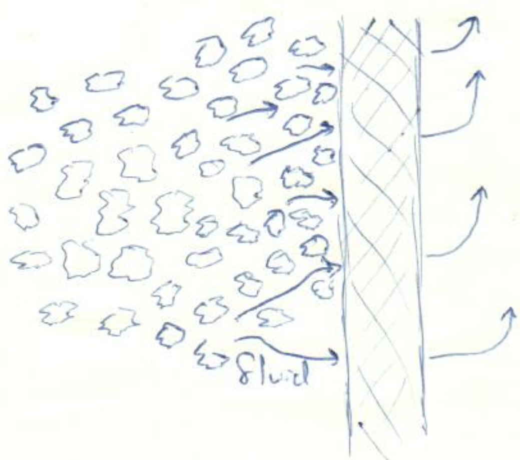
Objective: Control/Understand manufacturing process to increase precision and Accuracy of Sand control screens used for sand exclusion.



℄

Make screen grid mesh both precise & accurate

Scale

Size = 0.008" ± 0.001"

Precision < 99%

DESIGN PROCESS: FR, DP, A, R, RC, M

* Functional Requirement

A) Minimal cost

B) High Volume

c) High through put (1.4×10^6 ft Screens in 2004

d) Existing manufacturing method.

e) minimal complexity

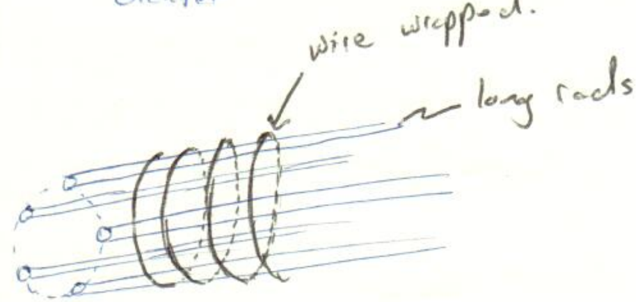
d) Hit precision & accuracy

* Design Parameters

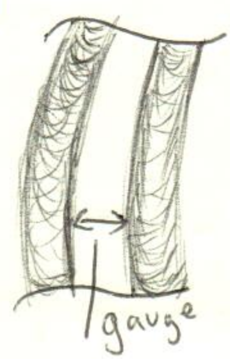
(Reference: Modern Sandface Completion Practices 33–56.

Screen Types
- → Wire wrapped * (Most Comprehensive) pg 34
- → Pre-packed
- → shrouded metal mesh
- → Expandable

Greater



Our gauge will be 8 ± 1

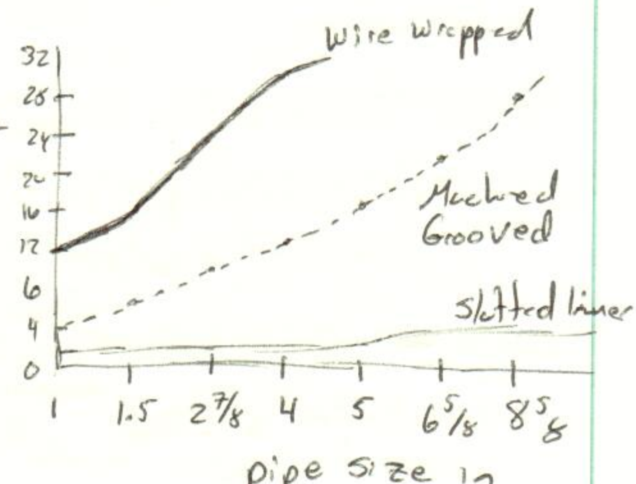


material typical Stainless steel (erosion & Corrosion)

Price/ft of wire wrapped screen?

{ Failure criteria spacing > 0.002" or 0.003" smaller than specified.

Given Fig 2.23 on pg 35 which shows a greater effective area of wire wrapped ribbed all welded screen.



I'm only going to focus on the wire wrapped design and controlling the sources of error that lead to higher σ (aka errors).

Now that we have limited the system to an existing process we must evaluate what are the components that we have to play width within this design realm.

Material → Stainless

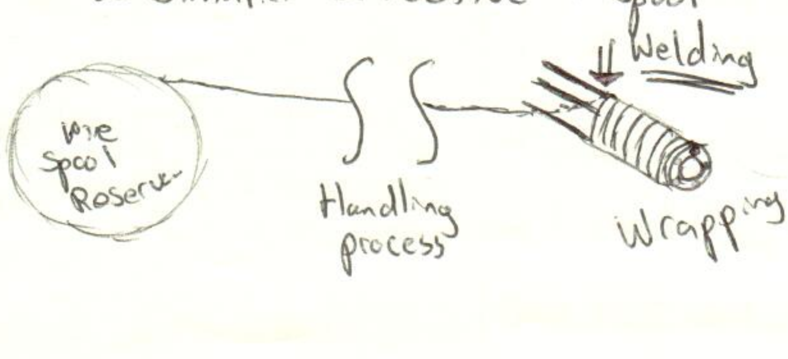
(How accurate is the diameter to begin with? Think of the doors of Toyota plant where they didn't control tightly their material properties.

