

EIGHTH PROGRESS REPORT  
TO  
MATERIALS LABORATORY, WRIGHT AIR DEVELOPMENT CENTER  
ON  
FOUR LOW-ALLOY STEELS FOR ROTOR DISKS OF GAS TURBINES  
IN JET ENGINES

by

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PROJECT NO. M903

AIR FORCE CONTRACT NO.: AF33(038)-13496  
SUPPLEMENTAL AGREEMENT NO.: S4(53-534)  
EXPENDITURE ORDER NO.: R615-13 SR-3a

DECEMBER 31, 1952

## INTRODUCTION

This report covers an investigation of the high temperature properties of low alloy steels for use as forged wheels for the gas turbines of jet engines for the period between October 1, 1952 and December 31, 1952. The investigation was originally undertaken under Air Force Contract Number: AF 33(038)-13496 (Expenditure Order Number: 605-227 SR-7). During the period covered by this report, the time of performance was extended under Supplemental Agreement Number: S-4 (53-534). Under this new extension (Expenditure Order Number: R615-13 SR-3a), the research work was to be completed on or before November 15, 1953, and the final report delivered on or before December 15, 1953.

The original objective of the investigation was to determine the influence of heat treatment on four low alloy steels in the form of forged wheels for the gas turbines of jet engines. The four alloys were 4340, "17-22A"S, H-40 and C6422. Three wheels of each alloy were furnished with varied heat treatments. Surveys were to be carried out to determine the best treatment for each alloy and design data were to be obtained at 1000°, 1100° and 1200°F on the disk of each alloy selected.

Before the work on the disks was started, the contract was amended to include a concurrent investigation of the high temperature properties of the products of isothermal transformation for each of the four steels. The objective of this work was to attempt to establish the influence of the various types of structures obtainable in the alloys by heat treatment on their high temperature characteristics. The results of the two studies were to be correlated in an attempt to explain the results of the tests on the forged wheels.

The work authorized under the Supplemental Agreement Number: S-4 (53-534) extends the studies of heat treatment alone and is limited to 4340, "17-22A" and H-40 steels. The general objective is to obtain information enabling the heat treatment of such low alloy steels for optimum properties in the temperature range from 700 to 1200° F.

## RESULTS

The results reported at this time will be very brief. In general, the tests carried out have been limited to completion of the necessary tests on the forged wheels to complete the study in anticipation of final reports. The work done on the three phases of the investigation may be summarized as follows:

### 1. Design Data for Wheels.

All the tests necessary were completed during the period and the results are being incorporated in a final report. An extensive micro-structure study is being carried out on the wheels for purposes of correlation with the structure studies on bar stock. It is anticipated that this work should be completed during the next period. The necessary tables and figures for a final report were also started during this period.

### 2. Properties of the Products of Isothermal Transformation.

No additional work has been carried out since the last progress report on this phase of the investigation. All of the work originally authorized and contemplated has been previously reported. As mentioned in the previous paragraph, work is in progress utilizing the results in order to explain the influence of heat treatment on the forged wheels.

3. Influence of Heat Treatment on the High Temperature Properties of Low Alloy Steels.

Negotiations have been made with the Timken Roller Bearing Company, Steel and Tube Division, to obtain the necessary additional 4340 and "17-22A" S bar stock to expand the studies of heat treatment. Sufficient H-40 stock is on hand for present purposes. It is expected that heat treatment studies and necessary testing will be started during the next period.



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