THIRD MAN

TRIPLEGRAPH

DESIGNED BY COPPERSOUND PEDALS AND JACK WHITE

- .-. .. .--. .-.. . --. .-. .- .--. ....

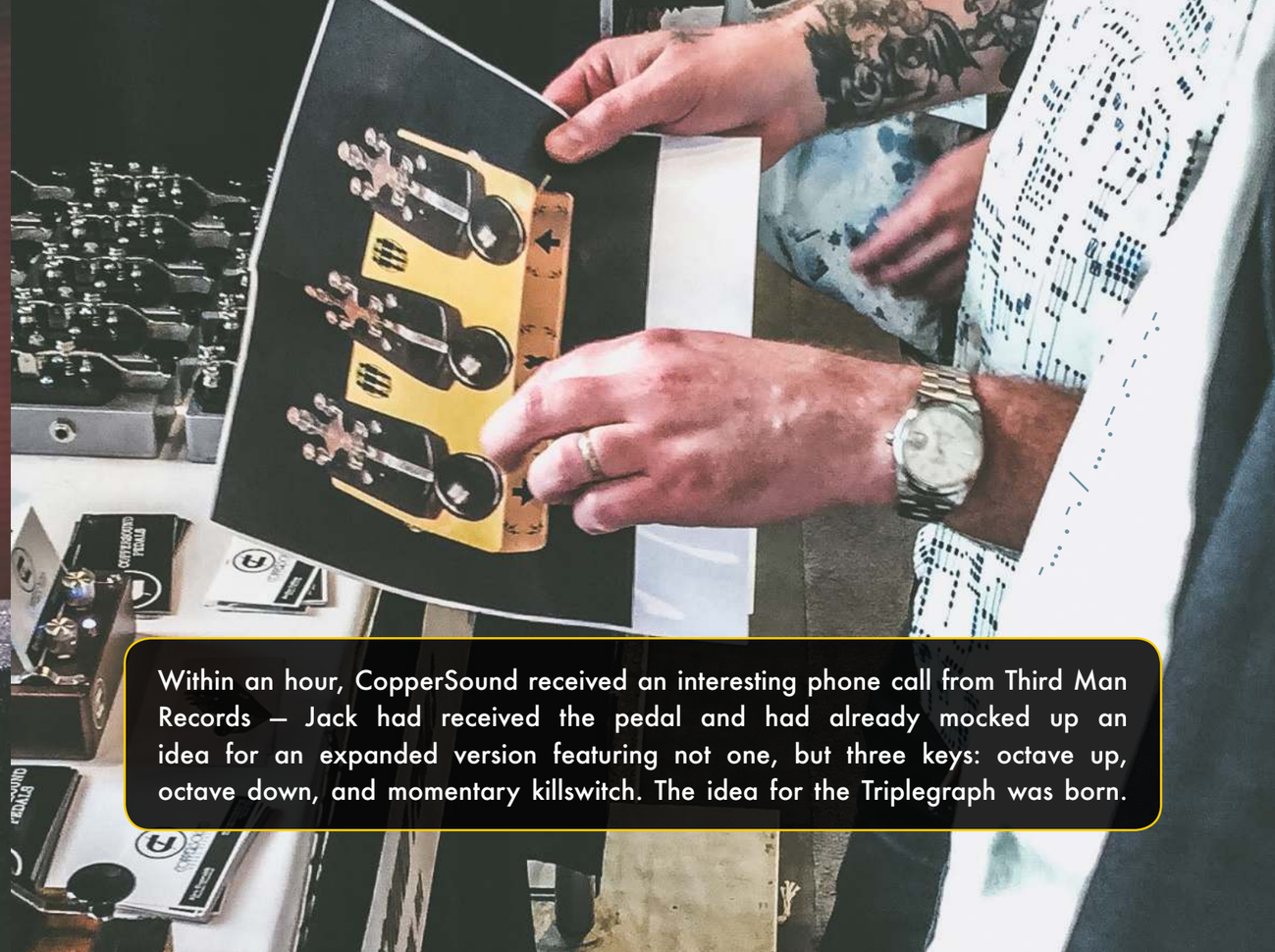
The Third Man Triplegraph is a digital, triple function octave pedal designed by CopperSound Pedals and Jack White. This exciting collaboration began in the summer of 2016 in Nashville, Tennessee.

After four years of rigorous engineering, prototyping, designing, and real-time road testing from Jack himself, the Triplegraph has come to life.

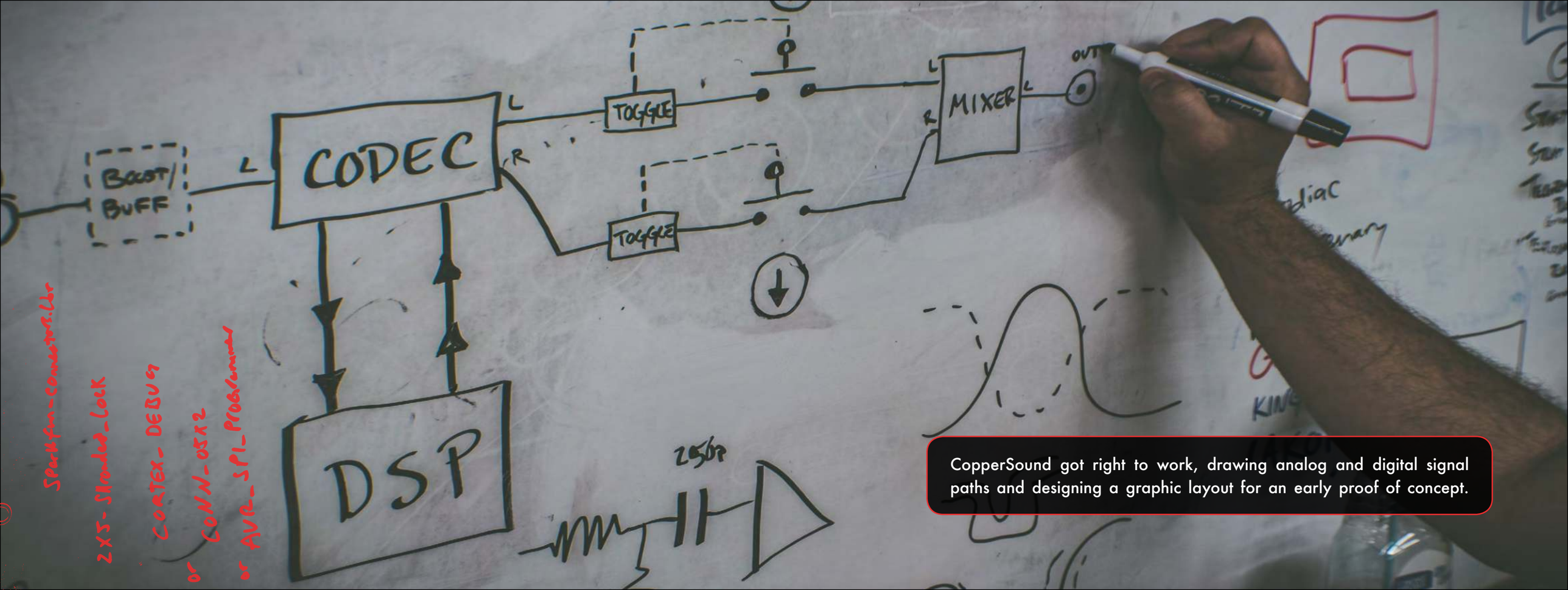
The collaborative result is an innovative, high powered digital octave pedal with three functional telegraph keys. These keys trigger a full octave down, killswitch, or 'auxiliary loop', and octave up, respectively.

The very first prototype of the CopperSound Telegraph Stutter – a momentary killswitch pedal – features an old school Morse code telegraph key.

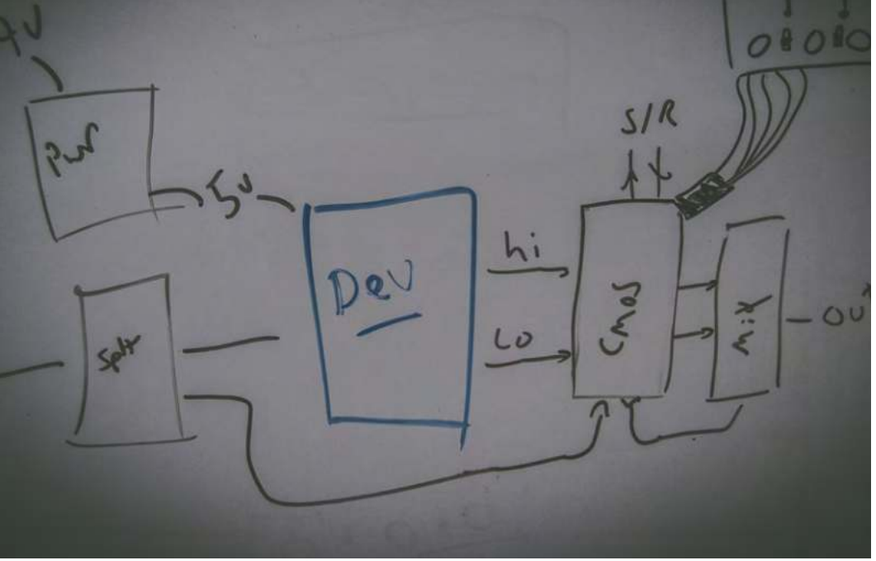
In the Summer of 2016, the CopperSound team built and delivered a custom, one-of-a-kind Telegraph Stutter addressed to Jack White's attention at Third Man Records' headquarters, hoping that he would receive it as a gift.

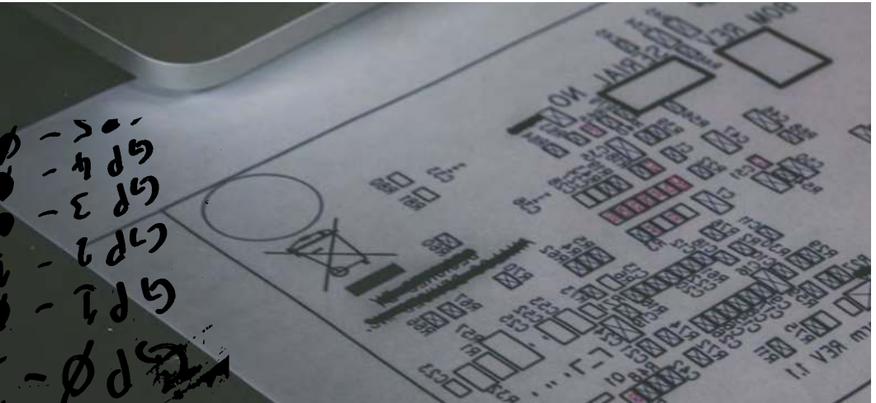


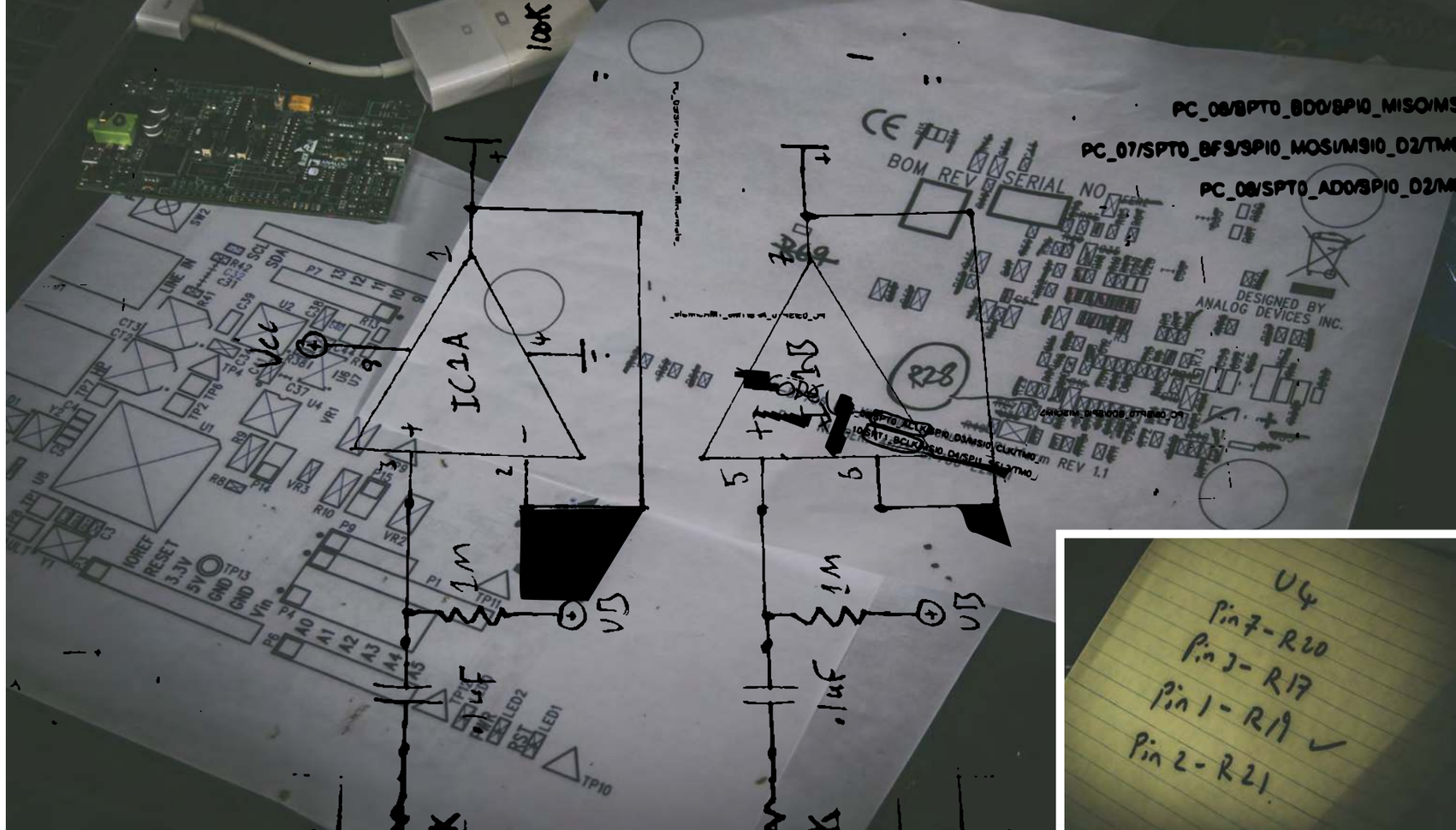
Within an hour, CopperSound received an interesting phone call from Third Man Records — Jack had received the pedal and had already mocked up an idea for an expanded version featuring not one, but three keys: octave up, octave down, and momentary killswitch. The idea for the Triplegraph was born.



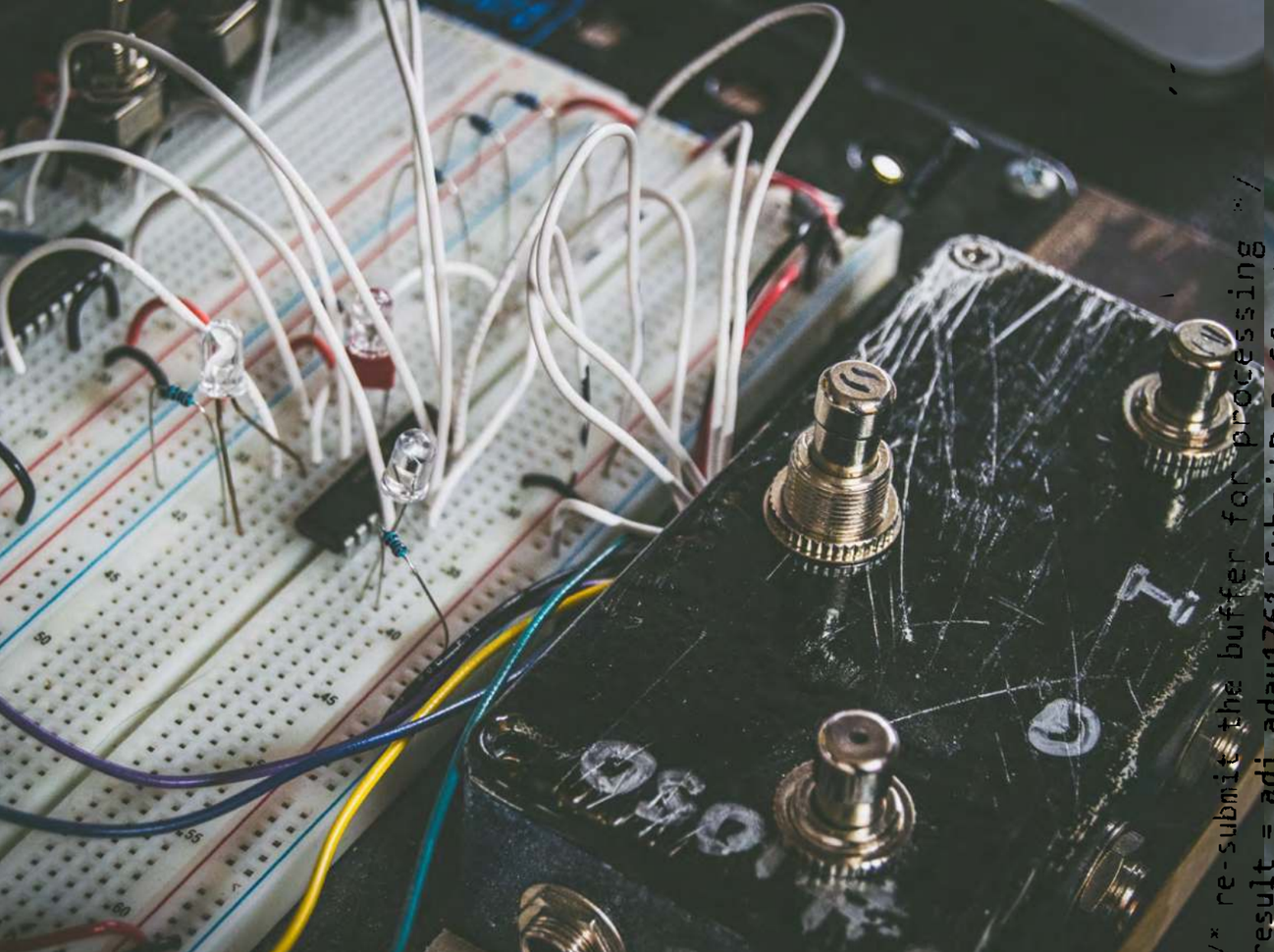
CopperSound got right to work, drawing analog and digital signal paths and designing a graphic layout for an early proof of concept.

