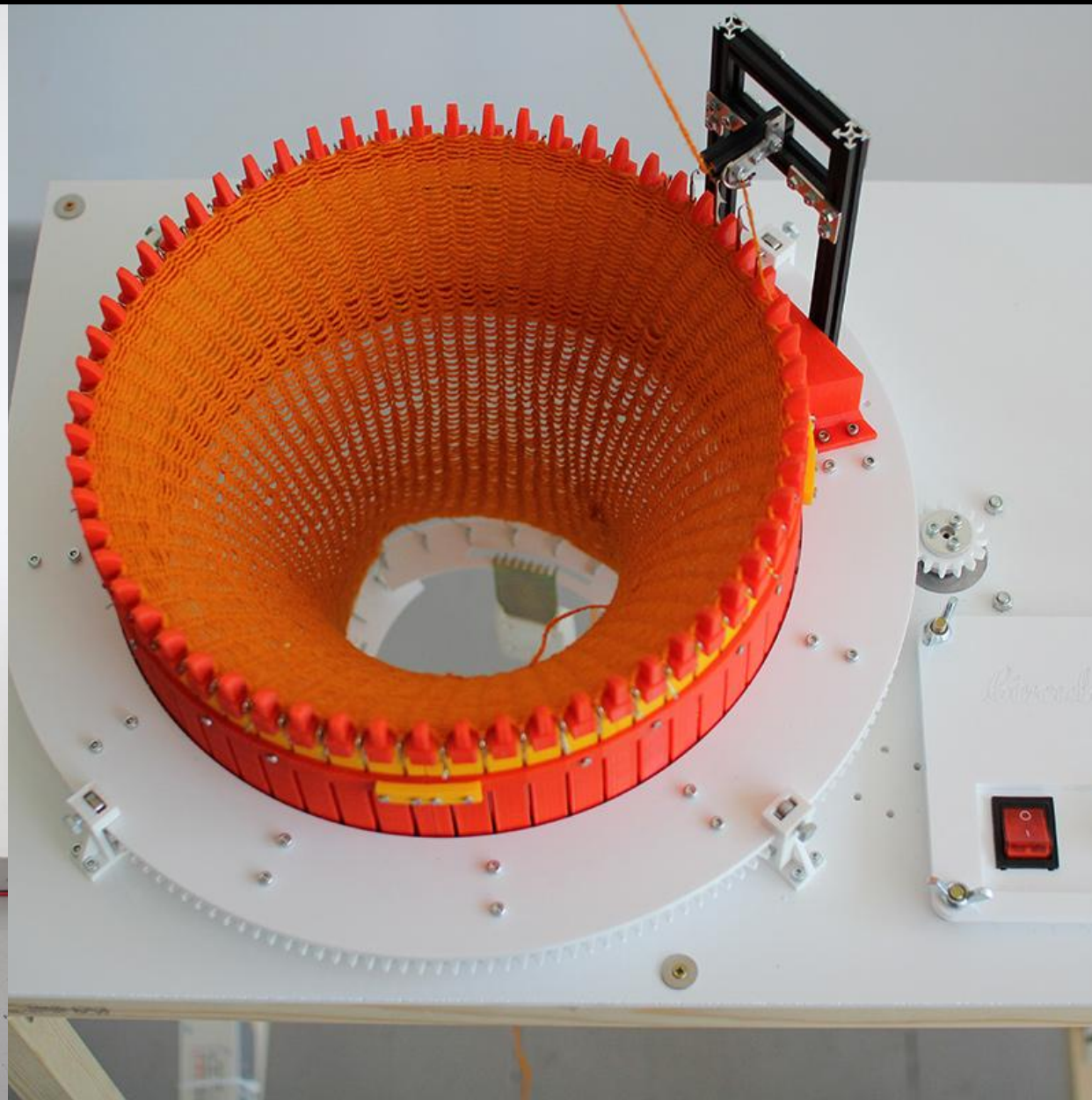
OpenKnit

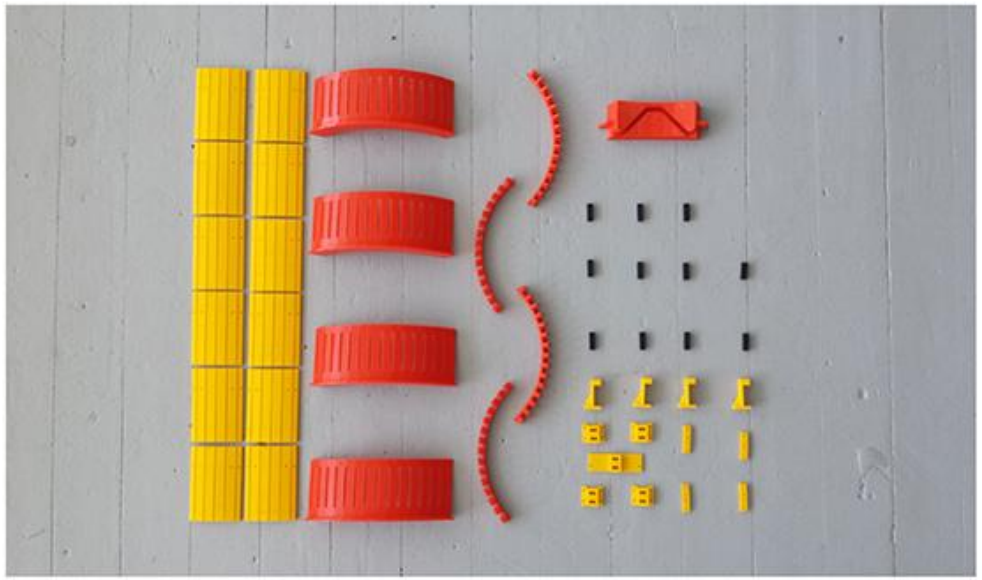
http://openknit.org

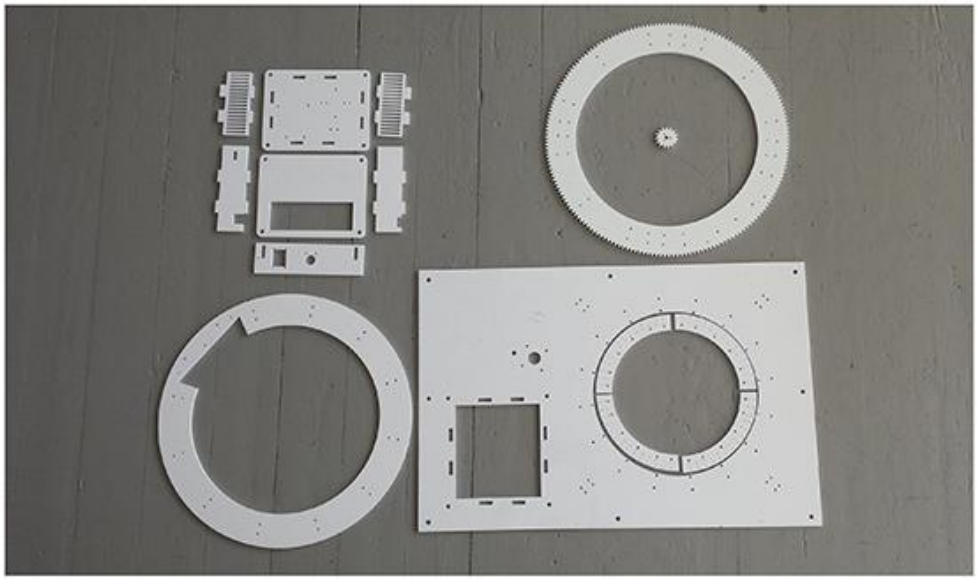


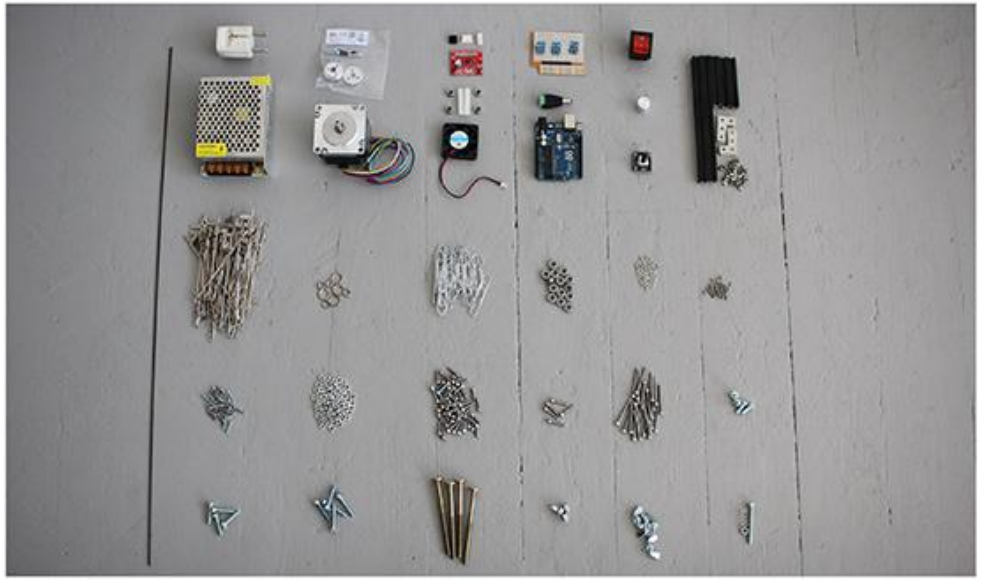
Circular Knitic

https://github.com/var-mar/circular_knitic



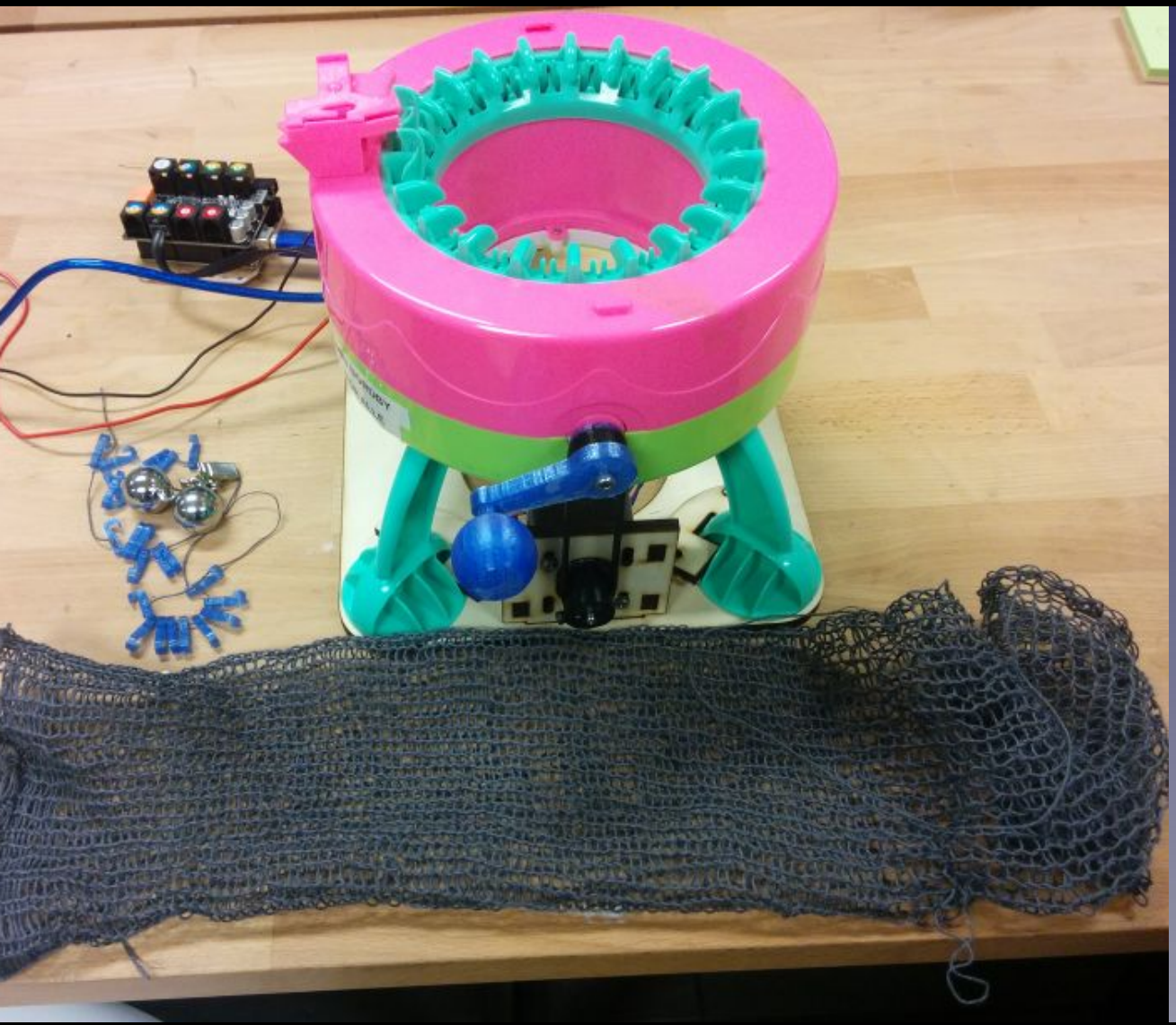


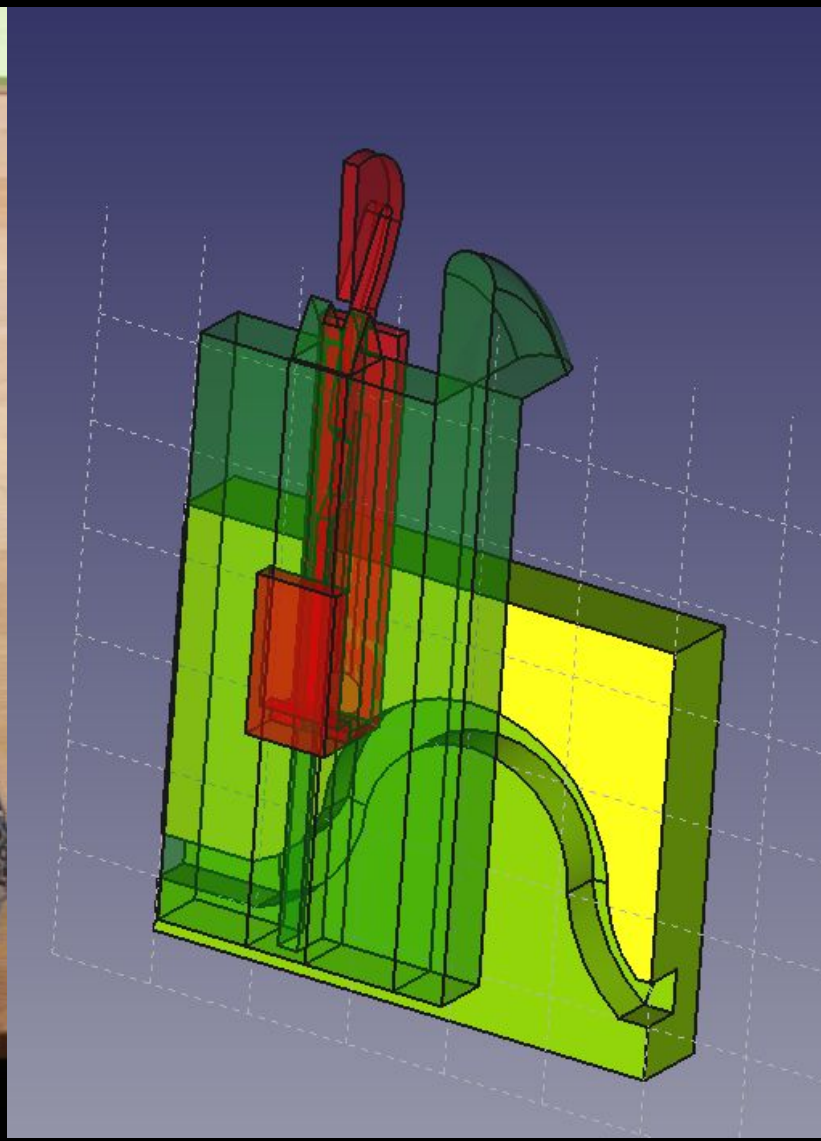




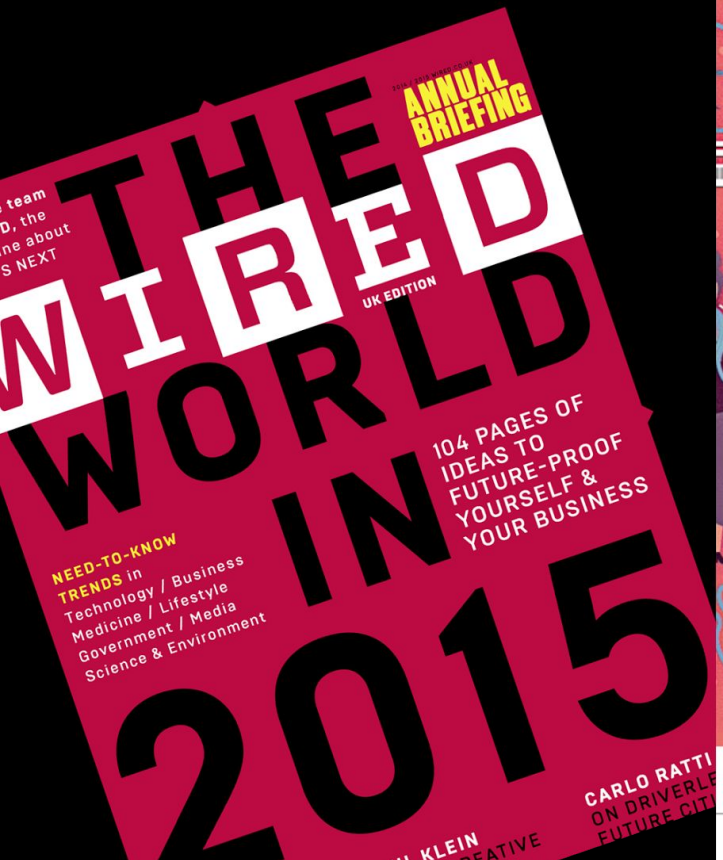
Source: https://www.youtube.com/watch?v=fp5OEGPKtcY

Idda - open-source 3d-printable circular knitting machine *(in-process)*





https://github.com/jonnor/idda-knitting-machine



3D KNITTING BEGINS TO CLICK

Just as the sewing machine brought clothes-making into the 20th-century home, a new generation of low-cost knitting tools is about to open up fashion

By **Mark Miodownik**

KNITTING WAS ONCE THE PRESERVE of grannies. Then it got adopted by hipsters, who made it cool for a while. Now it's gone high-tech and will become the next big thing in the maker world.

3D knitting, as the tech version is called, was inspired by the 3D-printing revolution and aspires to a similar goal: to be the one piece of manufacturing technology in every-one's home. It doesn't make objects, it makes clothes – and for this reason it has a big advantage over 3D printing because it has a much more obvious use. Everyone wears clothes – and we are constantly replacing and updating them because they wear out or become unfashionable. Another advantage over 3D printing is reusability. For the coarser knits at least, garments can be "unknitted" should you not like the way they make you look, or if you just get bored with them, leaving you with yarn to turn into something else.

Three-dimensional knitting machines are already available and growth is on the up. OpenKnit is one open-source example – it can be built from a kit and is part of a manufacturing ecosystem that includes a software interface and a digital hub to share designs. OpenKnit already has a large global community, developing the platform and iterating both the hardware and software. As with all successful open-source projects, this will grow and spawn new and unexpected versions in 2015.

Commercial 3D-knitting machines have been in operation for more than 20 years, but they are designed for established mass production. In contrast, the open-source knitting community will change the way clothes are designed and made, and create new forms of clothing – in particular by integrating different types of fibres into the knit, such as electrically conducting threads. By doing

Chris Stokel-Walker

THE NEW WAVE OF ADDITIVE MANUFACTURING

3D printing is moving from the hackspace to the production line

It may have reinvigorated the maker movement, but beyond the hackspace, large-scale consumer uses for 3D printing have proved limited. But designers and inventors are expanding the boundaries of additive manufacturing beyond pushing plastic through a nozzle.

Gerard Rubio, CEO of London-based Kniterate, built his first 3D printer in 2009, cobbled together with motors, drivers and parts from old paper-fed printers. That experience, plus an art project involving 3D-printing small figurines of passers-by on Barcelona's La Rambla, led to Kniterate, an on-demand garment "printer" that knits clothes across two decks of 125 needles. "I call it additive manufacturing," says Rubio, "but it's not melting anything. You knit the garment with instructions from a computer."

Kniterate, the initial prototype of which was itself 3D printed, can produce a sweater in a matter of hours and has the potential to upend fashion processes. "We want to offer a better experience," says Rubio, 31, who launched a Kickstarter for Kniterate in September. "It makes a garment to your measurements, in your pattern and design, on demand."

This is what excites Rubio the most: that the next generation of additive manufacturing can now produce a finished product, rather than just a model. And it's what Kirk Phelps, a former Apple engineer who worked on the first-generation iPhone, sees as the difference between first-generation 3D printing and the new wave of additive manufacturing. "When we look at 3D printing up to this point, it hasn't changed consumers' lives because it's largely used for prototyping," he explains. "We founded a company to make 3D printing not just about prototyping, but about production."

From whole-garment knitting to printing three-dimensional electronics, manufacturing is undergoing a transformation

