ASTT 2026 PICKERING

THE LOCOMOTIVE BLASTPIPE

AN ESSAY IN

FLUID DYNAMICS

REALITY CHECK

SEEING IS NOT BELIEVING

REALITY CHECK 2

FLUID DYNAMICS OPERATE AT UP TO AND BEYOND THE SPEED OF SOUND

PERSISTANCE OF VISION IS AN ITSY-BITSY BIT SLOWER

SO THE VISIONS OF HILDEGARD OF BINGHAM WERE JUST THAT – VISIONS

NOT THE FOUNDATIONS OF BELIEF

REALITY CHECK 3

THE EARS HAVE IT, THE EARS HAVE IT

(YES, THEY REALLY DO)

WHAT

- IT IS EASY TO FORGET THAT WHAT YOU ARE TRYING TO DO IS BOIL A BIT OF WATER...

WHAT

- OK, AND MAKE A NICE CHUFFING NOISE

WHY

- TO DO WORK

HOW

- IN PROPORTION TO THE WORK DONE

ANYTHING ELSE?

- EXERCISE SOME CONTROL OVER THE PROCESS

ANYTHING ELSE?

EXERCISE SOME CONTROL OVER THE PROCESS

COPE WITH A RANGE OF OUTPUTS

ANYTHING ELSE?

EXERCISE SOME CONTROL OVER THE PROCESS

COPE WITH A RANGE OF OUTPUTS

DEAL WITH A VARIETY OF FUELS

ANYTHING ELSE?