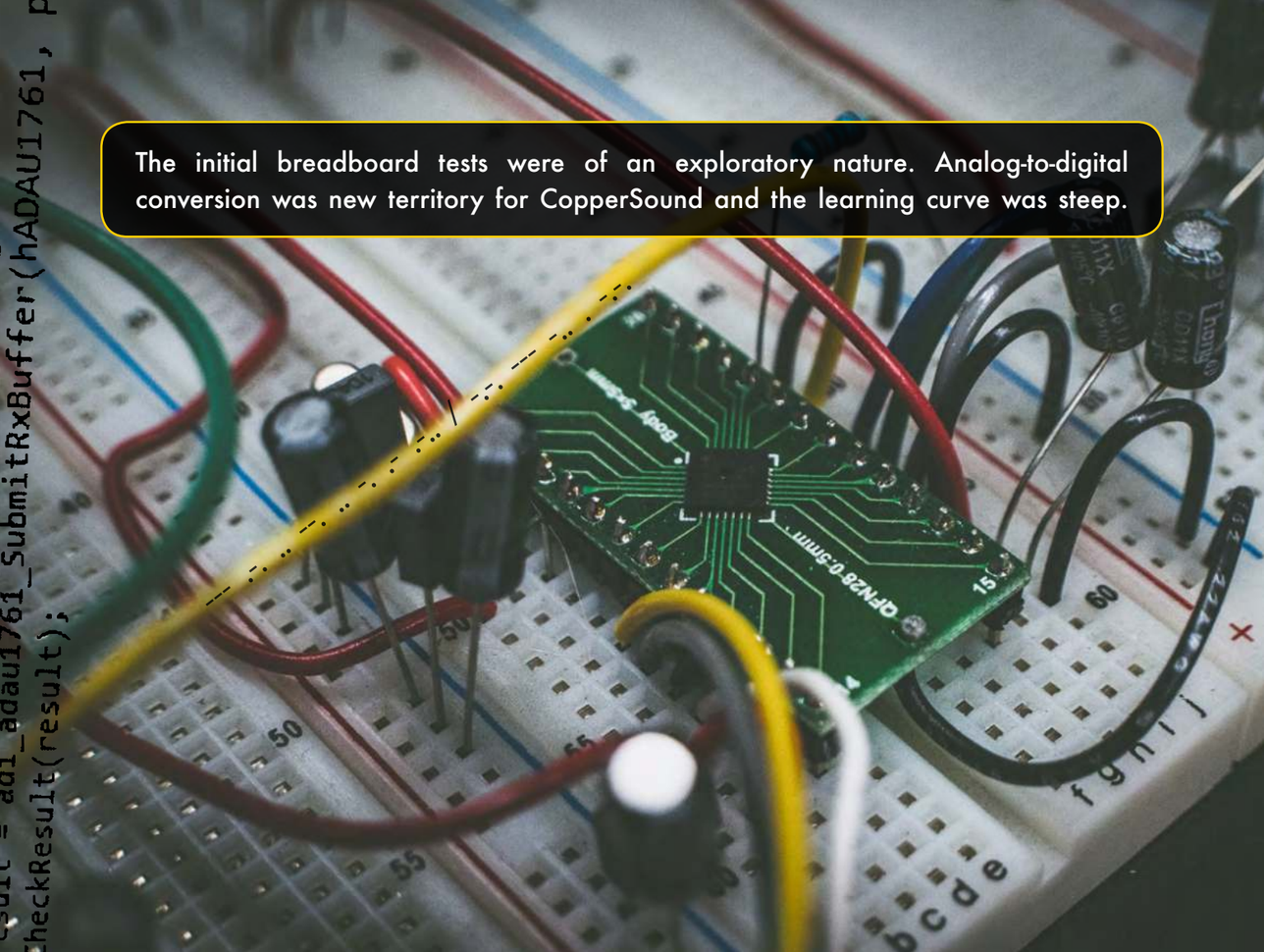

Pwr
5V
Soft
DeV
hi
LO
CMOS
S/R
mix
OUT


GP4
GP3
GP2
GP1
GP0

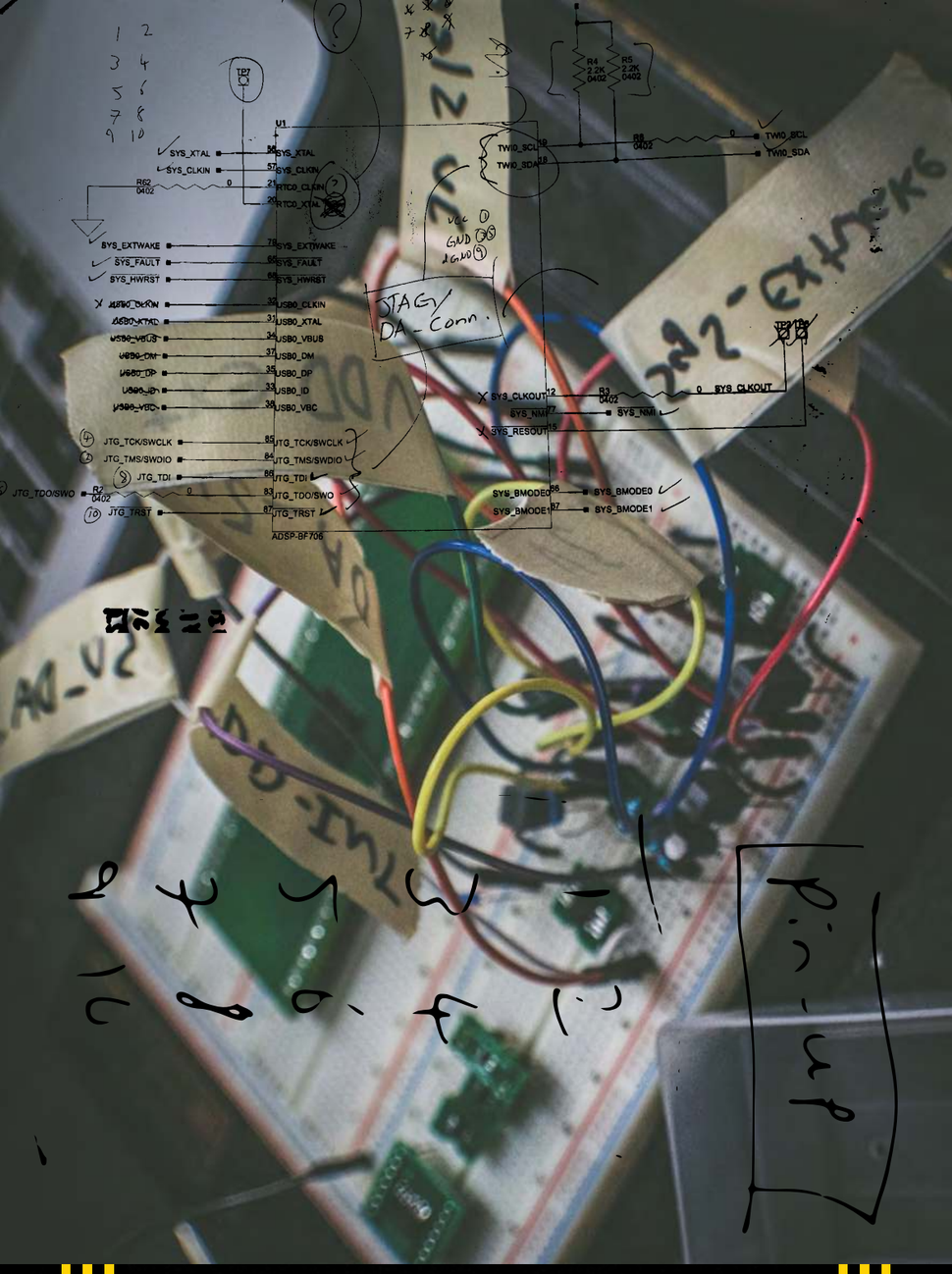

100K
IC2A
Vcc
VSS
1M
.1uF
PC_08/SPI0_MISO/MS
PC_07/SPI0_MOSI/MSI0_D2/TM
PC_06/SPI0_AD0/SPI0_D2/M
BOM REV
SERIAL NO
DESIGNED BY
ANALOG DEVICES INC.
REV 1.1
R28
RESET
LED1
LED2
TP10

U4
Pin 7 - R20
Pin 3 - R17
Pin 1 - R19
Pin 2 - R21





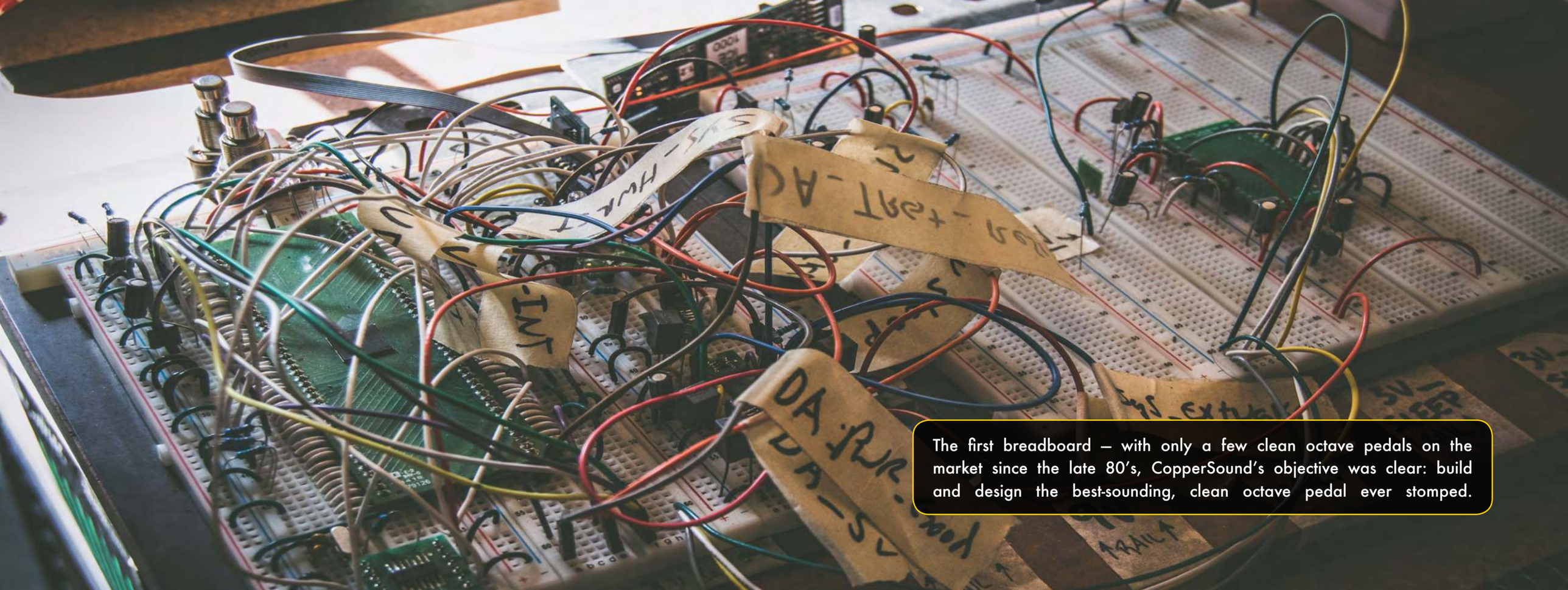
The initial breadboard tests were of an exploratory nature. Analog-to-digital conversion was new territory for CopperSound and the learning curve was steep.



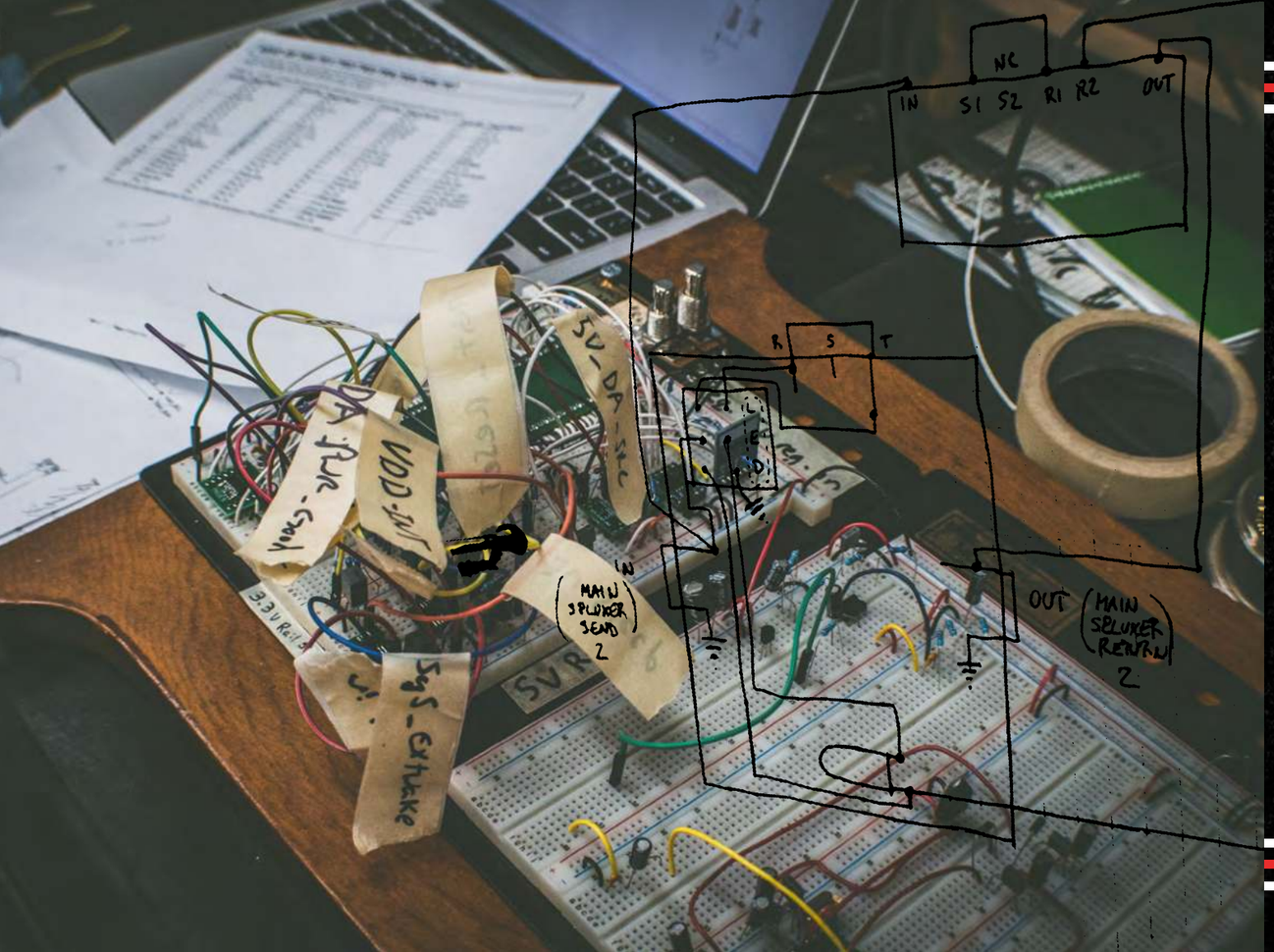
0 1 2 3 4 5 6 7 8 9

N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M



The first breadboard – with only a few clean octave pedals on the market since the late 80's, CopperSound's objective was clear: build and design the best-sounding, clean octave pedal ever stomped.


NC
IN
S1
S2
R1
R2
OUT
R
S
T
5V_DA_SRC
DA_PWR_SW1
VDD_3V3
SYS_ENABLE
IN
MAIN SPLUNGER SENSE 2
OUT
MAIN SPLUNGER RETURN 2
3.3V Rail

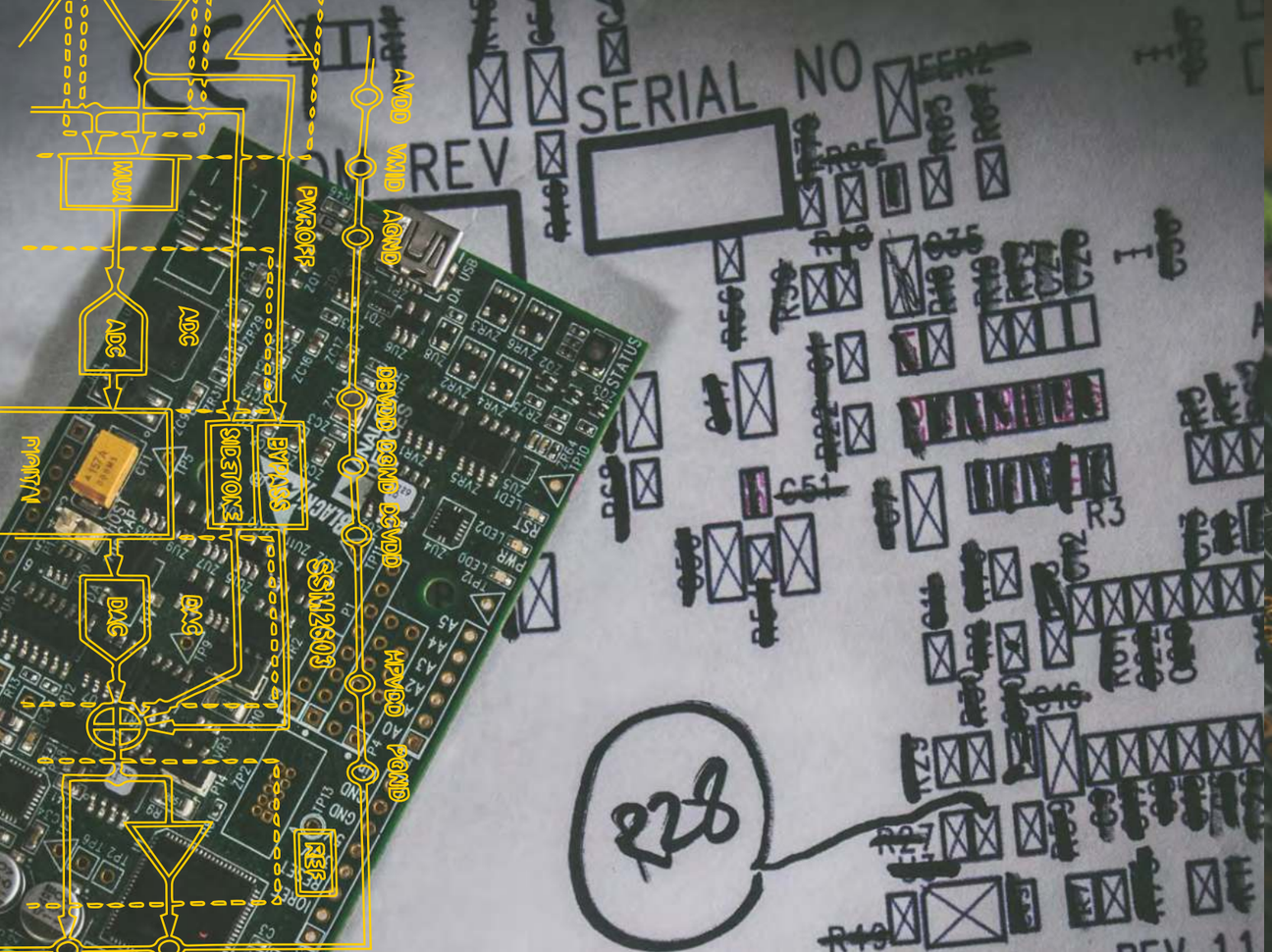
.. - .----. ... / --.- ..- .. - . / .--. --- ... . -... .-.. .

- .... .- - / .. .----. -- / -.-- --- ..- .-. / - ....-. -.. / -- .- -.

--..-- / --. .. .-. .-..

-... ..-- - / .. - .----. ... / .- / ...-. .- -.-. -

- .... .- - / .. .----. -- / - .... . / ... .- . -. - .... / ... --- -.



CopperSound's early breadboard efforts quickly gave way to experimenting with a development board. This was their first attempt at digital signal processing.

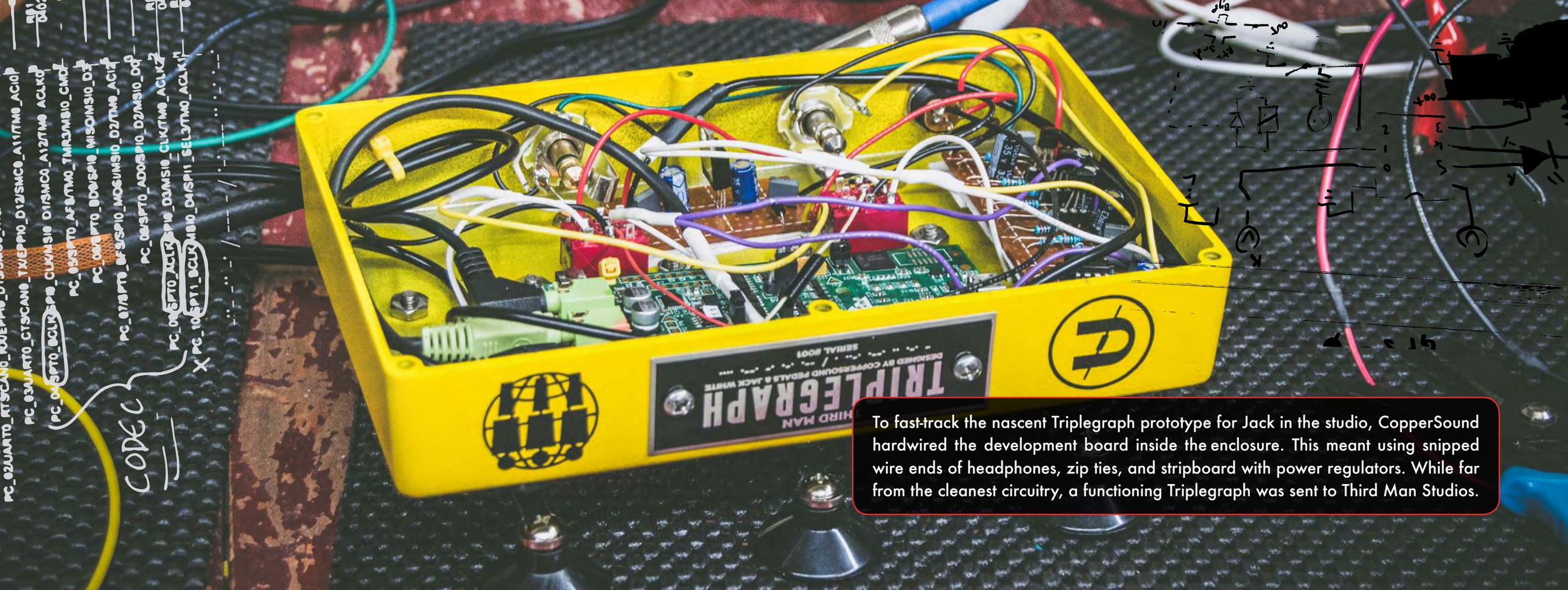
After countless sleepless nights and hundreds of code revisions, CopperSound engineers at last were able to pass audio through the development board with both lower and upper octaves; but latency, modulation, and stability issues persisted.

As the technical work continued, CopperSound auditioned countless design ideas for the enclosure, printing and cutting each idea in vinyl to visualize.

After approval from Jack to call the pedal 'Triplegraph,' CopperSound decided each limited edition should have its own serial badge number. Prototype badges were printed and cut at a trophy shop in CopperSound's home state of Massachusetts.

Two years into the development of the Triplegraph, CopperSound had finally reached a point where their octave code could hold its own against industry standards. Once informing Third Man, Jack reached out about getting a prototype to use in the studio.

Until this collaboration, CopperSound Telegraph Stutter pedals were ideally meant to be hand-operated due to the construction of the keys themselves. To allow for foot pressure and add a level of support, CopperSound used small rubber bumpers under the arms to avoid bending.



To fast-track the nascent Triplegraph prototype for Jack in the studio, CopperSound hardwired the development board inside the enclosure. This meant using snipped wire ends of headphones, zip ties, and stripboard with power regulators. While far from the cleanest circuitry, a functioning Triplegraph was sent to Third Man Studios.

This new prototype also featured 2 toggle switches between the bases, which allowed the player to lock the octaves on, bypassing the trigger on the telegraph keys. This later became known as the “Loctave” function.

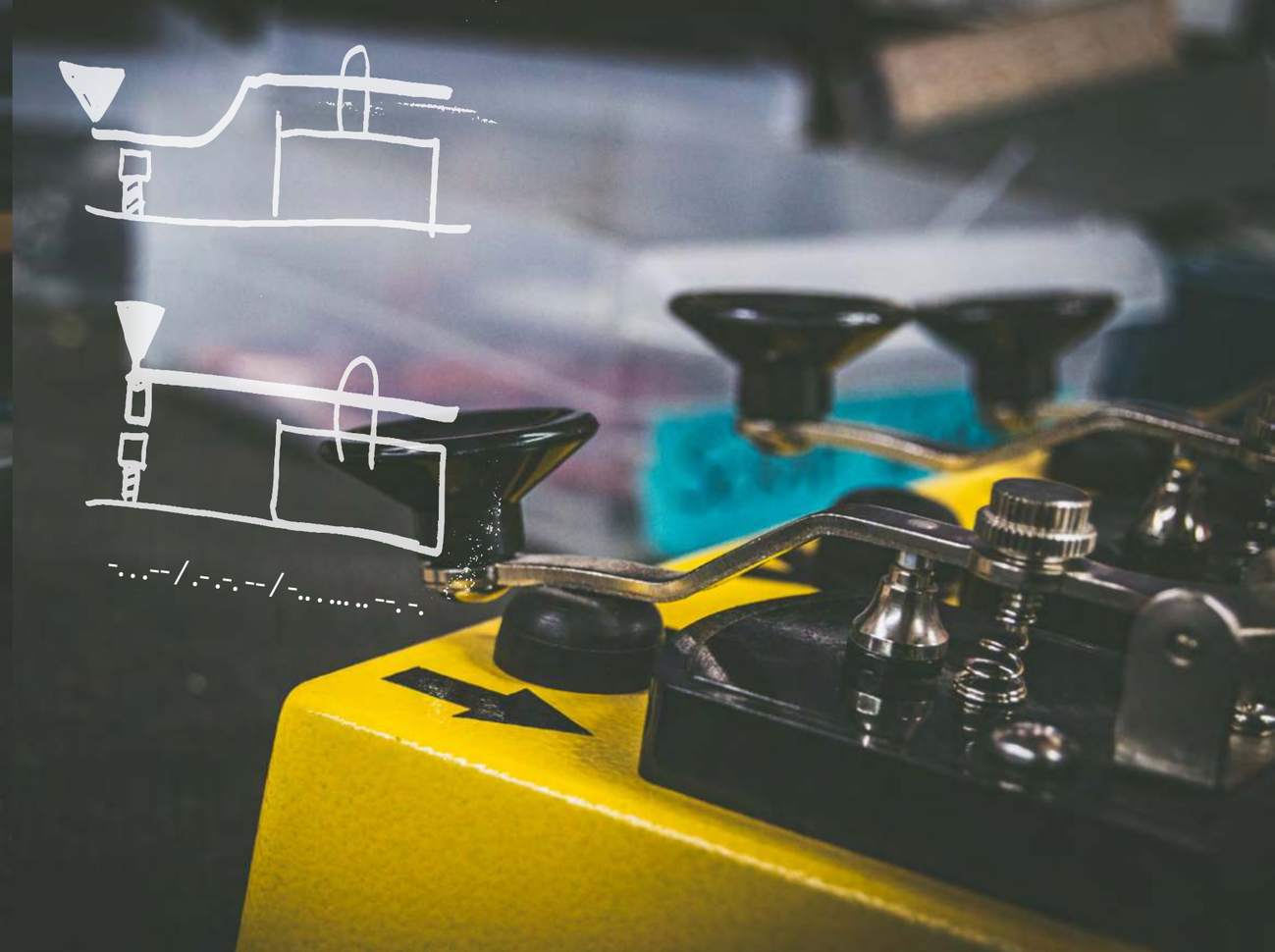
--- -. .-.. -.-- / -.-. ....-.. -..

