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PROJECT M

Report of Trip

to

NTH Products, Inc., San Diego  
Menasco Manufacturing Co., Burbank  
Fabriform Brazing Co., Los Angeles  
LeFiell Manufacturing Co., Los Angeles

January 11 - 18, 1961

David J. Goerz, Jr.  
Andrew M. Crabtree

INTERNAL MEMORANDUM

Project M Report No. 241

January 24, 1961

## TRIP REPORT

D. J. Geerz, Jr., and A. M. Crabtree

NTN Products. Visited NTN Products and met with Mr. Ben Salmonson. Primarily, discussion was centered in three areas: (1) A thin wall ultra-high-vacuum manifold for Project M; (2) Stainless-steel waveguides; and (3) Hardenable steel tubings.

Concerning the first topic, NTN Products has proposed the use of a thin wall stainless-steel tube with corrugations along its length which would provide both flexibility for expansion and rigidity from collapse. They propose a 24-in. tube made of 1/16 in. thick with 1/2 to 3/4 in. corrugations located at 6-in. intervals. These corrugations are about 1/2 in. in cross section. It is felt that these corrugations must be protected from damage. The tube would be rolled first and the seam brazed to provide a smooth inner surface. The corrugations would then be formed by hydraulic pressure. Side connections would be built in to the tube and the connections heliarced on. There would also be a semi-flexible connection in the form of a bellows combination; i.e., there would be two corrugated sections with a straight section in between approximately 12 in. long. This bellows and straight section combination would provide flexibility in all directions. They feel that they would be able to assemble units in twenty-foot lengths with all necessary side porting and leak checking prior to infield installation. They feel they are capable of attempting design and construction of equipment for infield installation, that is, the heliarcing installation, and weld-rolling such that we could obtain an internal surface of 32  $\mu$ in. including the weld. Such an assembly would be done with standard clean-room techniques. They have facilities for making 24-in. diameter pipe in lengths up to 24 feet (soon 30 feet). They have a very clean facility, modern and well-equipped. In addition to the tube-forming facility, they have a complete tool and die shop.

The waveguide problem was discussed. They were able to give us samples of rectangular waveguide in stainless steel and were now concerned more about the copper liner. A waveguide project of this type is within their capabilities. They can roll the tube to any

configuration and if necessary hold tolerances as tight as 1/1000 of an inch. They are also considering the various problems for rolling bends and twists.

Regarding high-temperature alloys they have complete facilities for making tubes of most exotic alloys. Such tubes as Inconel-X, 17-4 PH, 17-7 PH, are semi-stock items. They have special equipment along this line to cut tubes to length and flare the ends for flanging. They can cut tubes to very short lengths to make rings and are able to form light forged rings automatically. In addition to the above information it is important to note that they have complete leak-checking facilities with a Veeco MS-9 leak detector and also complete X-ray facilities in the plant.

Further work recommended. It is felt that an additional trip should be made to San Diego shortly with some drawings such that preliminary estimates on a prototype section of waveguide and manifold system may be constructed for testing.

Monesco Manufacturing Co. (Mr. Hamilton). This is a large Los Angeles manufacturer, specializing primarily in hydraulic landing-gear equipment. They are now attempting to develop a diversification in work on Atomic Energy Commission projects. It is a modern organization and is operated in an immaculately clean condition. Their equipment ranges from light production, lathes, etc., to extremely heavy equipment. They have excellent facilities for profile milling with both tap input and EC control. They are used to working with tolerances in tubing of the order of 5/10,000 of an inch in large diameters. They have their own heat-treating facilities, engineering, and testing. They would be interested in fabrication of parts which would involve a complete assembly. They are completely equipped for work with hydraulic systems. One other instrument which may be of interest is a pressure-welding machine capable of making a weld without feeler rod in tubing up to 24 in. in diameter and 1/2 in. thick. This welding can be done on a number of materials including high-strength steels and titanium. They are interested in our waveguide problems and will present further discussions on the bending and forming of special waveguide shapes.

Fabriform Brazing Co. (Tom Ruff). This is a Los Angeles operation having one of the largest facilities for dry hydrogen brazing on a production basis. They have a hump-back dry hydrogen furnace which is run continuously for copper temperatures and provides an economical and highly reliable source for stainless-steel brazing. They are aware of contamination problems and hence this furnace is used only for stainless steel. They have dip-brazing facilities for aluminum fabrications of large sizes.

LeFiell Manufacturing Company. This is a smaller Los Angeles company engaged in the production of special tubes. They are able to do amazing things with tubing such as providing constant outside diameter with continuity of otherwise difficult internal configurations. These shapes may be held to tolerances of the order of 1 mil. They have facilities for fabricating tubing of all materials. They are interested in fabrication of waveguide with copper plating on the inside or other copper sheet. They have facilities for corrugating large diameter pipes of which we saw samples of up to 8 in. in diameter. This plant may have applications where difficult and odd-shape tubing was required in a variety of materials. This is beyond a doubt one of the most interesting plants in the Los Angeles area as far as tubing manufacturing is concerned. It is felt that an additional visit to this plant would be advisable to further discuss our problems with Mr. LeFiell who is the owner and also chief designer. The company employs about 100 personnel.