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WASTE NEITHER FUEL NOR WATER

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DON'T SET FIRE TO THE LANDSCAPE

WHAT PROCESSES DO WE HAVE?

- PULSE EVACUATION

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- PULSE EVACUATION
* SURFACE CONTACT ENTRAINMENT

WHAT PROCESSES DO WE HAVE?

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- SURFACE CONTACT ENTRAINMENT
- INJECTOR ACTION

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- GRID MODULATION (x1 OR x2)
- LAMINAR FLUID FLOW

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- SUSPENSION LOADS

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- LOAD SHEDDING

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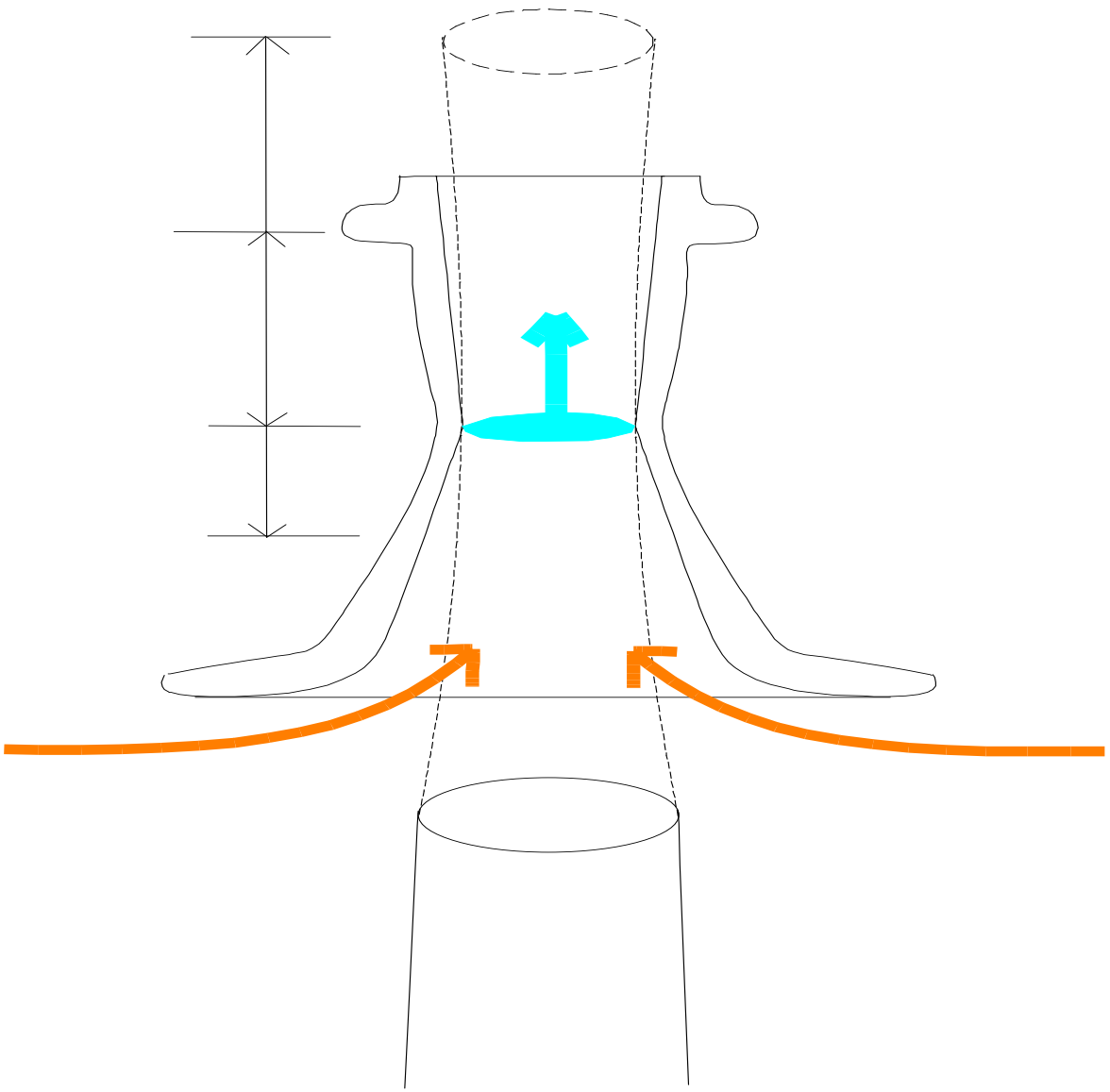
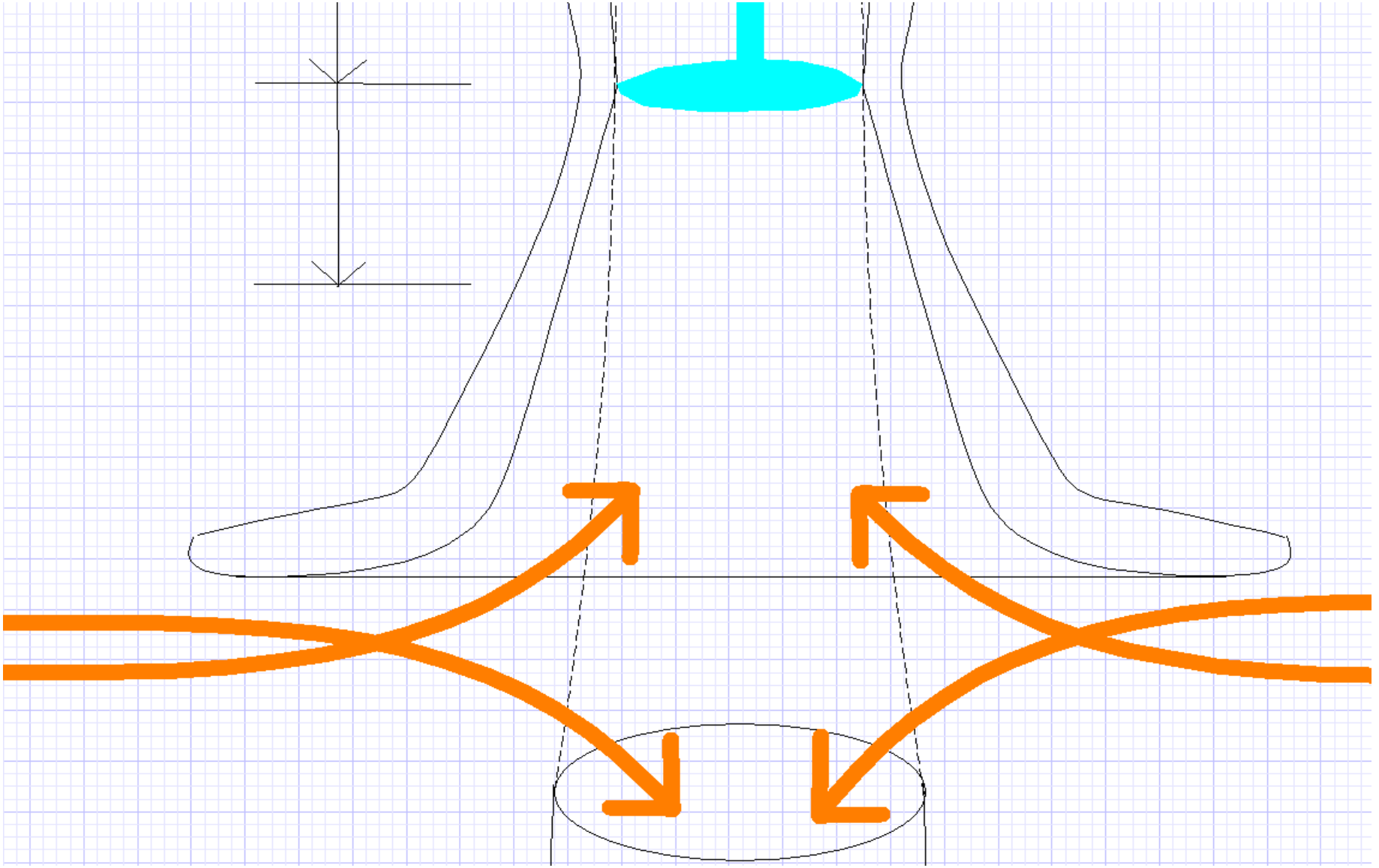
- SYSTEM INEFFICIENCES
- SUSPENSION LOADS
- LOAD SHEDDING
- FLOW OBSTRUCTION