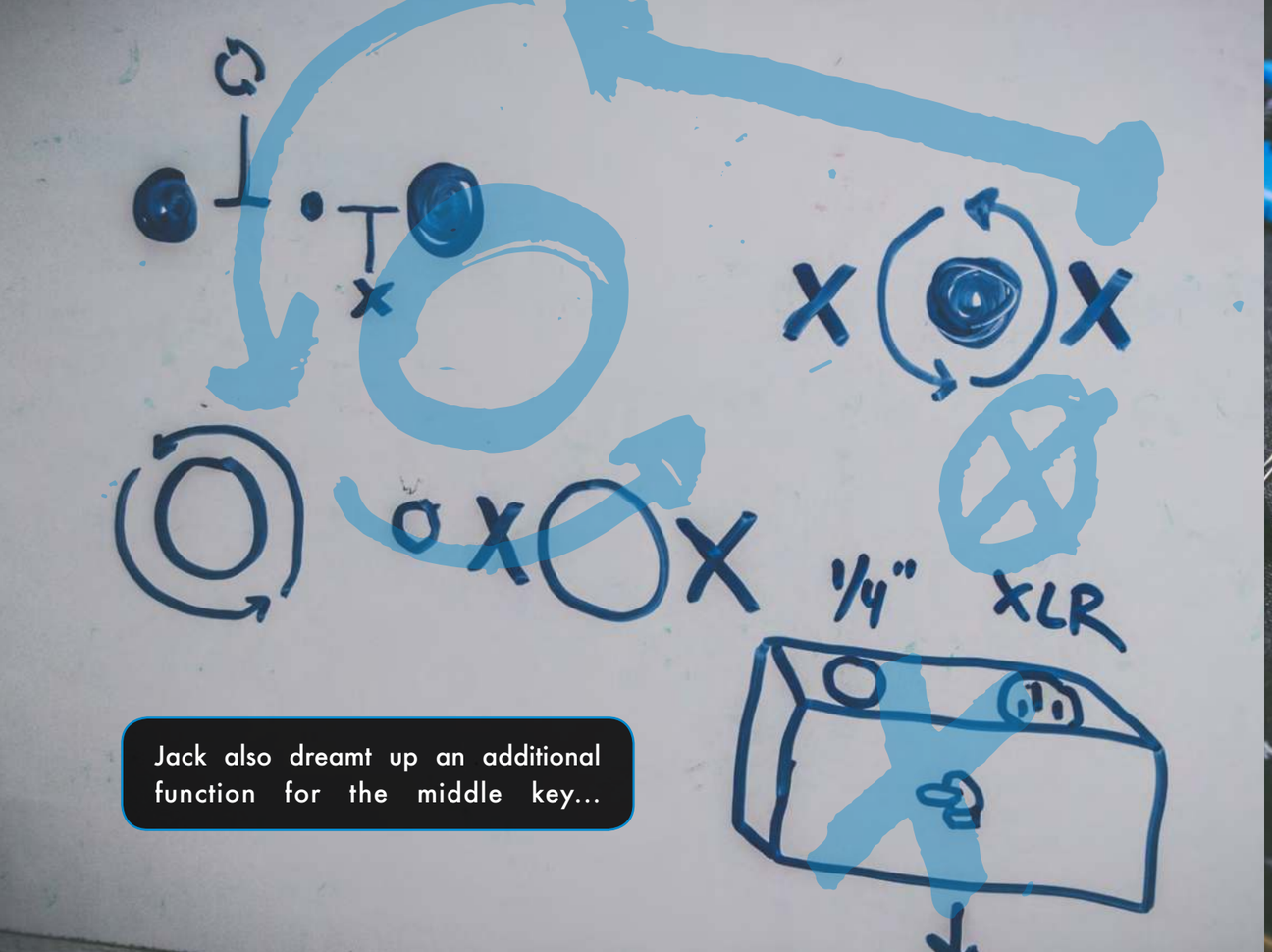
- .... . / .--. .-. --- -.. .. --. .- .-.. / ... --- -.

.... .- ... / -.-. --- -- . / -... .- -.-. -.- / .... --- -- . / .- --. . - .. -.

- --- / --. . - / .... / .-.. .- ..- -. -.. .-. -.-- / -.. --- -. .

After using the Triplegraph to record The Raconteurs' 2019 album *Help Us Stranger*, Jack sent the pedal back to CopperSound with ideas for improvement. The quality and tracking of the octaves were great, but durability and strength issues with the telegraph arms meant Jack was having to bend the arms back into place between takes.



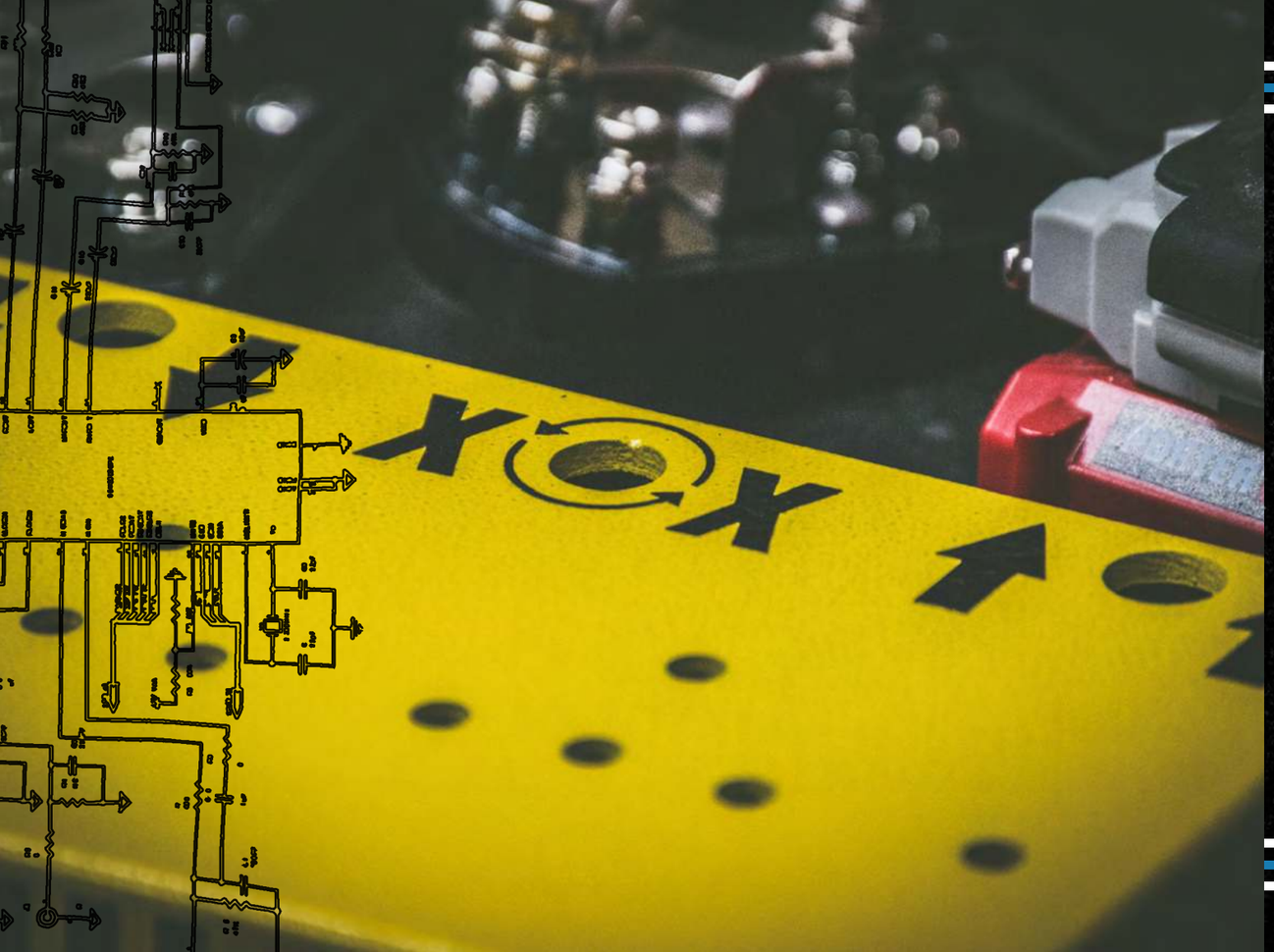


Jack also dreamt up an additional function for the middle key...

A toggle on the rear of the enclosure would choose between killswitch mode and a new momentary send/return mode. With this mode engaged, the middle key would send signal to an external pedal that's plugged into the "auxiliary loop."

Shortly after making these changes, The Raconteurs announced a world tour and Jack requested that the Triplegraph be added to his pedalboard.

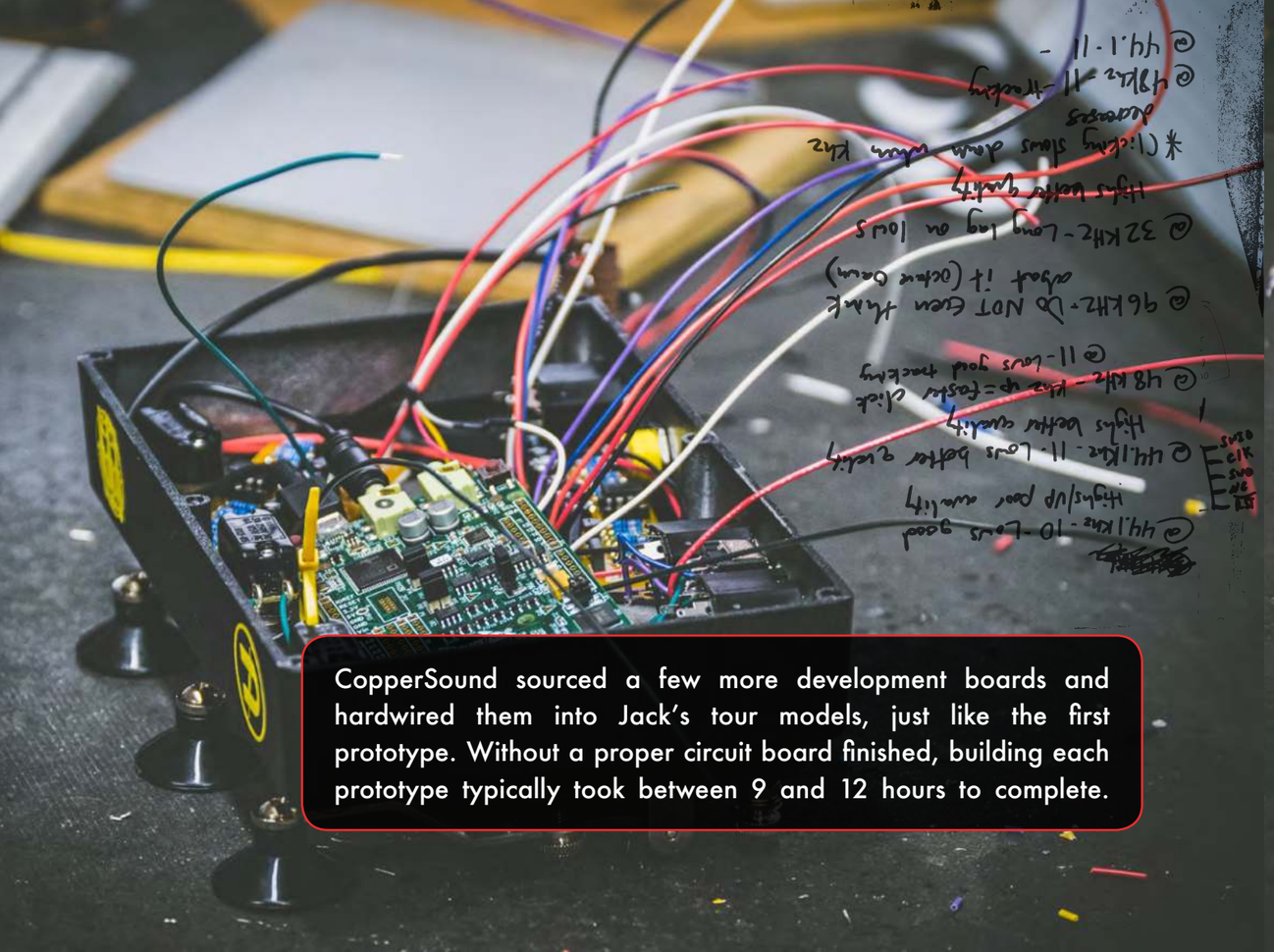
This would be the first prototype with the new soft-touch switches and send/return feature on the middle key. CopperSound cut and printed the artwork from adhesive vinyl and clear-coated the graphics on the enclosure.



-.-. ..- - / --- ..-. ..-. / - .... . / -... --- - - --- -- ...

--- ..-. / -- -.-- / ..-. . . -

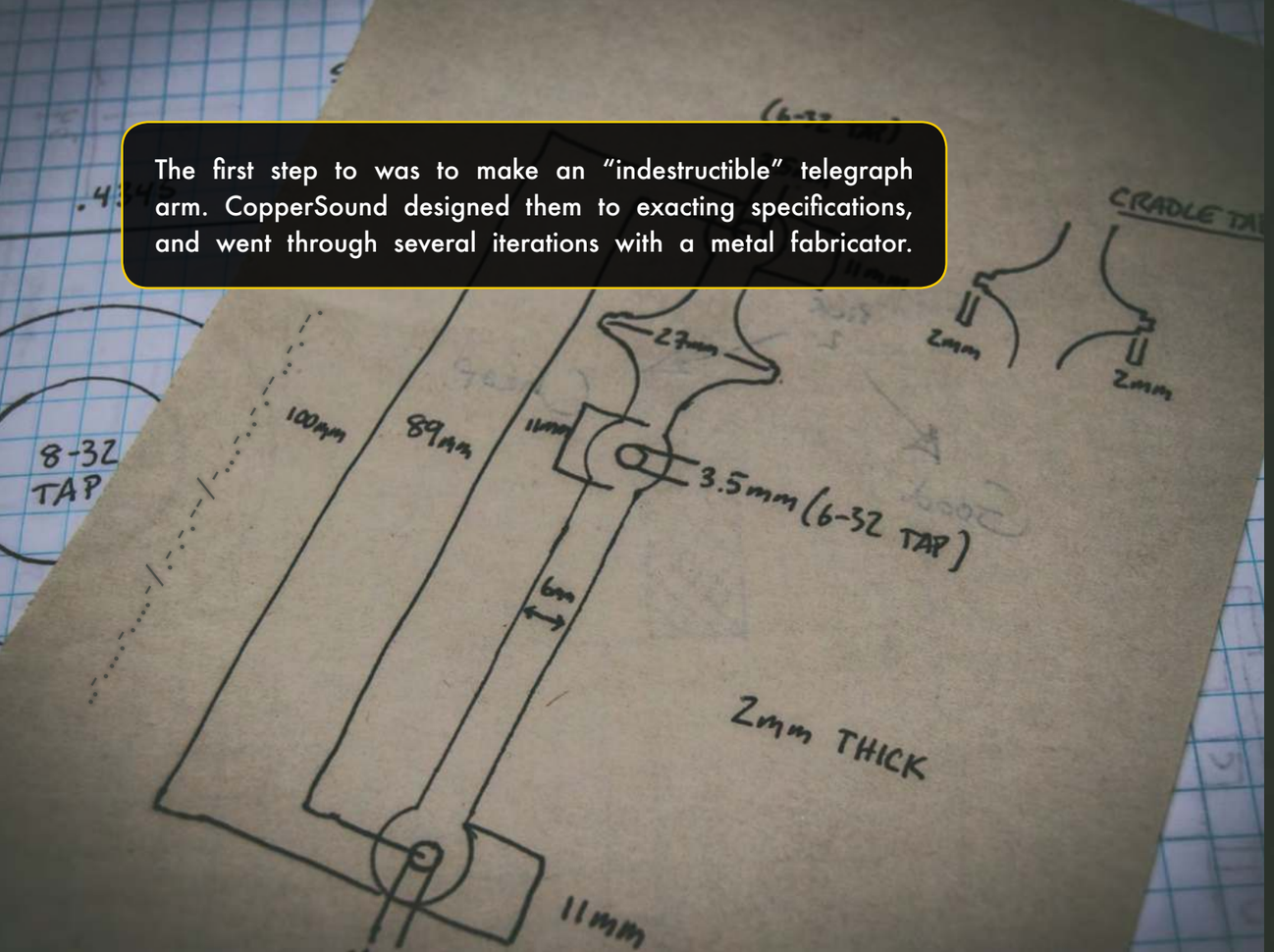
-- . - -.- . / -- . / .-- . - .-.. -.- / --- -. / ... . - .-.. -

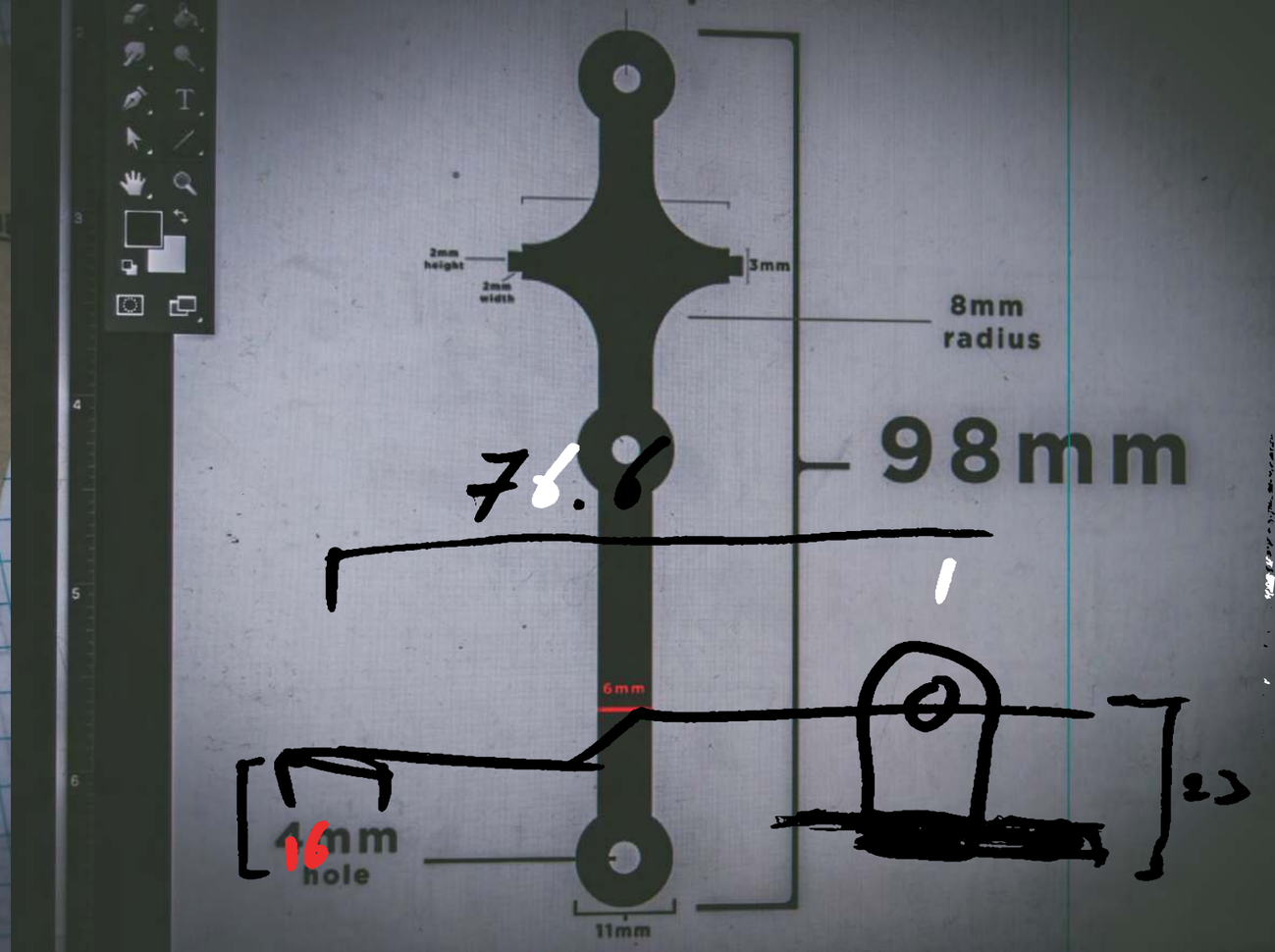


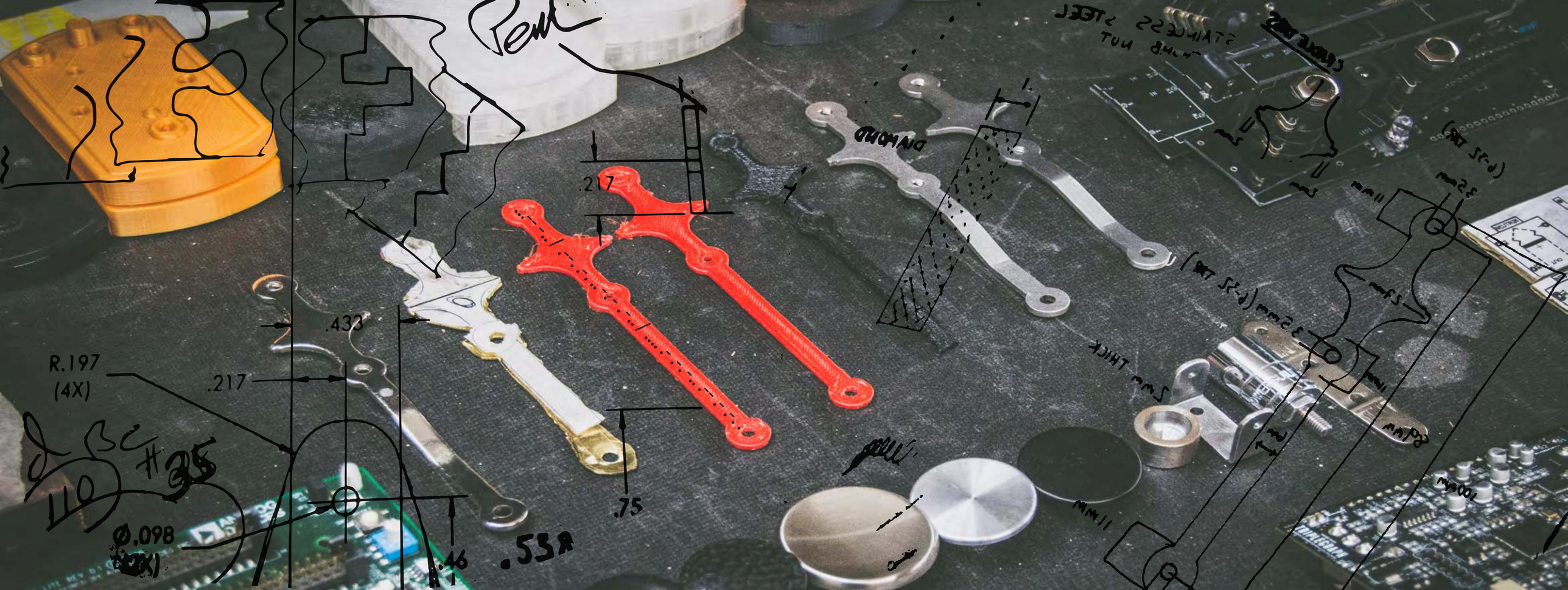
CopperSound sourced a few more development boards and hardwired them into Jack's tour models, just like the first prototype. Without a proper circuit board finished, building each prototype typically took between 9 and 12 hours to complete.

