FAILED PINION

(front part)

ONE OF NINE DRIVE PINIONS

FAILED PINION

(Front Part)

FAILED PINION

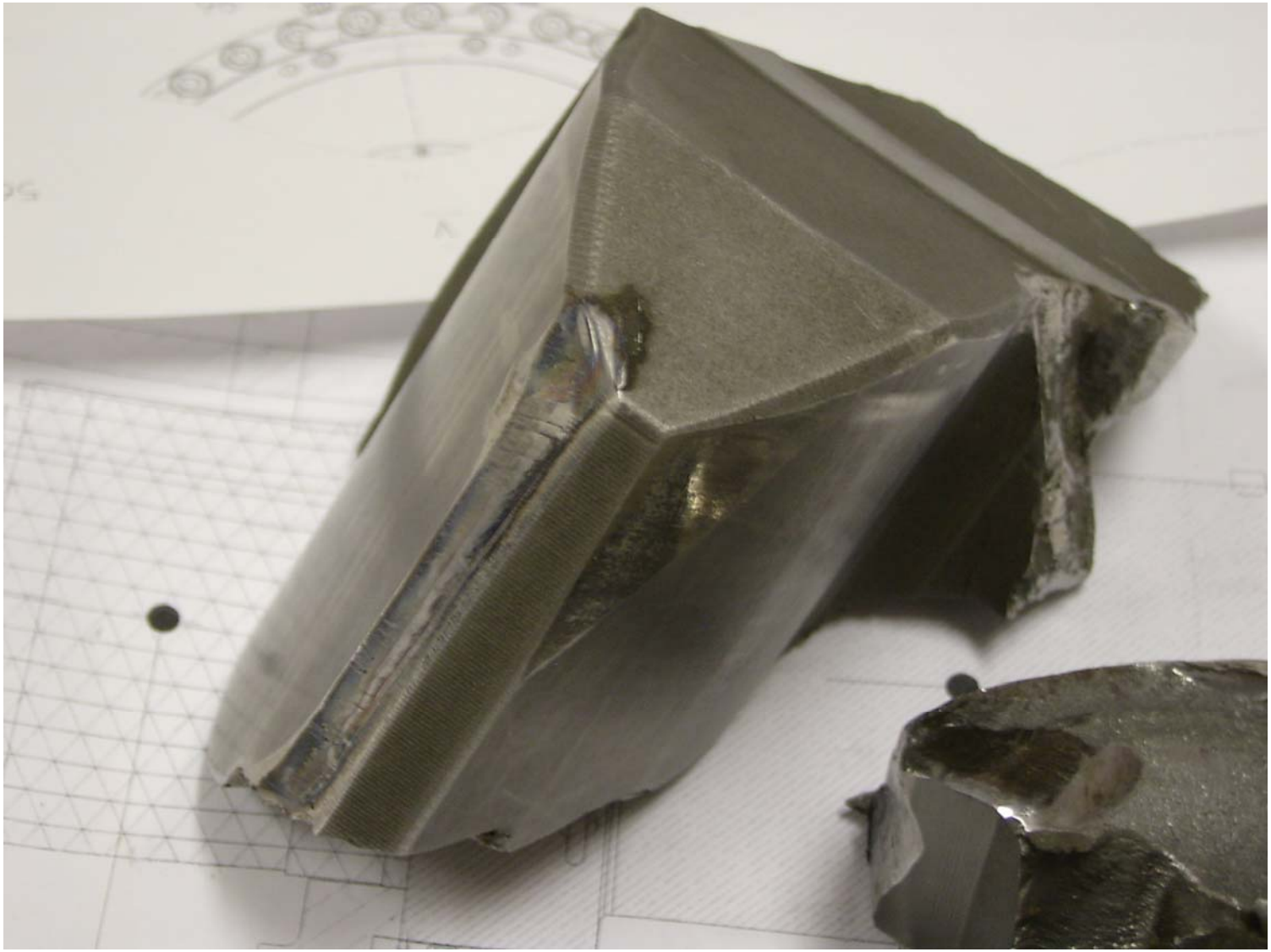
(Rear Part)