A LITTLE LIGHT RELIEF...?

PULSE EVACUATION

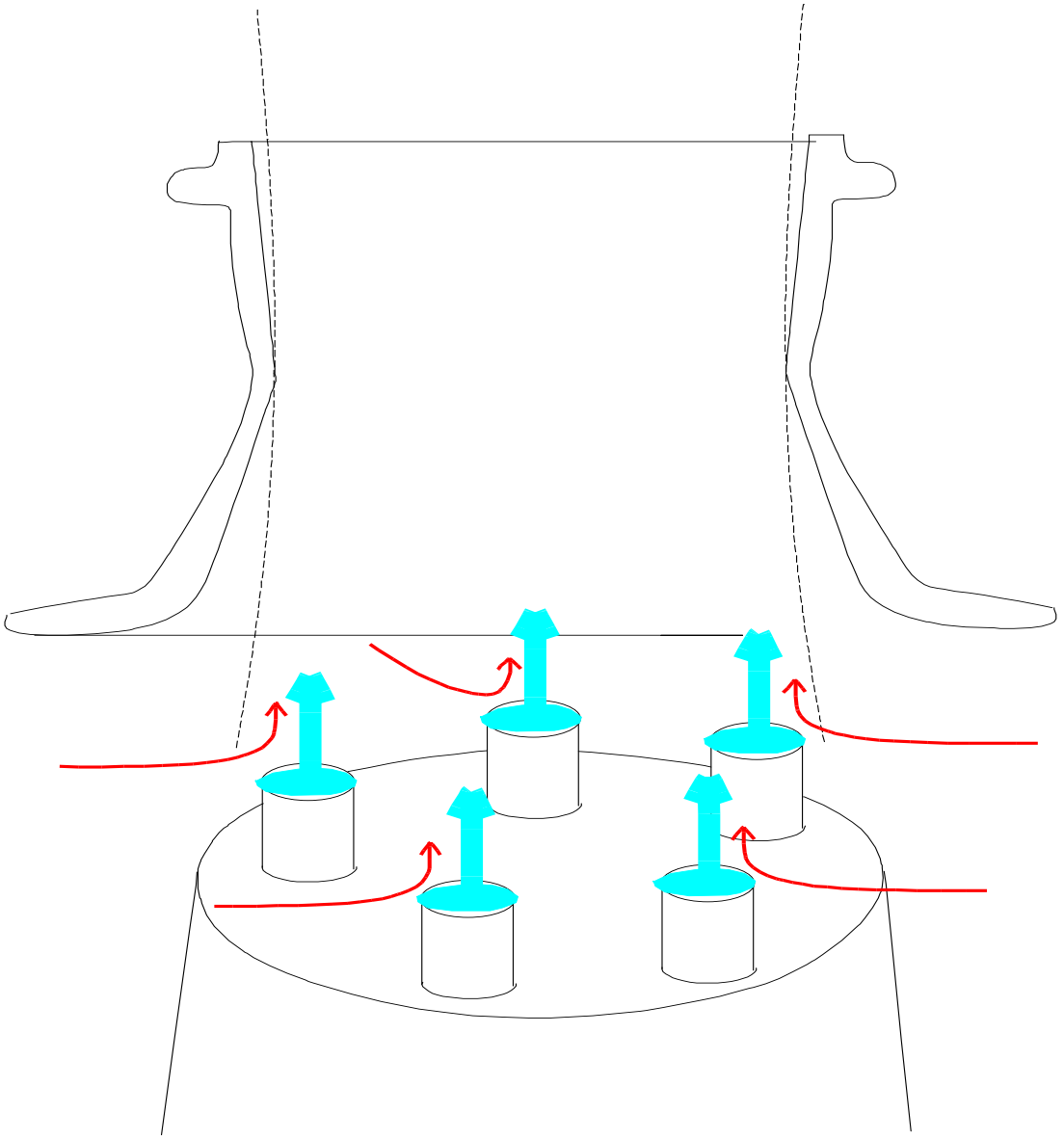


PULSE EVACUATION