Though these prototypes survived the first leg of the tour, the hardware required constant maintenance and replacement parts. It became clear that the only path forward for the Triplegraph was for CopperSound to design their own proprietary hardware.

The first step to was to make an “indestructible” telegraph arm. CopperSound designed them to exacting specifications, and went through several iterations with a metal fabricator.



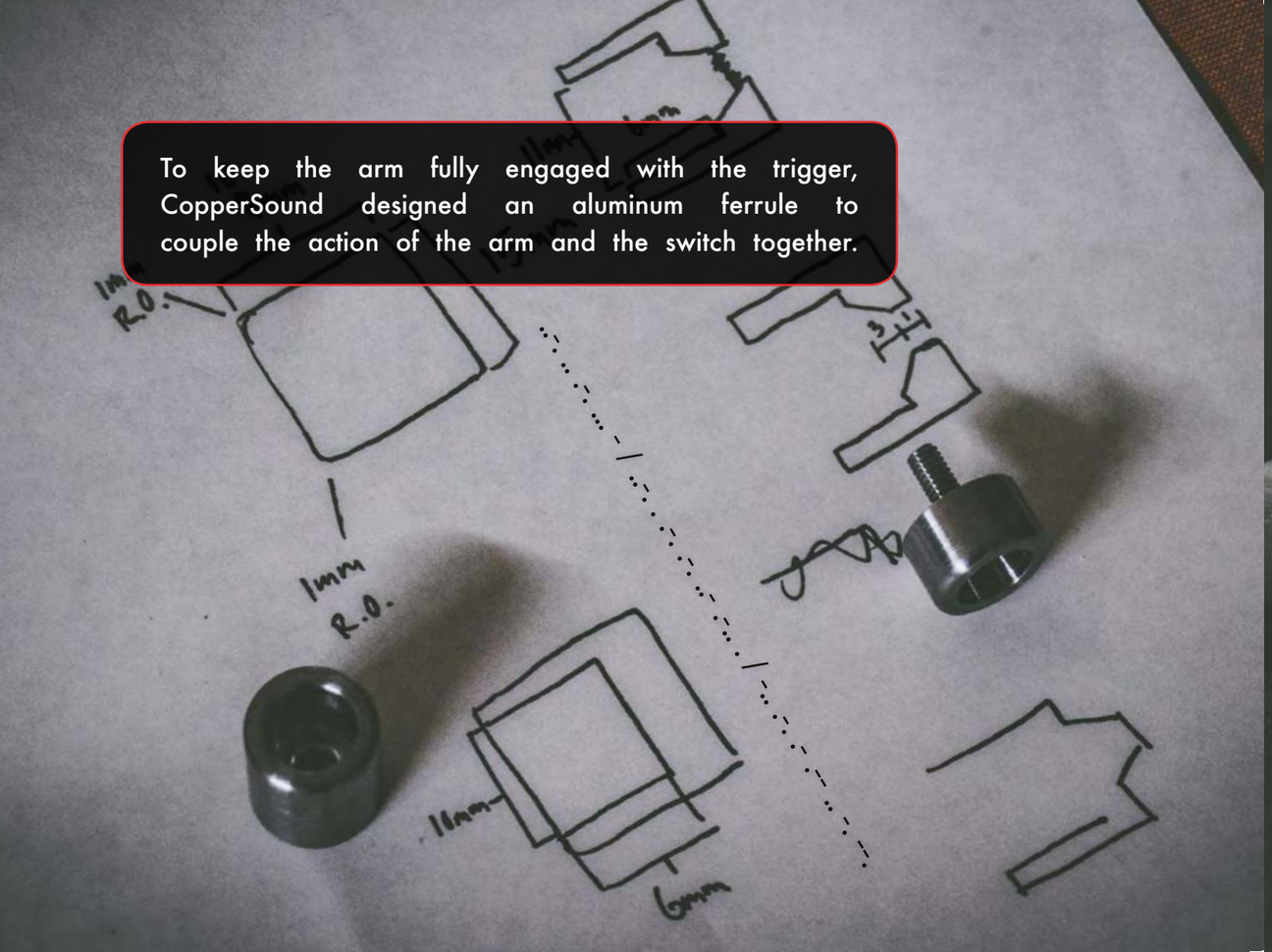



.217
.433
R.197
(4X)
.217
.75
.46
.53
Ø.098
(4X)

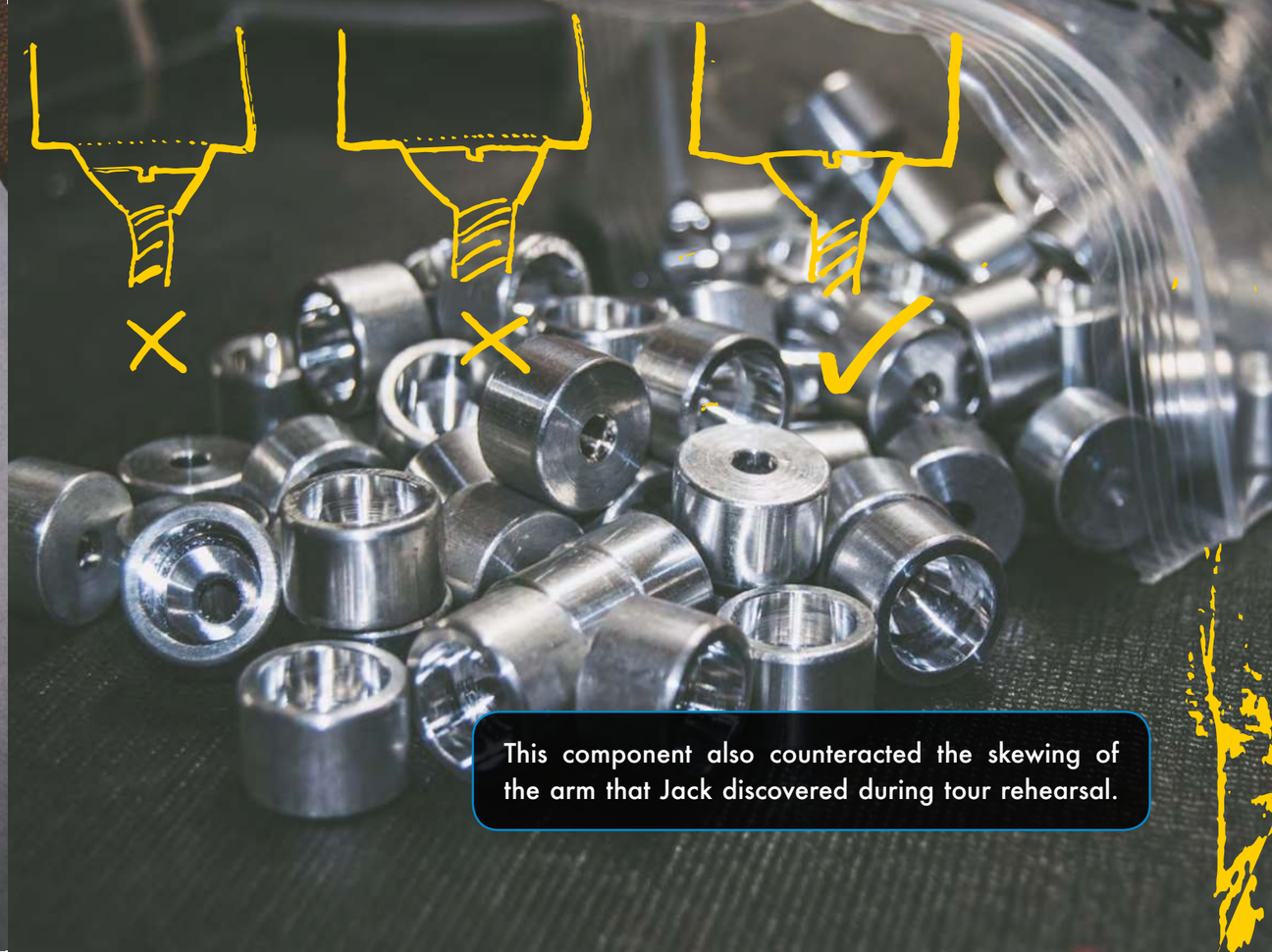

NEW
3/8" THICK
9.525 mm
Unlike the previous bases made of plastic, CopperSound's new bases were milled from aluminum stock for maximum durability.

Each limited edition badge was also custom milled and machined from aluminum, then anodized black. A laser-etching procedure revealed the text.

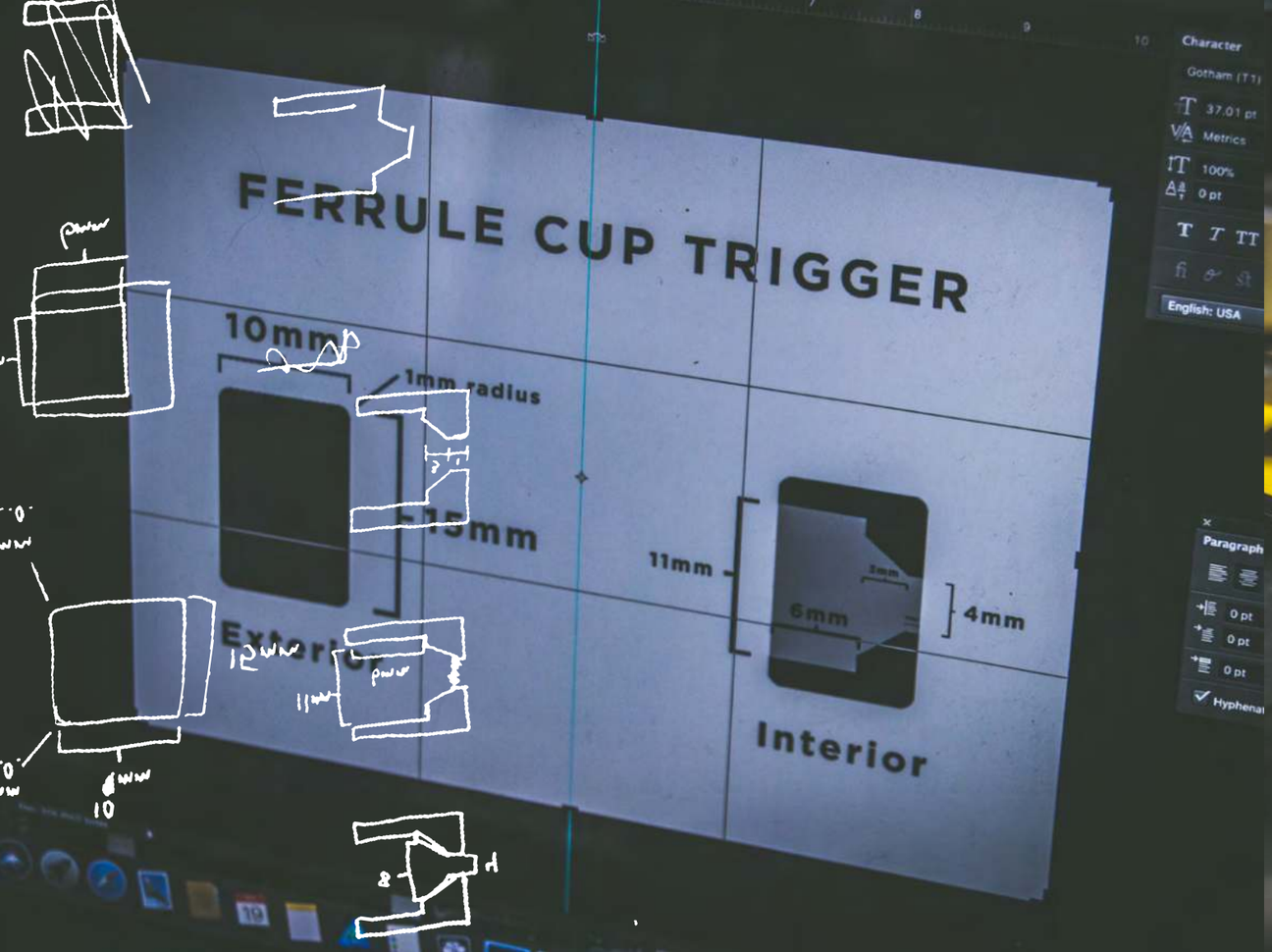
Despite improvements to the hardware, Jack was experiencing issues during rehearsal, where the intensity of his movements would cause the arms to skew sideways off of the new footswitches.



To keep the arm fully engaged with the trigger, CopperSound designed an aluminum ferrule to couple the action of the arm and the switch together.



This component also counteracted the skewing of the arm that Jack discovered during tour rehearsal.

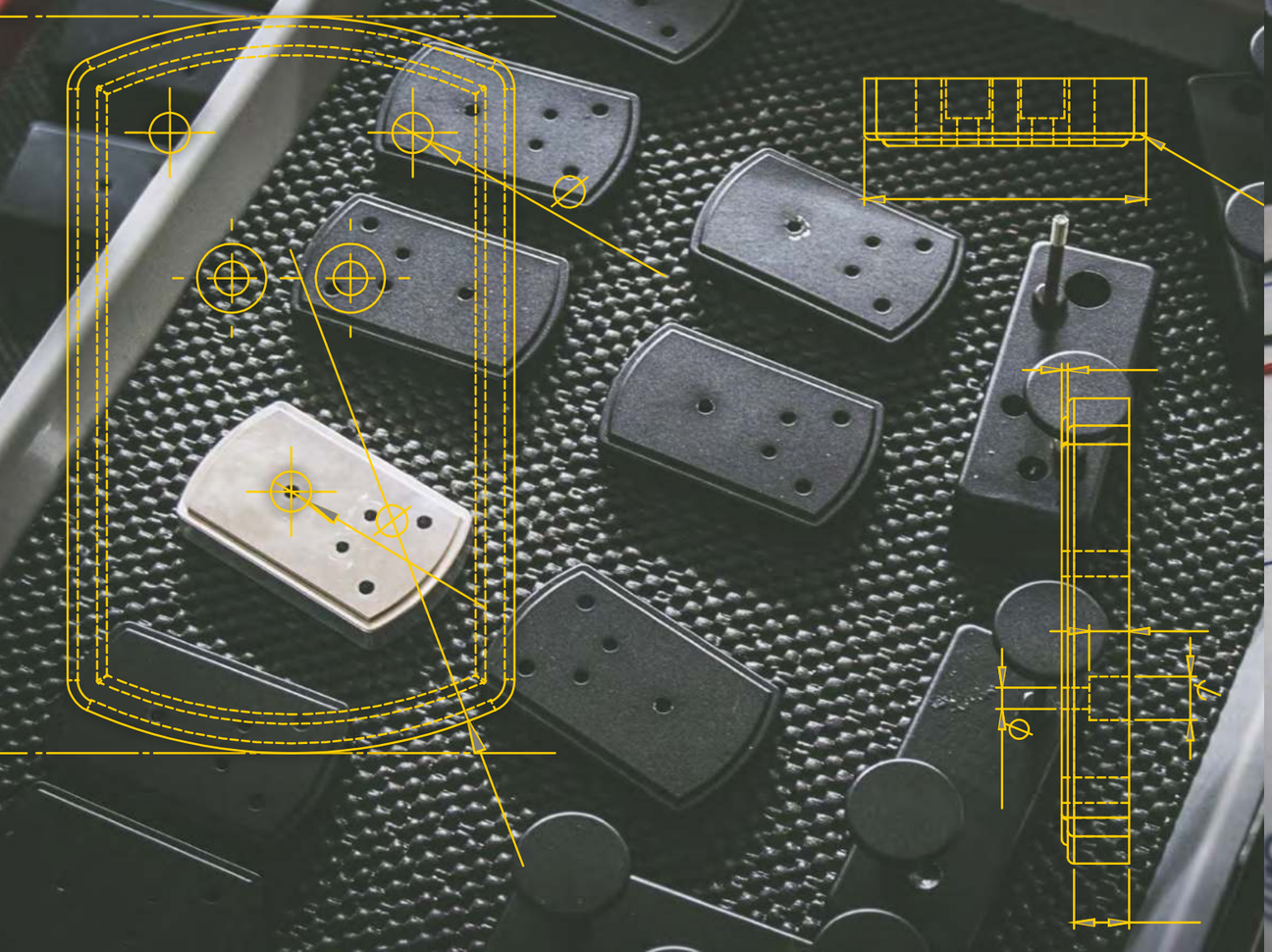

FERRULE CUP TRIGGER
10mm
1mm radius
11mm
6mm
4mm
Interior
Character
Gotham (T1)
37.01 pt
Metrics
100%
0 pt
English: USA
Paragraph
0 pt
0 pt
0 pt

Midway through the *Help Us Stranger* tour, Jack was still experiencing durability issues with the telegraph arms. Jack's guitar tech sent the pedals back to CopperSound for modifications, which included new hardware prototypes.

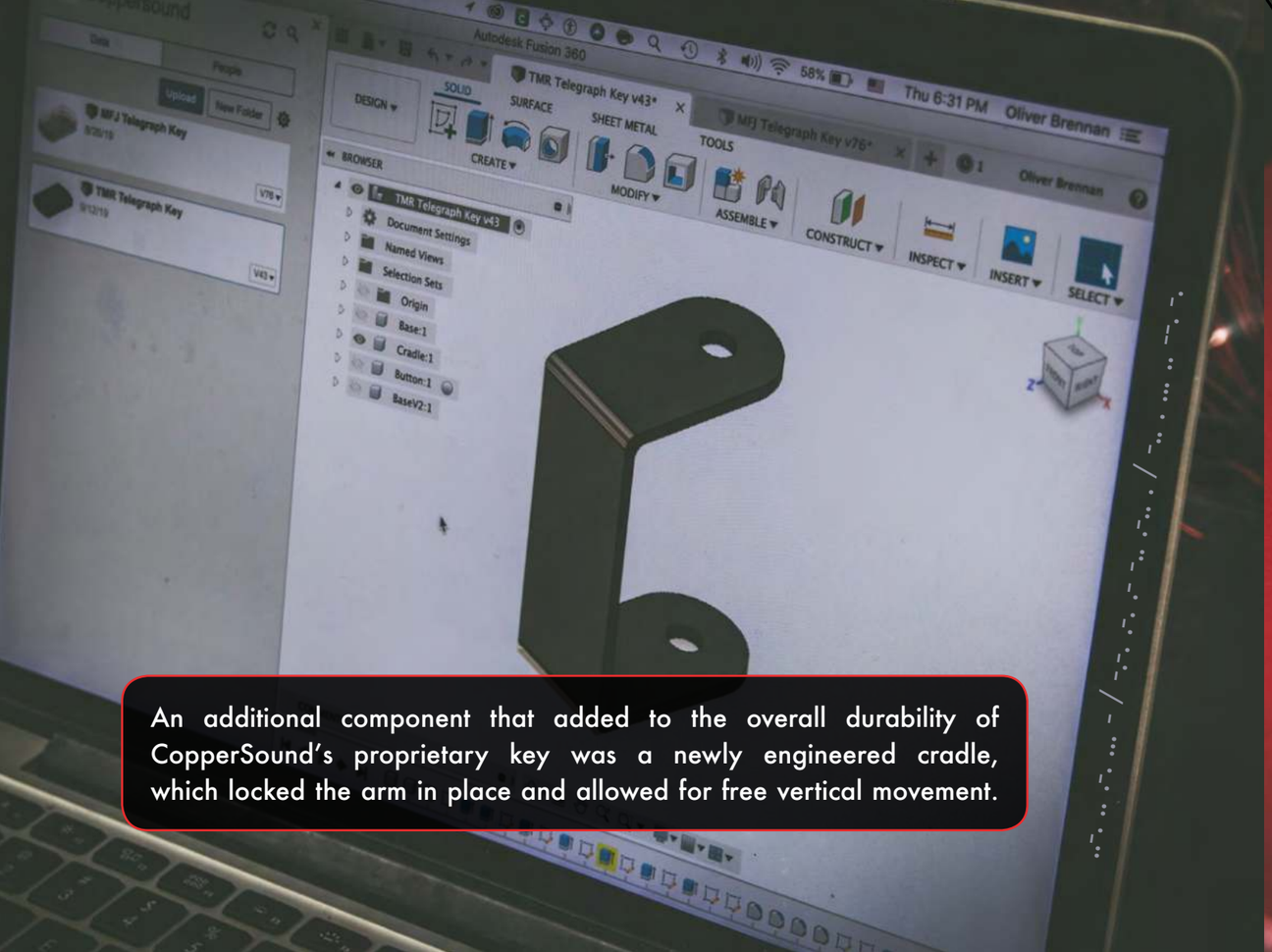
CopperSound had less than 24 hours to receive, modify, test, and ship the pedals back to Nashville in time for a three-night performance at the Ryman Auditorium. This was the first road-test for their new proprietary hardware.

