INVESTIGATION OF SURFACE FINISH EFFECTS ON RESIDUAL STRESS LEVELS IN HY80 PLATES & WELDMENTS

by

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This work provides the objectives, methodology and preliminary results of the residual stress measurement project. The use of the high speed drill in the blind hole technique and the need to utilize a 1/8" diameter hole to enable comparison with other slow speed drill data is discussed. Calibration of the system and preliminary results are also presented. Plans and objectives for the remainder of this project are developed.

OBJECTIVES: -to investigate effects of high vs low speed drill.

-to investigate surface finish effects on residual stresses; .....as rolled surface
.....milled surface
.....precision ground surface
.....hand ground surface

-to investigate residual stress in the vicinity of butt weldments.

EQUIPMENT: -high speed air turbine drill (400,000 rpm)

-limitation of commercial equipment (hole size about 1/16 inch)

- need for larger hole,....for comparison
....for larger depth

-eccentric displacement of turbine drill to use unit as an end mill

-initial difficulties with modified unit

-strain gauges,.....rectangular rosette

-measuring equipment

PLANNED METHODOLOGY:

-prepare calibration specimen
.....heat treatment
.....pre-load to beyond yield

-determination of calibration constants, A & B for various hole depths

-investigation using laboratory test specimens

- use of normal techniques of recording strains vs hole depth for calculation of residual stresses

PROGRESS & CHANGE IN PLANS:

-cart before horse.....submarine before calibration

-strain readings at many locations during the repair of submarine

-importance of this oportunity

-back to the lab for calibration
.....preparation & mounting of calibration specimen

CONTINUING WORK:

-more calibration points are necessary for comparison of A & B values at various hole depths & stress levels with others

-complete tests on laboratory test specimens

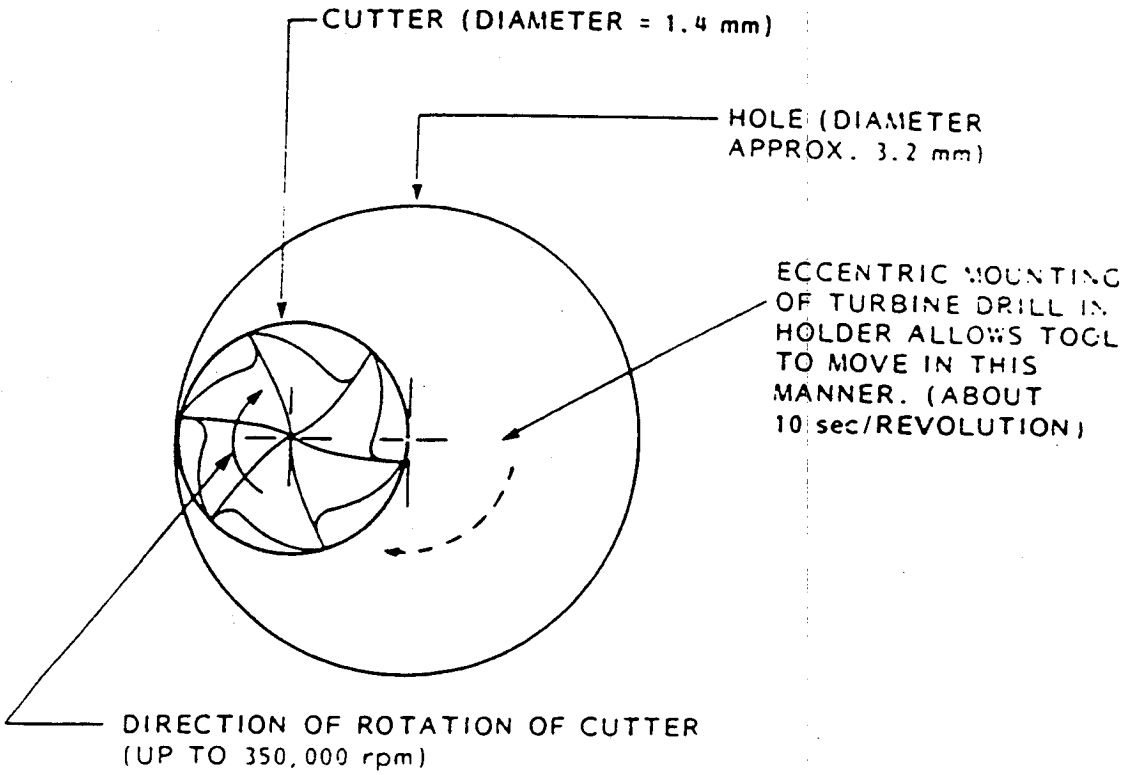
-reduction of test data obtained on the submarine hull

