Středoškolská technika 2018

Setkání a prezentace prací středoškolských studentů na ČVUT

PÍCKA NA TAVENÍ HLINÍKU Z NÁPOJOVÝCH PLECHOVEK

Small furnace for melting drink cans to make Aluminium

Jesse de Jong, Arturo Navarro Villacampa

The Prague British School
Praha 12, K Lesu 558/2

Ekologická stránka projektu:
Nápoje v plechovkách se ve škole používají stále častěji a plechovky jsou vyhazovány do směsného odpadu. Jestliže se ve škole vytvoří zajímavý způsob, jak plechovky využít, bude ve škole dobrá motivace ke třídění tohoto ušlechtilého materiálu.

Ecological side of this project:
Canned drinks are used in our school more and more often. Empty cans are thrown in the miscelaneous waste. If there is an interesting way how to make use of the cans, there will be a good motivation for separation of the cans not only for students but for teachers as well.

Technologická stránka projektu:
Pro snadné roztavení plechovek je potřeba dosáhnout teploty asi 850 °C. To je možné vytvořit běžným grilovacím dřevěným uhlím. Samotná pícka je vyrobena z běžného, plechového kýble (10l), tepelné izolace ze šamotu a tavícího kelímku buď vyrobeného z hasícího přístroje, nebo zakoupeného, grafitového kelímku.

Technological side of the project:
A temperature of about 850°C is necessary for Aluminium to be easily melt. Ordinary charcoal is a good source of energy. The furnace itself is made from an ordinary steel bucket (10l), the heat insulation is chamotte and the melting crucible is either made from a car fire extinguisher or a professional graphite crucible

Inspirace projektu:
Na počátku byli studenti PBS (15 a 16 let) byli inspirováni videem na You Tube
https://youtu.be/hHD10DjxM1g
Mnoho zajímavých činností je možno vidět na You Tube, ale většinou jsou mnohom komplikovanější, než se zdá na krátkém videu.
Ani tavení hliníku nebylo tak snadné, jak se zdálo a tak studenti velmi museli řešit mnoho technologických problémů, aby dosáhli výsledku. A jejich zajímavá práce stále pokračuje.

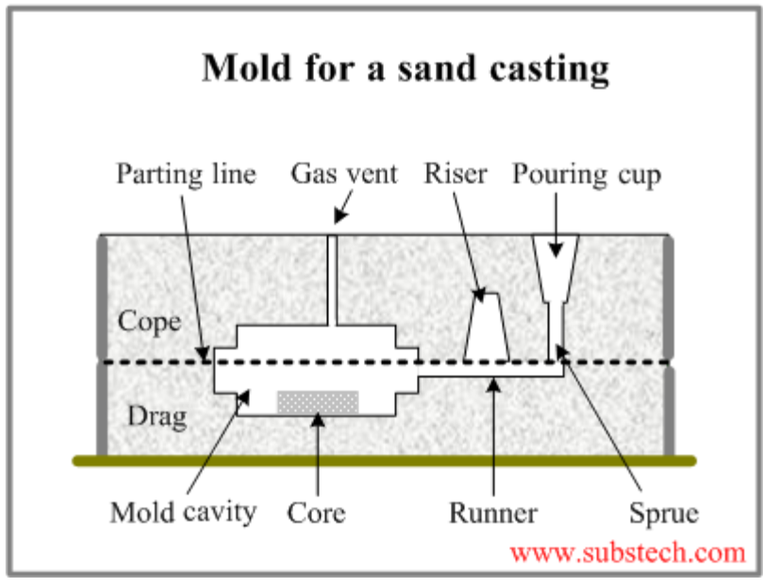
Inspiration of the project*:*
At the beginningthe students of PBS were inspired by You Tube video at
https://youtu.be/hHD10DjxM1g
*Many interesting videos can be seen on You Tube, but mostly they are much more complicated than it seems. Aluminium melting was not that easy and the students had to solve lots of technological problems to reach the result. And their interesting work still goes on****.***

POKRAČOVÁNÍ PROJEKTU v r. 2018

Po zvládnutí technologie odlévání hliníku z nápojových plechovek v pícce vyrobené z běžného 10 l kbelíku vyhřívané dřevěným uhlím následuje další krok:
Zvládnout výrobu klasické pískové formy.
Použité pomůcky:
Školní ocelové rámy, formovací směs – písek + jíl + válcový olej, separátor – křída,
modely – různé, zajímavé předměty, původně odlitky (s úkosem).

CONTINUING OF THE PROJECT in 2018

After we had managed casting aluminium from the drinking cans in the furnace made of an ordinary bucket powered with charcoal we started the next step:
To make a classical sand mold.
We used these aids:
School steel frames, forming mixture – sand + clay + oil, separator – chalk, models – various interesting things made by casting (with conuses)



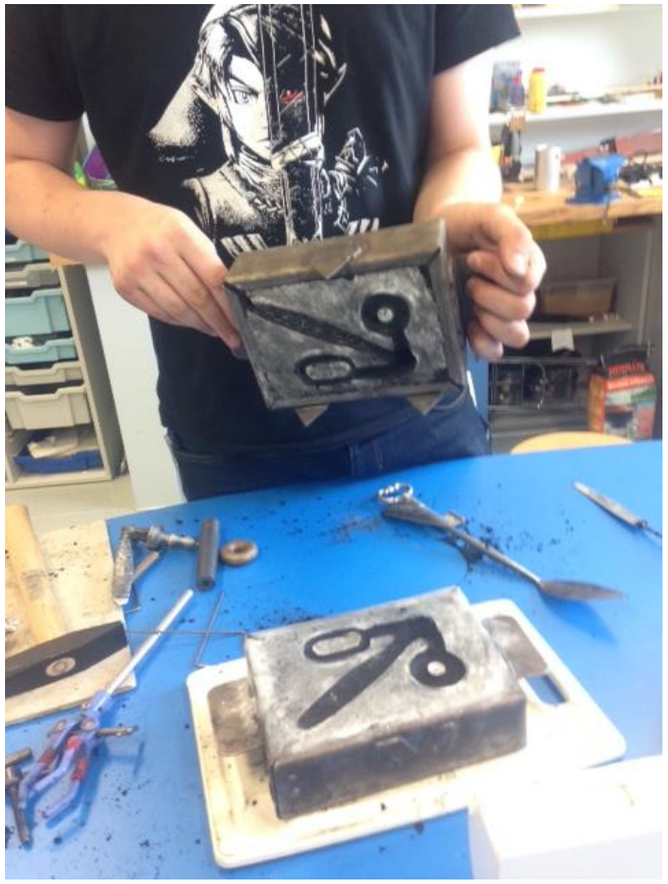
Postup výroby formy:

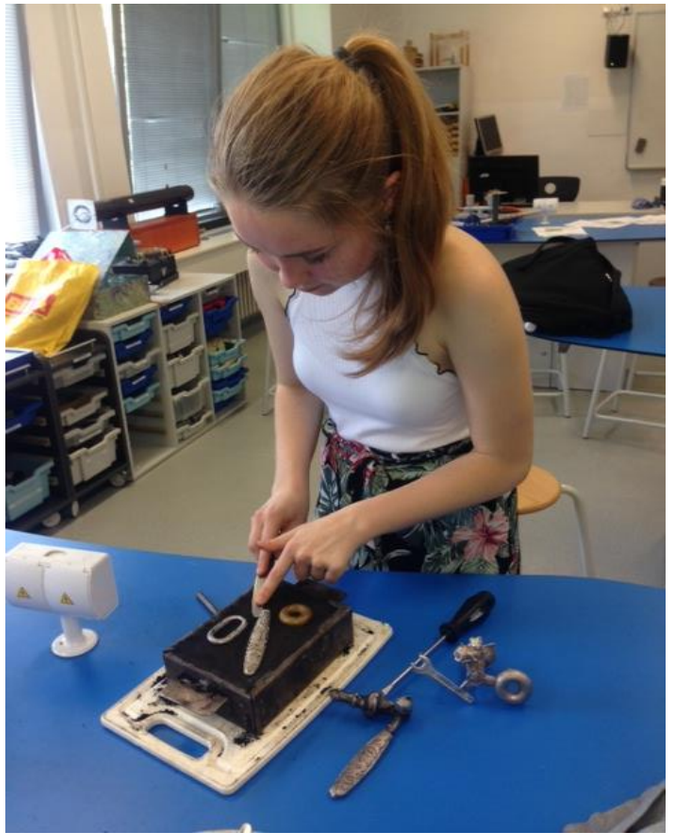
1) **Spodní část rámu se vyplní formovací směsí.**
2) **Modely se zalisují až po dělící rovinu a směs se uhladí.**
3) **Povrch se popráší separátorem.**
4) **Nasadí se horní část rámu a model vtoku.**
5) **Horní část rámu vyplní směsí a upěchuje kladivy.**
6) **Forma se otevře, modely vyjmou, propíchnou se výfuky, prořízne vtok a nalévací kalíšek**
7) **Forma se složí a je připravena k odlévání.**

Proces of making the form:

1) **The bottom part of the frame is filled with the forming mixture, the top is smooth.**
2) **The models are pressed into the mixture – just up to its parting line. The surface has to be smoothed.**
3) **The surface is covered with the separator.**
4) **The top part of the frame and the sprue conus are added.**
5) **The top part of the frame is filled with the forming mixture (pressed with hammers)**
6) **The form is opened, models are put out, gas vents, runners and pouring cup are made.**
7) **Both parts of the form are put together and the form is ready forcasting,**

Natalia, Rohan and Dominik





Our experience with making forms and casting:

„As hobby engineers we enjoy working on this project as it gives us good chalenges to solve. This project is a great fun and great way to learn new skills and includes new practical engineering skills to our experience.
It really opens up new experiences with different materials that can be used in future projects. We all want to study technical schools.

METAL MELTING FURNACE

BY THE PBS ENGINEERING CLUB

BY: ARTURO NAVARRO, JESSE DE JONG, ROHAN LAMBERT

Here is, how we made the furnace:

EXPLANATION

THIS IS THE METAL-MELTING FURNACE OR FOUNDRY.

IT WORKS BY HEATING UP CHARCOAL OR COAL TO TEMPERATURES OF UP TO 900 DEGREES!

A POWERFUL HAIRDRYER BLOWS IN LOTS OF AIR INTO THE COALS.

THE HEAT HEATS UP A CONTAINER WHICH THEN MELTS METALS. WE HAVE WORKED ON THIS FOR THE LAST MONTHS, AND MEANWHILE COLLECTED ALUMINUM CANS TO TEST OUR CREATION.

AS YOU CAN SEE IN THE PICTURE, IT IS A SIMPLE DESIGN: A STEEL BUCKET LINED ON THE INSIDE WITH CEMENT, AND ON THE TOP A LID WHICH MAKES SURE THE HOT TEMPERATURES OF THE FURNACE STAY INSIDE, MAKING THE FURNACE MUCH MORE EFFICIENT.

THE LINING HAS BEEN CAREFULLY MEASURED OUT SO THAT THE COALS TIGHTLY SURROUND THE CONTAINER .

THE HOLE INSIDE OF THE LID IS JUST TO MAKE OUR LIVES EASIER AND SAFER WHEN PUTTING THE ALUMINUM CANS IN THE CONTAINER.

IT GETS HOT ENOUGH TO MELT ALUMINUM!