The new telegraph arms were laser-cut from stainless steel to match CopperSound's exacting specifications.

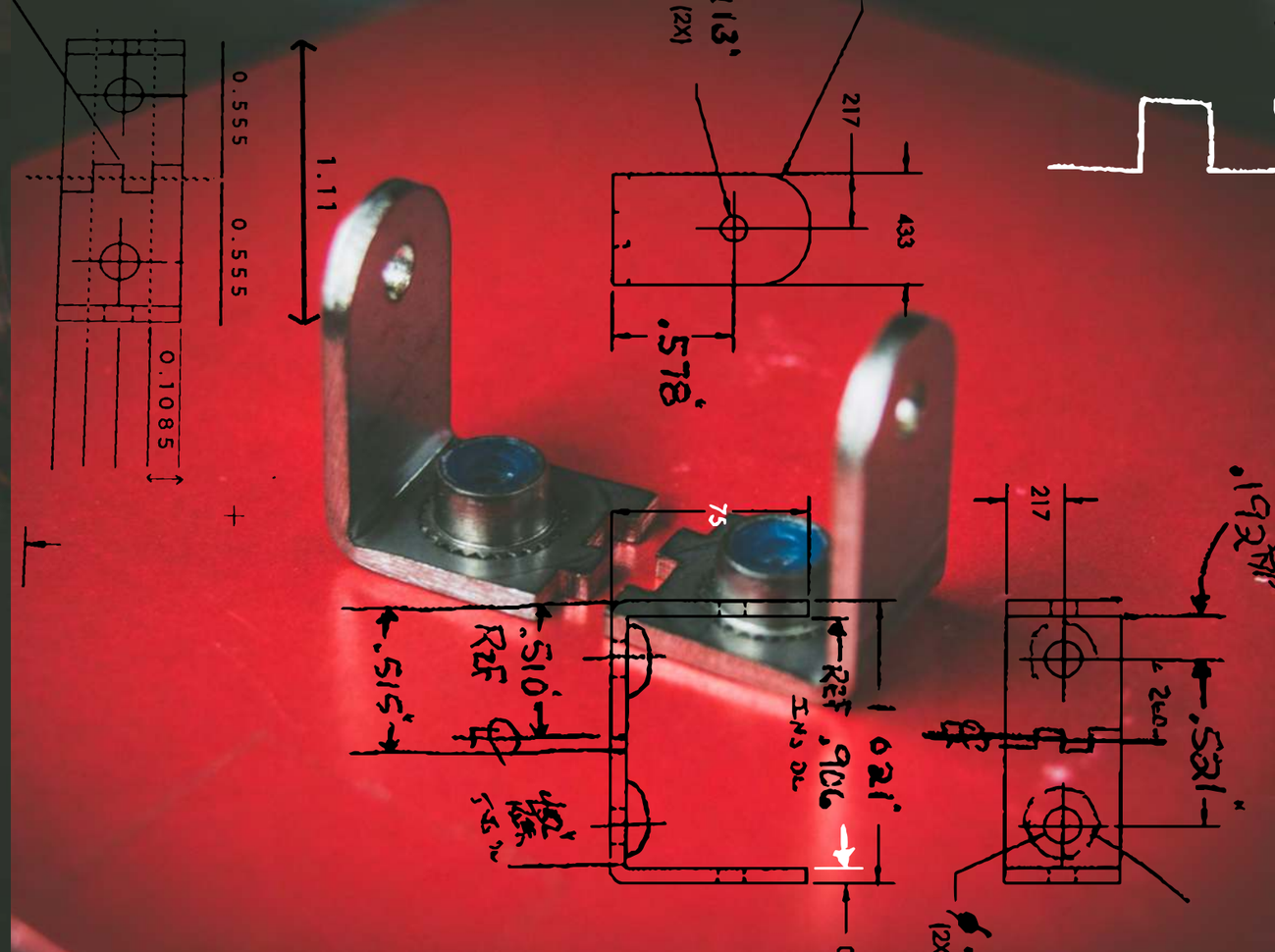
.- .-.. .-.. / .... . -. -. -.. .-- .- .-. . / -- . - -.. . / .. -. / -- .-

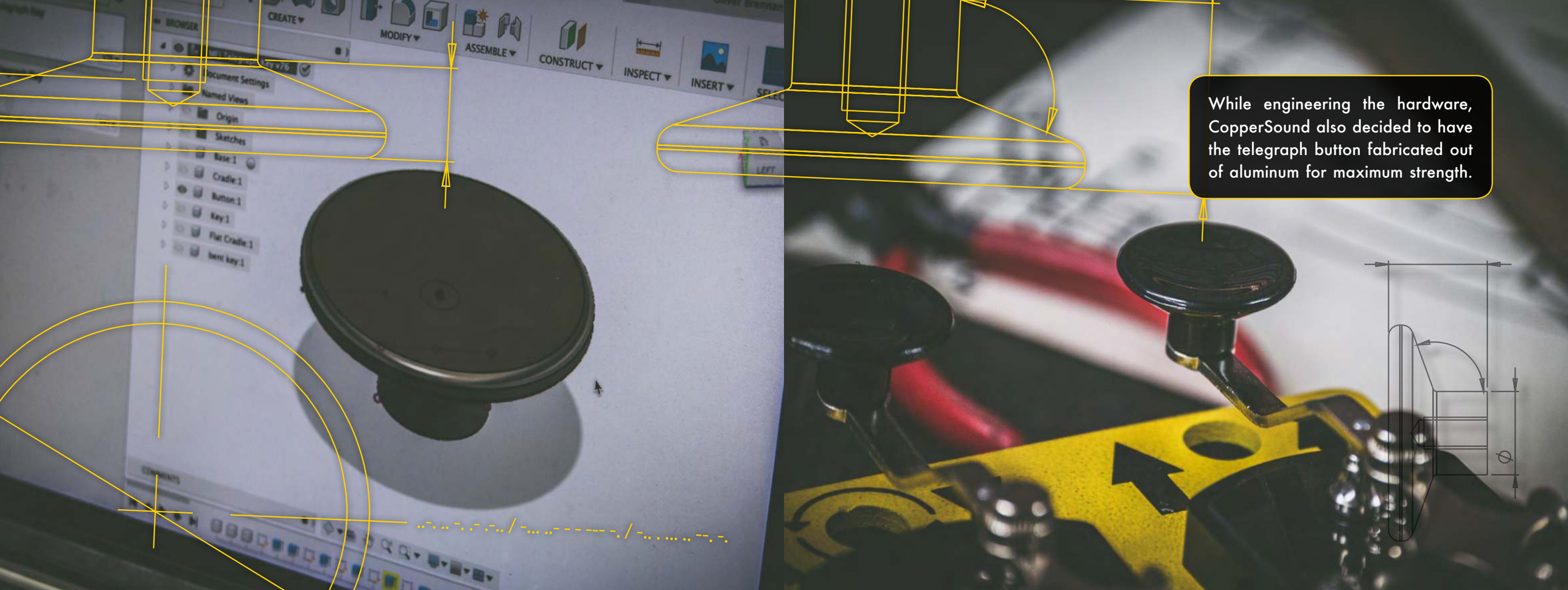


Once the bases were milled, each one was anodized in a sharp, matte black finish.



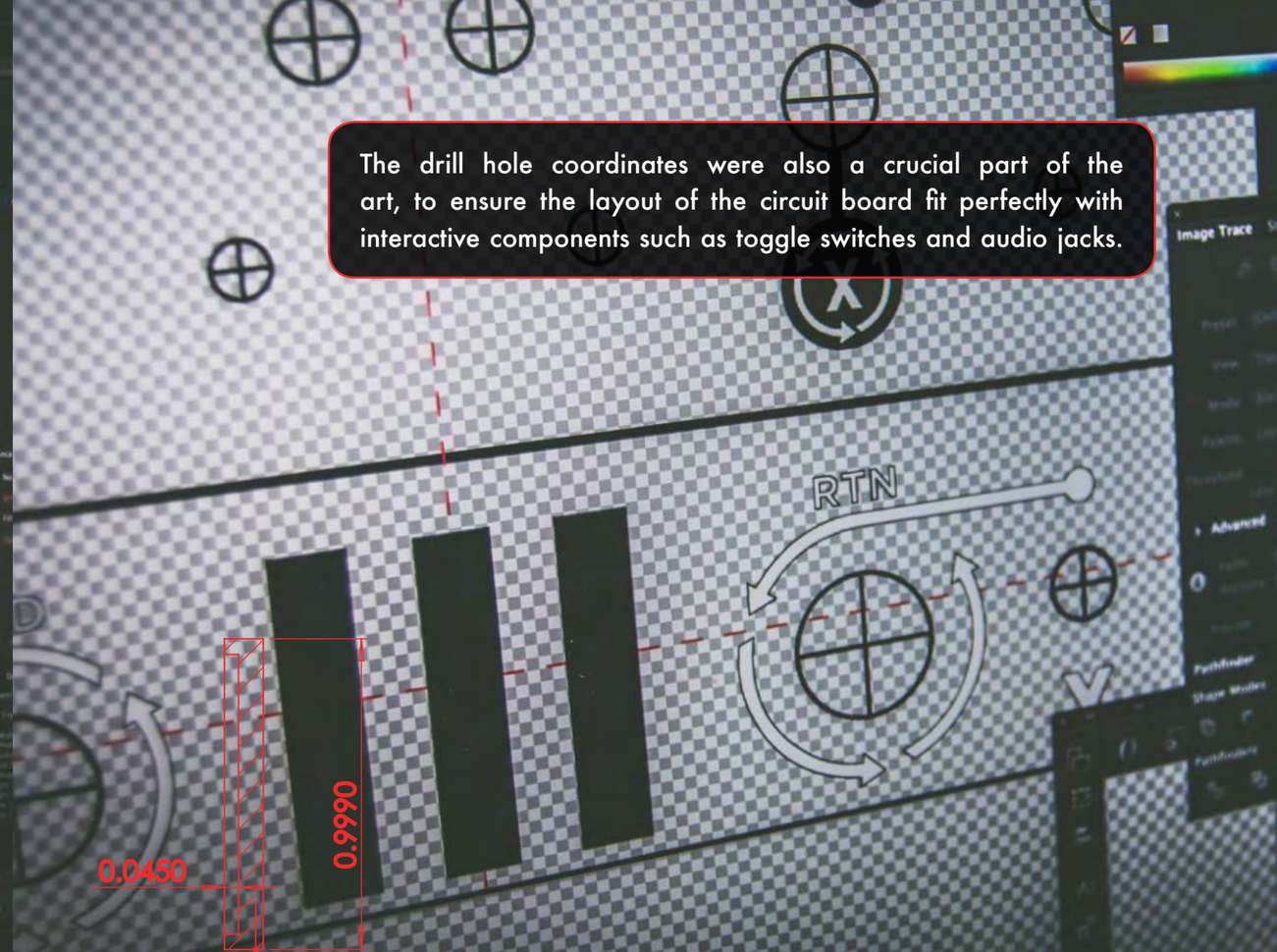
An additional component that added to the overall durability of CopperSound's proprietary key was a newly engineered cradle, which locked the arm in place and allowed for free vertical movement.

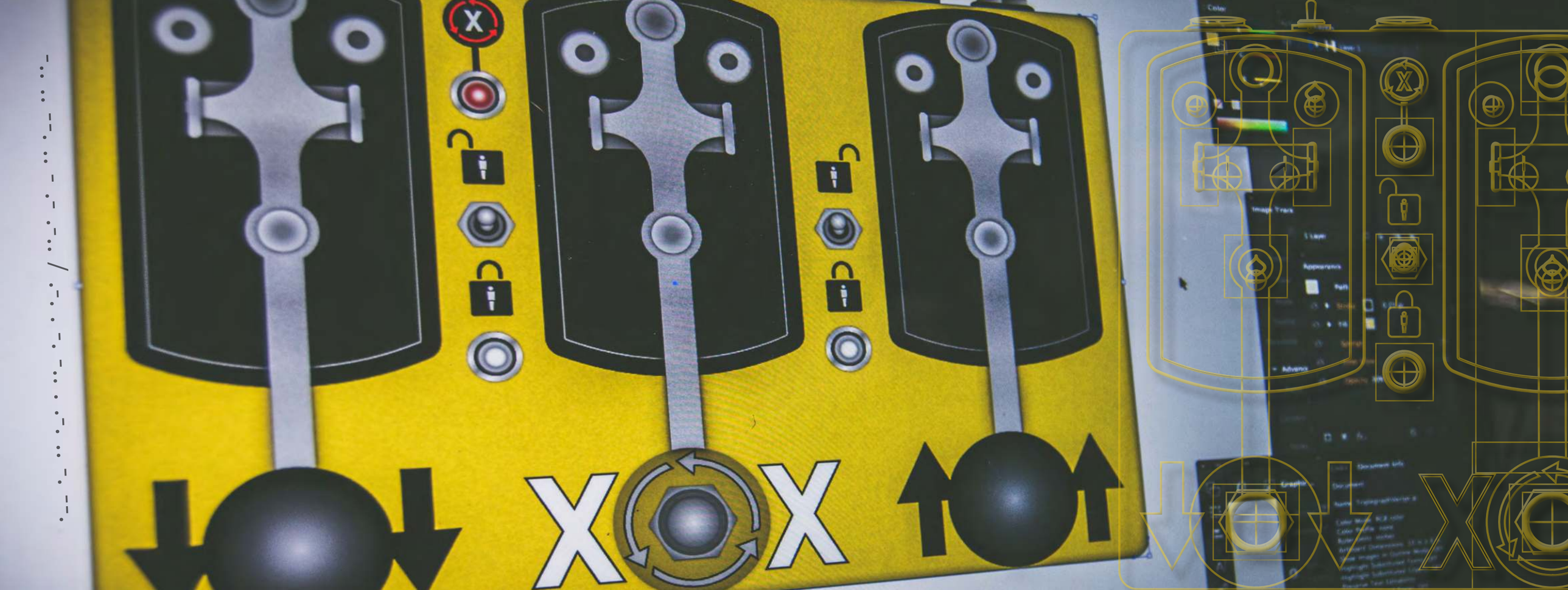



While engineering the hardware, CopperSound also decided to have the telegraph button fabricated out of aluminum for maximum strength.

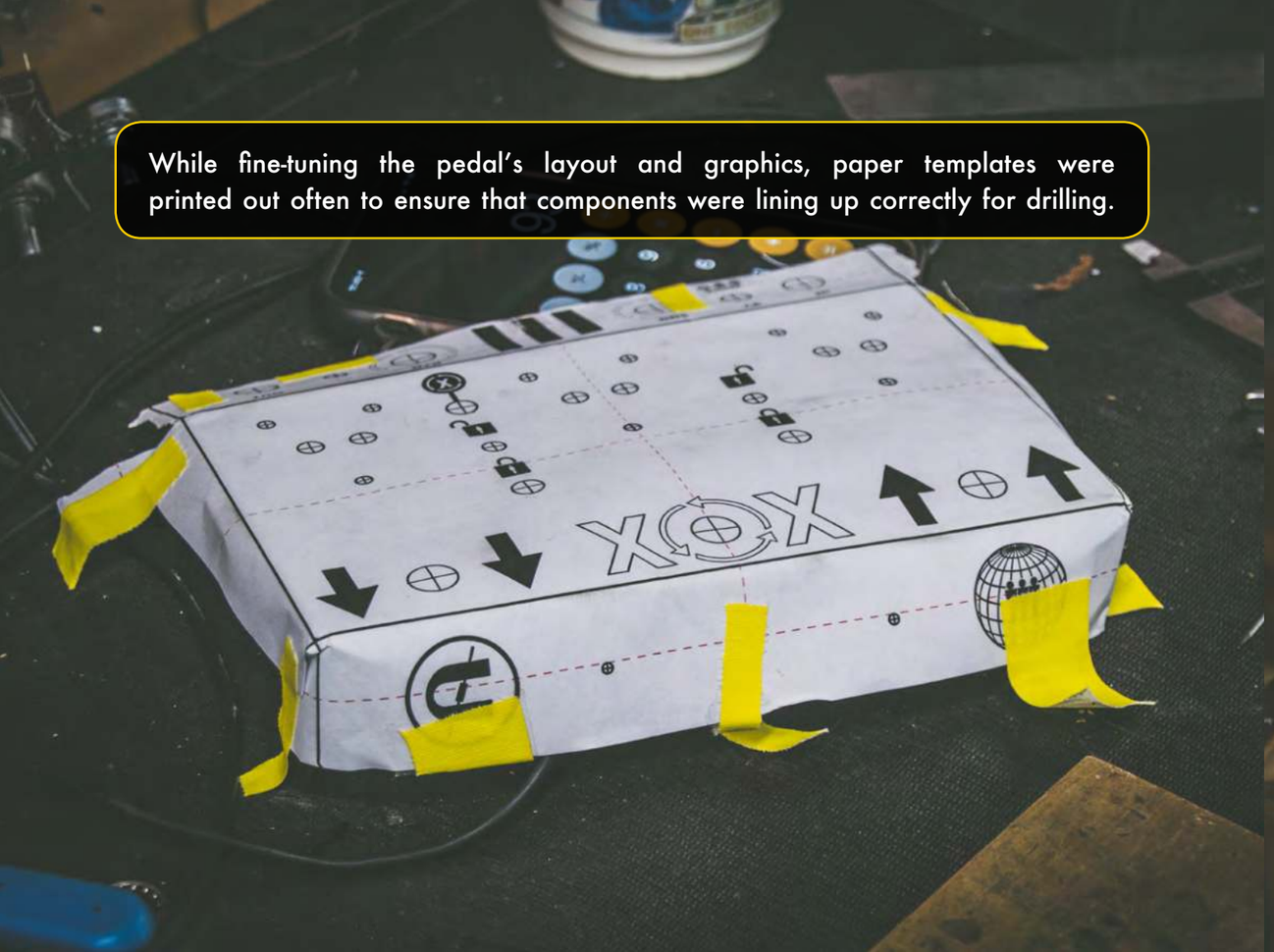
With the hardware engineering and fabrication complete, the next step was to finalize the artwork for UV printing. Every time a new function was added, the graphics grew to accomodate it.

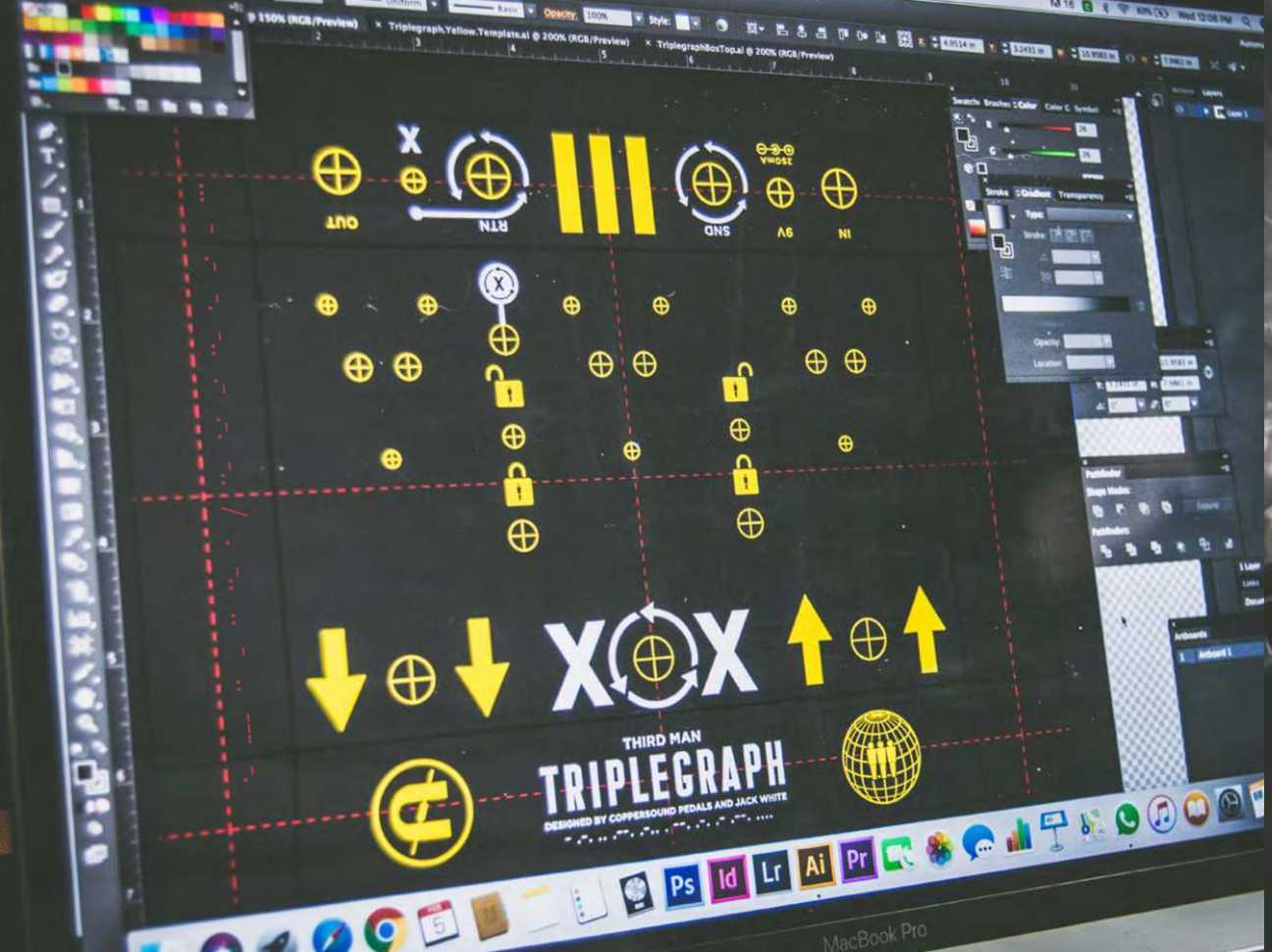
The drill hole coordinates were also a crucial part of the art, to ensure the layout of the circuit board fit perfectly with interactive components such as toggle switches and audio jacks.