-comparison of results with those of other researchers

THE APPRECIATION OF THE AUTHORS IS EXPRESSED TO

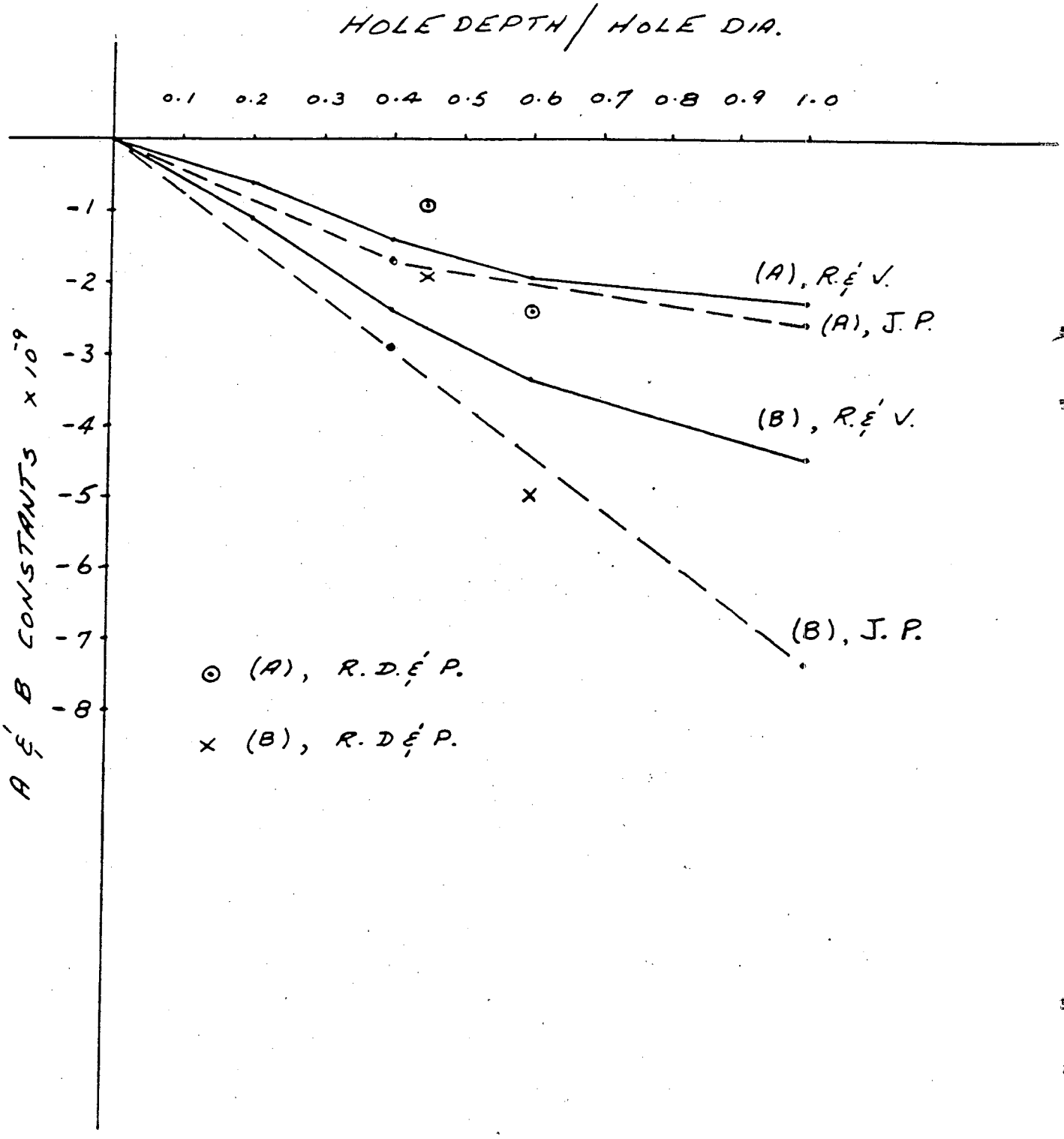
THE DEFENCE RESEARCH ESTABLISHNENT ATLANTIC

FOR THEIR SUPPORT OF THIS PROJECT



CUTTING ACTION OF OFFSET HIGH SPEED DRILL

(SHOWN HERE TO PRODUCE 3.2 mm HOLES FOR MICROMEASUREMENTS EA-XX-125RE-120 ROSETTE)


HOLE DEPTH / HOLE DIA.
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
-1
-2
-3
-4
-5
-6
-7
-8
A ε' B CONSTANTS x 10⁻⁹
(A), R. ε' V.
(A), J. P.
(B), R. ε' V.
(B), J. P.
⊙ (A), R. D. ε' P.
× (B), R. D ε' P.