Phelps works for Carbon3D, which has developed a machine that uses continuous liquid interface production (CLIP) to create objects 100 times faster than standard 3D printers, and to a higher, more durable standard. "All 3D printers work layer by layer, building up an object by extruding materials on to a surface at increasing height," Phelps explains. Layers can be brittle, and break under pressure – which is why 3D-printed objects are usually prototypes, rather than finished products. "So, we got rid of the layers."

The underlying science behind CLIP has been known for 30 years, but Carbon3D is the first company to realise its potential for additive manufacturing. The machine controls both light and oxygen input using complex physical modelling. This ensures a gradated change between liquid resin as it comes out of the machine's nozzle and the solid state it will eventually set as.

End products made of the most durable resin Carbon3D's printer uses can withstand 55,000kPa of pressure – a durability that's caught the eye of the automotive industry, which has contacted Carbon3D to make mesh structures that make a car's plastic parts stronger but lighter.

Phelps is bullish about 3D printing's future, believing it will become a mainstream way to produce everyday items within three years. But it's not only big parts for cars and aeroplanes that could soon be built by additive manufacturing machines: the humble printed circuit board is being upended by advances in 3D printing technology.

The two-dimensional thinking of printed circuit boards is limiting the development of electronics, argues Michael Bell of Voxel8, a startup spun out of a Harvard University research laboratory. Everything is flat: flat-screen televisions; flat smartphones; flat laptops and tablets. "With our process, you can put the electronics in and wire them up in three dimensions, which frees you up from the constraints of flat printed circuit boards," he explains.

© Oriol Vidal

Voxel8 prints electronics in a similar method to the way 3D printers make trinkets. A process called sheer printing turns microparticle silver from a peanut-butter consistency in a nozzle, to liquid as it is extruded, then back to a thicker state when needed. This allows the Voxel8 printer to lay out precise circuits in three dimensions, forming wires that can be as narrow as 50 microns (0.05mm) thick.

Bell, 26, won't disclose how many machines have shipped, but did say that demand has been healthy, and the first production run of machines has all sold. The feedback helps Voxel8 hone its technology, "helping us find the billion-dollar use-case markets and enabling us to tailor our development to that," Bell says.

Even on its home turf of prototype production and model making, 3D printing has its downsides – namely speed and cost. At ETH Zurich's department of computer science, Christian Schüller is reviving an old-school process for truly rapid prototyping: thermoforming.

Long used in the production of packaging items and chocolate-box trays, thermoforming had previously been limited to the production of simple and flimsy single-colour items. By running highly detailed designs through a computer simulation of the thermoforming process first, Schüller's process allows the deformations that occur when the thin sheet of plastic is pressed around a mould to be accurately modelled and accounted for. Colours and details – such as the numbers on a remote-controlled car chassis – can be printed in anticipation of the changes thermoforming will make them undergo, meaning the end product looks perfect.

"If you want to do 20 or 30 copies of an object with a 3D printer, it will cost you a lot of money," says Schüller. Thermoforming is much cheaper, particularly at scale. "On top of that, with 3D printers the surface finish is just not as good as we can get with thermoforming."

So how excited should we be by the developments in additive manufacturing? Very, argues Voxel8's Michael Bell. "You see Boeing and Airbus starting to print many of the parts in their aircraft engines, and already the next generation of 3D printers are upending automotive and consumer electronics," he says. "There's so much work in 3D printing going on that there's never been a better time to get into the field."

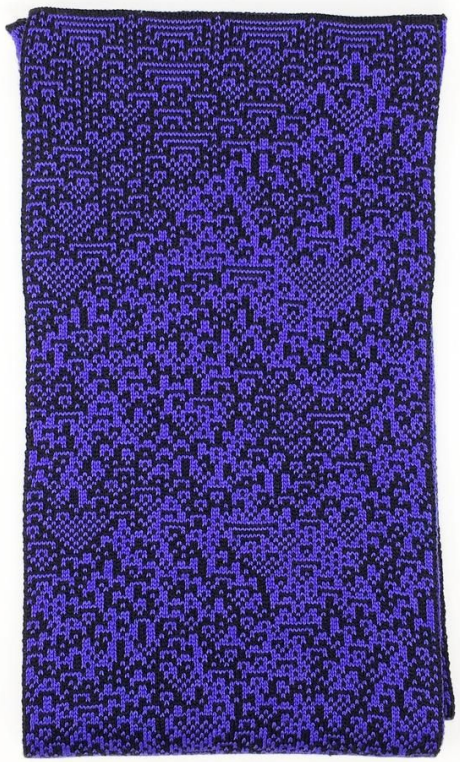
Some startups are coming

http://kniterate.com

http://unmade.com (London)

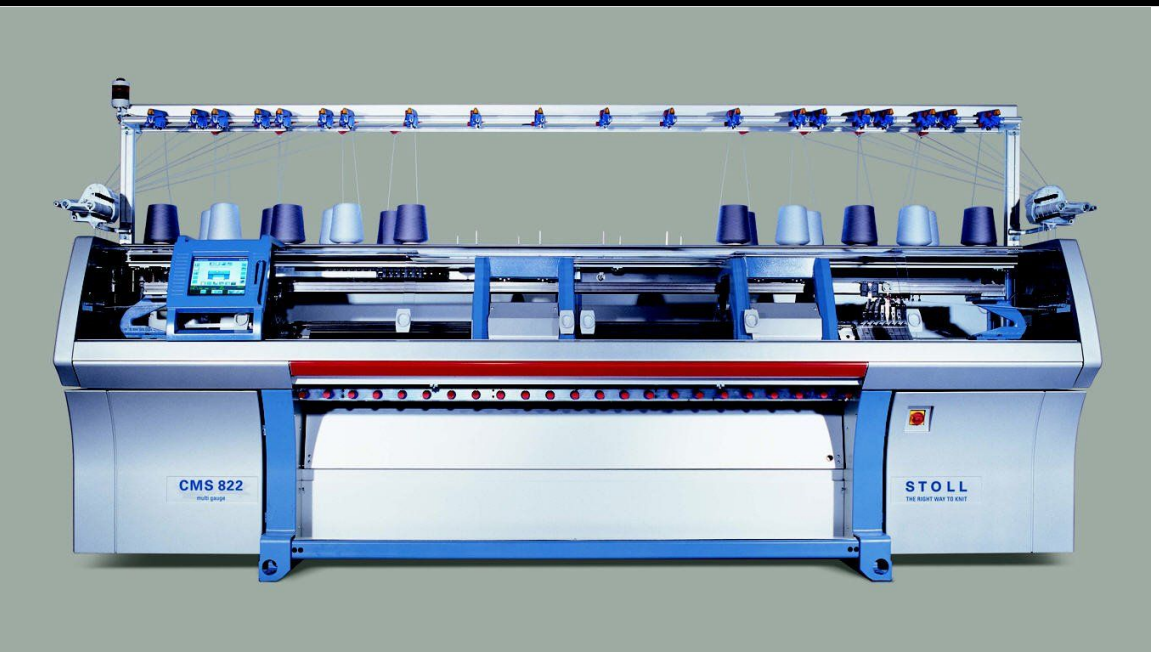
Created top layer in software from Stoll.
it is proprietary software