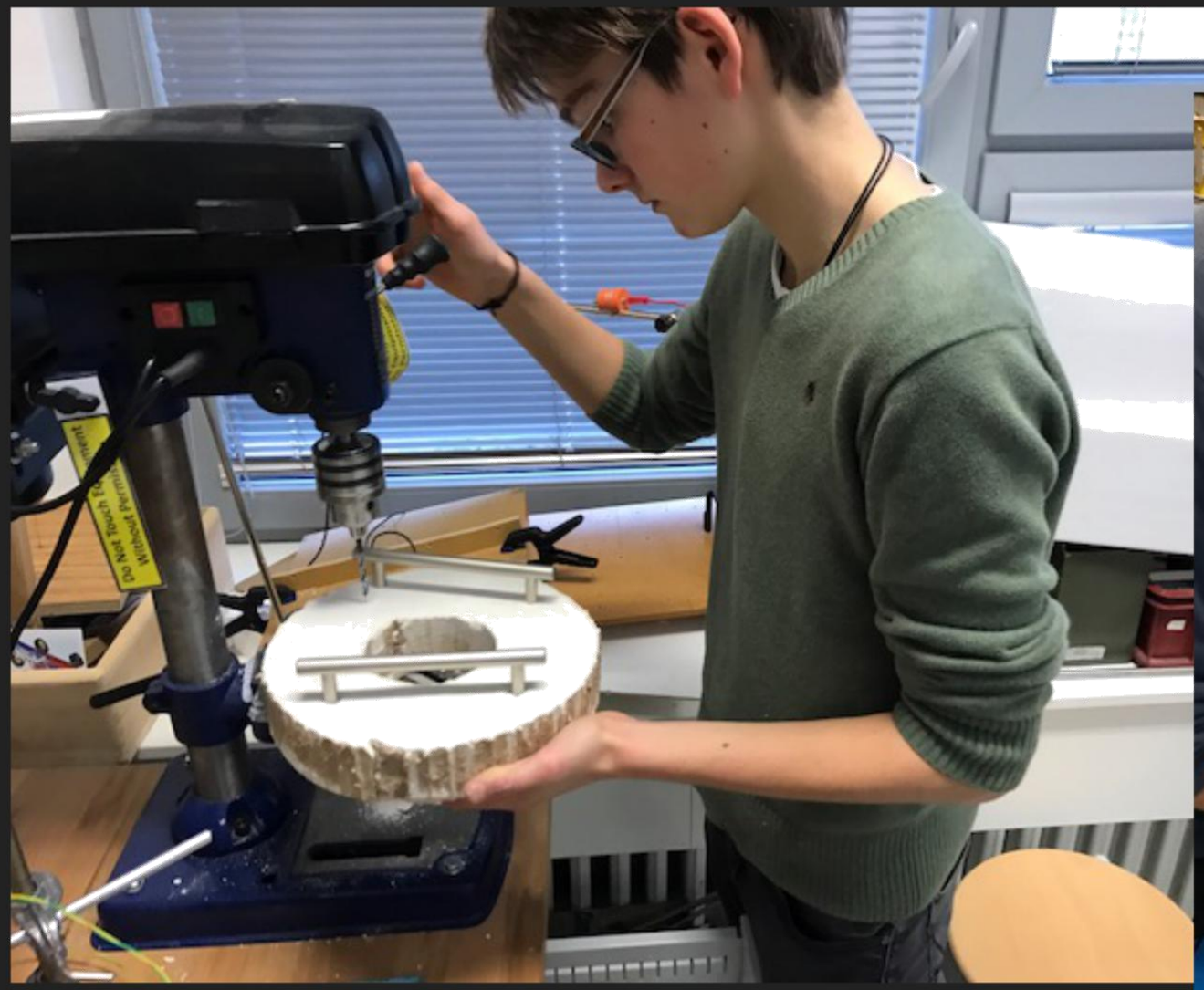
WE STARTED BY MIXING PLASTER FOR THE LINING OF THE FURNACE

FILLING THE BUCKET HALF WAY WITH THE PLASTER, WE PUSHED IN A PLASTIC FLOWER P

AFTER A FEW DAYS THE PLASTER HAD HARDENED SO WE TOOK THE FLOWER POT OUT

WE THEN USED CARDBOARD TO ALIGN THE BOTTOM AND REST OF THE SIDES OF