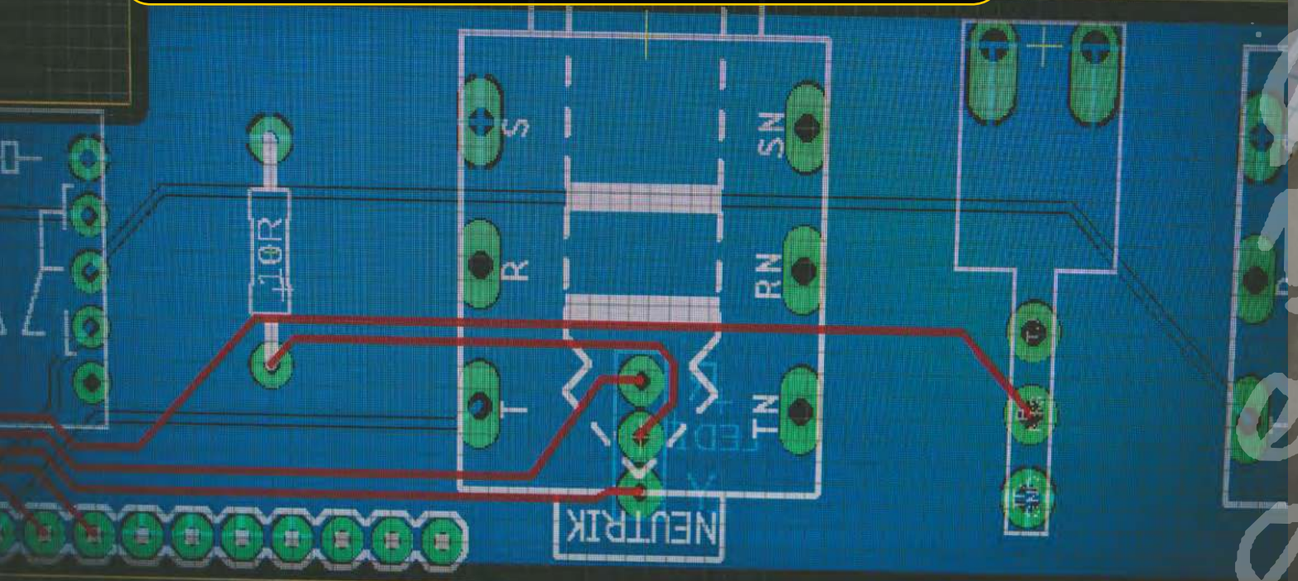
While fine-tuning the pedal's layout and graphics, paper templates were printed out often to ensure that components were lining up correctly for drilling.

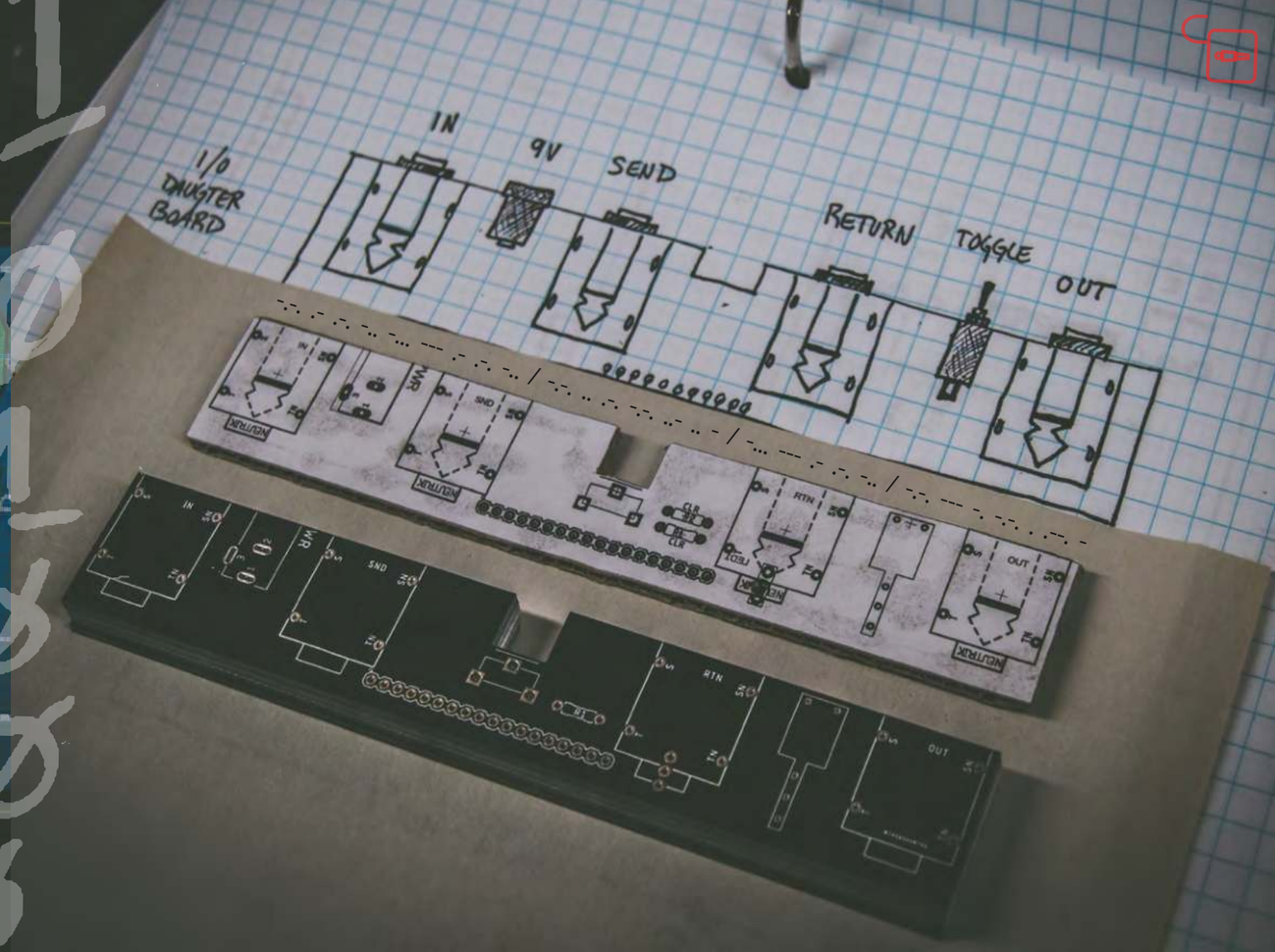


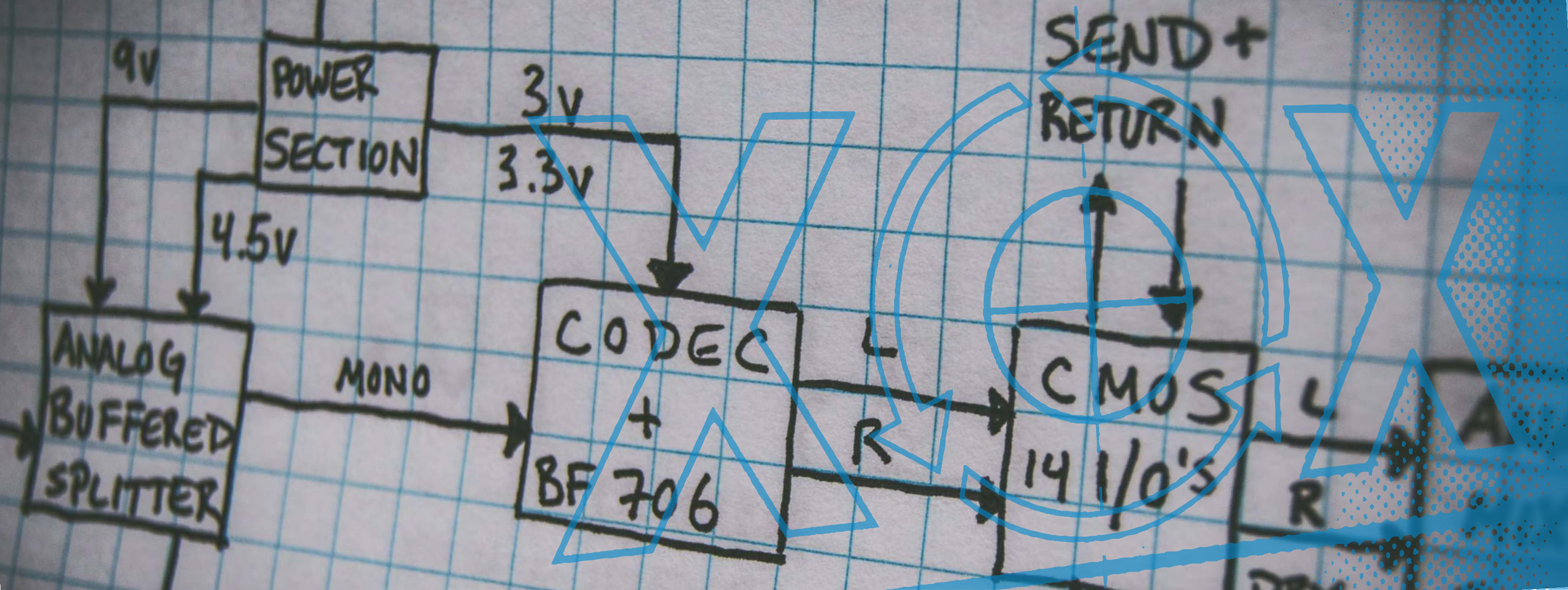

OUT
RTN
SND
9V
IN
THIRD MAN
TRIPLEGRAPH
DESIGNED BY COPPERSOUND PEDALS AND JACK WHITE
MacBook Pro

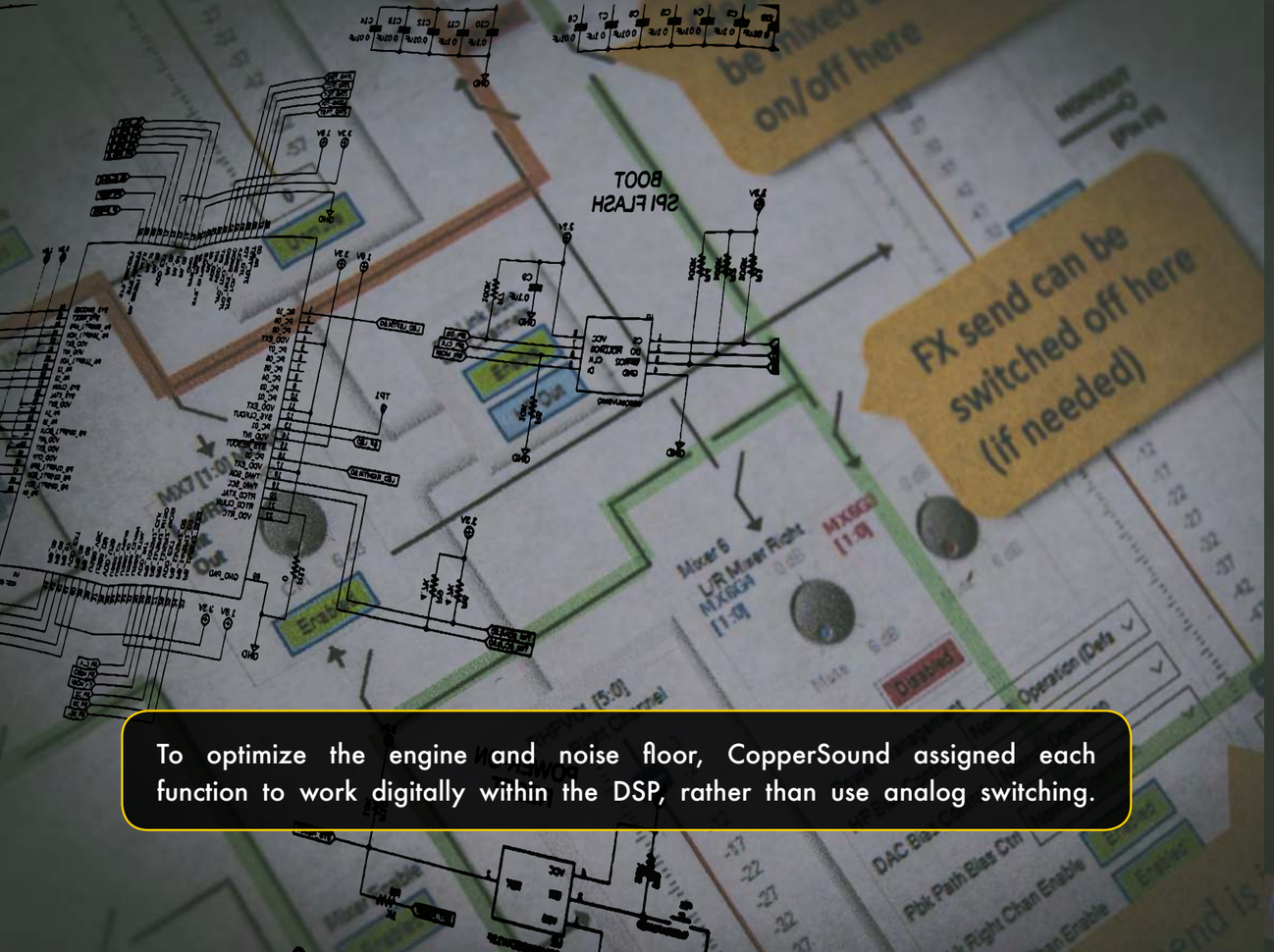

THIRD MAN
TRIPLEGRAPH
DESIGNED BY COPPERSOUND PEDALS AND JACK WHITE

One of the final steps to complete the internals was to design the daughter board that would handle all of the in and out signals.



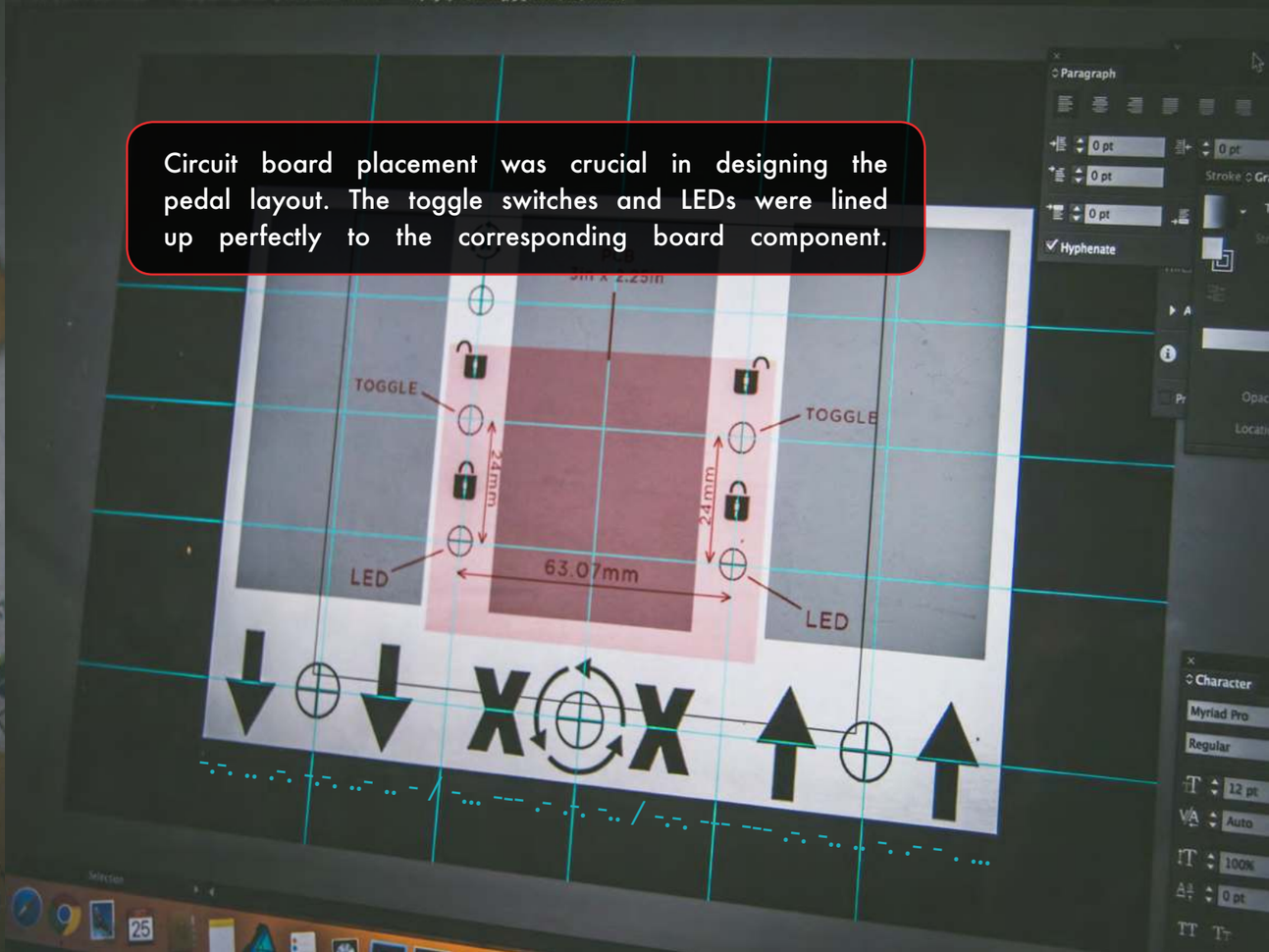


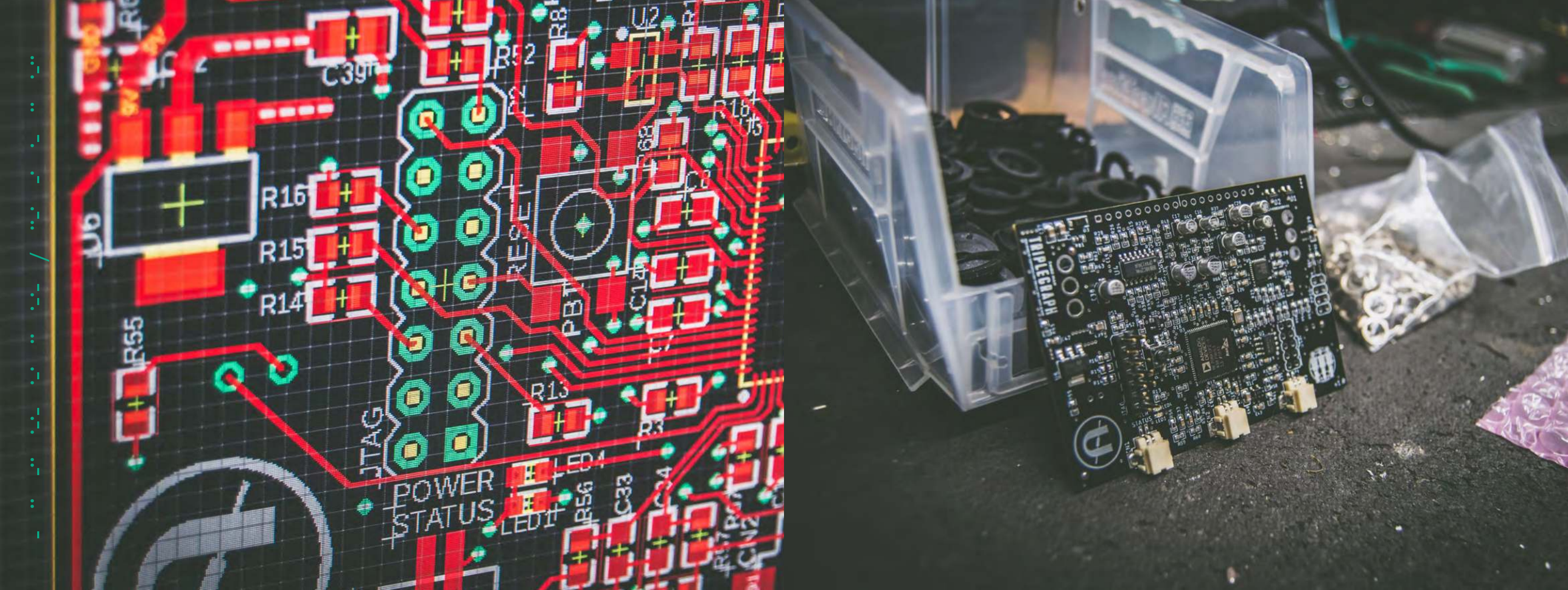

9V
POWER
SECTION
3V
3.3V
4.5V
ANALOG
BUFFERED
SPLITTER
MONO
CODEC
+
BF 706
L
R
SEND +
RETURN
CMOS
14 I/O's
L
R
A

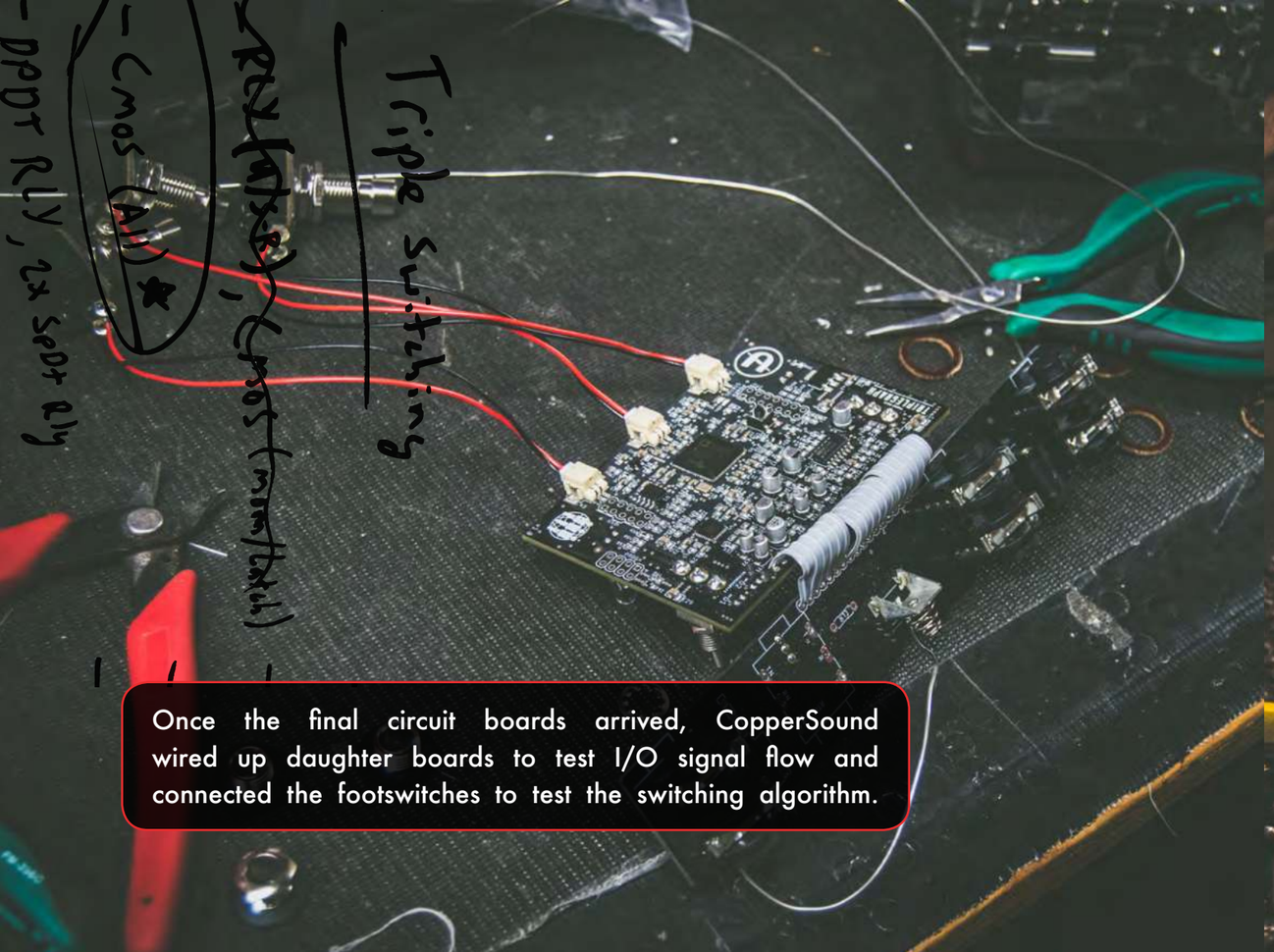


To optimize the engine and noise floor, CopperSound assigned each function to work digitally within the DSP, rather than use analog switching.