Creating software for industrial machines



Fabian Sierra - http://knityak.com She use Stoll

Industrial knitting machines



Stoll is a German company

http://stoll.com

History link

THE HISTORY OF STOLL

Let's go on a journey back in time and discover some milestones of our company's history. Among hundreds of patents and innovations and nearly 300 different machine types we have selected some interesting developments for you:

1873
Company agreement, July 27: Foundation of a „Mechanical Workshop for the Manufacture of Knitting Machines", Riedlingen

1878
Heinrich Stoll, founder of the company; change of company's name to „Strickmaschinenfabrik H. Stoll & Co." Reutlingen

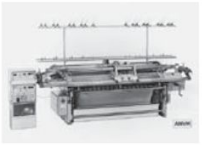
1919
First automatic all needle narrowing knitting machine with chain control

1926
First knitting machine with movement cards as information carriers to automatically control all machine functions

1936
First 2-system flat knitting machine AJUM with jacquard device

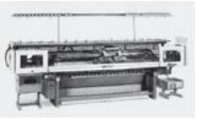
1936
LIFADO

1978
The dual-system NC-controlled ANVH



1979
Presentation of: world's first electronically controlled flat knitting machine, type CNCA-3; own programming language Sintral; world's first pattern preparation unit, type VDU

1982
Flat knitting machine with high-performance computer and Selan network connection, type CNCA-3



1987
CMS 400 machine generation: world's first computer controlled flat knitting machines which simultaneously can do intarsia, gore-technique and Fully Fashion

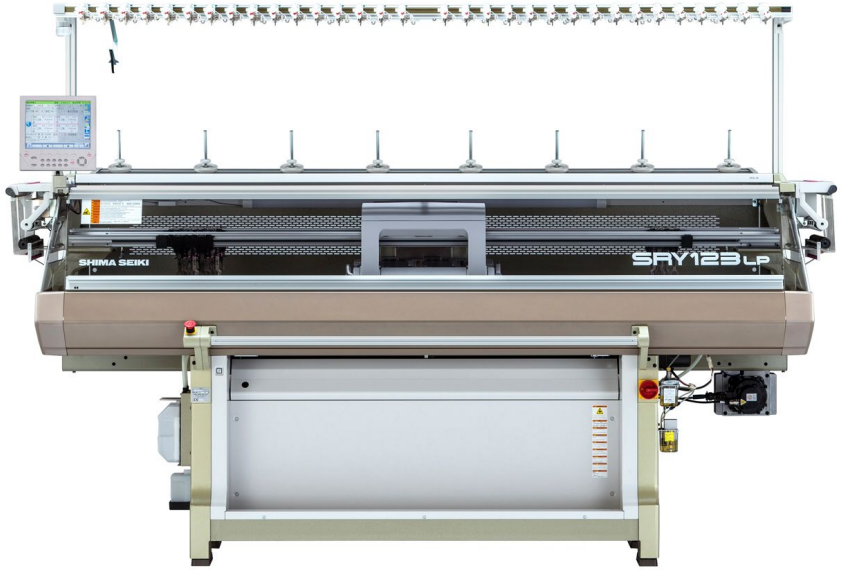
1997
Patent application for the Stoll-multi gauges® technique: several gauges in one knitted fabric, without gauge conversion

1999
All CMS machines are equipped with the worldwide unique operation system Stoll-touchcontrol®

2001
Presentation of pattern workstation M1, nowadays sample software M1plus®

2003
Introduction of product family CMS 322 TC-M, the machine with the largest working width and with a take-down comb and clamping/cutting device

Industrial knitting machines



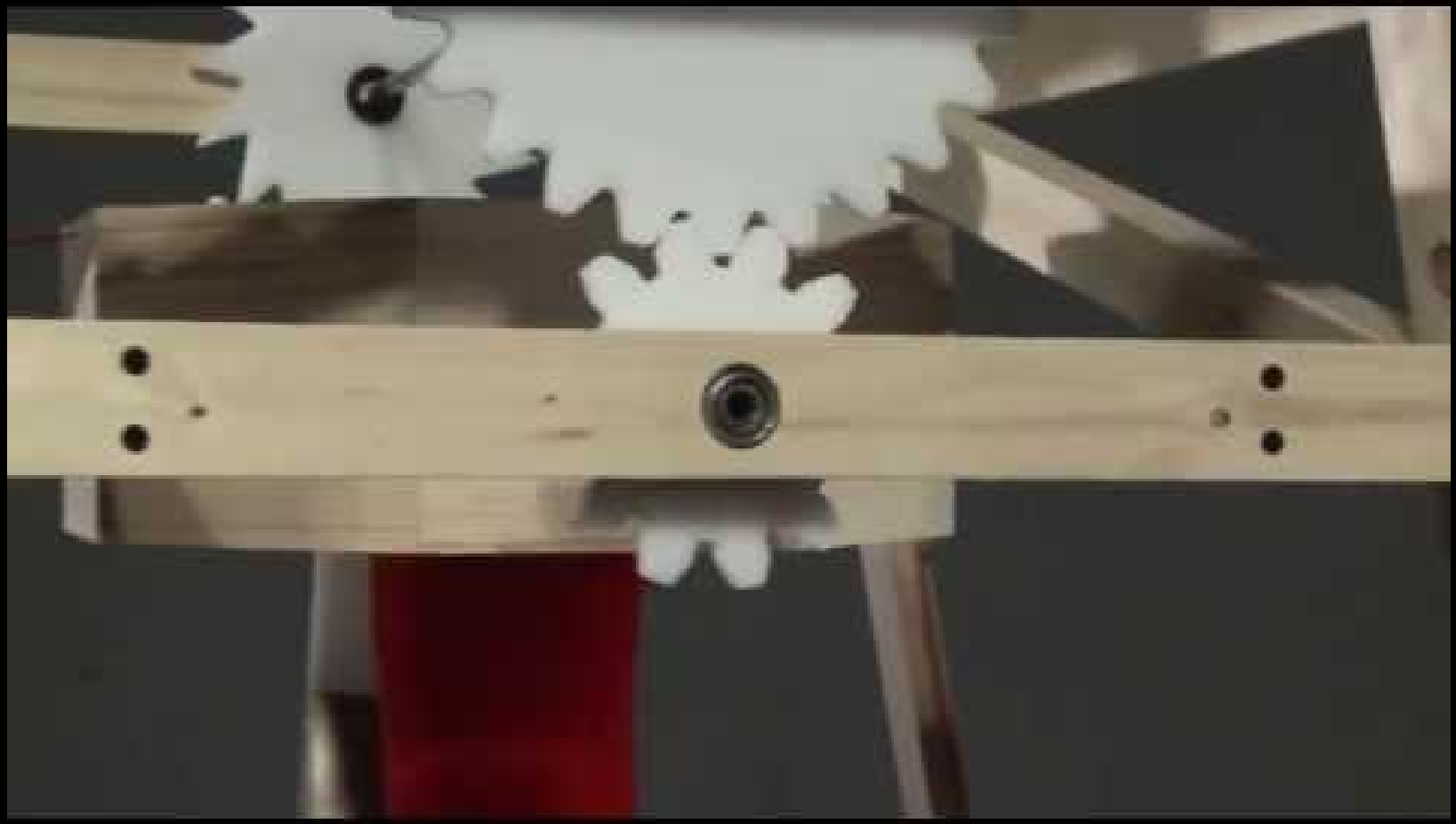
Shima is a Japanese company
http://shimaseiki.com

History link

Company started in 1961.

They started manufacturing in 1962 a complete automated glove knitting machines.

Rocking-Knit by Damien Ludi, Colin Peillex (ECAL)



Source: https://www.youtube.com/watch?v=H6m92HRZm2Y

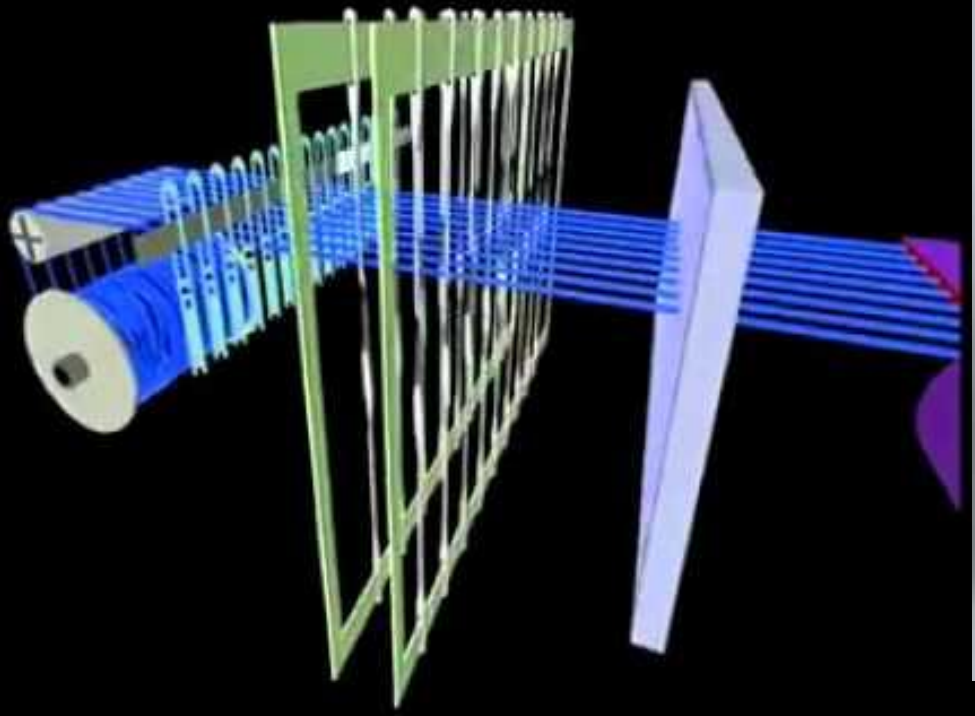
Wind Knitting Factory

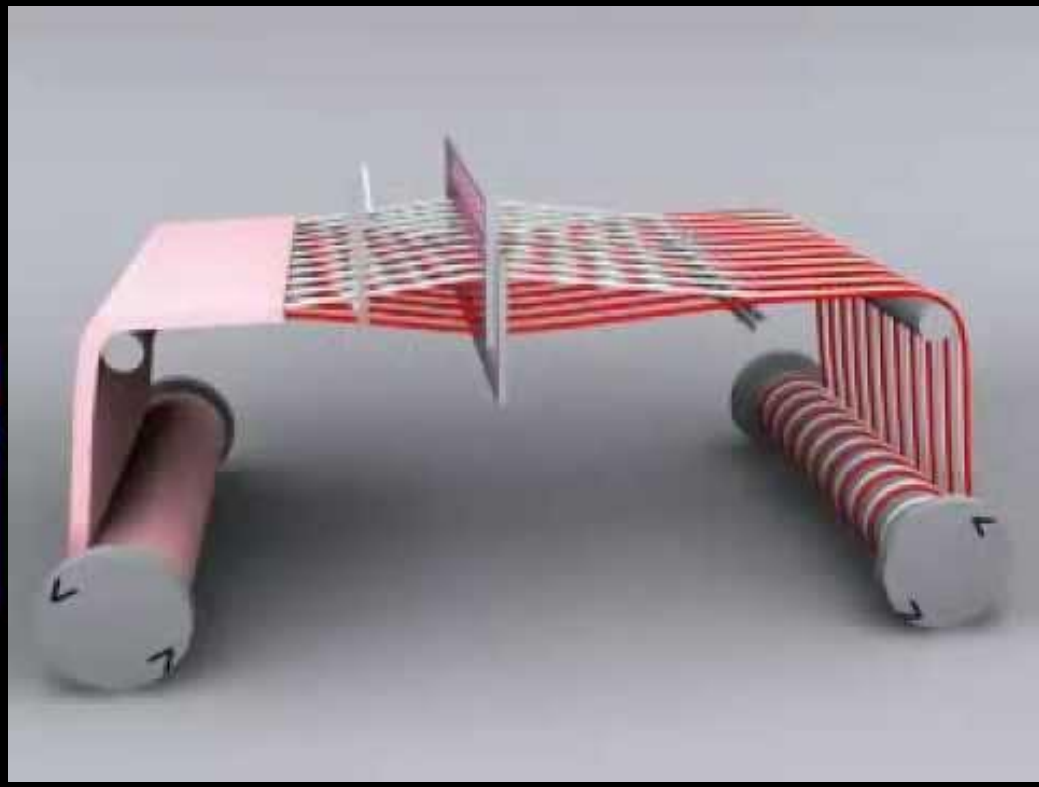
Source: https://www.youtube.com/watch?v=itHjRzzKuTQ