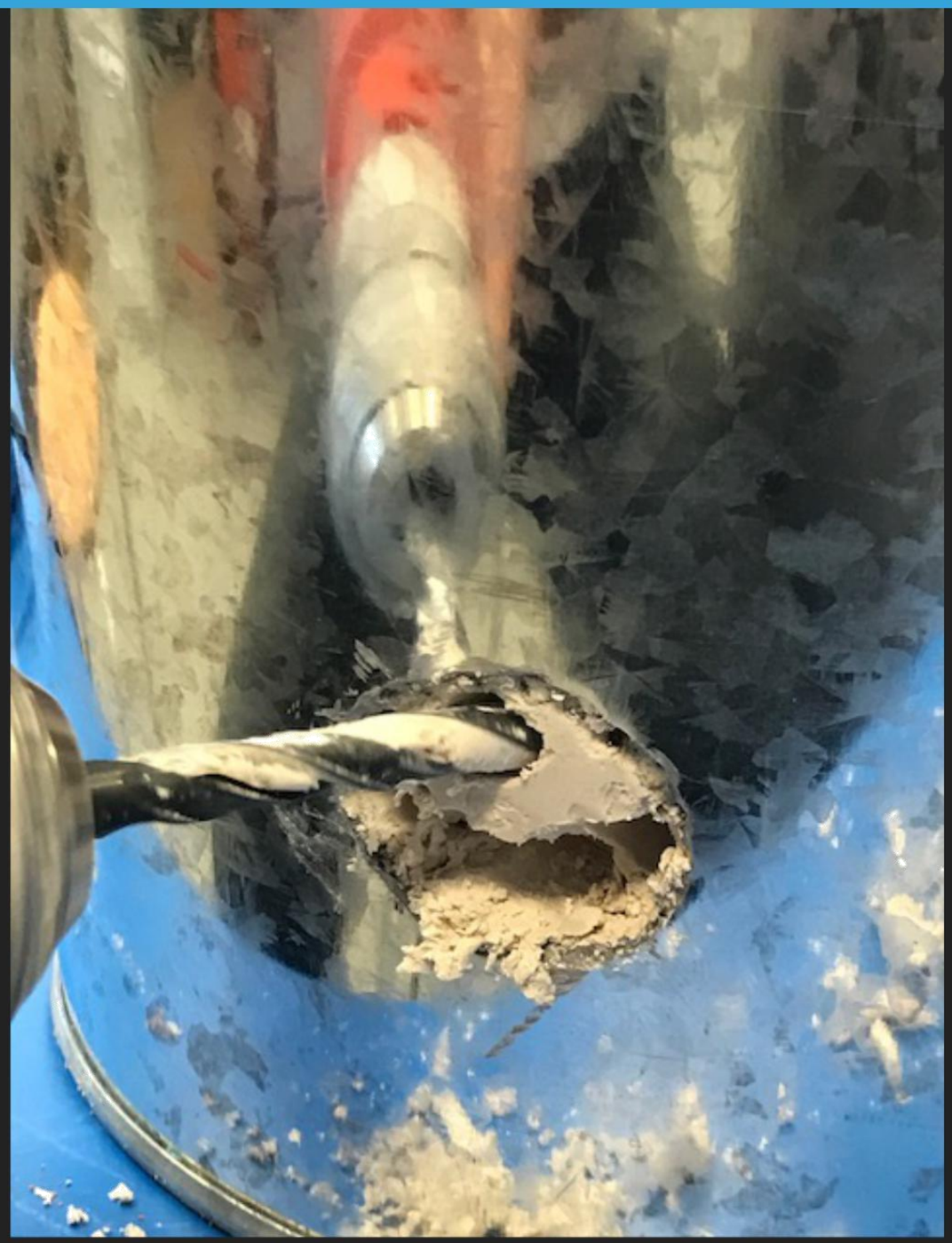
THE BUCKET AND POURED IN MORE PLASTER TO FORM THE LID

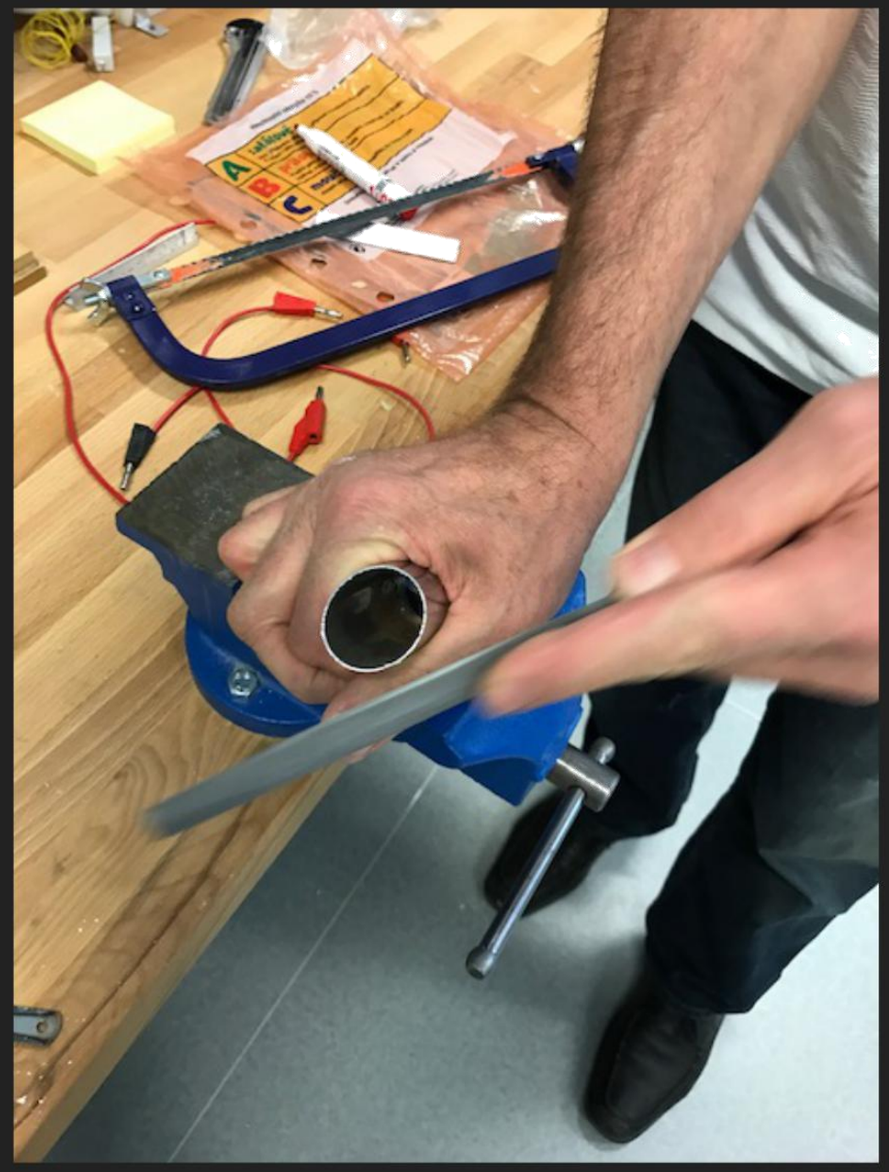


AFTER THE LID HAD DRIED, WE ATTACHED HANDLES TO IT, SO

WE WOULD BE ABLE TO LIFT IT DURING OPERATING

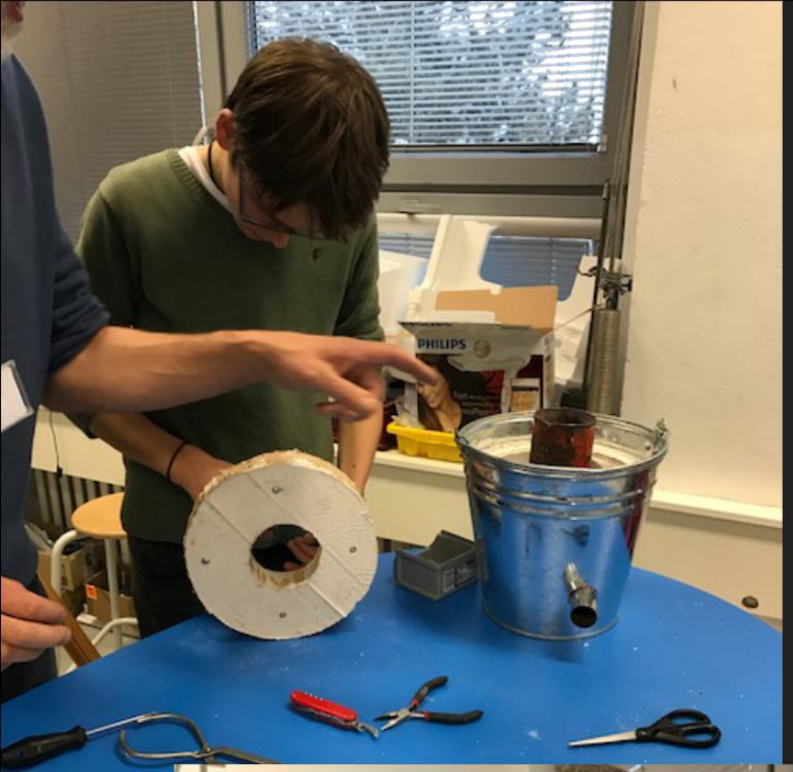
WE MADE A HOLE IN THE SIDE OF THE FURNACE AT A TANGENT DIRECTED ANGLE,