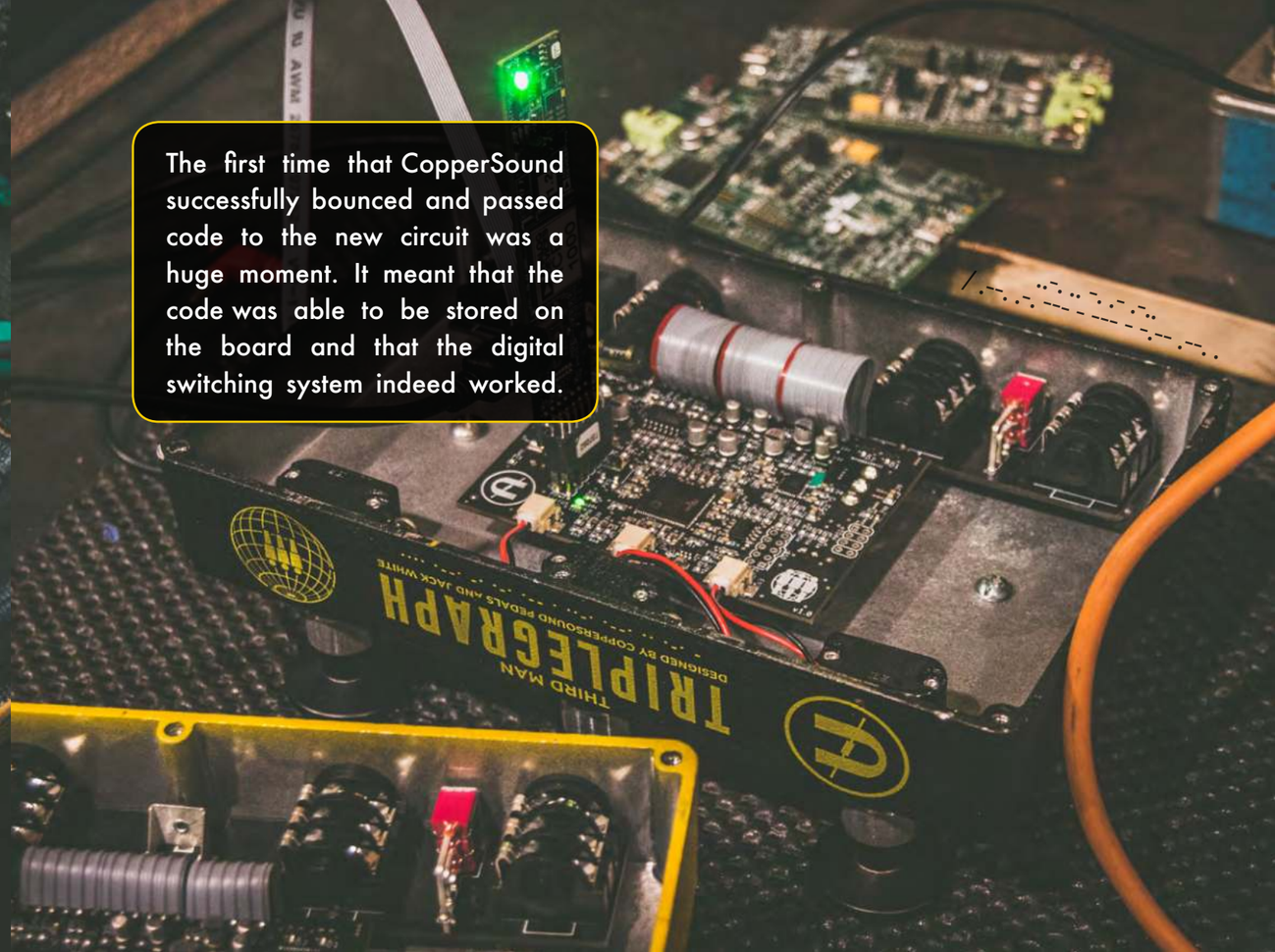
Circuit board placement was crucial in designing the pedal layout. The toggle switches and LEDs were lined up perfectly to the corresponding board component.



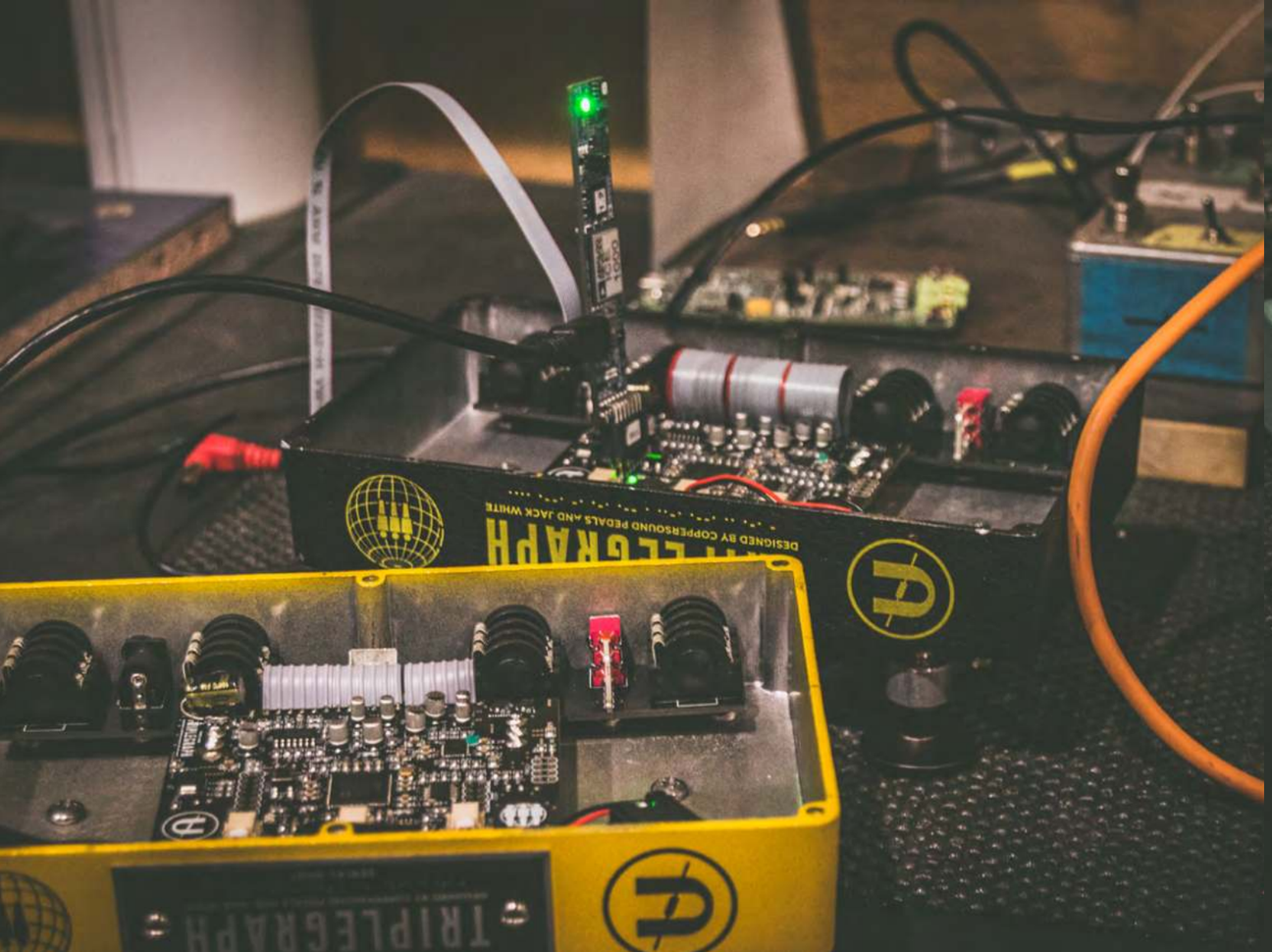

R16
R15
R14
R55
R52
C39
U2
R13
JTAG
POWER
STATUS
LED4
LED1
R56
C33
TRIPLEGRAPH



Once the final circuit boards arrived, CopperSound wired up daughter boards to test I/O signal flow and connected the footswitches to test the switching algorithm.



The first time that CopperSound successfully bounced and passed code to the new circuit was a huge moment. It meant that the code was able to be stored on the board and that the digital switching system indeed worked.



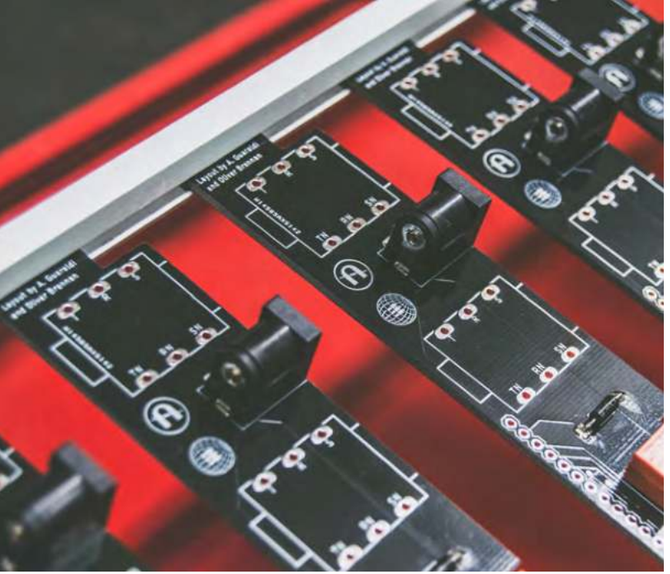
On December 31st, 2019, CopperSound officially finished the final prototyping stage and had a perfectly functioning Triplegraph. It was time to head back to Nashville.

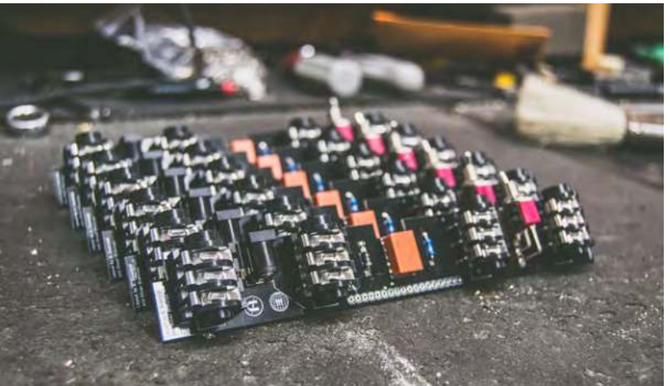
CopperSound prepared for the meeting with different types of badges, boxes, packaging designs, user manuals, and accessories to hammer out the final details.

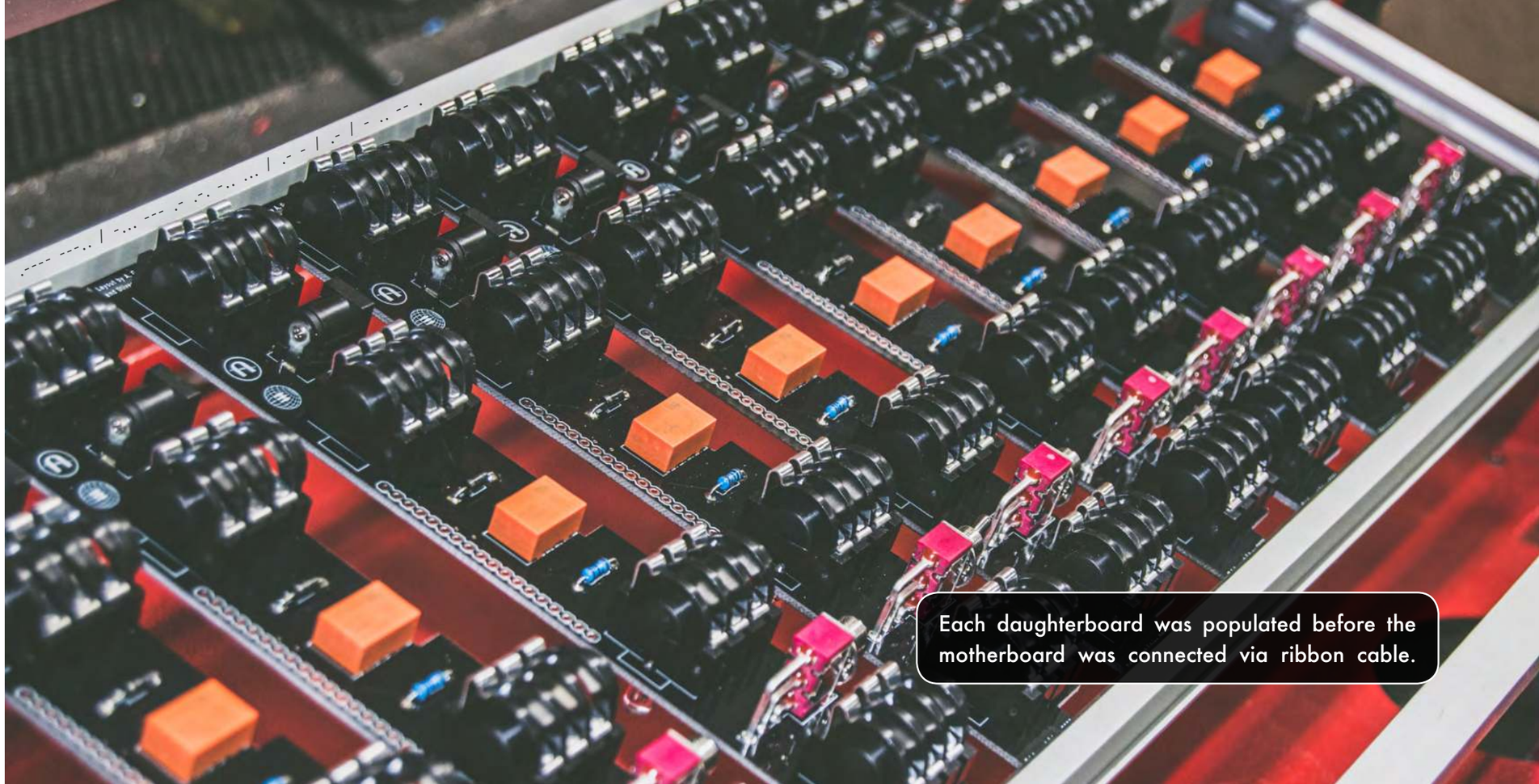
Approval from Jack on the final prototype meant it was time to start full production. The enclosures were machined, powdered, and UV printed.

CopperSound designed custom boxes for the Triplegraph: one for the Limited Edition and one for the Standard Edition, staying true to the Morse code and Third Man aesthetics.


COPPERSOUND
PEDALS
THIRD MAN
HARDWARE
CopperSound also designed a special Certificate of Authenticity for the first 100 limited edition Triplegraphs, signed by Jack himself.
Limited Edition
TRIPLEGRAPH
TRIPLE FUNCTION OCTAVE PEDAL DESIGNED BY
COPPERSOUND PEDALS & JACK WHITE
Certificate of Authenticity
#
SERIAL
COPPERSOUND
PEDALS
JACK WHITE III
THIRD MAN RECORDS

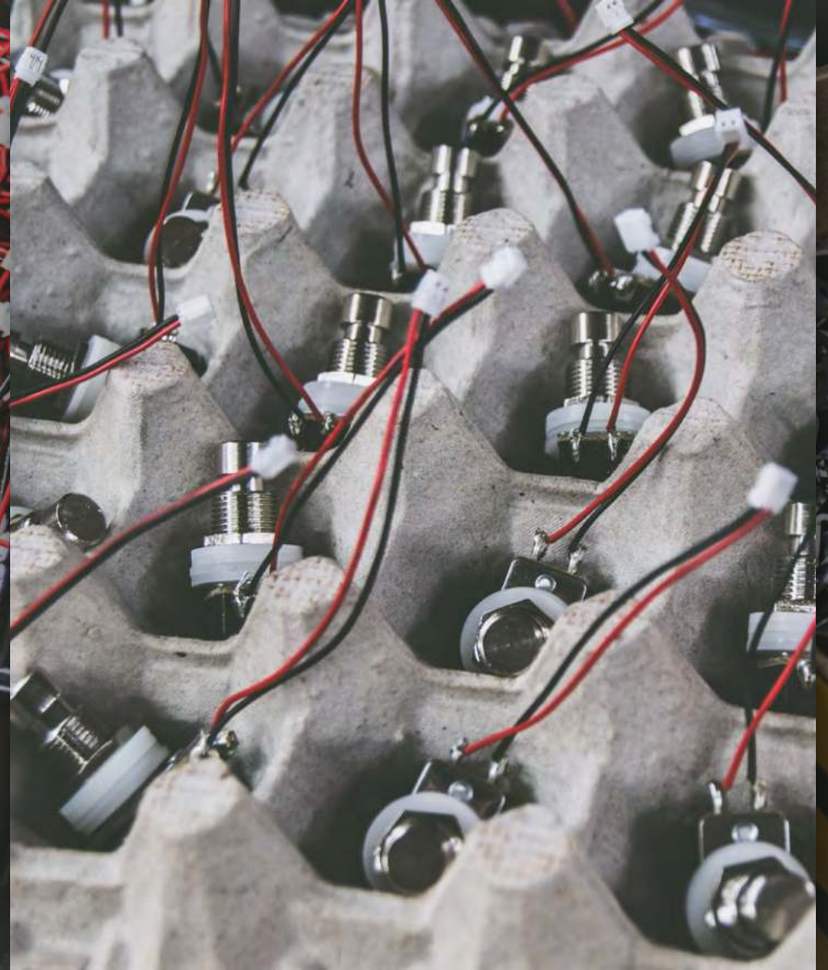




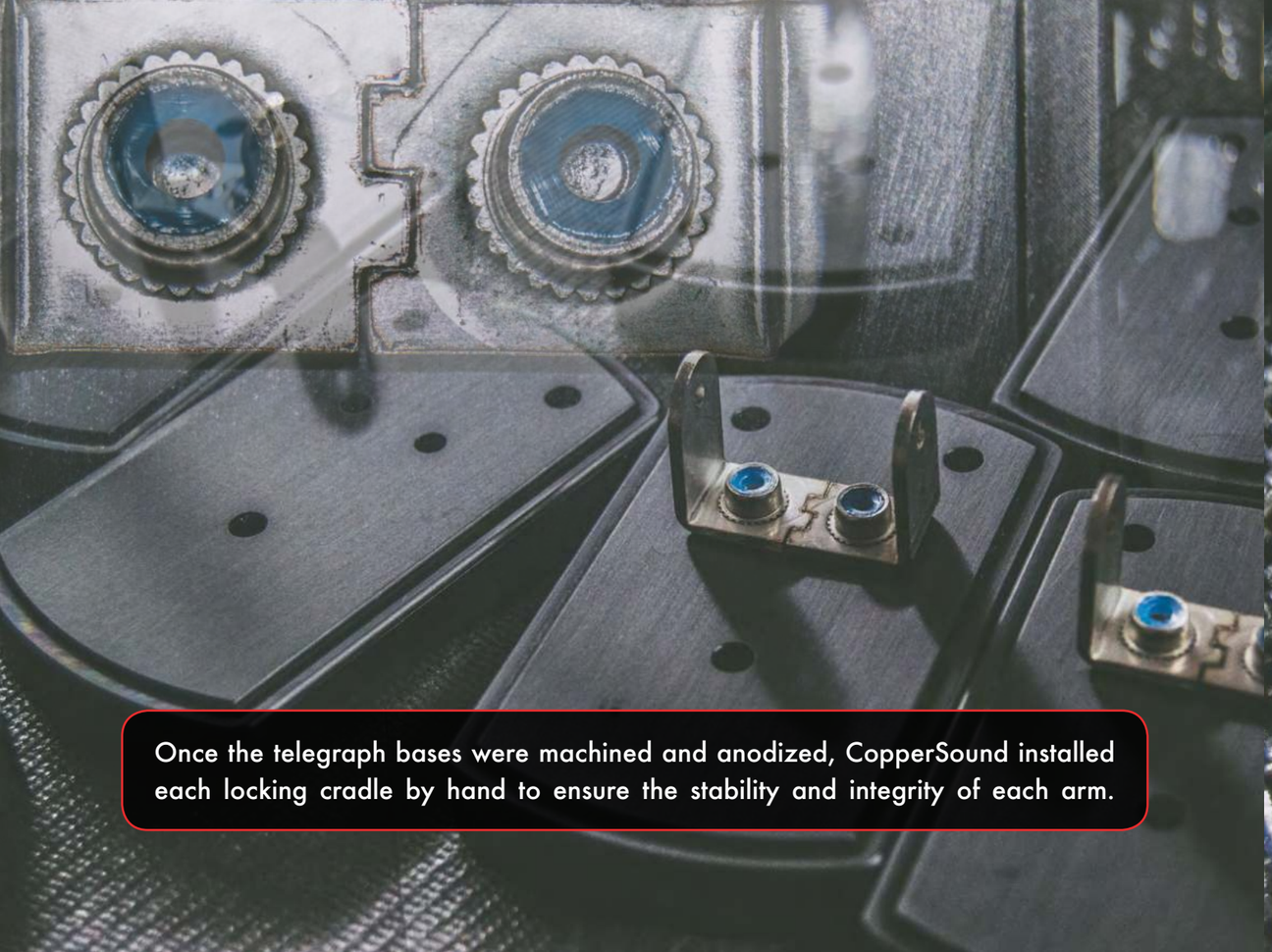


Each daughterboard was populated before the motherboard was connected via ribbon cable.

