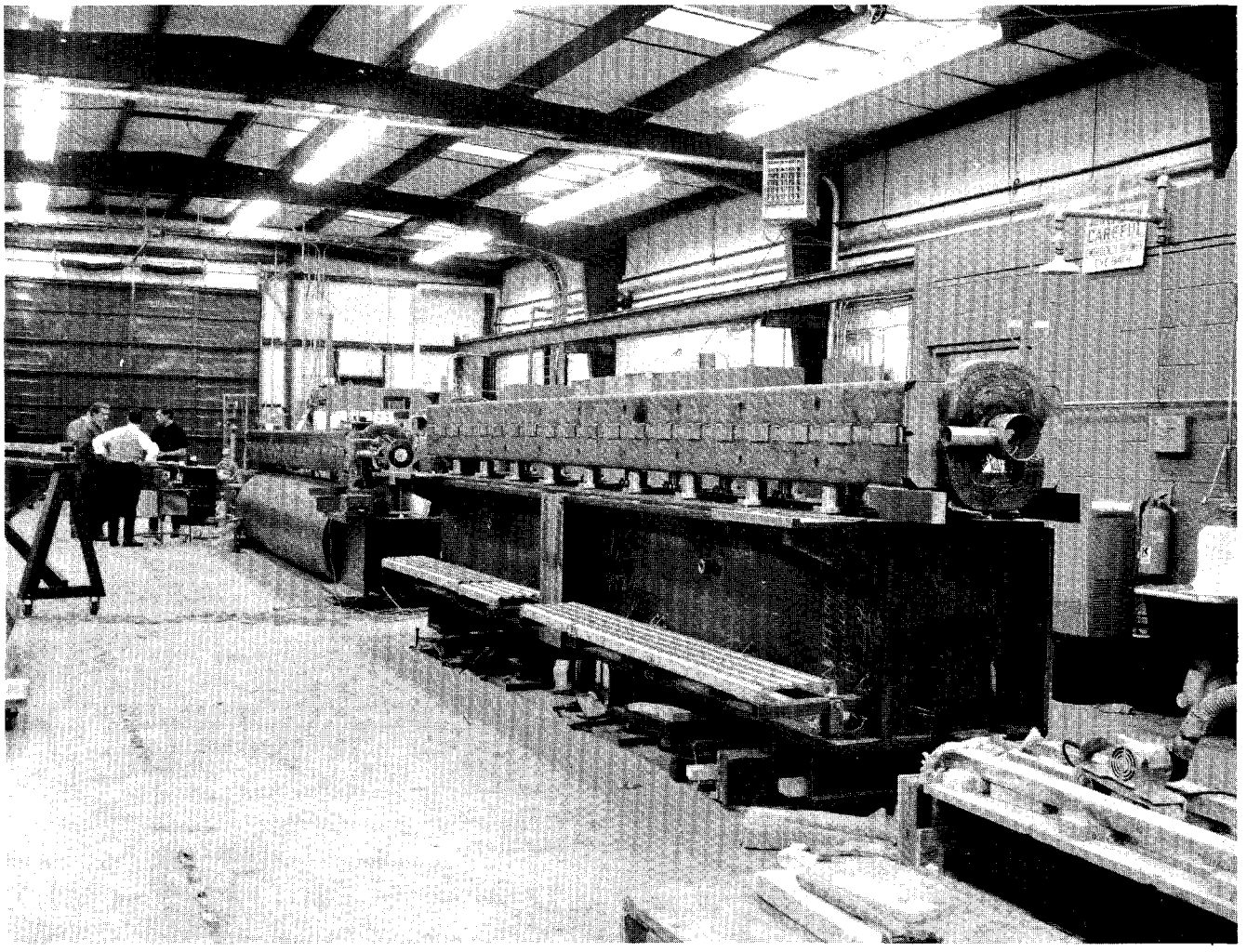
national accelerator laboratory FERMILAB-NAL-038

MONTHLY REPORT OF ACTIVITIES

January 31, 1970



FIRST PRODUCTION BENDING MAGNET

Operated by Universities Research Association Inc. Under Contract with the United States Atomic Energy Commission

NAL-38
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MONTHLY REPORT OF ACTIVITIES

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January 31, 1970

Abstract: This report summarizes the activities of the National Accelerator Laboratory in January, 1970.