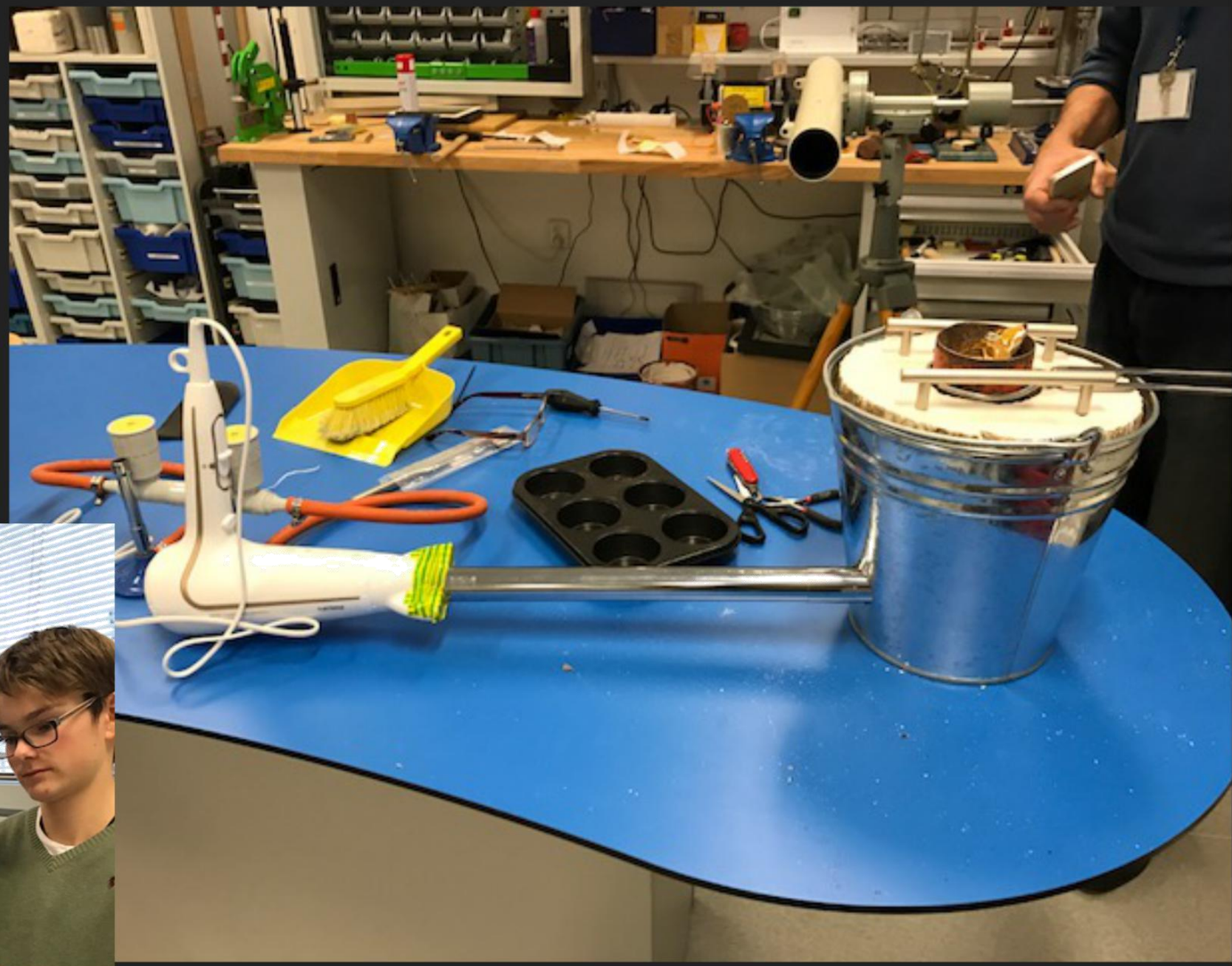




AND SAWED OFF AN OLD VACUUM CLEANER PIPE TO

FORM AN AIR TUBE FOR THE HAIRDRYER





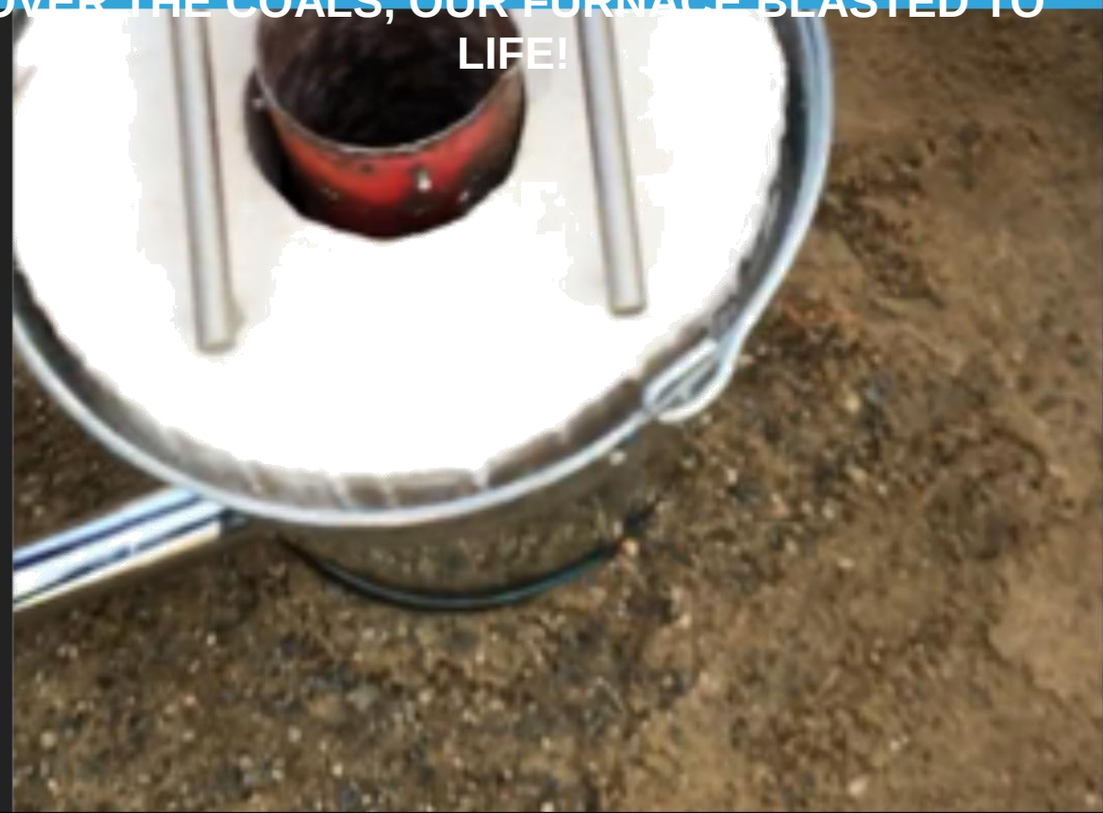
JIRÍ HAD FOUND AN OLD STEEL CAR FIRE EXTINGUISHER, CUT IT IN HALF, AND WE PUT OUR FURNACE TOGETHER. WE ALSO ATTACHED THE HAIRDRYER TO THE TUBE, FINISHING OUR DESIGN