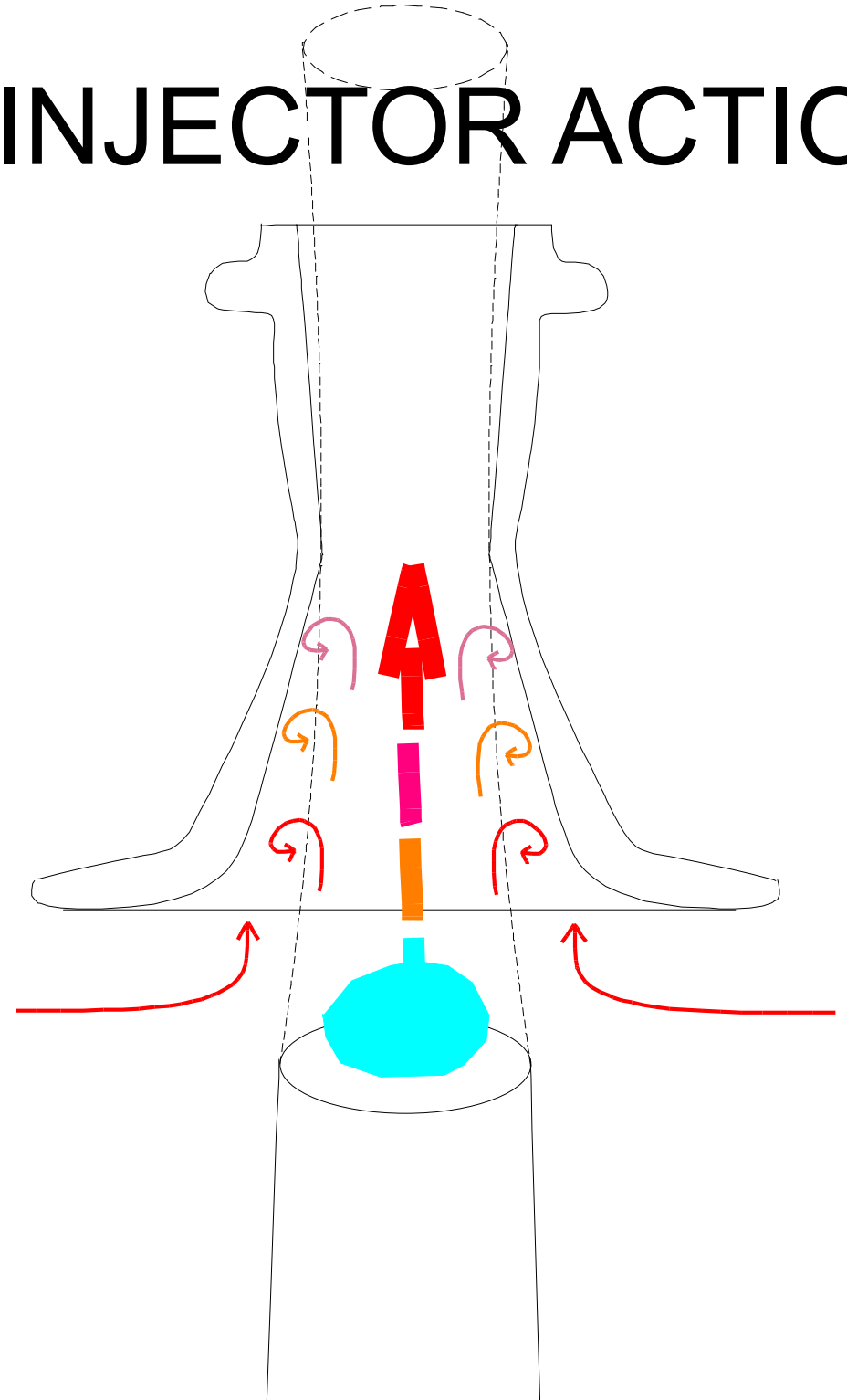


SURFACE CONTACT ENTRAINMENT

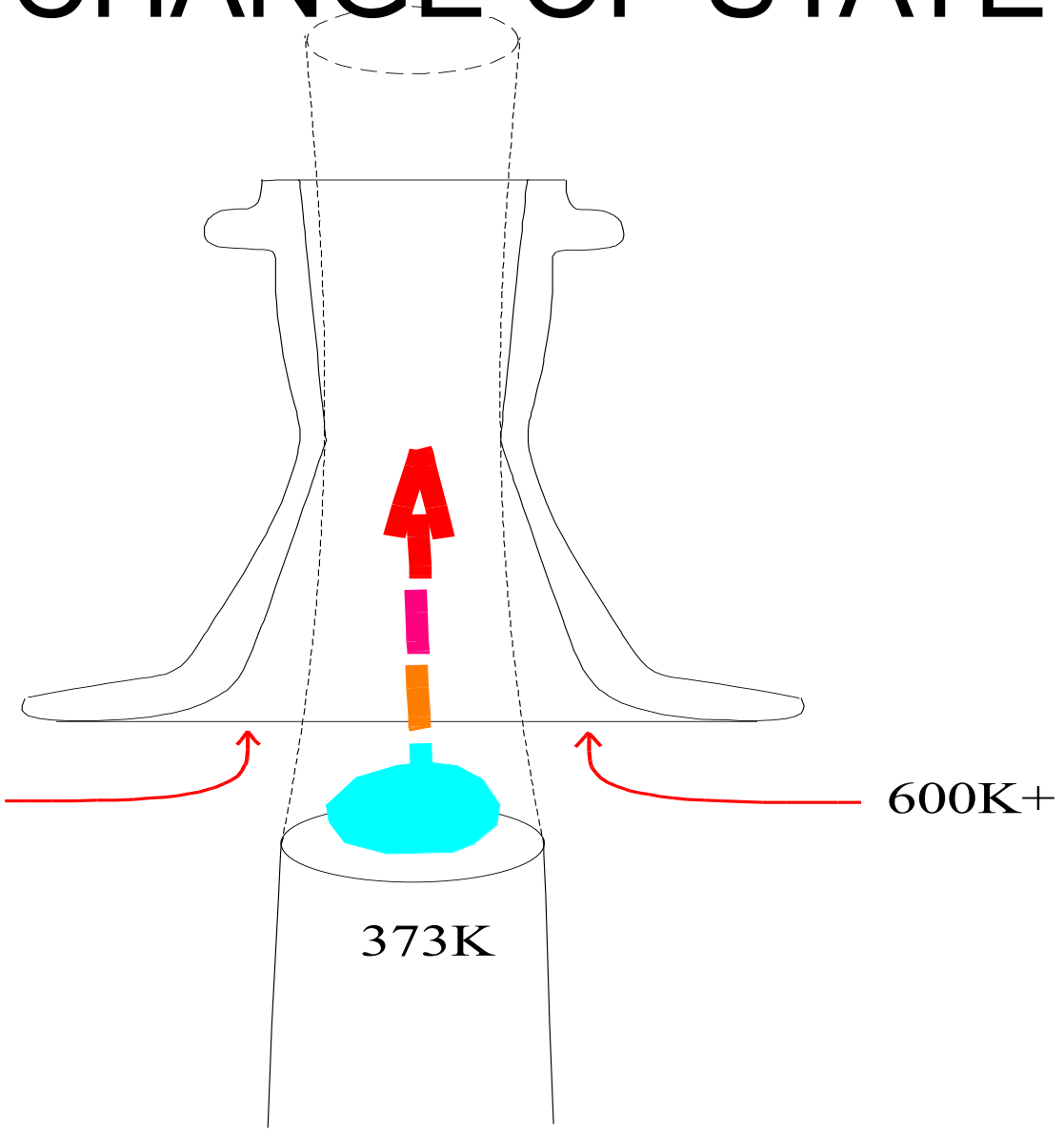
(after Lemaitre)