General

1. Professors of the Month. Prof. C. N. Yang will lecture at the Laboratory on February 2 and 4 at 4 p.m. His topic will be "Droplet Models of High-Energy Collisions." Professors S. Fubini and G. Veneziano will lecture on February 12, 19, and 26. Visitors are welcome to attend.

2. Experimental-Facilities Workshop. The third Experimental-Facilities workshop will be held on Friday, March 13, starting at 9:30 a.m. The topic will be Experimental Area 1, the area being designed for neutrino beams and bubble chambers. Physicists who wish to participate are invited at attend.

3. Construction Progress. In spite of extremely cold weather, construction has proceeded generally on schedule. Figure 1 is an aerial photograph of the injection area taken in January.

Fig. 1. An aerial photograph of the area, looking northeast. The Ring Road is at the right. The Transfer Hall and Main-Ring Tunnel excavation are just to the left. Road A comes down from the top of the photograph and jogs around the Linac Building. The Booster Equipment Galleries can be seen in front of the Linac.

a. Main-Ring Enclosure. As anticipated in last month's report, notice to proceed on Phase II of the enclosure was issued to the Corbetta Construction Company on January 2. This contract covers the remaining four-fifths of the

underground ring, the service buildings, and the rf house above straight-section F. Completion date of the contract is February 14, 1971, with partial occupancies of certain areas at earlier dates.

Work is continuing on Phase I of the enclosure. Figure 2 is a recent photograph of work on the Transfer Hall. The contract is 23% complete.

Fig. 2. Concrete work on the Transfer Hall. The Cross Gallery is above it to the left.

b. Booster. We have taken occupancy of the Linac Extension, where the 200-MeV beam is bent down to the booster. The first equipment is being installed in this area. The booster tunnel is being painted and the equipment galleries above are well along. In particular, steel roof beams are in place on the west gallery. These galleries are visible in Fig. 1. The entire booster contract is 62% complete.

c. Cross Gallery. Steel erection is now taking place on the upper floor; this work is shown in Fig. 3. The contract is now 56% complete.

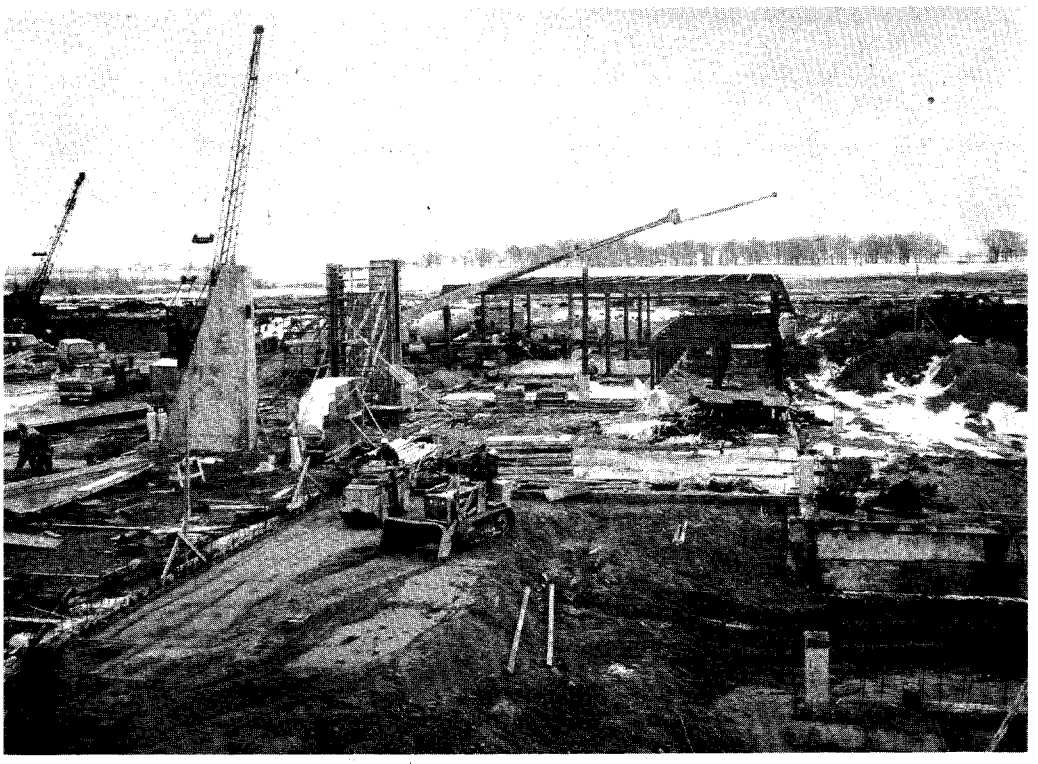

Fig. 3. Steel erection on the Cross Gallery. This photograph was taken from the roof of the Linac Building.