Knitting a huge american flag

https://vimeo.com/28618663

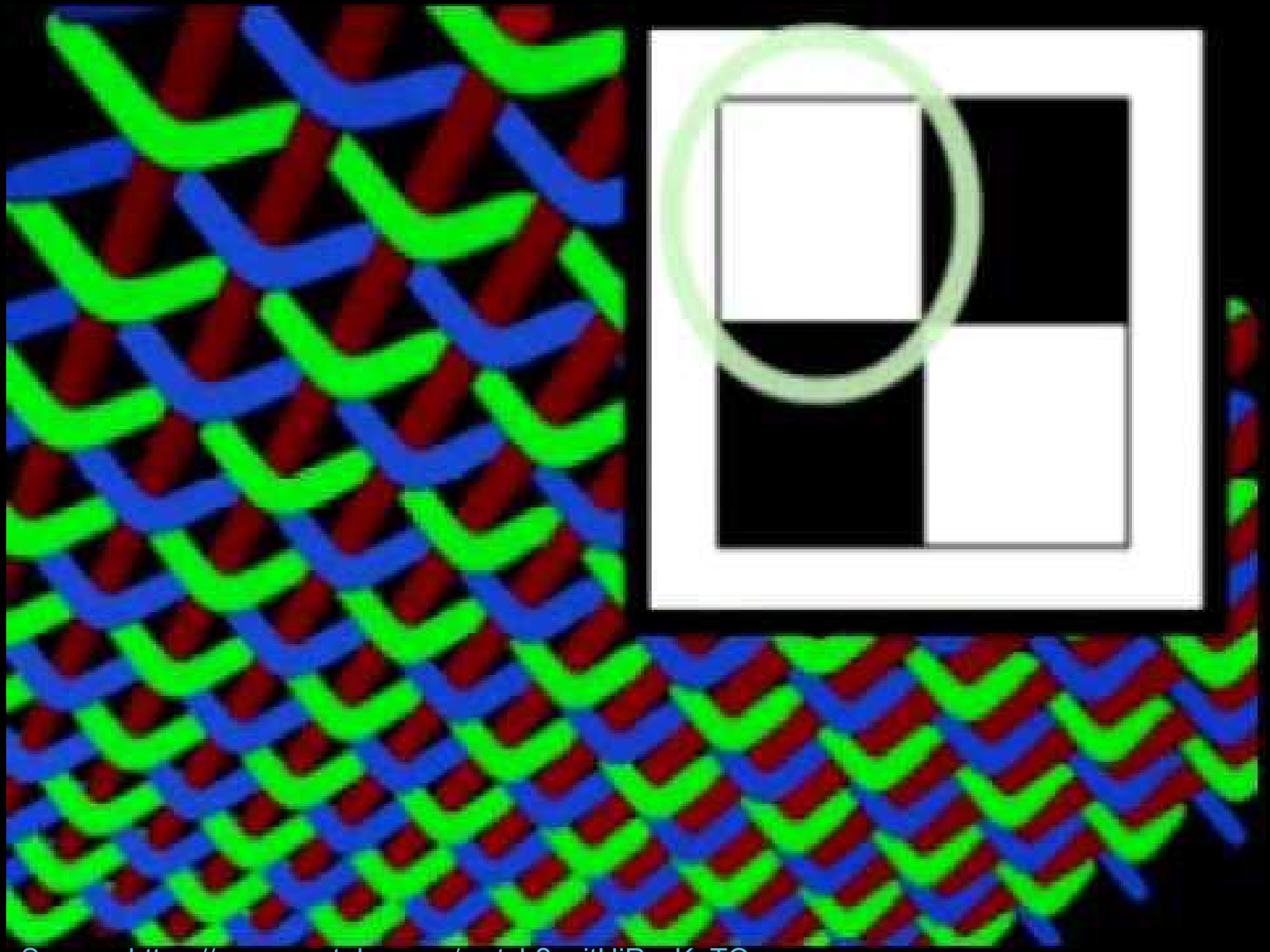
Weaving





Source:
Left video: https://www.youtube.com/watch?v=zw8idLj5U2s
Right video: https://youtu.be/worKmsWZqYE

More of fabric design

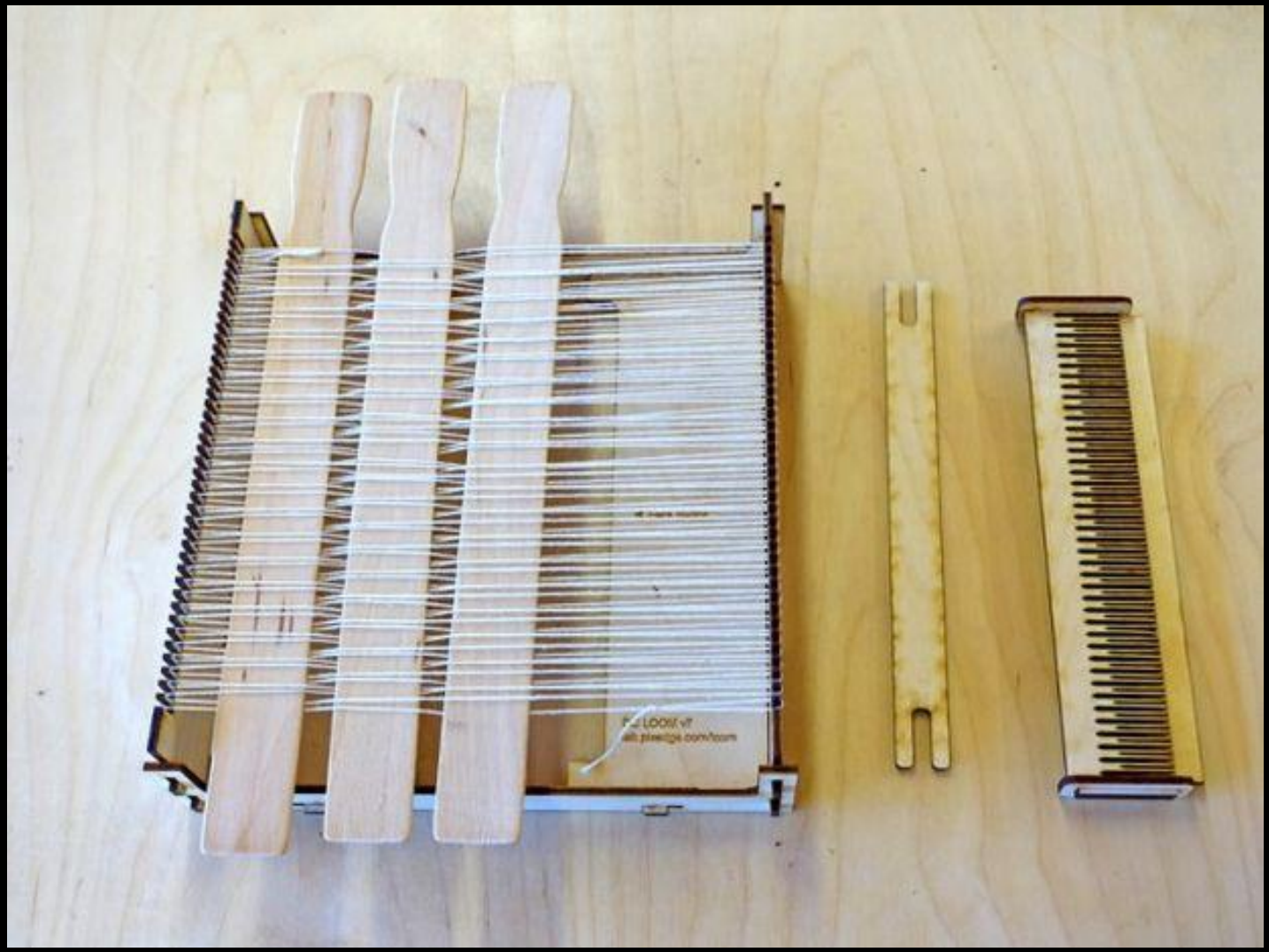


Source: https://www.youtube.com/watch?v=itHjRzzKuTQ

Fab loom

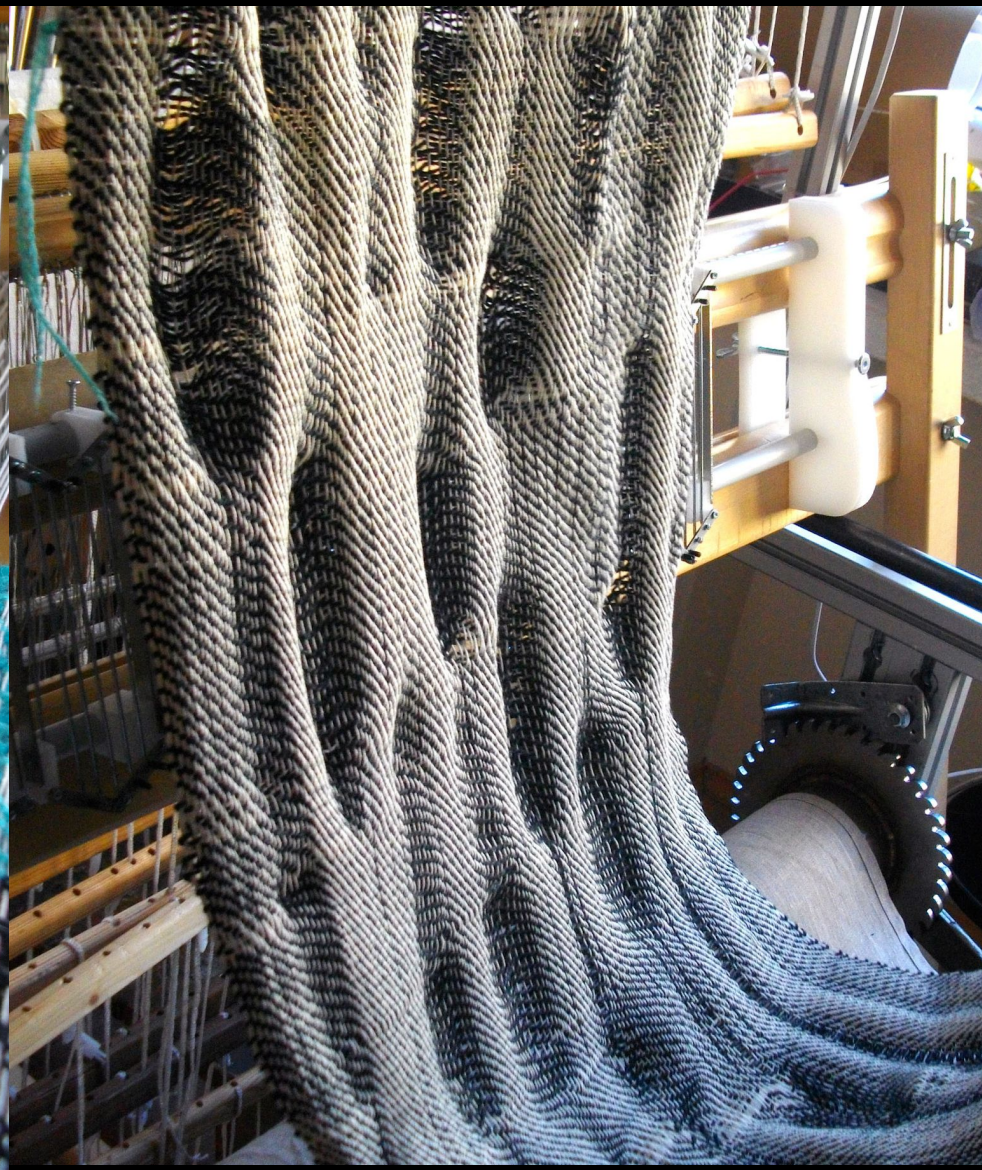
https://drive.google.com/drive/folders/1tPHUS_cNbcsyu9nELvTc-qP4PBjWtsHS?usp=sharing

Mini Loom



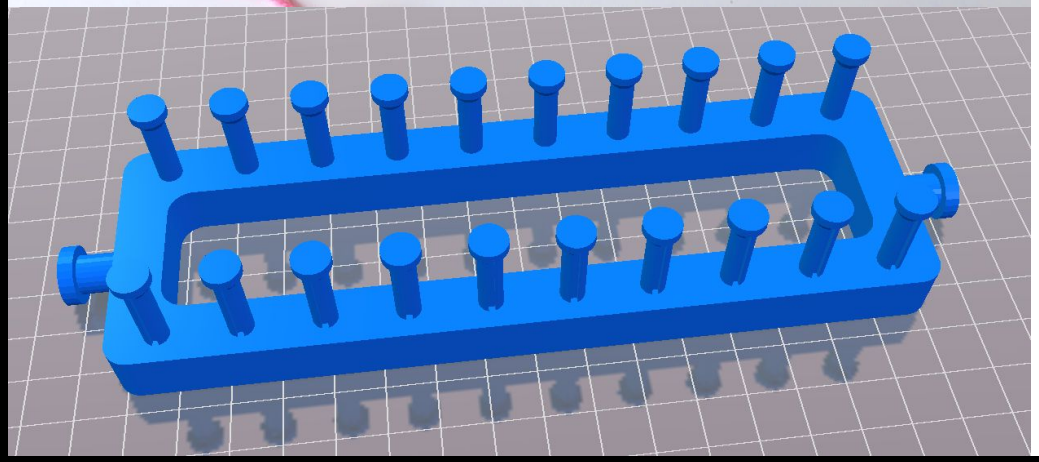
https://www.instructables.com/id/Mini-Loom-2/