Geometry → Mold/draw shape to ideal.

Control material specs & shape.

Process

Going from a large spool of wire to a smaller effective spool

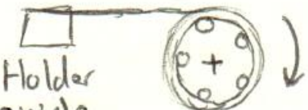


Now assuming we have controlled the wire material and spool cleanliness as well as geometry we can move over to handling

when a wire goes from a large spool to a smaller shape there will be plastic and elastic deformations.

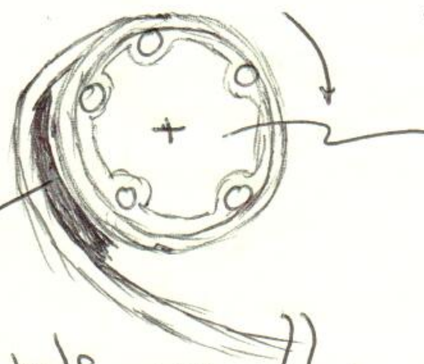
The plastic deformation will result in residual stresses in the material grain structure. Hence we can heat up the wire a little to help; however if we straighten the wire again we undue the process thus instead of feeding wire like I would do in a lathe let's instead preform the wire.

existing design.



Holder guide

New design.

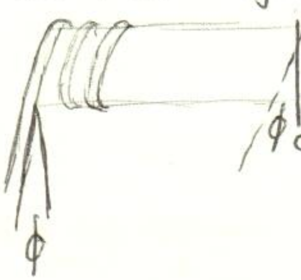


die

Curved holder

Not only does it help preform the wire but also can serve to measure the material that was just welded. While this will not eliminate screening issues it will help later address any issues early on before producing a batch of trash screens.

Next Need to consider alignment of the holder with regards to the spool. The feed angle must be the same as the spiral otherwise it leads to slight misalignments which can not be overcome due to friction.



So even if we were to precurve and align there may be material on the die.

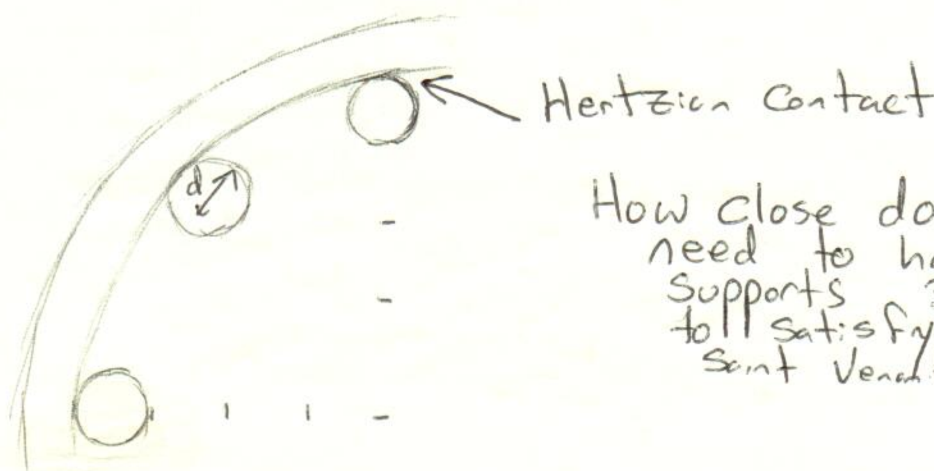
Thus the die must be cleaned in front of the wire.

Consider that 1 hair diameter is 0.004" or less then 100 μm. Now if there were to be a hair or even worst a piece of small metal on the die before placing the wire that alone may be (good/Bad) ~~engoo~~ enough to cause a discrepancy in the error. So while most of the mesh will be in spec that region where the metal shaving was present is out of spec.

We may need to consider cleanliness where machine is present and wire.

Also think if any particles get released during the welding process.

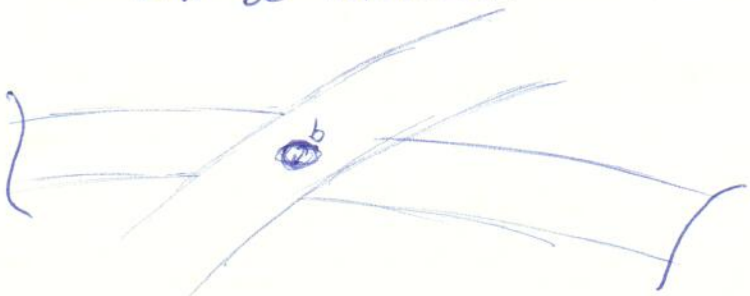
Now to the wrapping process: ohh this is going to be fun!