d. Industrial Buildings. Steel erection is complete on the first building and in progress on the other. The contract is 25% complete.

e. Master Substation. Work on grading and foundation caissons is in progress. The master substation is 17% complete.

Linac

1. Installation. Work is proceeding at a growing pace on installation. Figure 4 is a recent photograph of the Linac Gallery showing the state of the work. The control computer was moved to the temporary control room in the Cross Gallery Stub and was back in operation four days later.

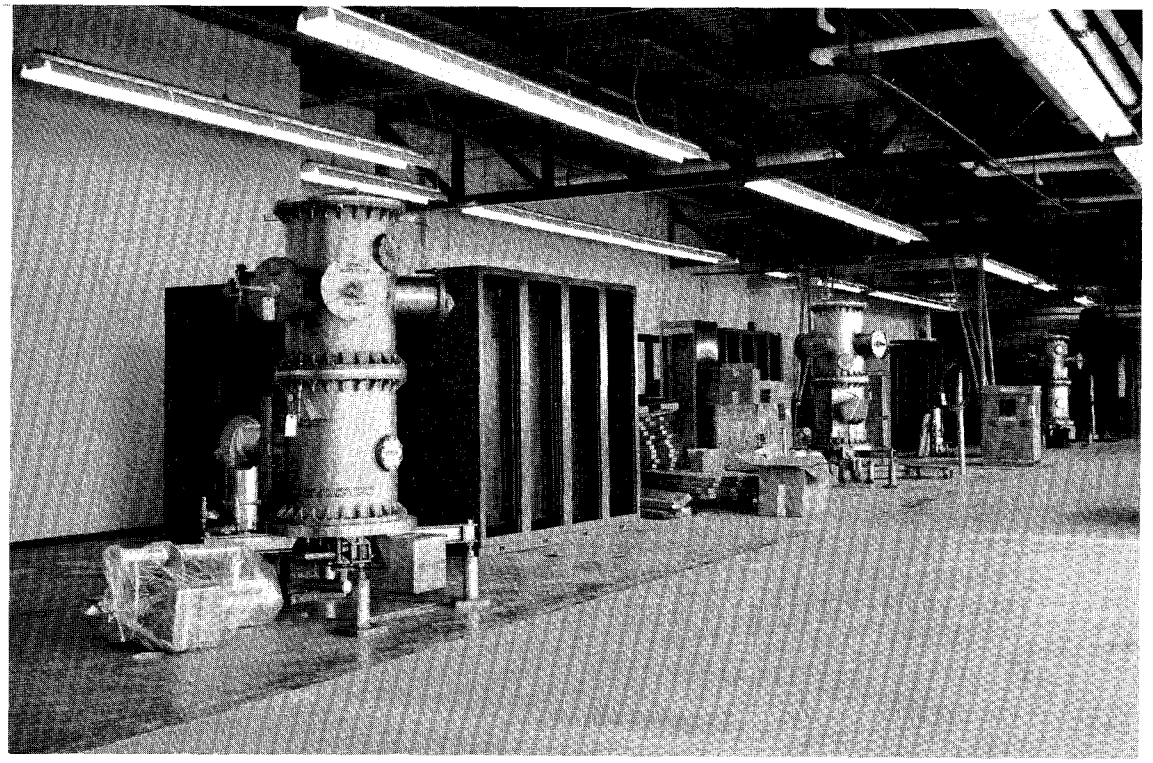

Fig. 4. Power-amplifier cavities and rf-system racks being installed in the Linac Building.

Main Accelerator

1. First Production Bending Magnet. The first production B2 magnet was completed in the main-ring laboratory on January 23. It has been excited to 22.5 kilogauss and detailed field measurements are in progress. Since that time, a second production magnet has also been completed. These two magnets are the cover photograph of this report. They will be installed in the prototype cell in the Village. Hopefully, they should also qualify subsequently to be a part of the final main-accelerator magnet system.