BROKEN MAIN GEAR TOOTH

Found during initial inspection

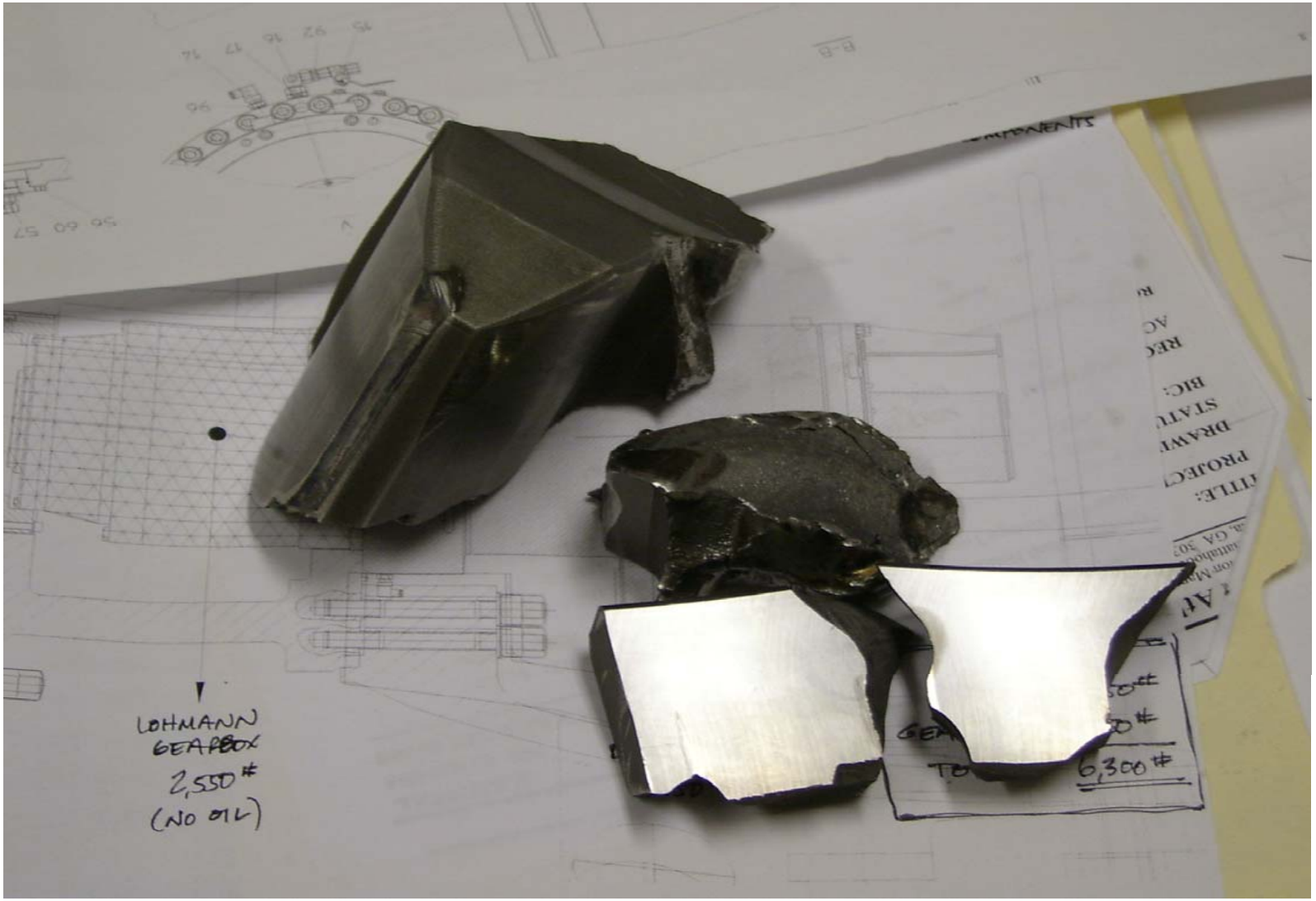
Crushed and indentation caused by broken pinion running out of mesh with main gear