A FEW WEEKS LATER WE WERE ABLE TO SET UP THE FURNACE DURING LUNCHTIME. YOU CAN SEE IN THE FIRST PICTURE HOW THE COALS NEATLY FIT AROUND THE FIRE EXTINGUISHER

WE HADN'T THOUGHT OF STARTING UP THE FURNACE YET, AND THIS PROVED TO BE SLIGHTLY MORE DIFFICULT THAN WE THOUGHT... WE ENDED UP USING ALCOHOL AND A PROPANE TORCH TO IGNITE THE COALS

BUT THEN, WITH A LOUD ROAR OF THE AIR BEING BLOWN

OVER THE COALS, OUR FURNACE BLASTED TO LIFE!



AFTER A FEW MINUTES WE WERE EVEN ABLE TO MELT

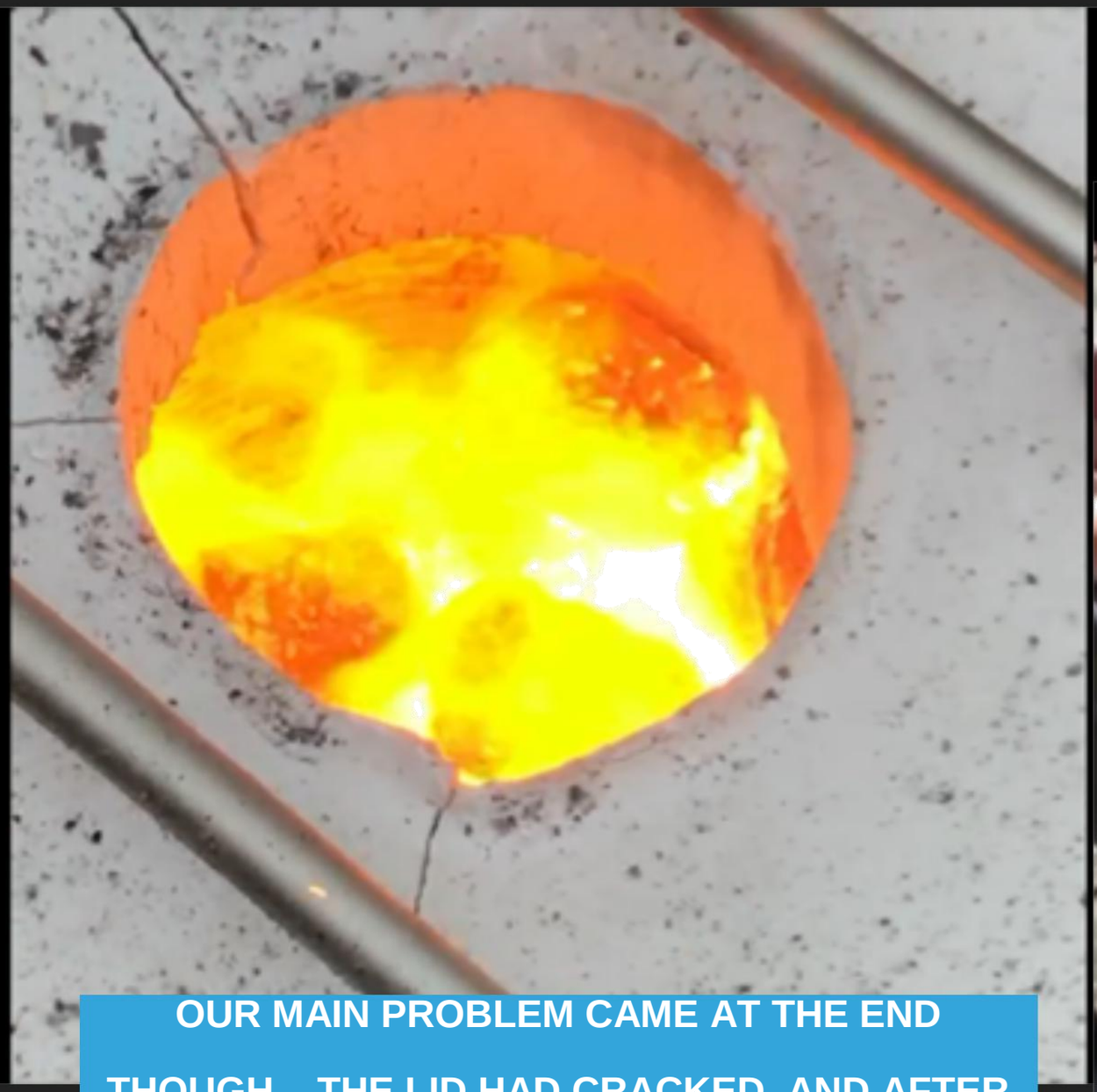
A SOLID BLOCK OF ALUMINUM!!