2. Magnet Handling Vehicle. A successful test was carried out with the transfer vehicle, which was constructed to carry magnets into the tunnel and put them in place. In this test, the vehicle picked up a bending magnet core from

actual supports, took it away, then brought it back and replaced it. The vehicle is shown in Fig. 5.

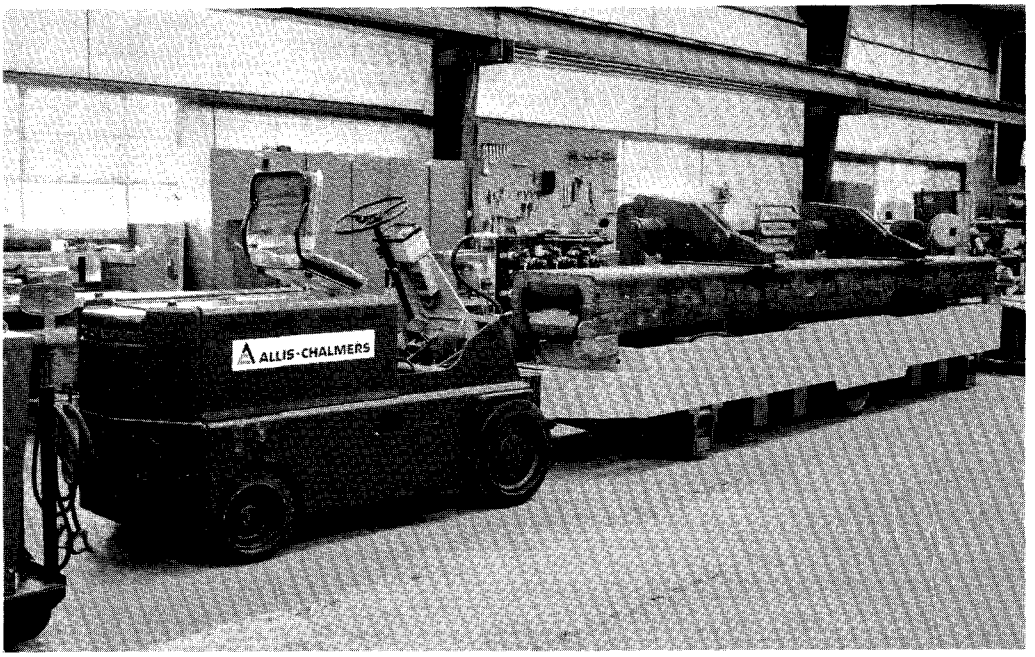

Fig. 5. Magnet-handling vehicle.

3. Fabrication. Contracts have been placed with two companies for 200 pairs of 7-foot quadrupole coils and, in addition, for 50 4-foot quadrupole coils. We are also placing a contract for 30 bending-magnet rectifier stations, a major part of the magnet power supply.

4. Vacuum Chamber. A new design has been developed for vaccum-chamber joints. Figure 6 is a photograph of a prototype joint of this design. In place of the flange on each end of a chamber section, a 6-inch diameter stainless-steel cylinder is welded to the chamber. Chamber sections are joined by welding these cylinders. Sections are disjoined by a cutter that is guided accurately by a groove in the cylinder surface. The positioning of this cutter has always been the most difficult part of the vacuum-chamber joint development; the groove will avoid this difficulty.