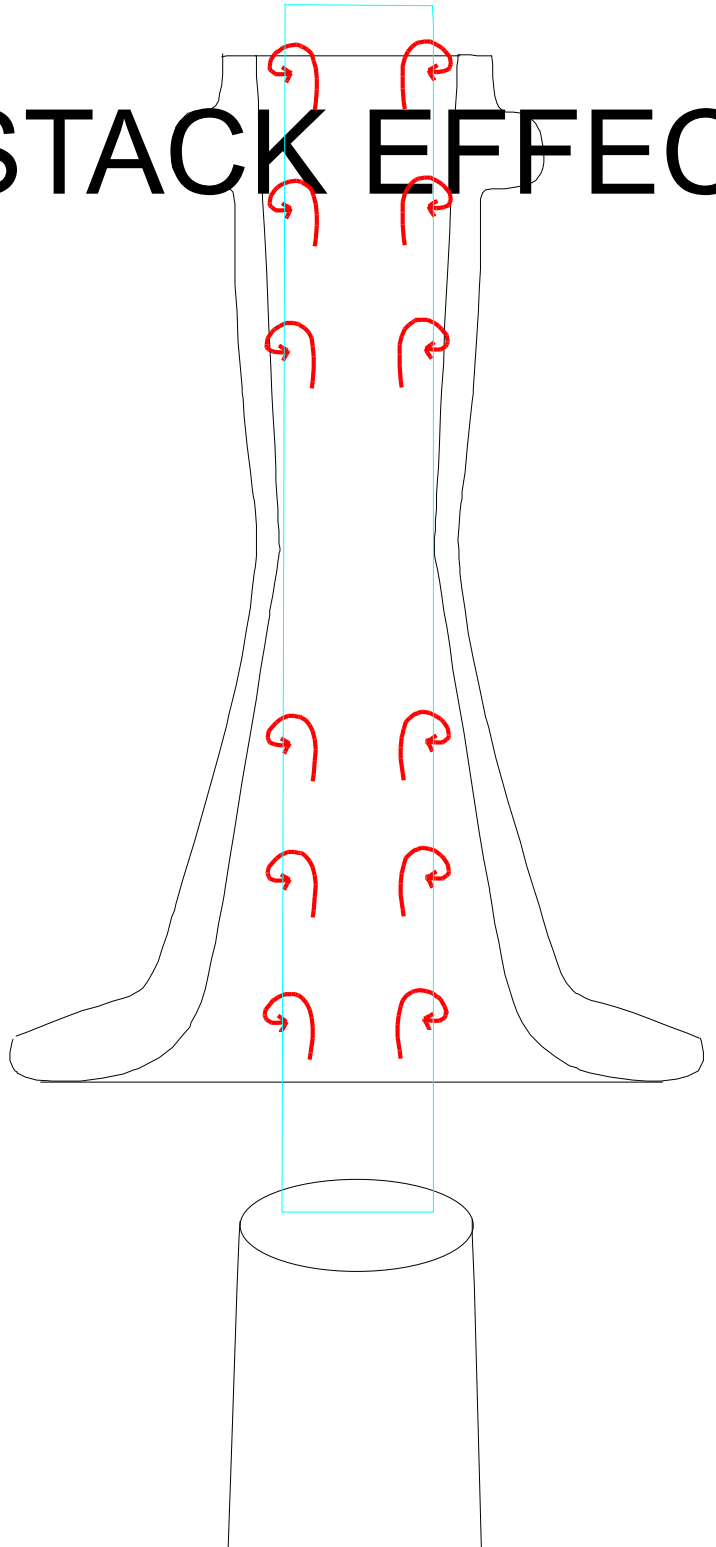
INJECTOR ACTION



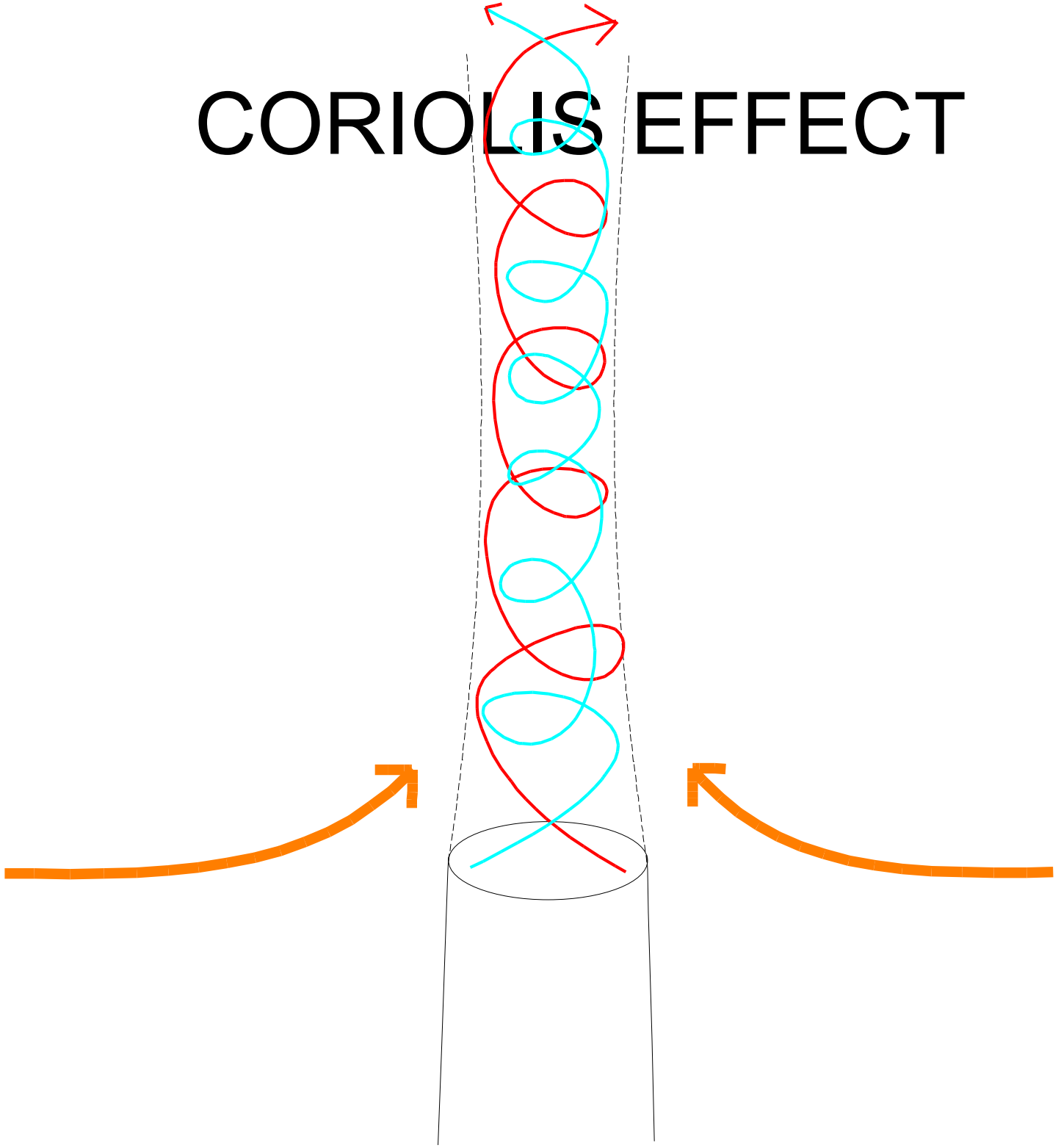
CHANGE OF STATE



STACK EFFECT



CORIOLIS EFFECT



IN CONCLUSION

WHAT HAVE WE GOT?

* A COMPLEX DYNAMIC FLUID FLOW

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* REPEATED TRANSITION BETWEEN LAMINAR AND TURBULENT FLOW

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* REGULAR FLOW REVERSALS

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* EJECTOR, INJECTOR AND PUMP ACTION – PASSING FROM ONE TO ANOTHER VERY QUICKLY

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* A COMPLEX DYNAMIC FLUID FLOW
* REPEATED TRANSITION BETWEEN LAMINAR AND TURBULENT FLOW
* REGULAR FLOW REVERSALS
* EJECTOR, INJECTOR AND PUMP ACTION – PASSING FROM ONE TO ANOTHER VERY QUICKLY
* MASSIVE ENERGY FLOWS -TYPICALLY 9X THE LOCOMOTIVE'S USEFUL WORK

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* A GROSSLY INEFFICIENT SYSTEM
* A COLLAPSE IN BOILER EFFICIENCY AT HIGH OUTPUTS
* SOME REALLY ODD DESIGNS THAT DON'T DO A GREAT DEAL, IF ANYTHING (GOOD THAT IS)

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WHAT HAVE WE GOT?