BROKEN PINION GEAR TOOTH



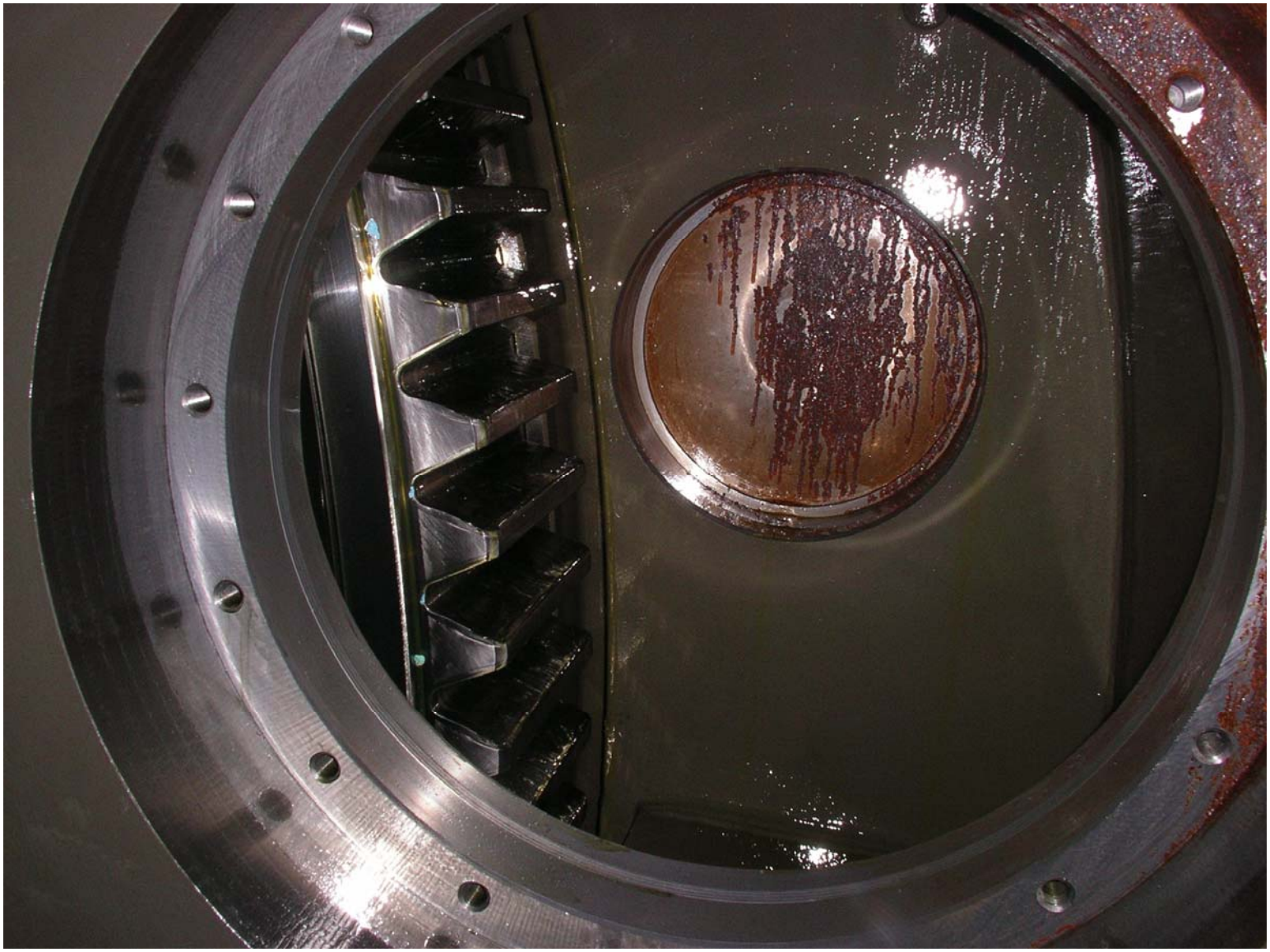
Top of tooth damaged by main gear when out of mesh