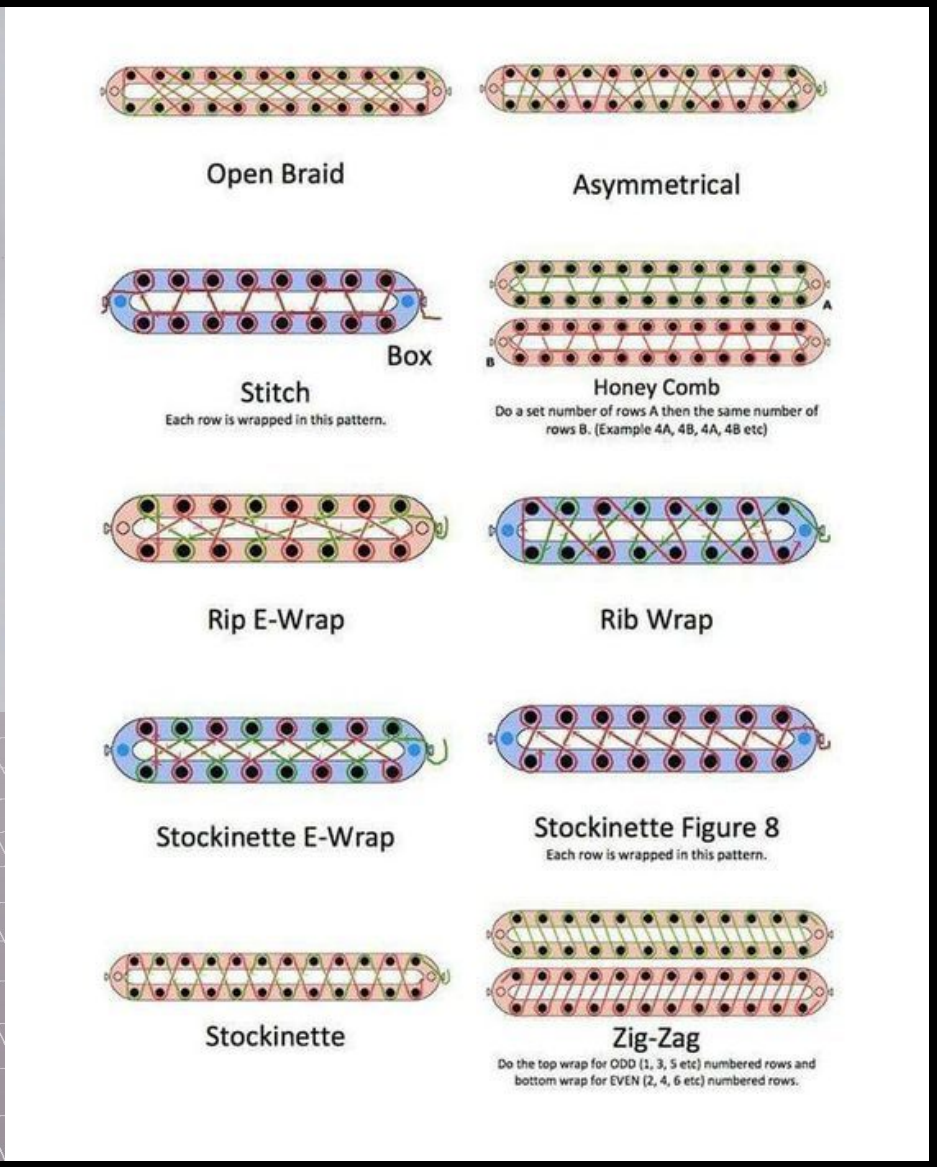
Railreed for freestyle weaving (http://www.railreed.ee/)



Mechanical loom with LEGO

Rectangular loom





3d printing rectangular loom: https://www.thingiverse.com/thing:1262192

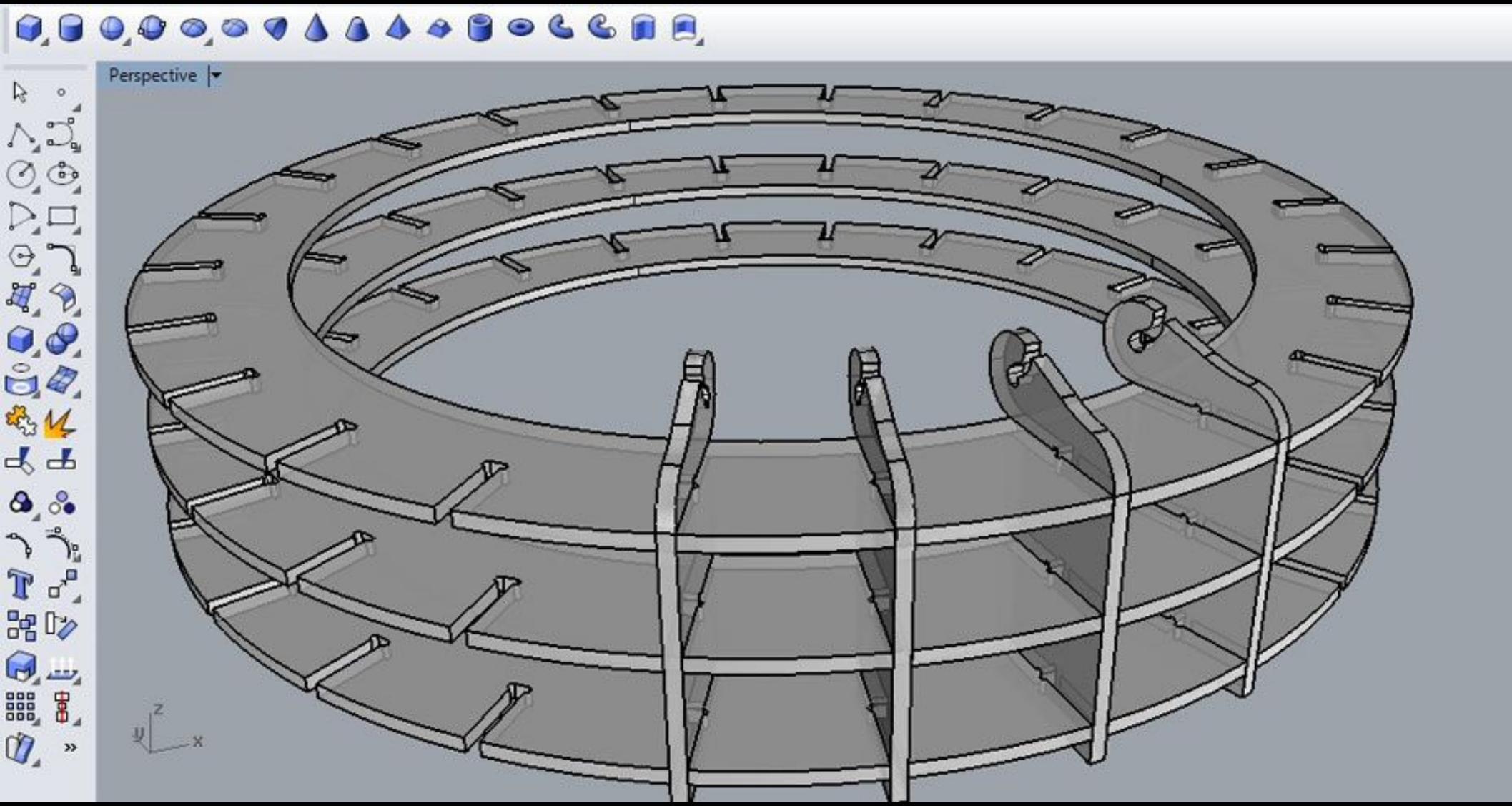
Circular and Afghan loom

Some example 3d printed circular loom:
https://www.thingiverse.com/thing:14214

Giant Knitting Nancy

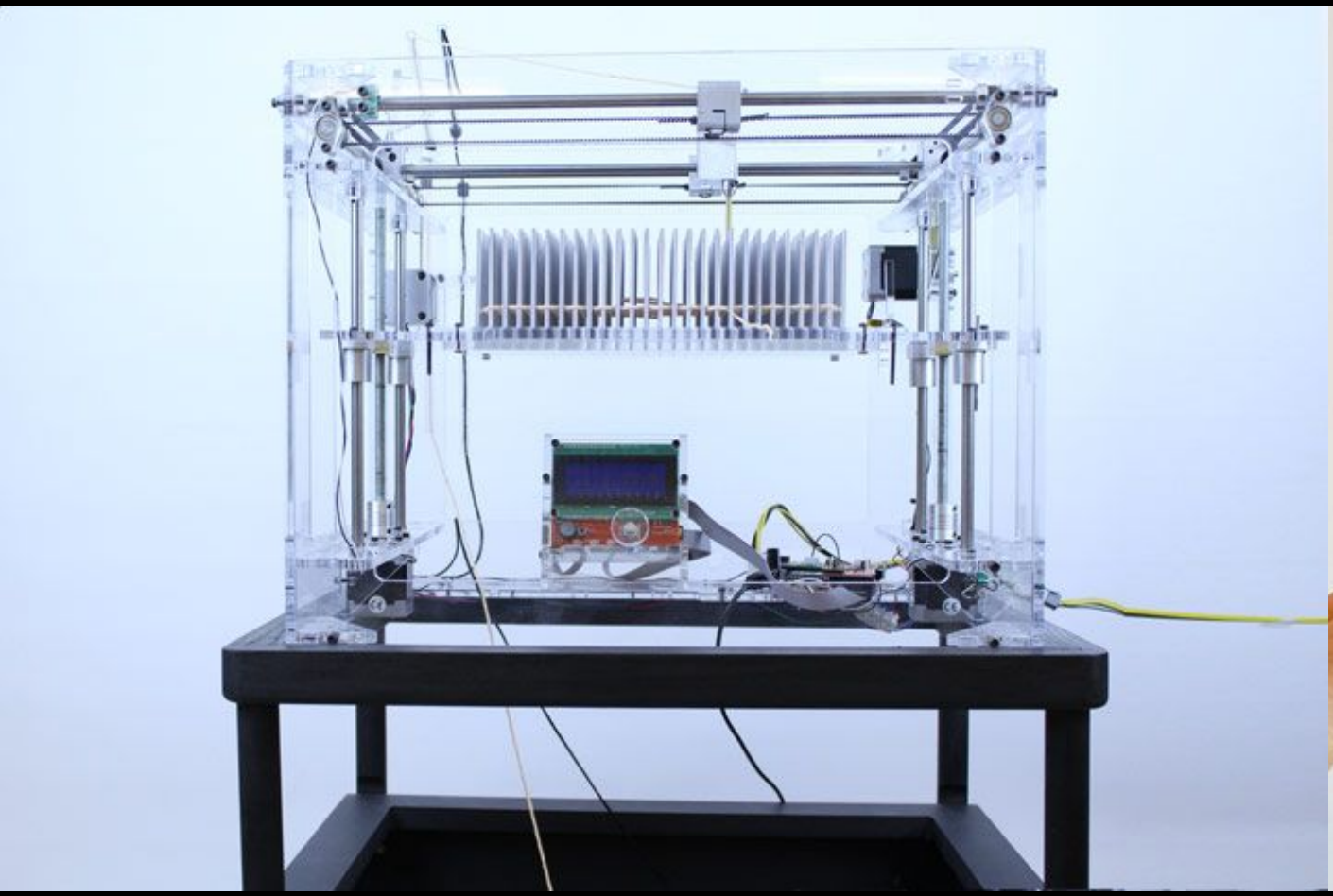
Big circular loom

by Francisca Perona

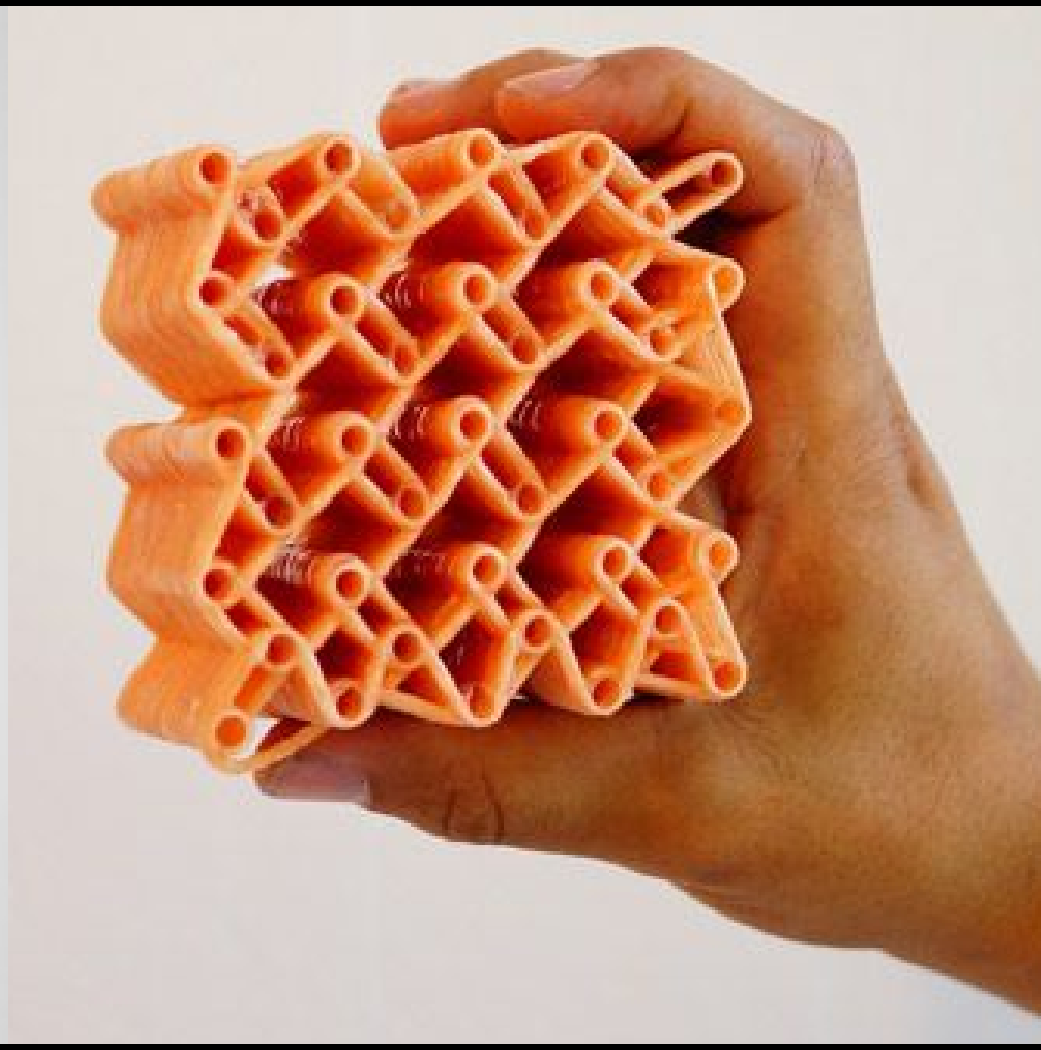


http://fabacademy.org/archives/2015/eu/students/perona.francesca/htm/08_week.html