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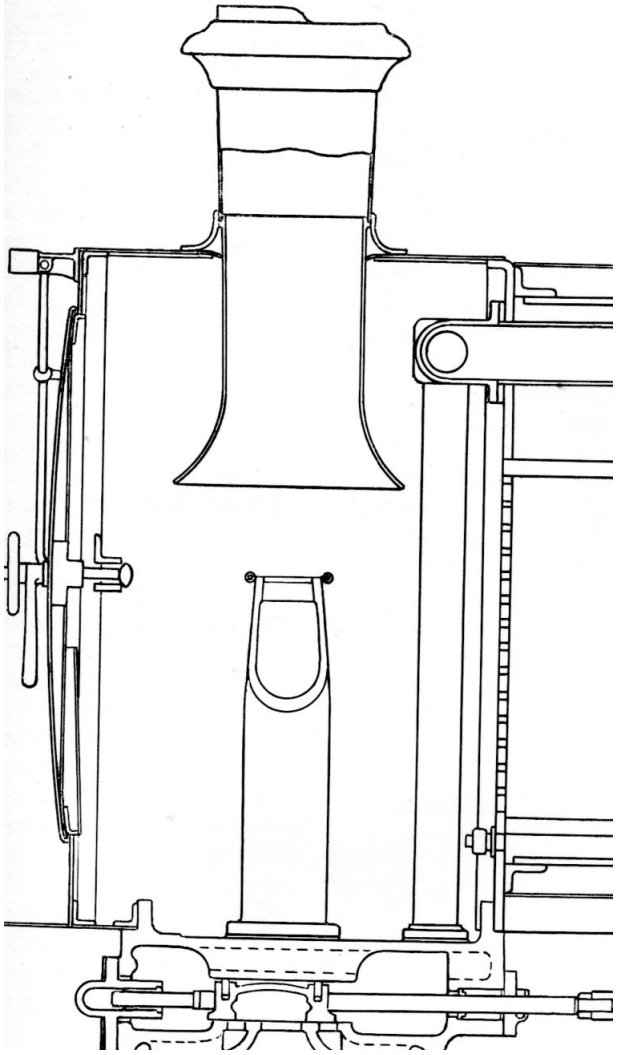
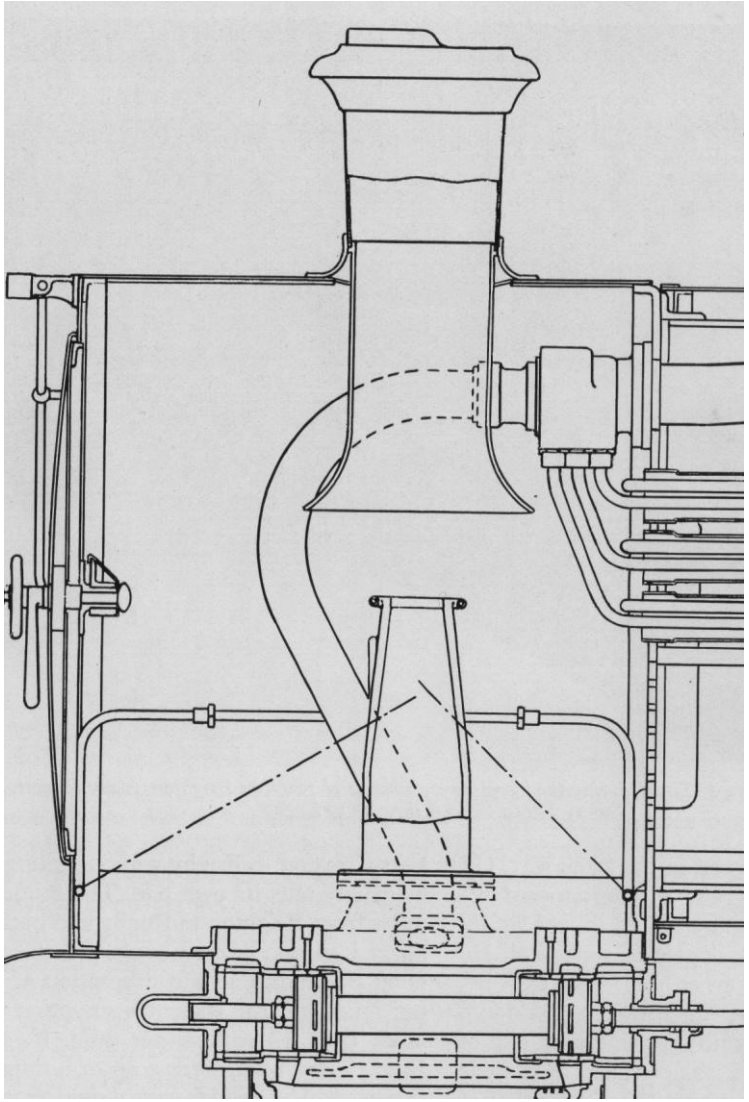
* A COLLAPSE IN BOILER EFFICIENCY AT HIGH OUTPUTS
* SOME REALLY ODD DESIGNS THAT DON'T DO A GREAT DEAL, IF ANYTHING (GOOD THAT IS)
* AN END OF TERM REPORT = 'COULD DO BETTER'