BROKEN PINION GEAR TOOTH



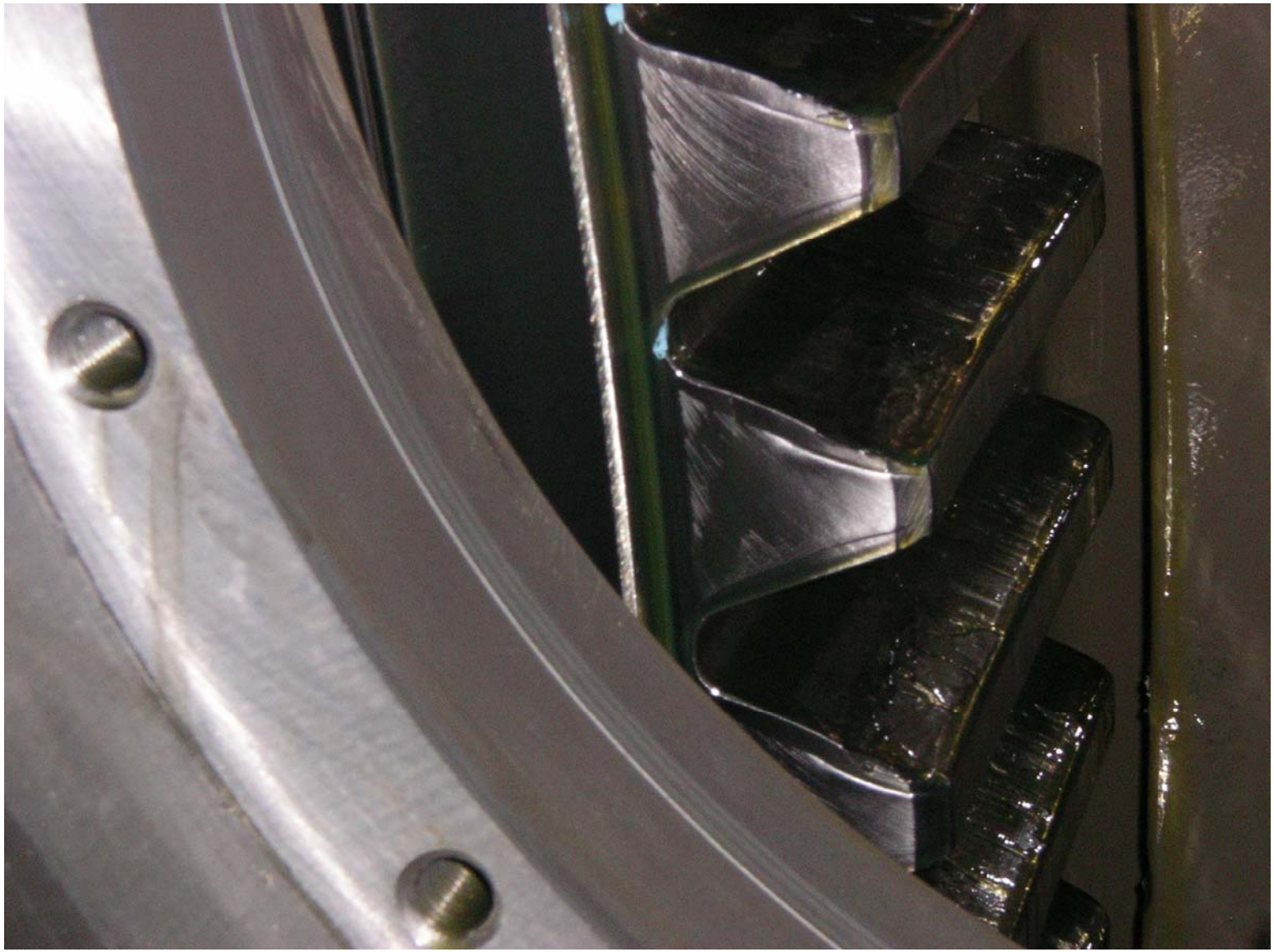
Chunk of gear tooth and broken support bearing outer race