3D weaving machine



Oluwaseyi Sosanya - https://www.sosafresh.com/3d-weaver/

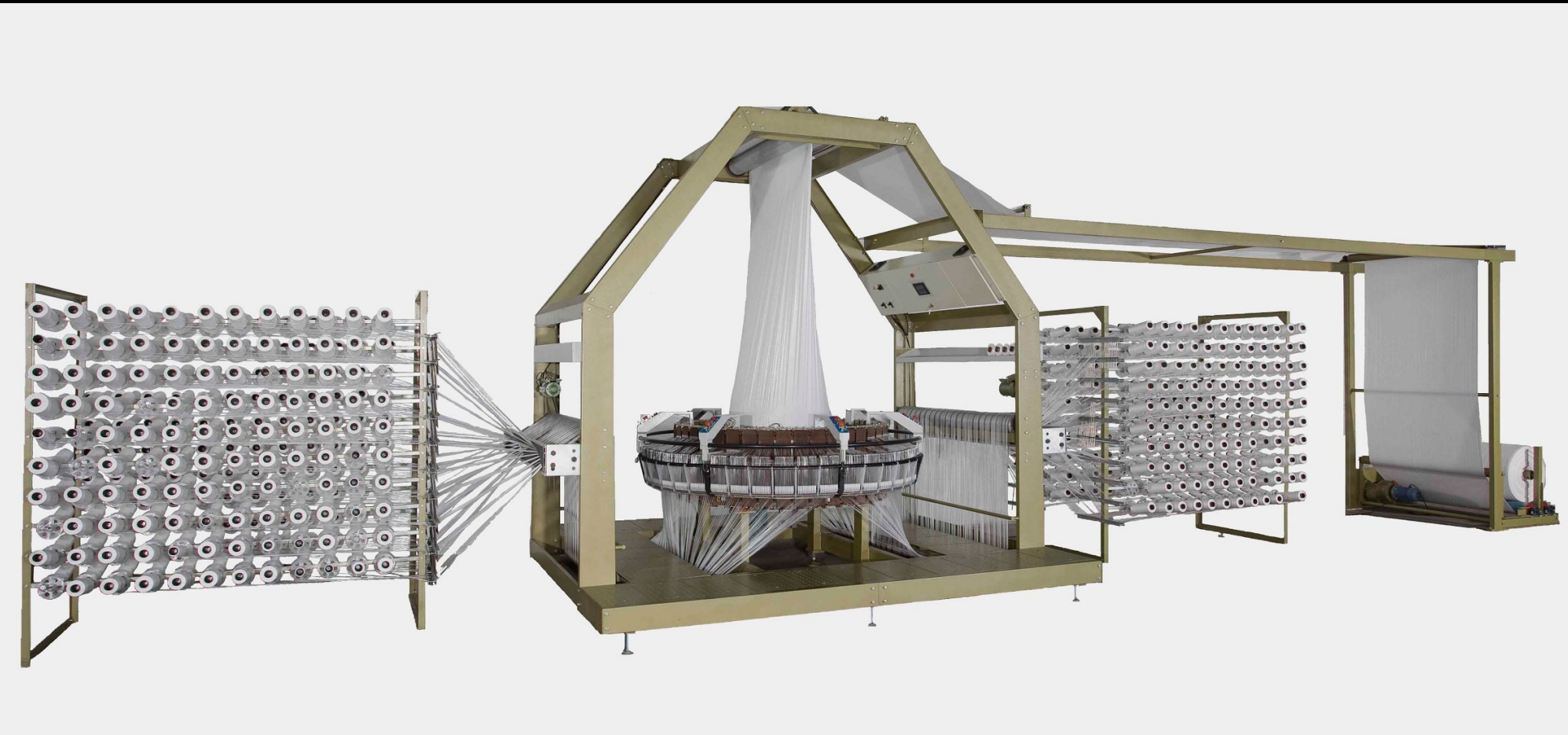


Chair weaving



http://www.instructables.com/id/Weave-Chair-Seats-With-Paracord/

Industrial High Speed Circular Weaving Machine for Mesh Bags



Sewing

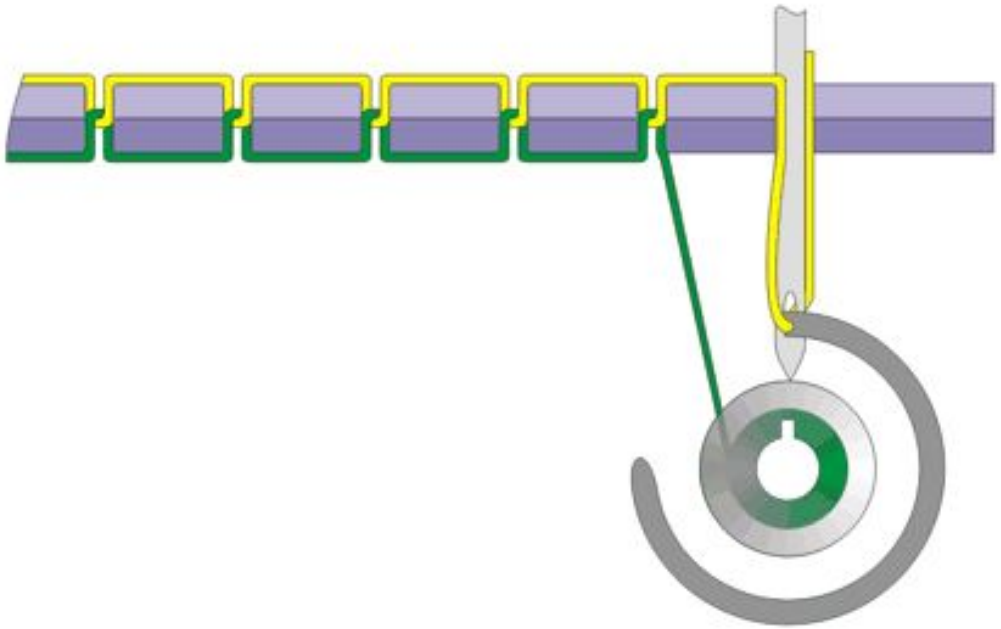
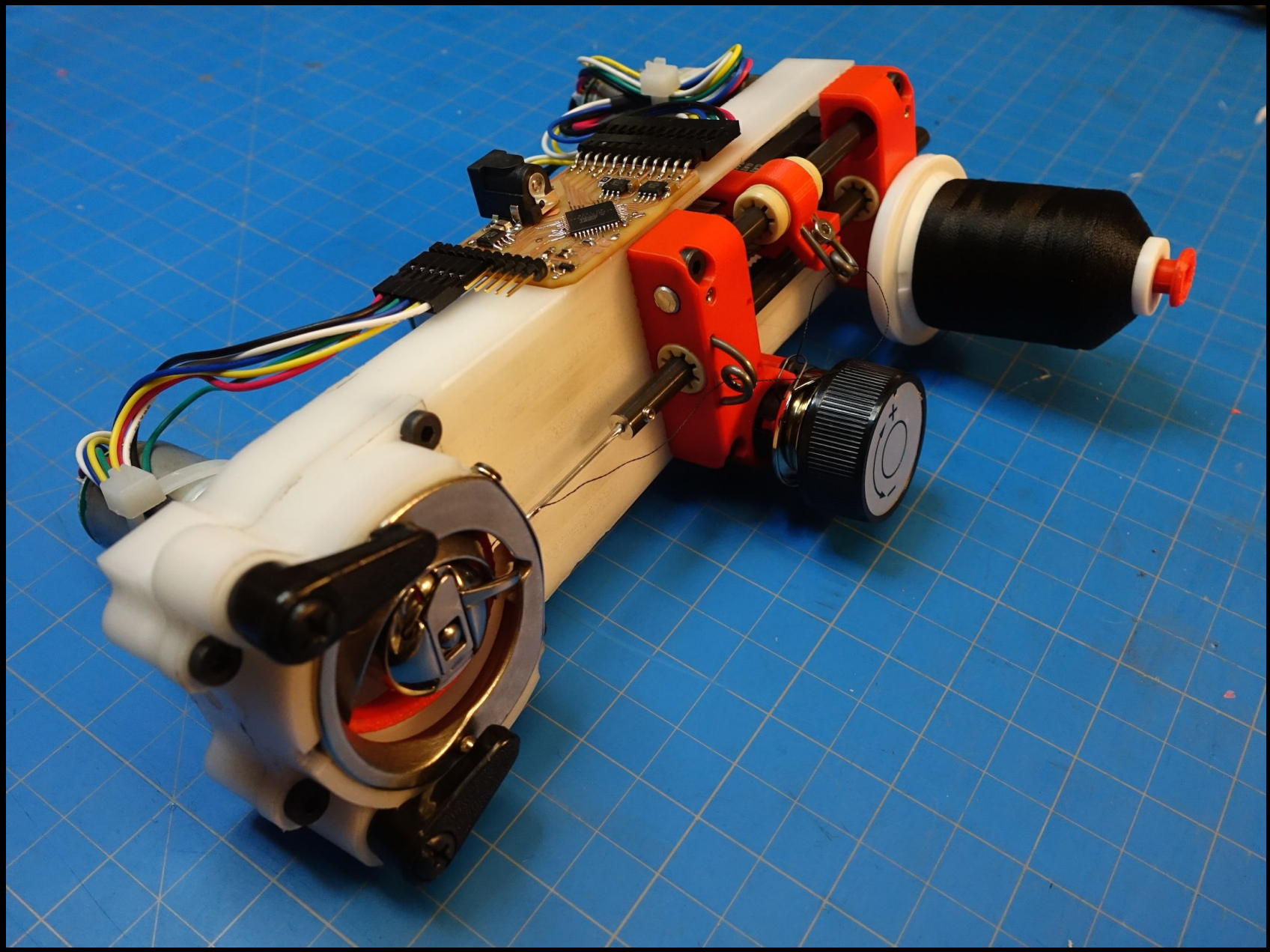


Image source: http://fab.cba.mit.edu/classes/863.16/doc/tutorials/sewing/sewing.html

Portable sewing machine

Sewing machine for girls

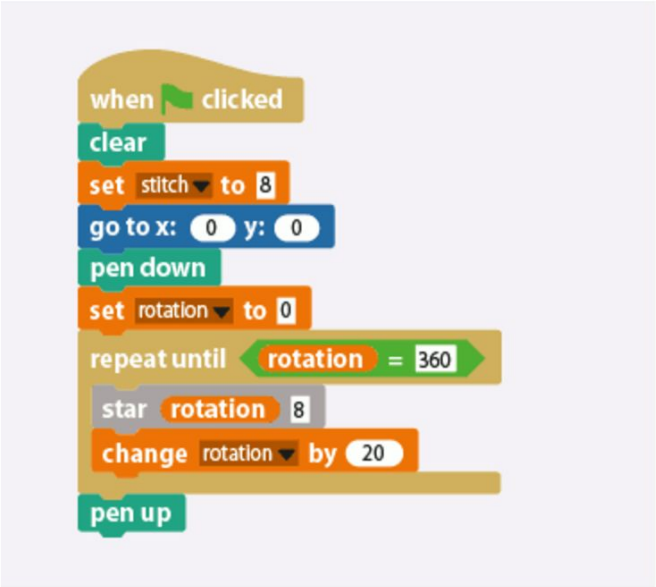
DIY Sewing Machine

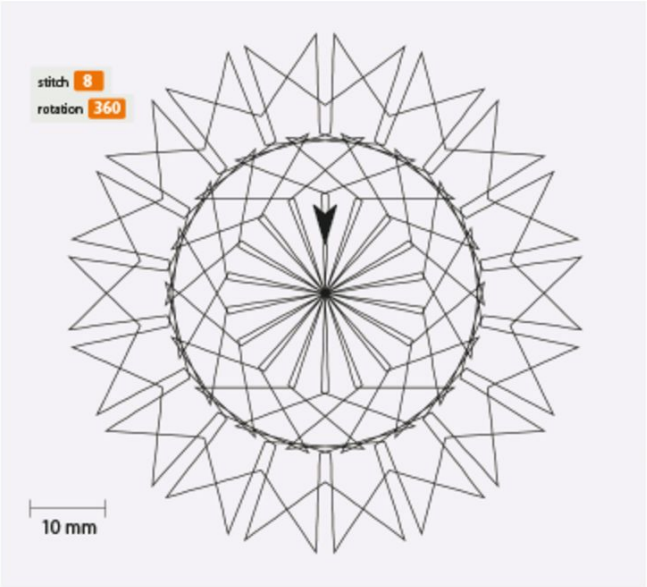


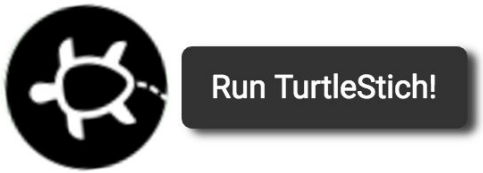
Turtlestitch.org module for Scratch

http://turtlestitch.org

Turtlestitch - Coded Embroidery

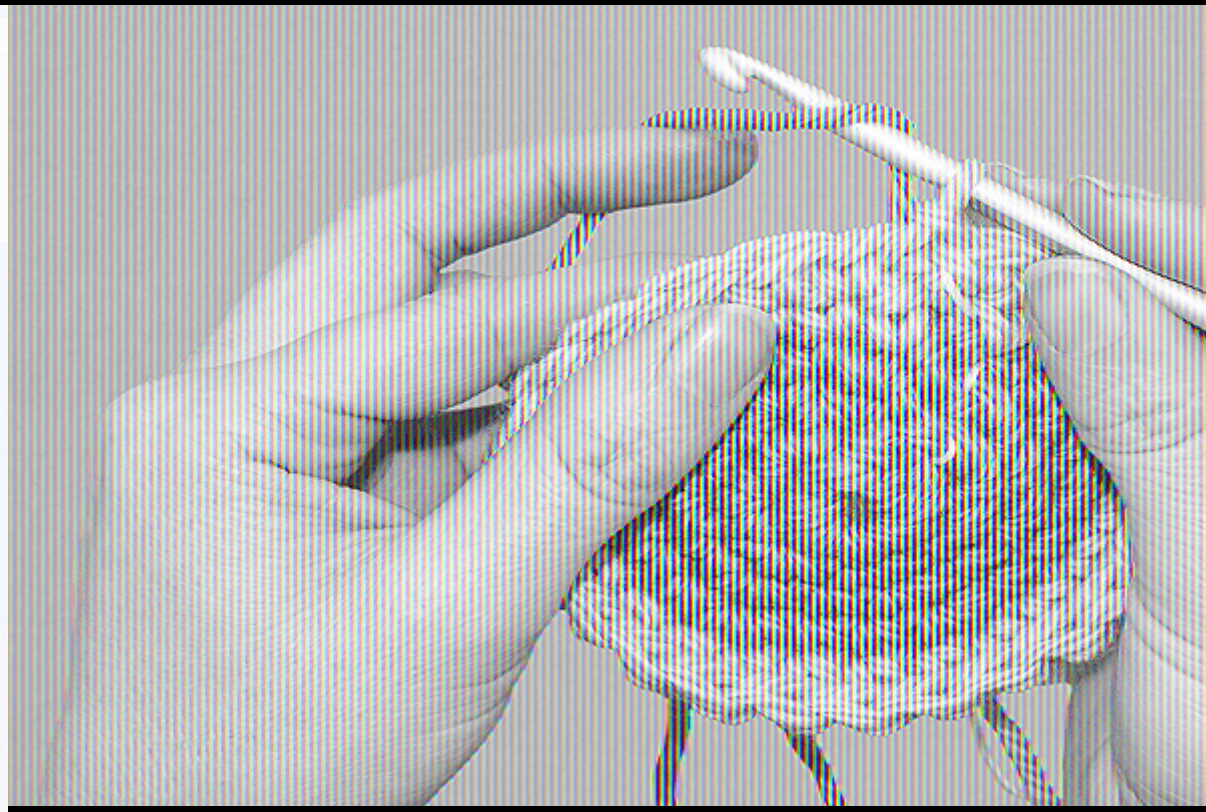






Code! .. Draw! .. Stitch!