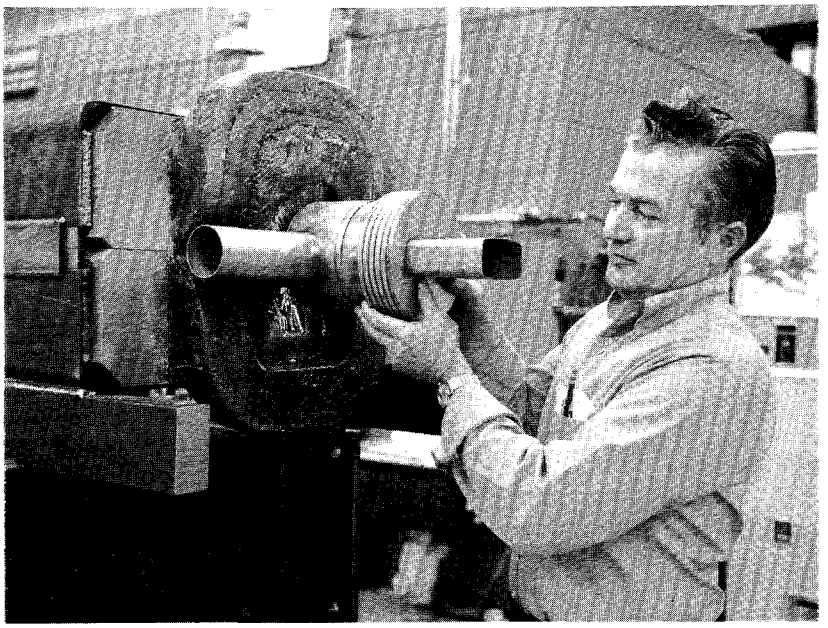

Fig. 6. Walter Pelczarski of the Main Accelerator Section and the vacuum-chamber joint he has developed.

Radio Frequency

1. Prototype Booster Cavity. The first prototype booster cavity has been installed in the booster prototype and operated at fixed frequency. This cavity is shown in Fig. 7. If has operated successfully both in a separate

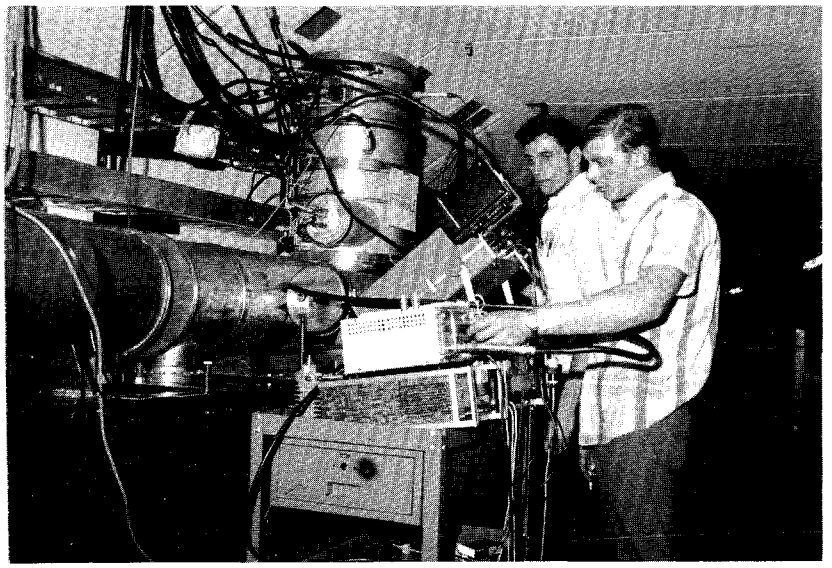

Fig. 7. The prototype booster rf cavity being worked on by Jim Vesely and Mark Augustine of the RF Section.

vacuum system and connected to the booster magnet vacuum system.

2. Fabrication. A contract was let in January for the main anode power supplies. Work is proceeding satisfactorily on chamber-body fabrication and on the other fabrication contracts.

Experimental Facilities

Activities of Task Forces. The muon beam task force has been examining three different types of muon beams. The first one uses a single (quadrupole doublet or triplet) lens to capture pions with a large solid angle, followed by a decay space. The length of the decay space has been a variable, ranging from 90 meters (as suggested by J. Christenson in SS-96) to 590 meters (the length of the neutrino beam as designed by Nezrick and Kang). The muons are momentum analyzed by a pair of bending magnets separated by a collimator (approximately 50 meters long). A part of the collimator will be filled with an absorber in order to filter out hadrons in the beam.

The second type of muon beam uses a high-flux pion beam, followed by a hadron filter and a collimator. It has been shown by a Monte Carlo computer calculation that either one of these two beams can produce a flux of the order of 10^7 muons/10^{13} interacting protons at 100 GeV/c ($\Delta p/p \simeq \pm 5\%$). The beam size is taken to be 4 inches by 4 inches.

The third type of beam is a more sophisticated one. The front end of this beam is designed to capture approximately 10^9 to 10^{10} pions (depending on the momentum) within a 10% momentum bite. This front end is followed by a 700-meter long decay channel containing 11 pairs of quadrupoles. Detailed design of the decay channel is in progress. This beam is expected to produce approximately 10^8 muons/10^{13} interacting protons at 100 GeV/c.