THEN THE MOST EXITING PART OF THE MELTING CAME: POURING THE MOLTEN ALUMINUM INTO OUR STEEL CUPCAKE TRAY

WE ENDED UP WITH LOTS OF SLAG,

AND TWO AWESOME LOOKING,

PURE ALUMINUM MUFFINS!



OUR MAIN PROBLEM CAME AT THE END THOUGH... THE LID HAD CRACKED, AND AFTER LIFTING IT UP, SHATTERED INTO MANY PIECES!

SO WE MADE A NEW ONE!

BUT THIS TIME REINFORCED WITH STEEL WOOL!

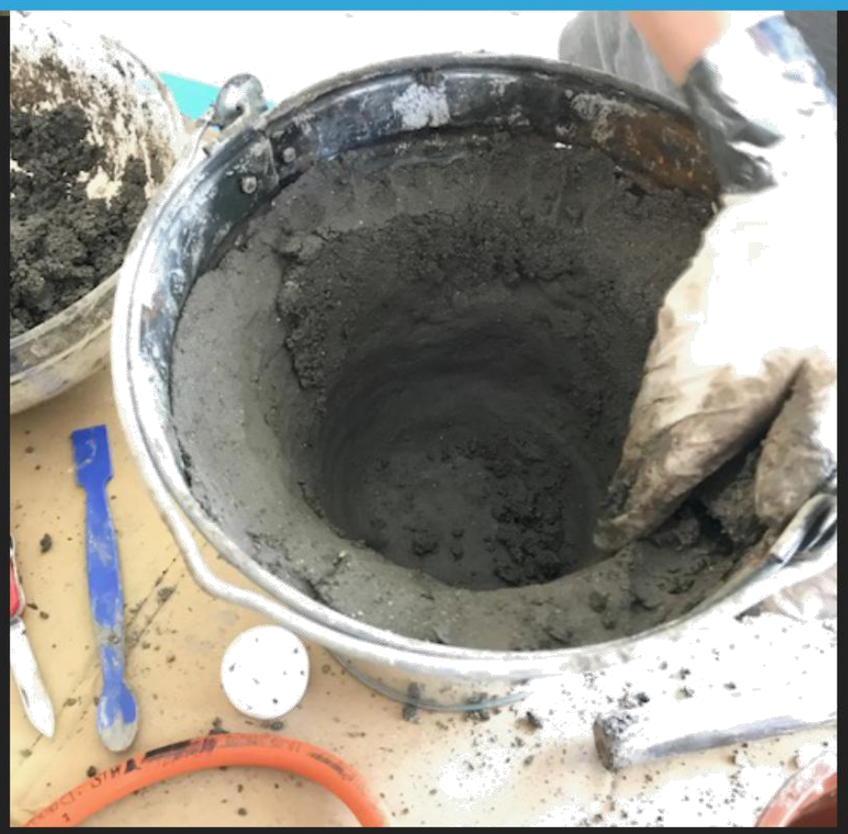
AGAIN, A FEW WEEKS LATER WE TRIED IT OUT!

AND AGAIN, THE LID HAD BROKEN. BUT WE NOW HAD AN EVEN BIGGER PROBLEM! THE INTERIOR WALLS OF THE FURNACE STARTED TO CRUMBLE WHICH MEANT WE SOON HAD TO REPLACE THIS TOO...

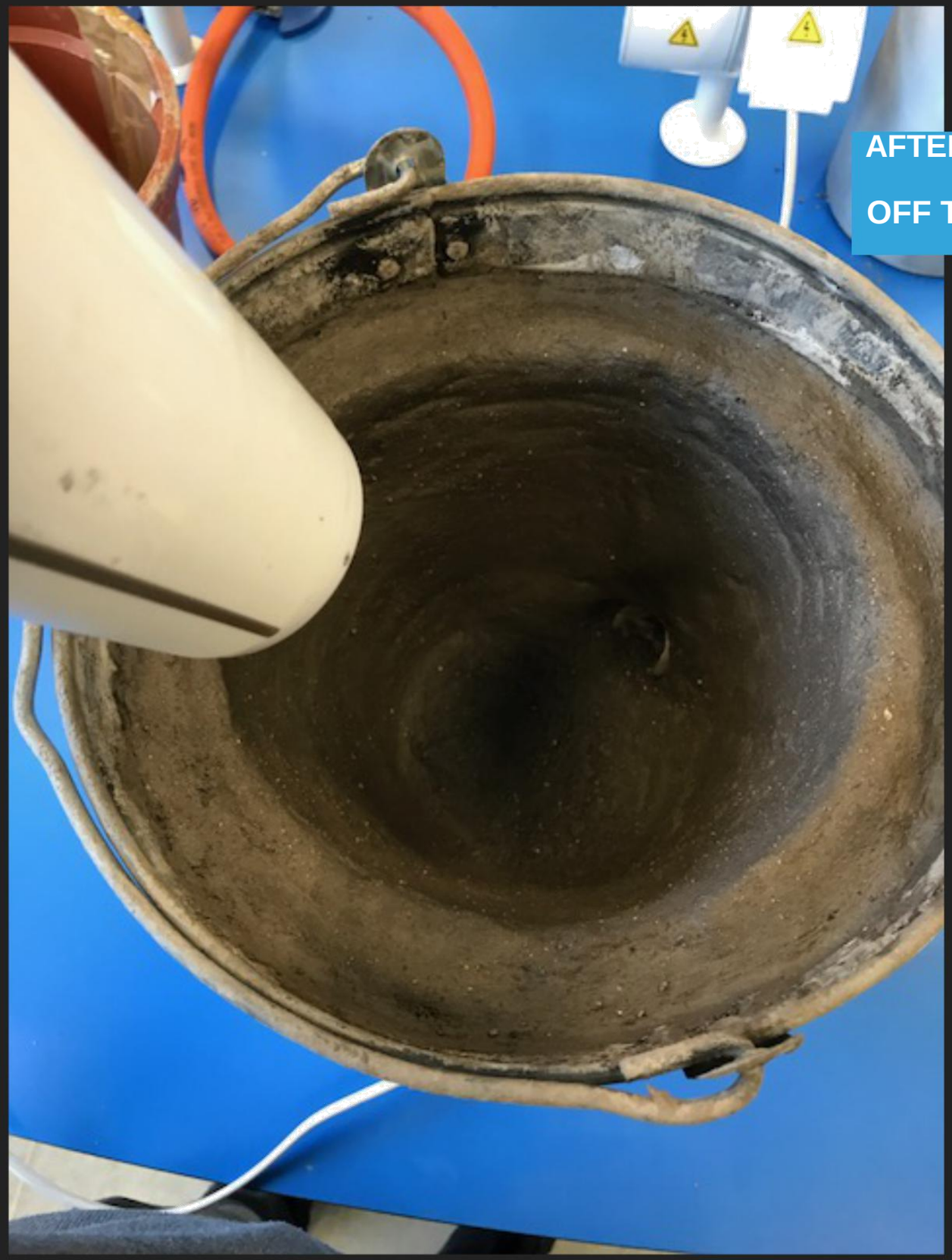
WE HAD A SMALL ACCIDENT LATER ON... WE USED AN EXPERIMENTAL LID MADE OF HEAT-PROOF MATS, BUT IT TURNED OUT THEY WEREN'T 900-DEGREES PROOF. SO OUR LID HAD EVAPORATED, BUT THAT WASN'T THE BIGGEST PROBLEM... AFTER MANY USES, THE CRUCIBLE HAD OXIDIZED FORMING IRON-OXIDE. WHEN WE WERE ABOUT TO POUR OUT THE ALUMINUM, IT REACTED WITH THE IRON-OXIDE STARTING A THERMITE REACTION WHICH USED THE CRUCIBLE AS FUEL!! AFTER A FEW MINUTES (AND THE HELP OF A FIRE-EXTINGUISHER) THE REACTION HAD STOPPED. NOBODY GOT HURT BUT HALF OF OUR FURNACE HAD BEEN DESTROYED.