Crochet



https://makeanddocrew.com/crochet-shoes-flip-flops-moccasins/

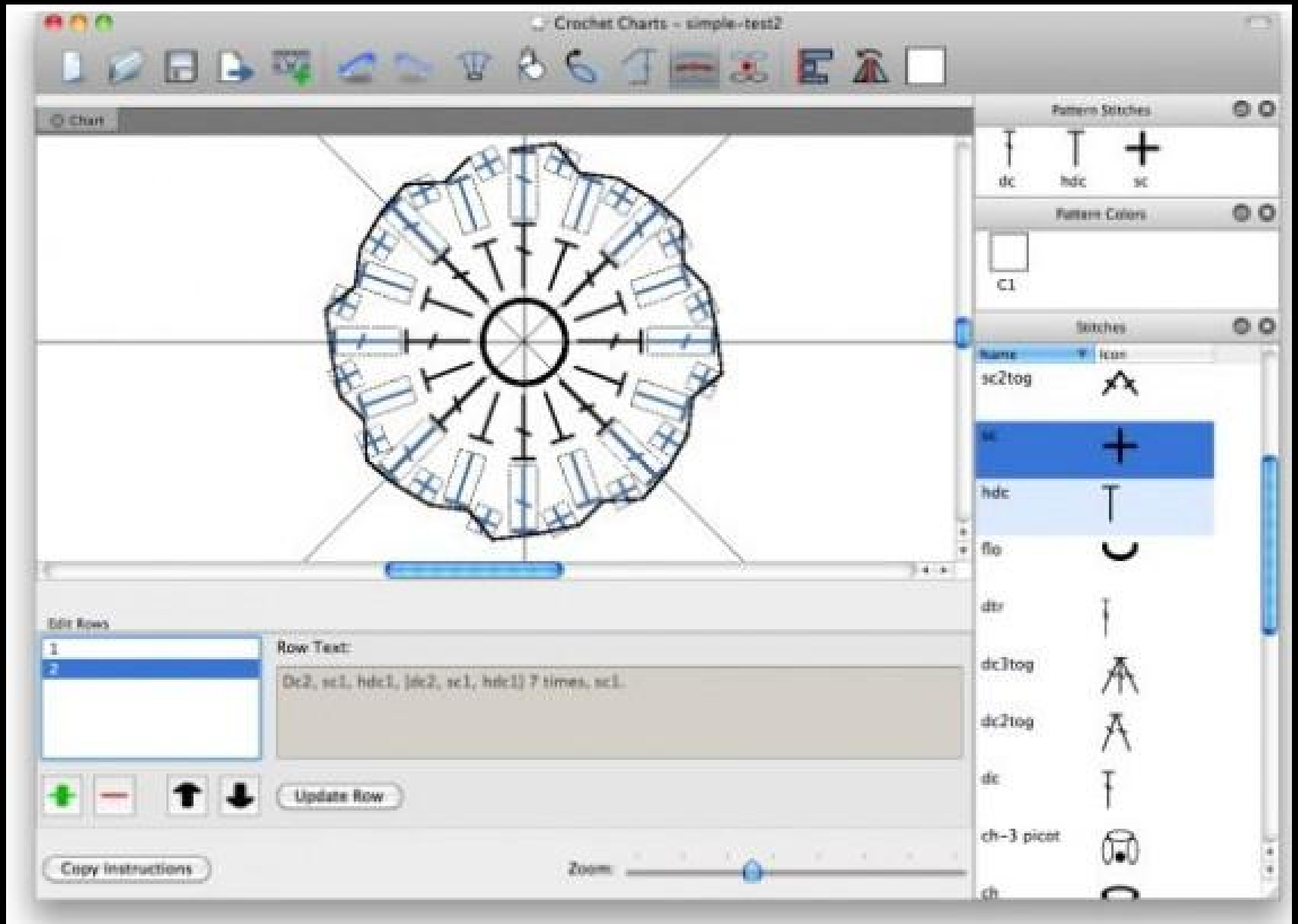
Ohm Hook - a Vibrating Resistance Meter for Crochet

This crochet hook translates electrical resistance into vibration, making electrical resistance a tangible property of an E-Textile making process. The Ohm Hook allows you to develop an electrical sense for the materials you work with. For example, if you are crocheting stainless steel yarn to make a stretch sensor you can tailor your design to the range of resistance you want because you immediate feedback on the resistance of what you are making.

https://www.instructables.com/id/Ohm-Hook-a-Vibrating-Resistance-Meter-for-Crochet/

Software for pattern design and knitting guidelines

http://stitchworkssoftware.com/



Embroidery

Source: https://www.youtube.com/watch?v=TroeRHwIN8o

DIY Open Embroidery Machine -> OpenBuilds Open Source Embroidery machine

https://openbuilds.com/builds/embroidery-machine-with-xy-belt-and-pinion-drive.691/

Article:https://blog.adafruit.com/2014/06/11/diy-open-embroidery-machine-wearablewednesday/

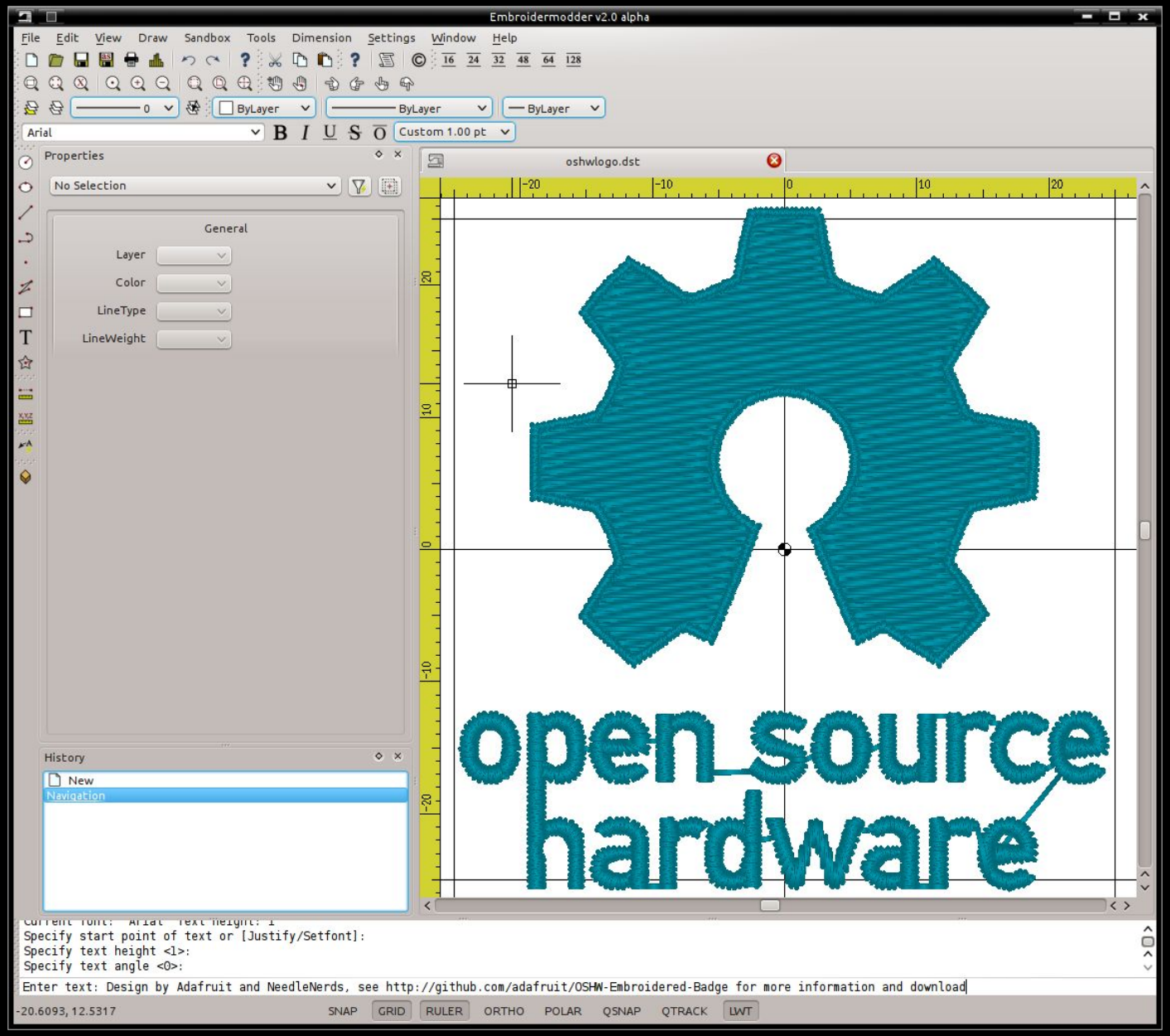
Lego NXT Embroidery Machine

Source: https://www.youtube.com/watch?v=69yXCR2de_k

Maquina Bordadora Computarizada DIY

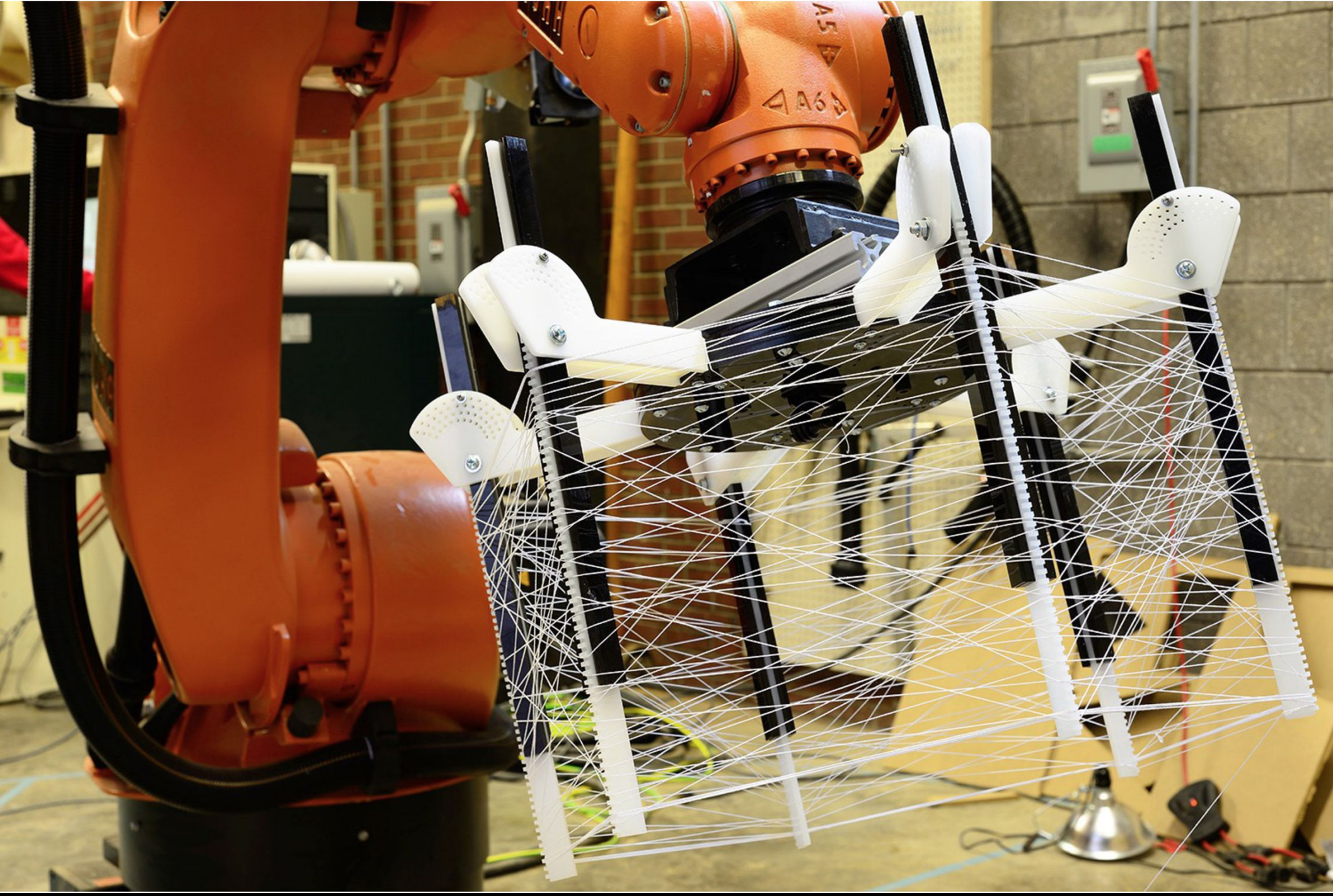
(http://bordadorascaseras.blogspot.com.es/)