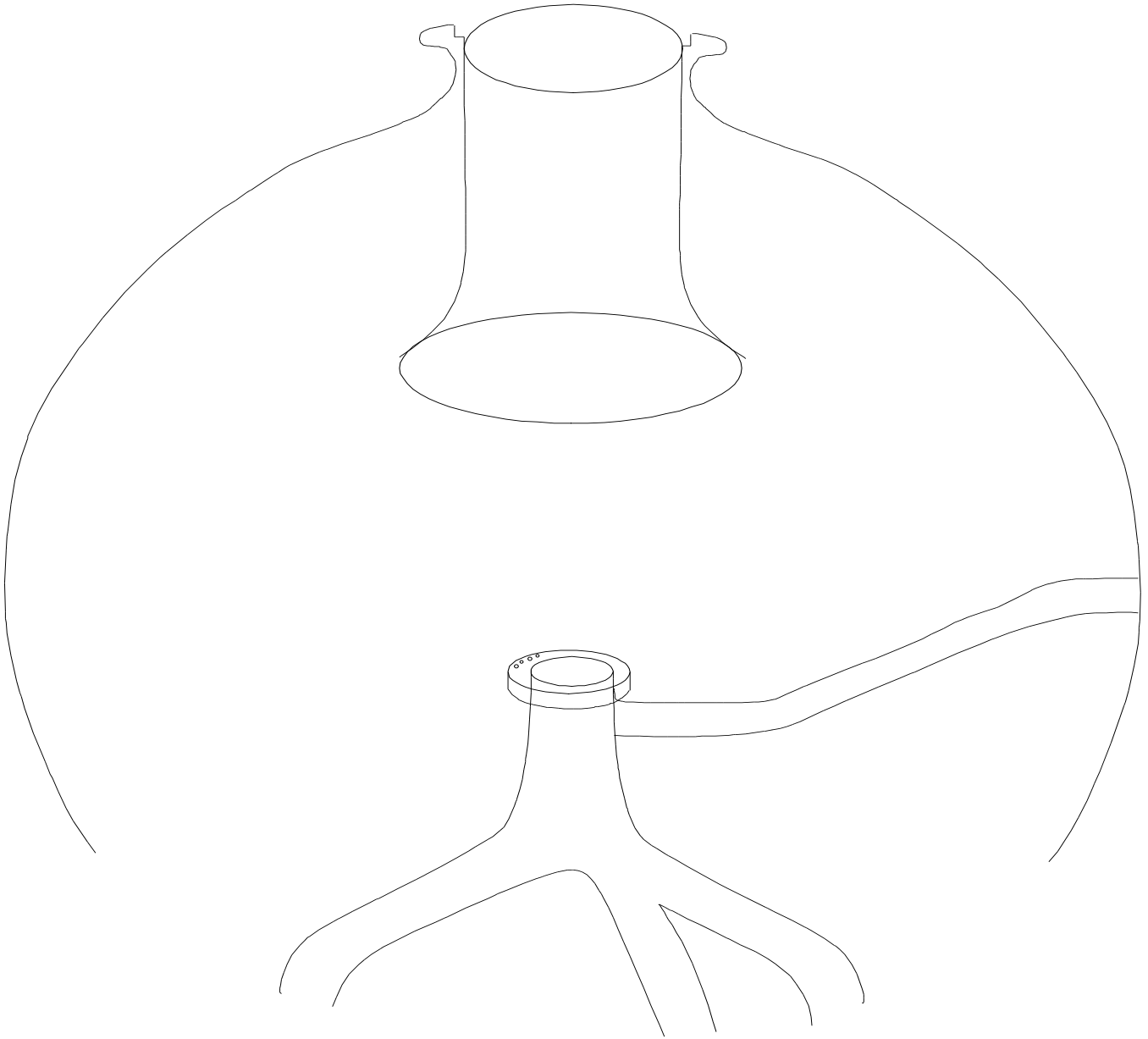
Crewe 1910



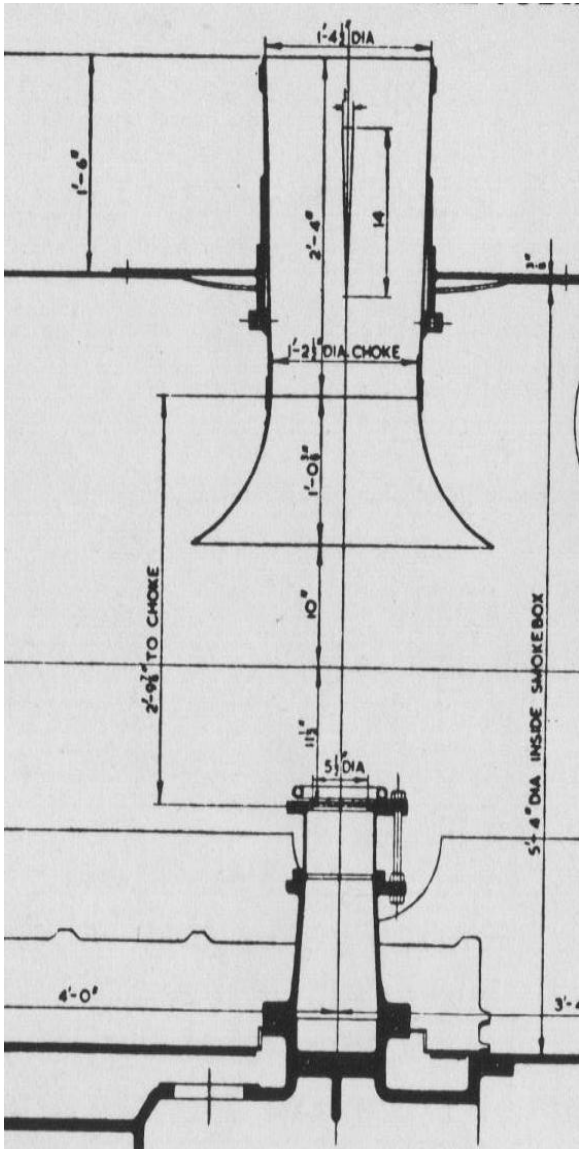
Crewe 1914



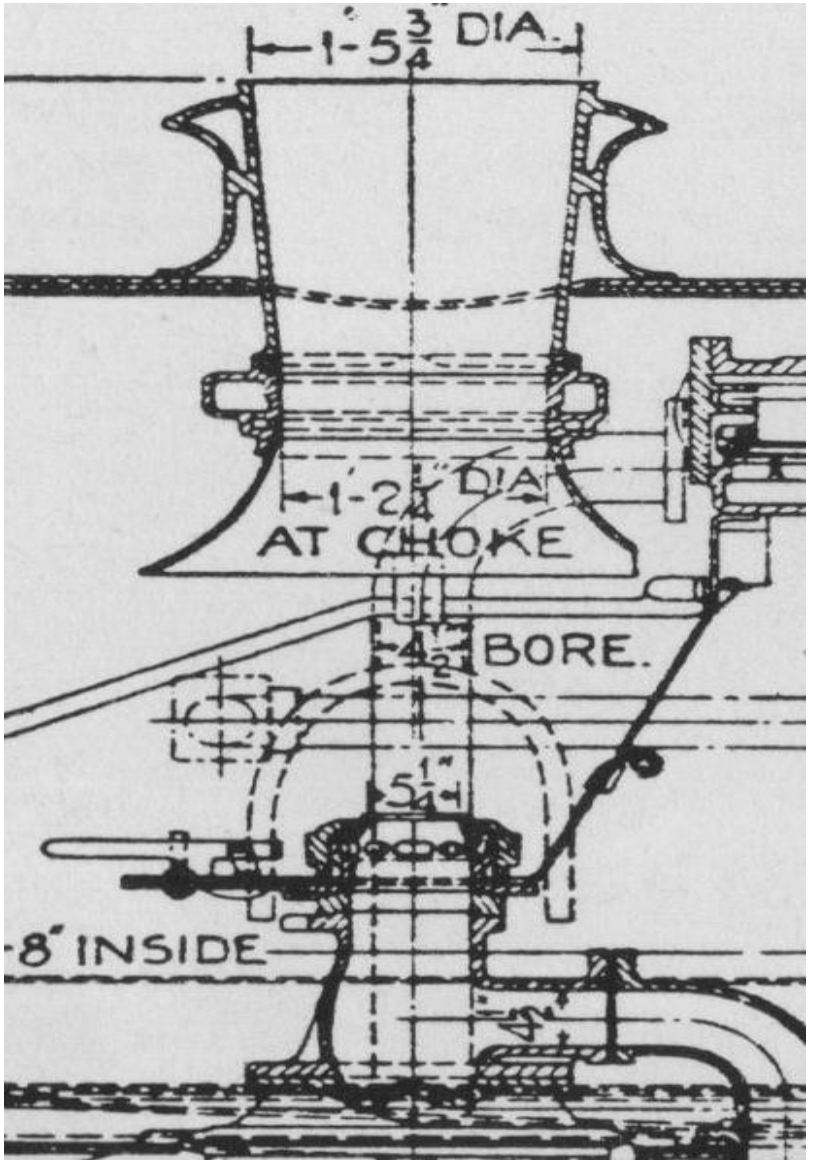
Glasgow 1927



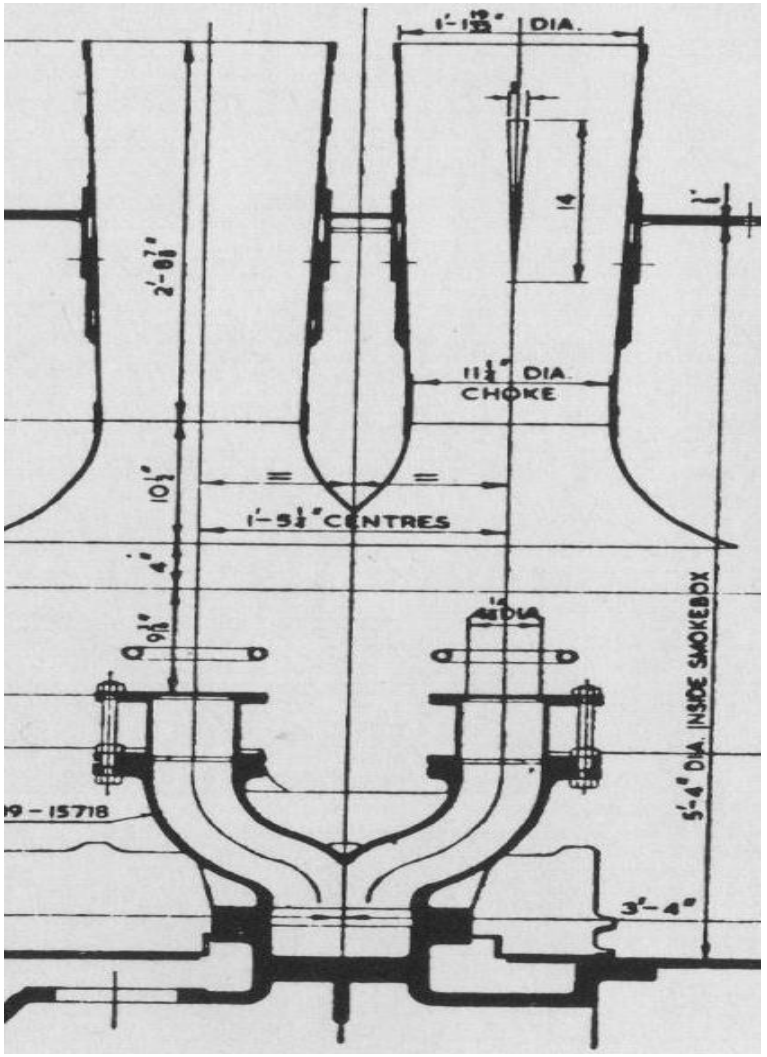
Crewe 1933


1'-4½" DIA
1'-6"
2'-4"
14
1'-2½" DIA CHOKE
1'-0½"
10"
2'-0½" TO CHOKE
11½"
5½" DIA
5'-4" DIA INSIDE SMOKEBOX
4'-0"

Crewe 1937



Crewe 1941


DIA.
14
11½" DIA.
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1'-5½" CENTRES
DIA
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