How close do we need to have supports 3d to satisfy Saint Venant's principle

Will Need more info

- Equation for Hertz contact can be found in Shigley's, Precision Machine Design, & Roark's
  - → However I suspect that stainless on stainless will be minimal.



Stainless σ_{UTS} 579 MPa

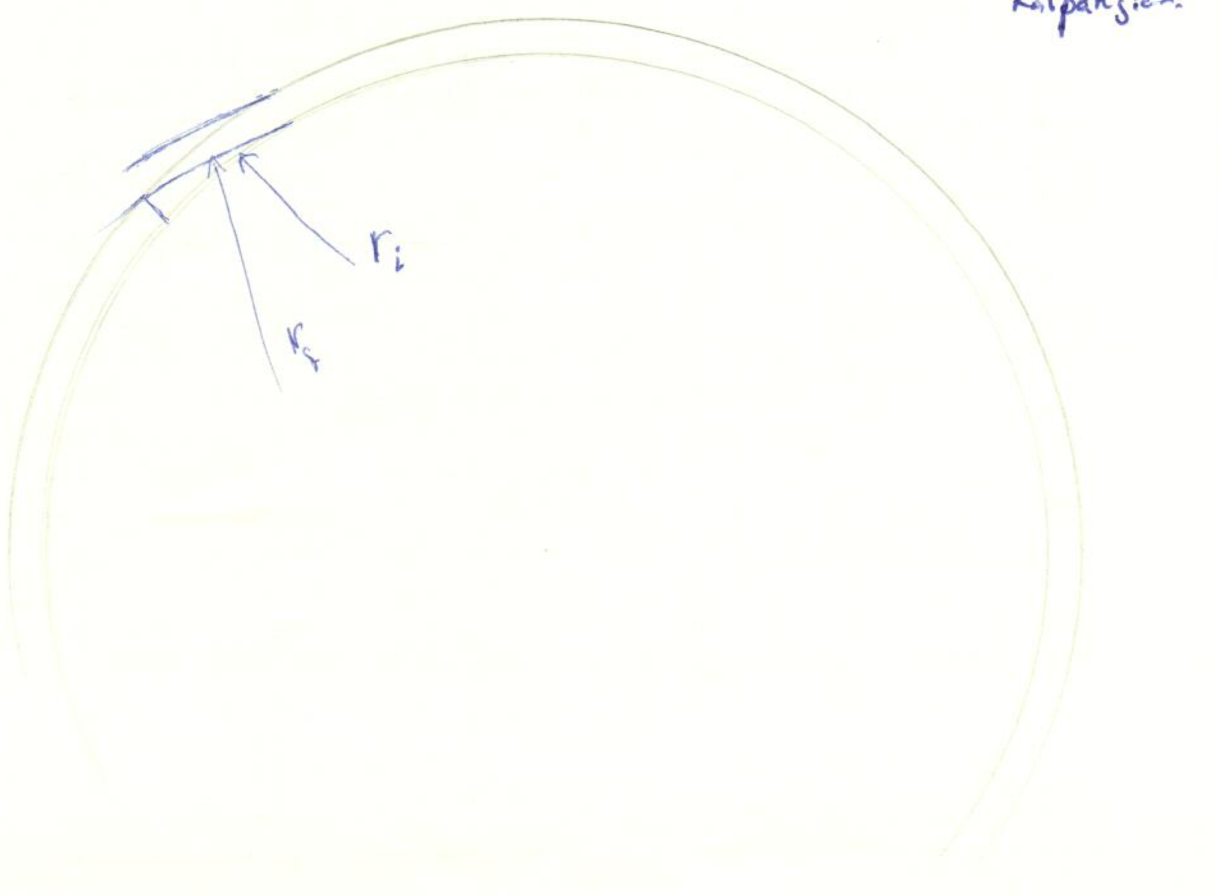
if wire not "perfectly" placed then friction takes over.

This however is a second order effect.

- The first order effect is the curving of the element given a specific shape

$$\frac{R_i}{R_f} = 4\left(\frac{R_i Y}{E T}\right)^3 - 3\left(\frac{R_i Y}{E T}\right) + 1$$

pg 443-44K Kalpakjian.



Roadmap

determine sources of error (1st & 2nd order)

limitations of process

Cost/Price optimization.

Perform first order analysis to converge on a design that will give most accuracy & precision for the smallest cost.

determine functional engineering space, & integrating automation

Improve repeatibility

Look at surface finishes & friction & contact points.

structural loops & over constraints.