https://www.youtube.com/watch?time_continue=185&v=gAvDDnfBSWA



http://embroidermodder.org by Jonathan Greig, Josh Varga, Mark Pontius

Hybridization techniques



http://www.wit-o.us/robowinder

REGEN
by Wendy Andreu

Latex and rope

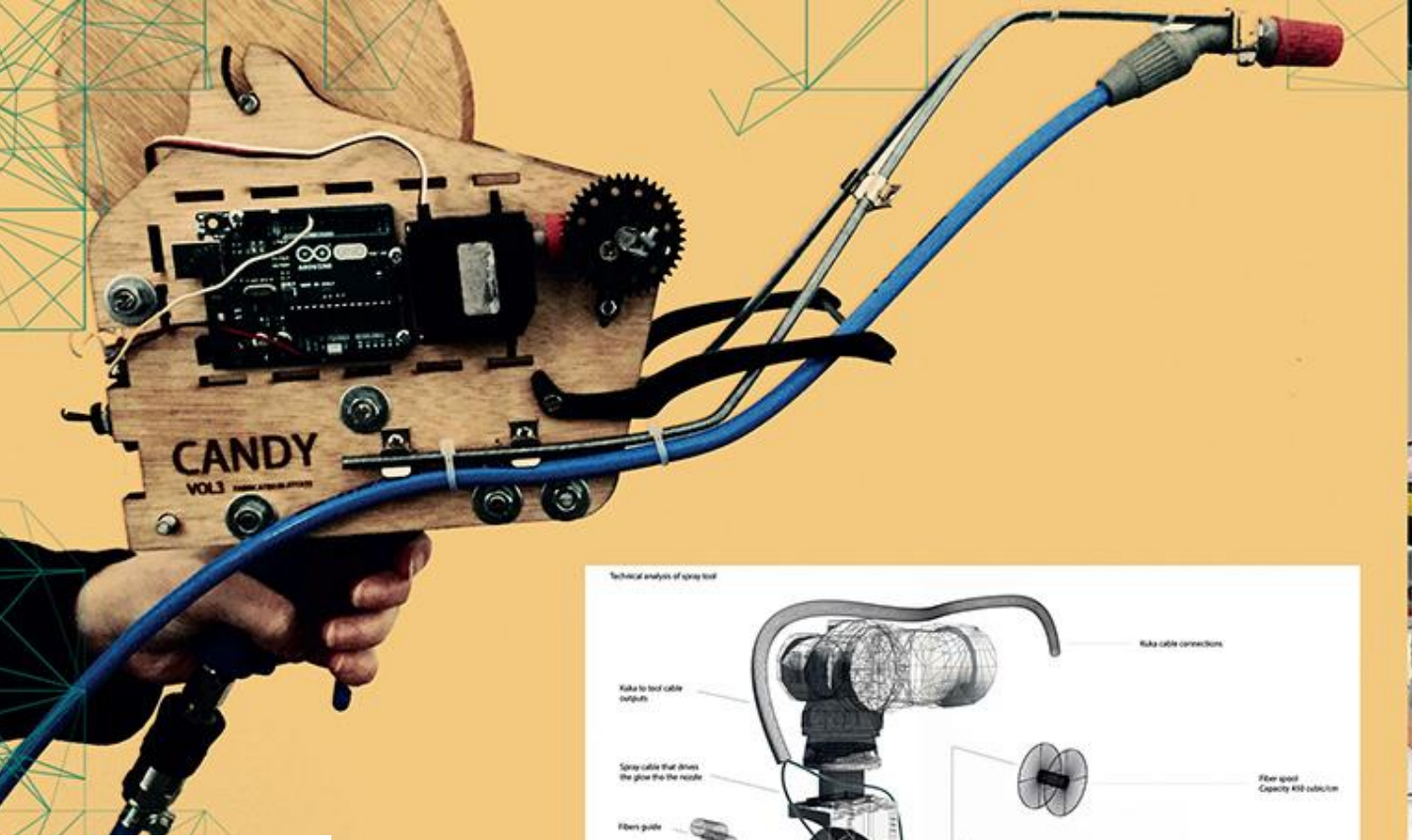
Video: https://vimeo.com/170029283

http://www.wendyandreu.com/

Digital Wax printer

by Eugenia Morpurgo and Olivia de Gouveia

http://digitalwaxprint.com/



er Spray

Yerdel & Anastasia

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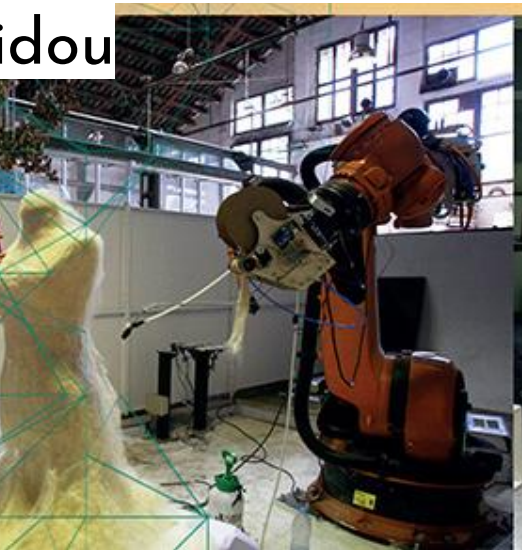

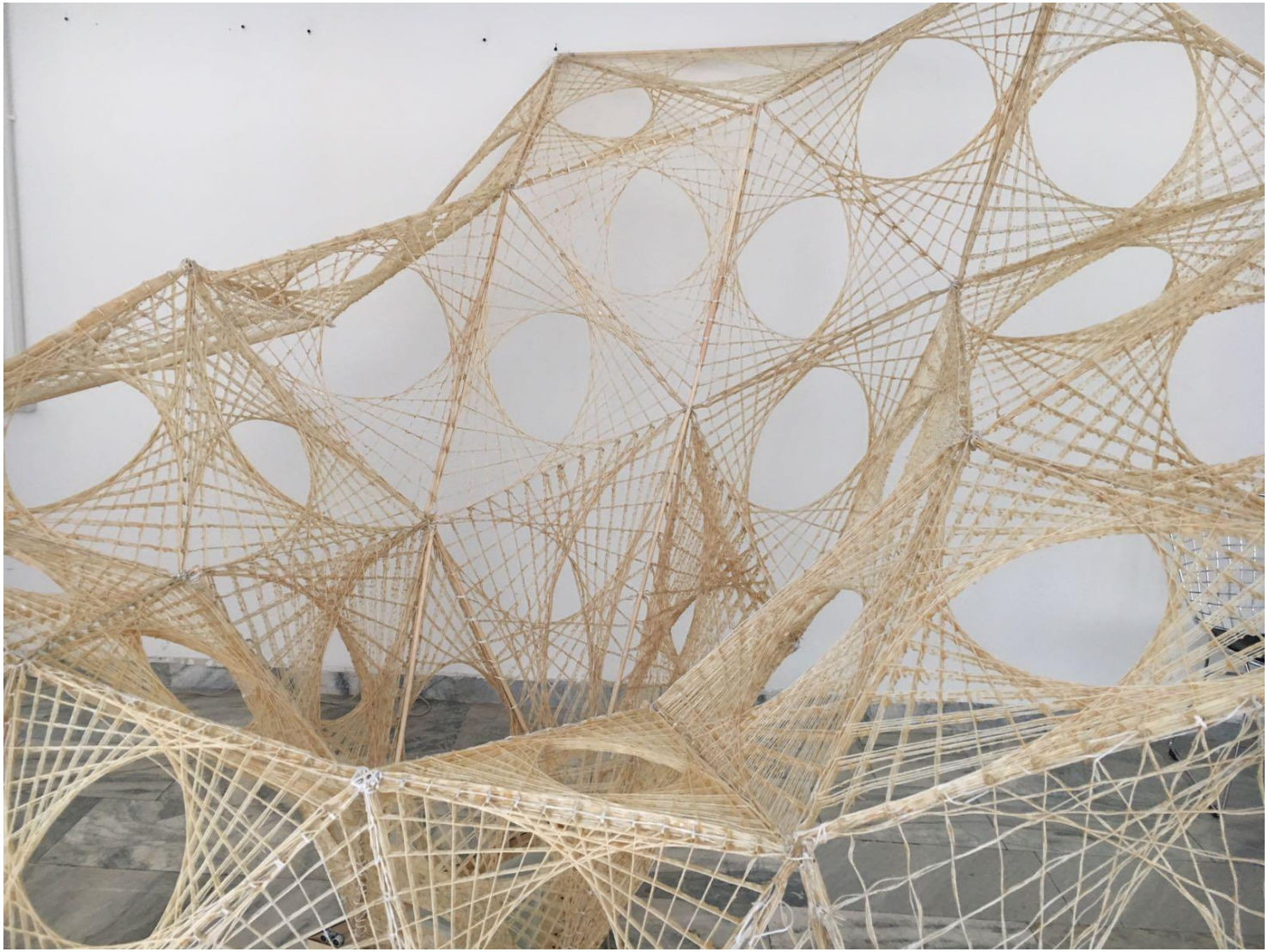

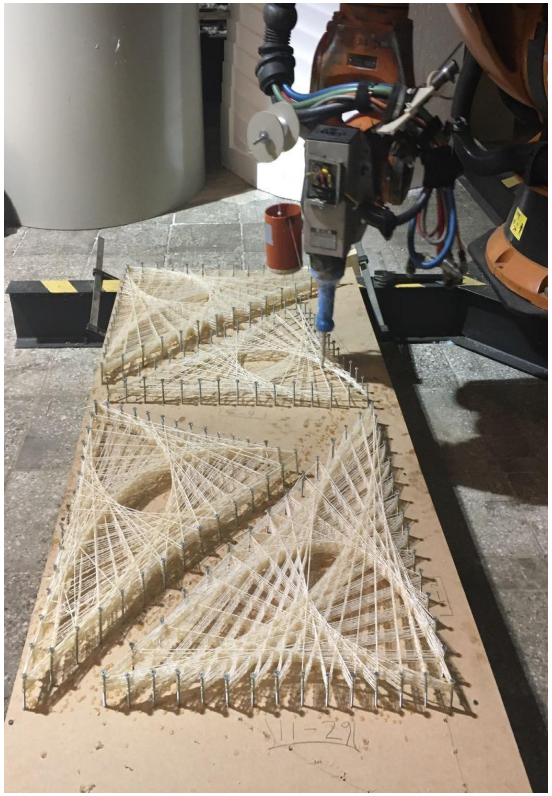

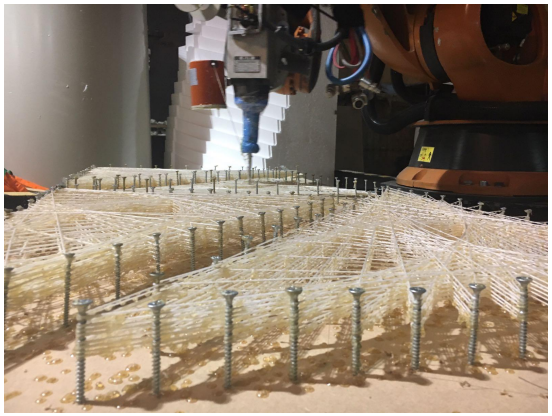

Glue Jeans

http://gluejeans.com

Niet naaien maar lijmen

www.gluejeans.com

Donkerblauw denim met lichtbruine stiknaden, zo'n spijkerbroek hangt bij iedereen in de kast. Variaties waren er tot nu toe alleen in kleur en model, maar met de Gluejeans van ontwerpduo G+N is er eindelijk ook iets veranderd in het fabricageproces. In plaats van gestikte naden zijn de delen stof van deze spijkerbroek aan elkaar gelijmd.

Het ontwerpduo Gerrit Uittenbogaard en Natasja Martens zocht een manier om in eigen beheer een spijkerbroek te maken, zonder de beperkingen van de huidige productiemogelijkheden waar specifieke machines voor nodig zijn. Bij toeval vroegen ze zich af of lijmen een optie zou zijn. Twee jaar testen later is de Gluejeans een feit. 'Het was even zoeken naar de juiste lijmsoort, de juiste vloeibaarheid en welk pigment je het beste kan gebruiken om de lijmnaden een mooie kleur te geven', zegt Uittenbogaard. Dat de lijmnaden zichtbaar een bijdrage aan het ontwerp van de broek mochten leveren, besloot het duo tijdens het experimenteren met de lijm. 'Als je de twee helften op elkaar legt, pers je de lijm er tussen uit.'

Eén exemplaar werd een jaar lang gedragen door een vriend om er zeker van te zijn dat lijmen een duurzame methode was. Uittenbogaard: 'Omdat jeans het imago sterk en stoer hebben, wilden we er zeker van zijn dat onze broek dat ook was. Onze proefpersoon ging erin naar zijn werk, mee op vakantie en heeft 'm vaak gewassen. De Gluejeans is gewoon oersterk. Consumenten betwijfelen de stevigheid van lijm misschien, maar de industrie heeft er veel vertrouwen in. We lijmen toch ook marmeren tegels tegen een gevel?'

De spijkerbroek van G+N is dit jaar genomineerd voor een Dutch Design Award, Audi Design Award en Fashion Award. 'De Dutch Design Award vinden we wel heel bijzonder. Omdat we uit de modehoek komen is dat echt een verrassing.' Uittenbogaard benadrukt dat de broek geen kunst of gimmick is, maar exclusieve mode. 'Van de Gluejeans 1 maken we maar 300 exemplaren. Wel garanderen we dat we altijd weer een nieuw gelijmd product maken. Dat kan een jas zijn, een paar schoenen, of misschien een ander model spijkerbroek.'

Passen kan in de Fitting Room in Amsterdam en later dit jaar in de flagshipstore van Droog Design. Prijs: € 420. [CG]

Thank you for attention!
Questions!?

www.var-mar.info
varvarag@gmail.com, mar.canet@gmail.com