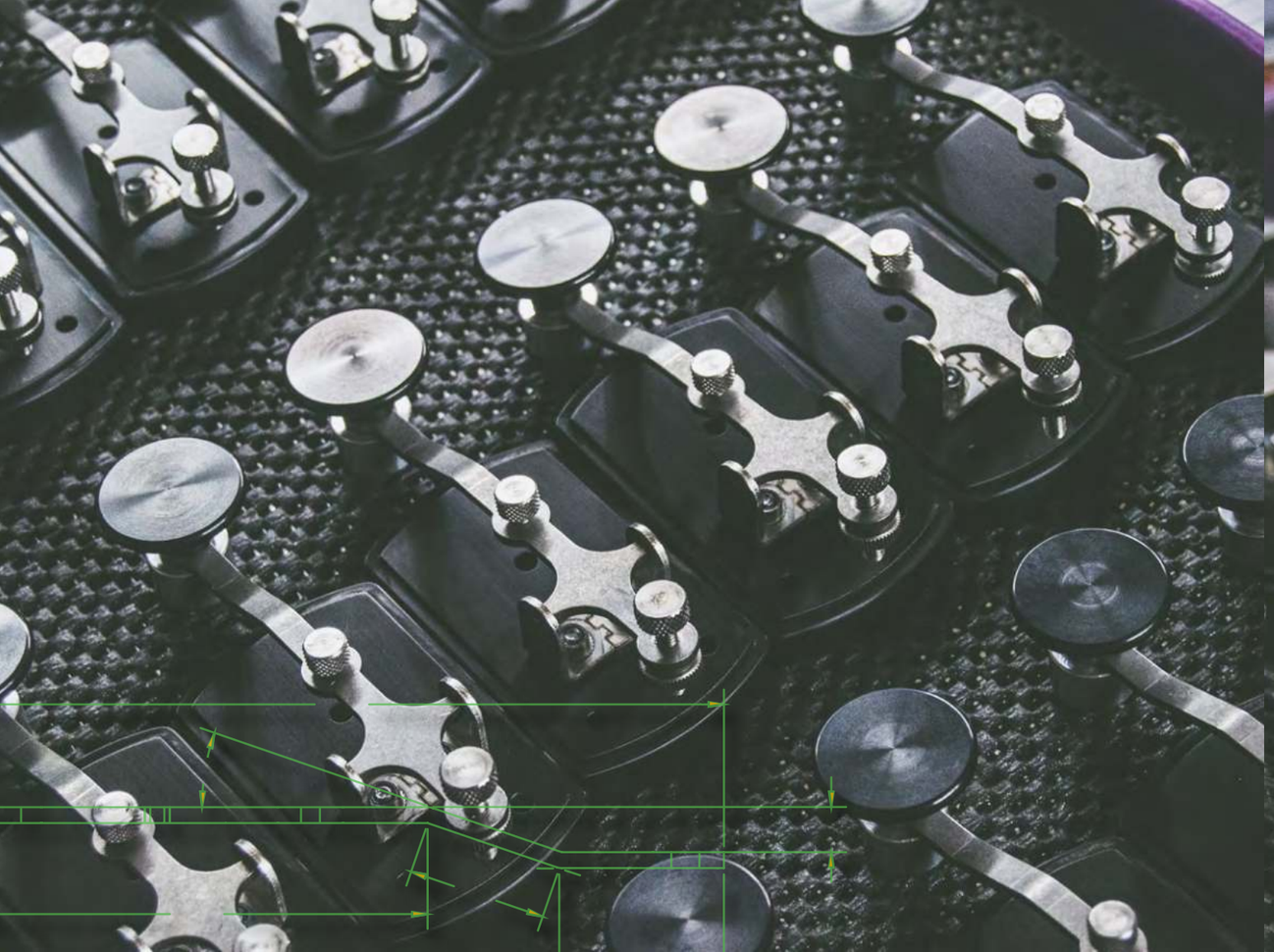
Telegraph key preparation was in full swing. Each arm and button was securely fastened to a locking ferrule and cradle before reaching the base assembly line.



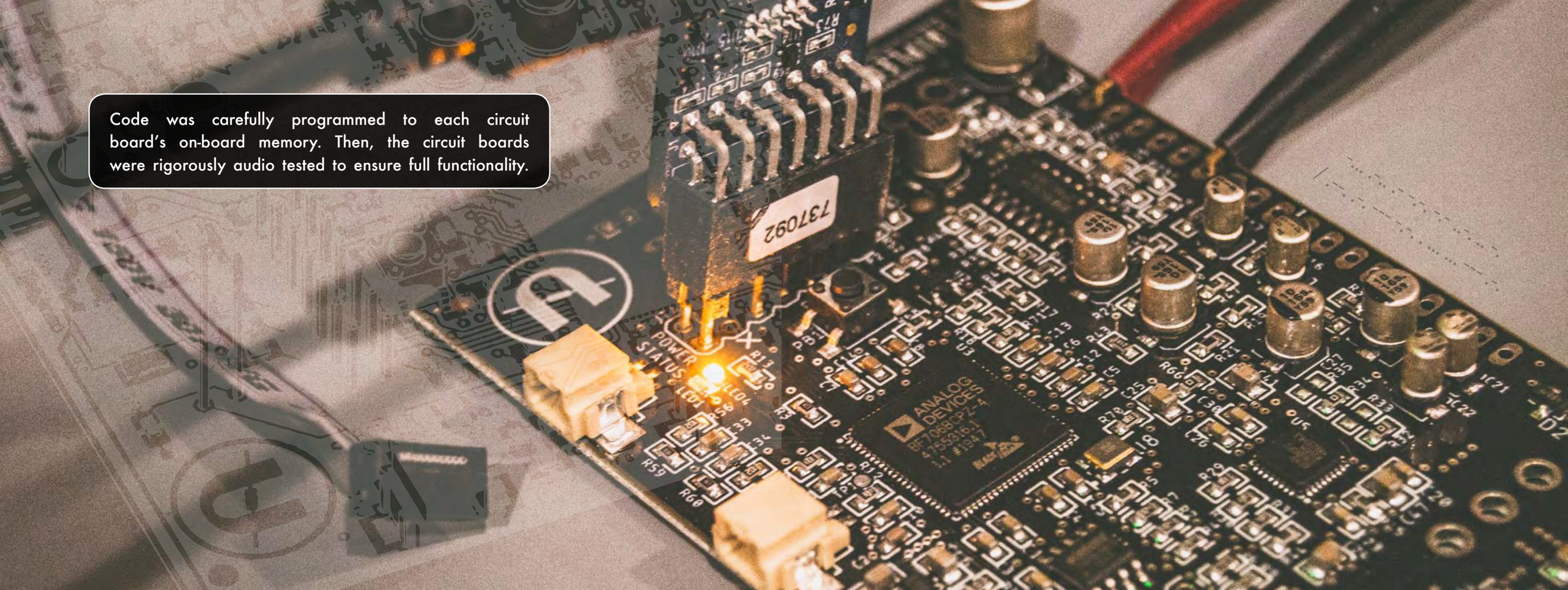
CopperSound cut and soldered each wire by hand, ensuring each switch was made to perfection.



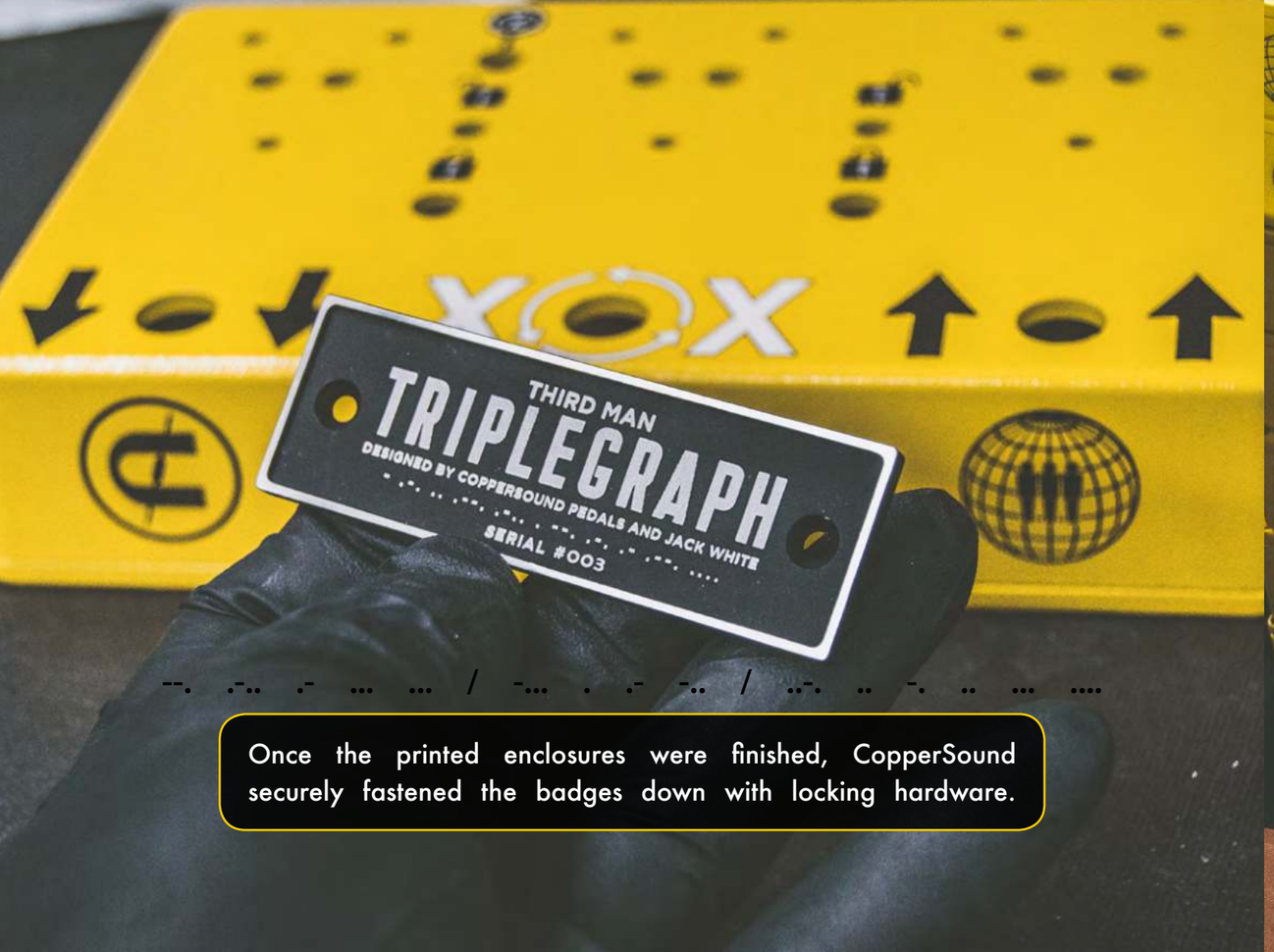
Once the telegraph bases were machined and anodized, CopperSound installed each locking cradle by hand to ensure the stability and integrity of each arm.



Each telegraph key is comprised of 22 custom pieces, designed by CopperSound specifically for this collaboration.



Code was carefully programmed to each circuit board's on-board memory. Then, the circuit boards were rigorously audio tested to ensure full functionality.



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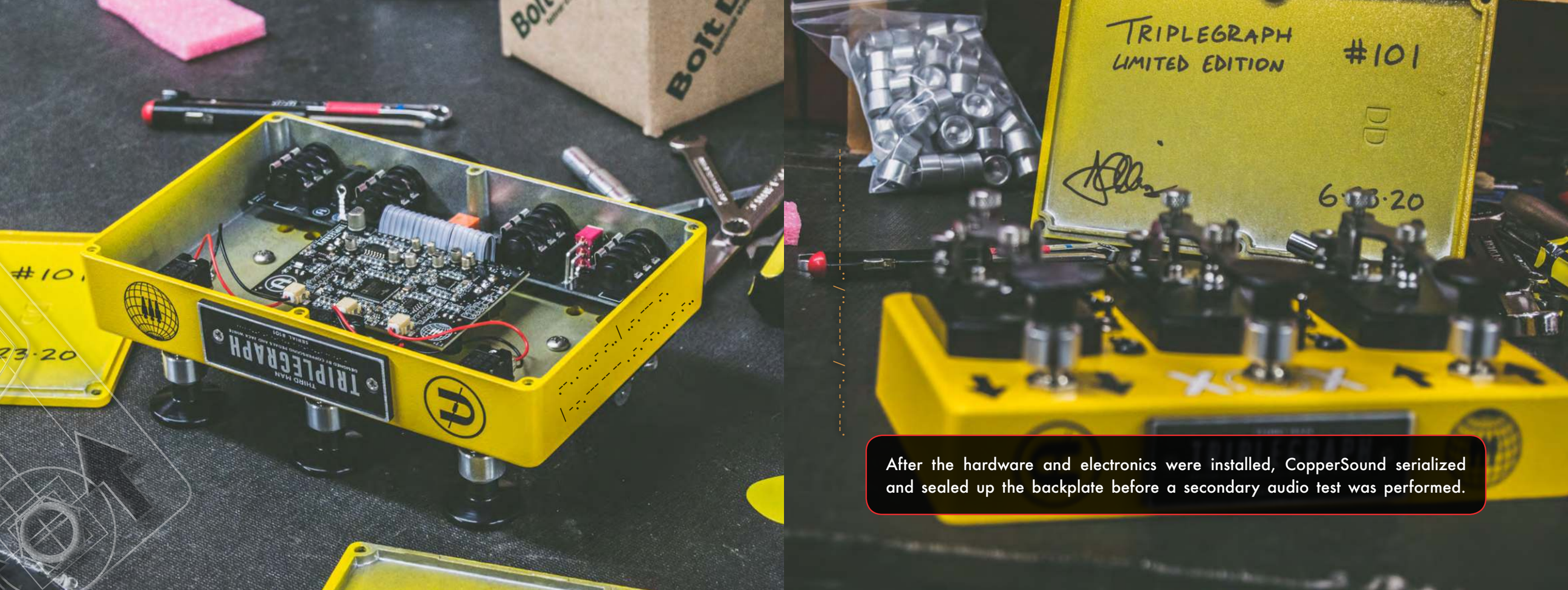
Once the printed enclosures were finished, CopperSound securely fastened the badges down with locking hardware.

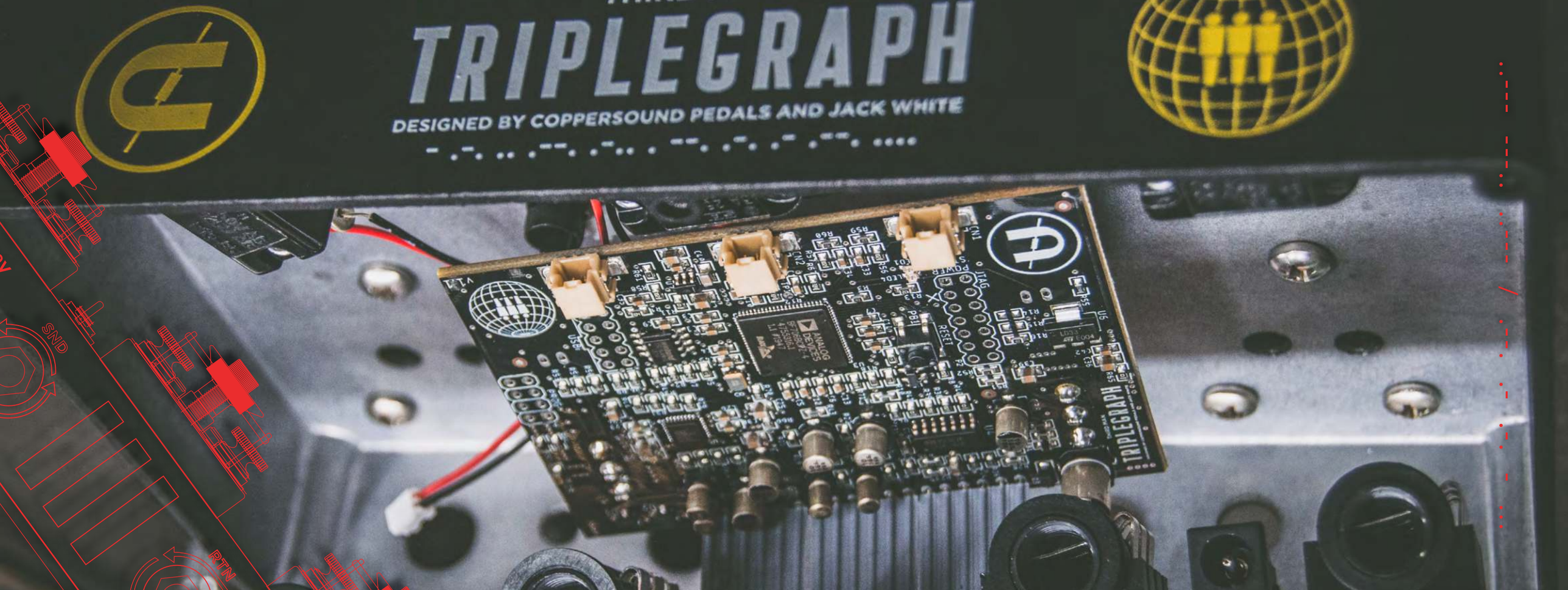

THIRD MAN
TRIPLEGRAPH
DESIGNED BY COPPERSOUND PEDALS AND JACK WHITE
SERIAL #009
THIRD MAN
TRIPLEGRAPH
DESIGNED BY COPPERSOUND PEDALS AND JACK WHITE
SERIAL #010
THIRD MAN

CopperSound prepared each enclosure, starting with the telegraph keys and ending with the mother and daughterboards. The order of operations was very important due to the amount of steps necessary to complete a Triplegraph.



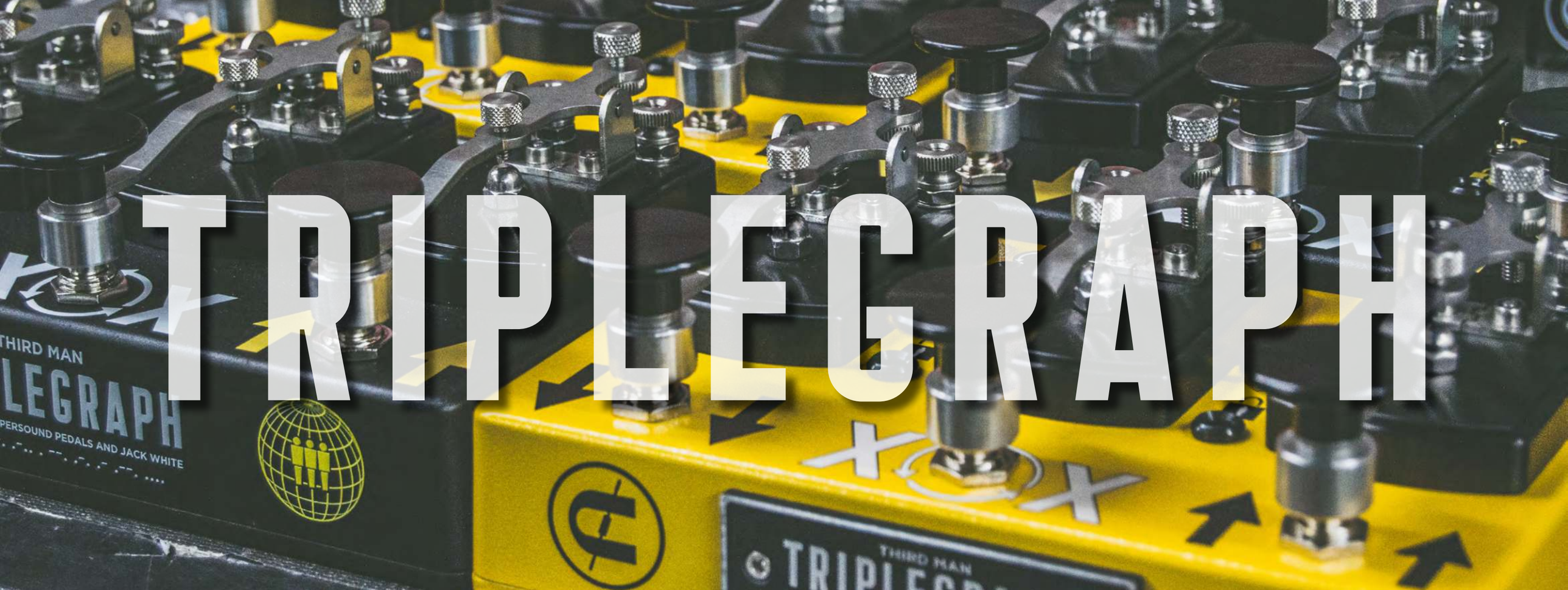
After the hardware and electronics were installed, CopperSound serialized and sealed up the backplate before a secondary audio test was performed.

Once each Triplegraph passed the final audio test, it was time to package them up. CopperSound finely inspected every key, button, switch, audio jack, cradle, and locking component before signing off on each pedal.


TRIPLEGRAPH
DESIGNED BY COPPERSOUND PEDALS AND JACK WHITE
SND
PTN
TRIPLEGRAPH
ANALOG DEVICES

Each pedal is made from exactly 282 individual components. After thousands of hours learning, engineering, designing, prototyping, and building, the Triplegraph was born. CopperSound built each one by hand with the highest level of passion and care.


4 YEARS
IN THE MAKING



TRIPLEGRAPH

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CopperSound Pedals is:

Alex Guaraldi - Jordan Collins - Tris Coffin - Oliver Brennan

We would like to extend our greatest of thanks to:

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