WE DON'T HAVE ANY PICTURES OF THIS EVENT, BUT WE ASKED ARTURO TO DRAW IT:

AFTERWARDS WE REDID THE WHOLE FURNACE AND JIRÍ (OUR HERO) HAD BOUGHT A CARBON CRUCIBLE! THESE ARE USED WORLDWIDE IN MELTING METALS AND ARE VERY DURABLE! AS CARBON CRUCIBLES CANT OXIDIZE, WE WONT BE ABLE TO CREATE ANY SORT OF THERMITE REACTION



WE USED MUCH HIGHER QUALITY CEMENT THIS TIME AS WE HAD GOTTEN A FUND FROM MR. **BARDSLEY HIMSELF!!**



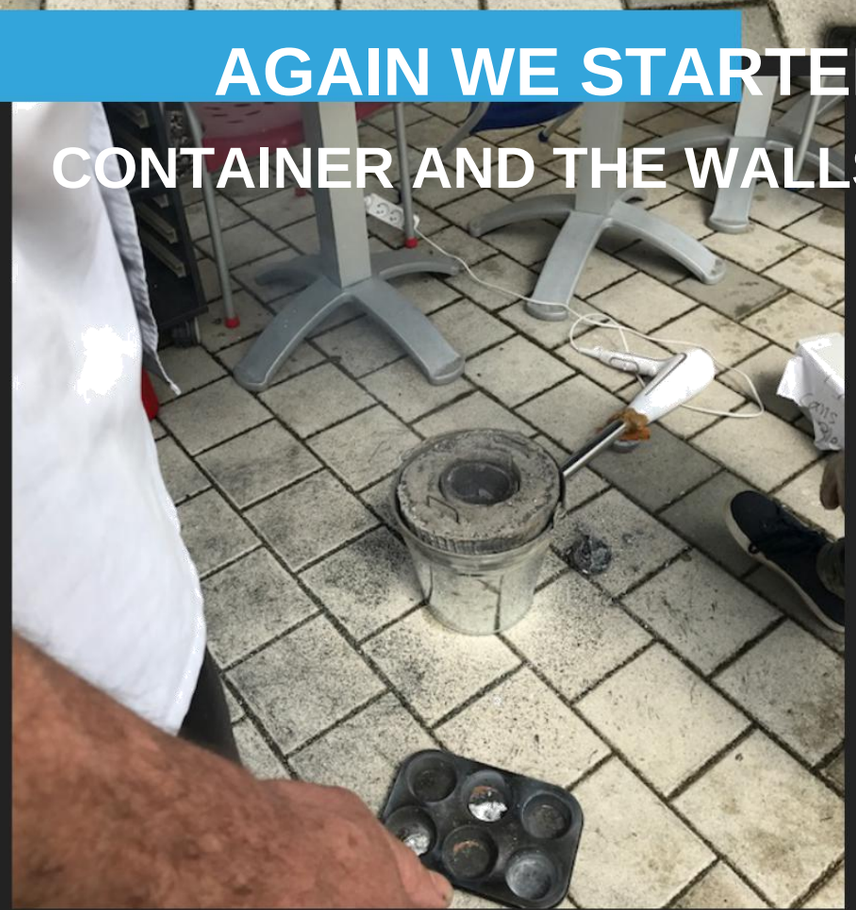
AFTER DRYING, WE THEN FINISHED

OFF THE LID MADE OF CHAMOTTE

BUT HIS TIME THERE WAS NOT MUCH SPACE

AGAIN WE STARTED UP THE FURNACE!

BETWEEN THE CONTAINER AND THE WALLS OF THE FURNACE, WE HAD TO BREAK DOWN EACH PIECE OF COAL INTO SMALLER PIECES...



LOTS OF ASHES WERE SHOT OUT FROM THE FURNACE, AND IT DID NOT GET AS HOT AS BEFORE

WE WERE ONLY ABLE TO MELT A VERY SMALL AMOUNT THIS TIME

OUR FURNACE IS CURRENTLY STILL IN PROGRESS, AND HOPEFULLY WITH MANY TESTS WE WILL BE ABLE TO CREATE A FULLY FUNCTIONAL, EFFICIENT AND DURABLE FURNACE TO RECYCLE ALUMINUM.

ENGINEERING CLUB

THANKS A LOT TO JIRÍ TOMAN FOR LEADING US AND

HELPING US!

OUR SPONSORS

923 Company

The Prague British School

ENGINEERING CLUB

JIRÍ TOMAN

(we could use some more!)