DRIVE MOTOR GEAR BOX



Assembly and pinion removed to show damaged teeth of main gear

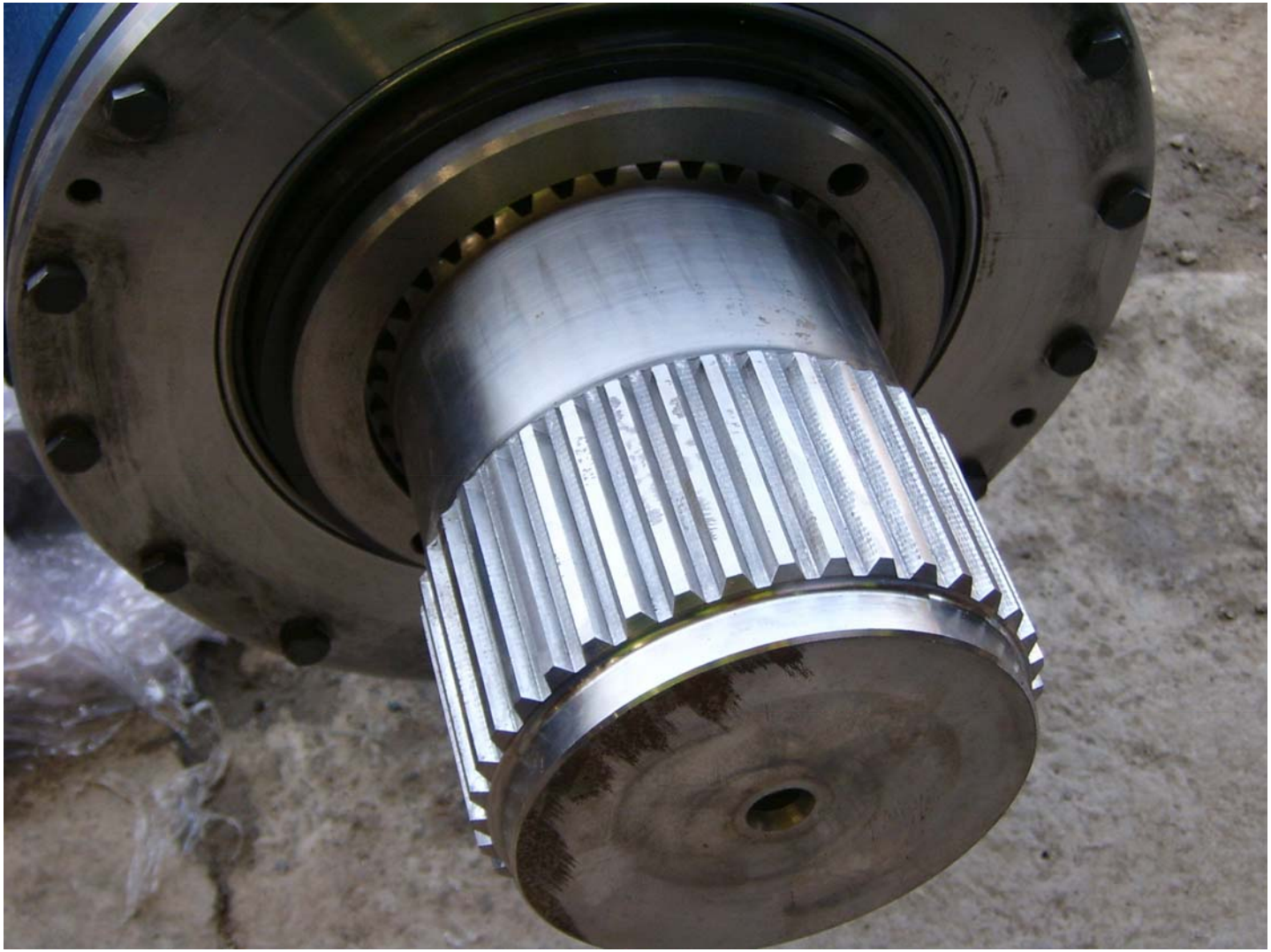
DAMAGED GEAR TEETH ON MAIN GEAR



SPLINED DRIVE SHAFT

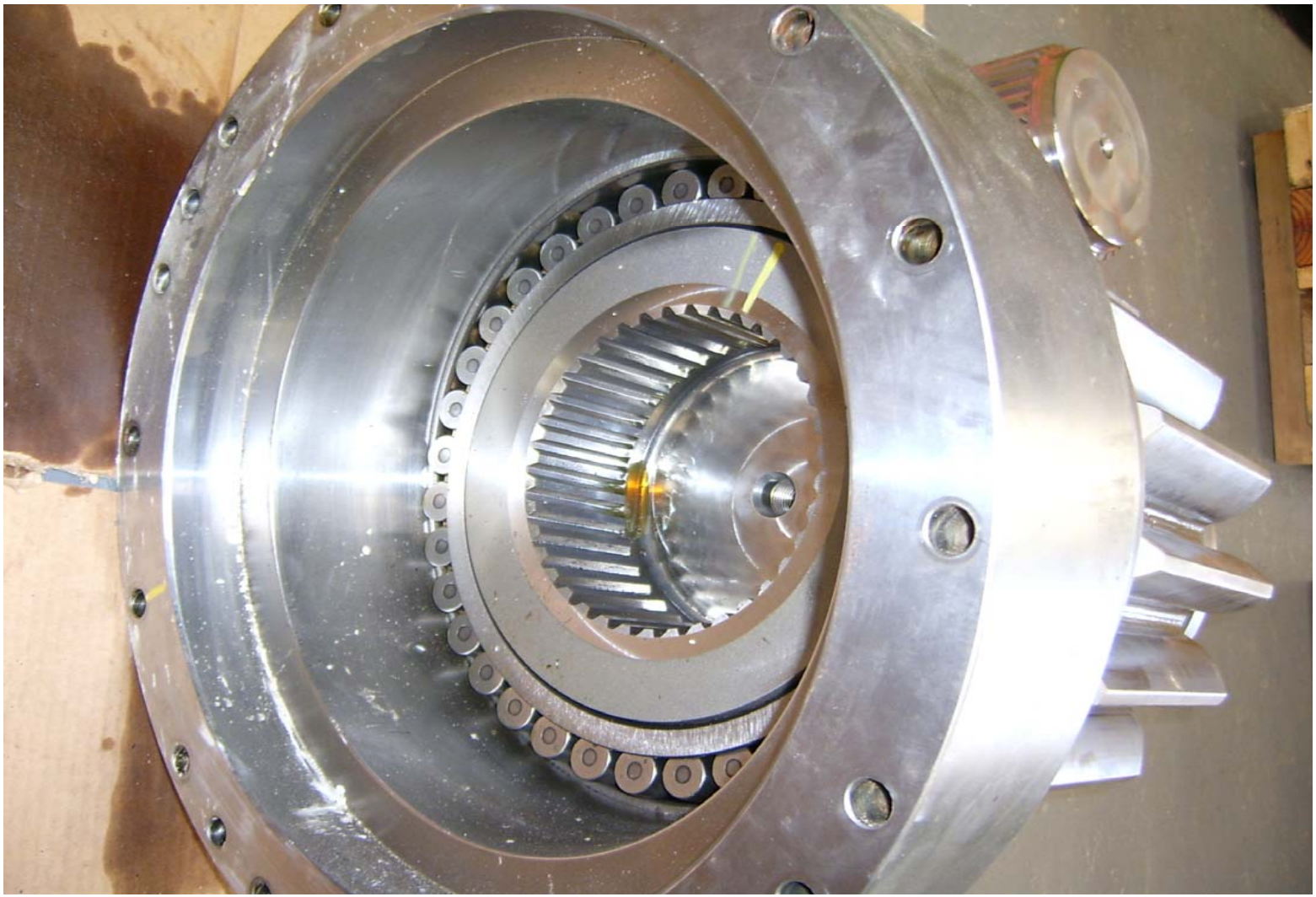
One end connects to gear box and other end connects to the splined pocket of the drive pinion

SPLINED SHAFT



Mounted in gear box output

SPLINED POCKET



Splined pocket of pinion receives drive shaft connected to output of gear box

SPLINED DRIVE SHAFT OF BROKEN PINION

Destroyed when pinion failed

INSIDE MAIN BEAM

Looking out front of TBM

Cutterhead has been removed and bolted to the tunnel face.

Bearing Bypass Cavern

In tunnel side wall

Blasted 300 ft. from tunnel face behind TBM trailing gear

Bearing Bypass Chamber

Housing new main bearing and man-lift

ROCK BOLTS & STRAPS

Supporting roof bypass cavern

FRACTURED ROCK

- Fractured rock above Bypass cavern prevent TBM gripper from being used to walk past cavern.
- A “walking shoe” was fabricated and bolted to the tunnel floor.

WALKING SHOE

Walking shoe attached to tunnel floor allows moving TBM without using the gripper as it moves past bearing bypass cavern

Bypass Cavern

Looking back from face

Note: gripper shoe is off the wall

OVERHEAD MONORAIL SYSTEM

5O ton monorail system to lift and move main bearing

MAIN BEARING

Damaged main bearing removed from TBM on 8/16/06