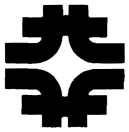

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MONTHLY REPORT OF ACTIVITIES

March 31, 1969

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MONTHLY REPORT OF ACTIVITIES*

F. T. Cole

March 31, 1969

General

1. Canadian Interest in NAL. A study of possible means of Canadian participation in the National Accelerator Laboratory has been completed by a Canadian group. A. W. Key of the University of Toronto has been a member of the Experimental Facilities Section of the Laboratory and played a major part in the Canadian study, which is titled "A Particle Physics Programme for Canada." The study has been supported by the National Research Council of Canada.

2. Construction Progress. Work began in March on the Booster Enclosure with excavation. A view of the construction site at the beginning of excavation is shown in Fig. 1. The "Black Hole," the analysis and debunching room inside the Booster ring, has been eliminated for reasons of economy. A simpler beam line outside the ring will carry the 200-MeV beam from Linac to Booster and will be equivalent in every respect except cost.

In the Linac Building, the walls of the preaccelerator house and the floor and parts of the walls of the linac-cavity enclosure have been completed. Figure 2 is a recent photograph of this construction.

Work on the rough-roads contract has been extended across Feldott Road toward Batavia Road, as can be seen in Fig. 3.

*This work was done under contract with the U. S. Atomic Energy Commission.

The structural work on the main-ring prototype enclosure, shown in Fig. 4, is virtually complete.

3. Appointments. We are happy that James R. Sanford has accepted an appointment as Head of the Experimental Facilities Section. A. L. Read, who as Acting Head has carried out with distinction the bringing of the work on experimental areas from its primordial beginnings to the present state of firm concepts, will continue as Associate Head.

Harold K. Ticho of the University of California at Los Angeles has accepted the post of head of the National Accelerator Laboratory Users Organization in Sanford's place.

4. Laboratory Staff. On March 31, at the end of the first quarter of 1969, the Laboratory has 376 employees, including 88 engineers and scientists.

Accelerator Theory

1. Long Straight Sections. Alternative lattices that require fewer kinds of quadrupoles have been worked out for long straight sections. As of this time, these alternative lattices possess some orbit disadvantages and work is continuing on the subject.

In a separate investigation, following a development by D. L. Edwards at Cornell University, it has been found that adjustment of the focusing quadrupoles in and next to the straight-section insertion makes possible a significant increase in the orbit parameter β_x. An increase of β_x by a factor 10 at the electrostatic extraction septum can be achieved with feasible parameters. This increase, if the modification is adopted, could result in an increase in extraction efficiency or it might allow us to choose a smaller

horizontal aperture in the main-ring magnets.

2. Design of the External-Beam Line. A conceptual design for the external-beam transport line has been worked out. This design has the desirable properties that the beam size throughout the beam line is within an acceptable range, and that the phase-space shapes of the beam are preserved from one branch point to the next.

Linac

1. Preaccelerator. In spite of difficulties with the building grounding system and with the resistor chain that distributes the voltage along the column, the voltage conditioning of the prototype accelerating column has been operating up to a voltage of 780 kV. The first 750 keV proton beam is planned for April. The mounted accelerating column is shown in Fig. 5.

2. Prototype Cavity. Machining of drift-tube holes and welding of studs on the tank has been completed.

Some difficulties were encountered in the electron-beam welding for the final closure of the drift tubes. No drift tubes have as yet been completed, but they will all be done within the next month.

A production prototype of the drift-tube quadrupole pulsed power supply has been tested satisfactorily at the fabricator.

3. RF System. Assembly of the rf system is proceeding. The power-amplifier tube and cavities and the modulator have been installed and the filament power supply has been received. A complete system test is expected to take place in April.

Booster

1. Magnet Program. The heat-cured model magnet has been baked out

and is now undergoing vacuum tests. The first results indicate that the outgassing of this magnet is almost 100 times lower than that of the previous cold-cured magnets.

Modelling work is also being carried on to determine the magnet end shapes.

2. Magnet Power Supply. It has been decided to utilize biased power supplies (this method is called "series pumping") rather than separate ac and dc supplies. Specifications for both the prototype and final supplies are now complete.

Main Ring

1. Model Quadrupole. A 3-foot model quadrupole has been assembled. It is shown in various stages of the work in Figs. 6, 7, and 8. Even after reworking, the coils fit poorly. Portions of the length are within tolerance, so the magnetic design can be tested. The portions that fail to meet tolerance will be used to test the analyses that have been made of construction tolerances. Another set of coils from a different fabricator will be delivered within the next two weeks.

Beam Transfer

1. Electrostatic Septum. Model testing on the elctrostatic septum has begun, with promising first results. A set of 2-mil wires spaced 50 mils apart has held an electric field of 70 kV/cm. The present design field is only 40 kV/cm. These results make the fine-wire grid septum look feasible and attractive.

Experimental Facilities

1. Study of Proportional Wire Planes. A wire-winding apparatus has been

built and is performing adequately. One wire plane (20-micron wires spaced at 3mm) has been constructed and tested. We have verified that the voltage gain vs. applied voltage is as expected in the proportional region. Preliminary studies are also in progress of methods for handling the associated electronics and computer-interfacing problems.

2. Neutrino-Beam Design Studies. These studies are continuing. We have been led to the tentative conclusion that it is possible to construct a neutrino-beam shield of fixed length that will range out either 200 or 400 GeV muons without appreciable loss of flux by changing the density of the shield when the accelerator energy is changed.

3. Superconducting-Devices Development. A small solenoid made with 21 strands of superconductor cabled into "Litz wire" (twisted strands) has been tested. There are turn-to-turn shorts in the coil because of poor insulation on the individual strands. The tests showed operation up to the short-sample characteristics at over-all current densities of approximately 18,000 A/cm^2. The coil exhibits charge-rate sensitivity, which can be attributed to these strands. The coil is being rewound with additional insulation.

Fig. 1. The Booster-Enclosure construction site as excavation begins. The view is toward the south from the high-energy end of the Linac Building.

Fig. 2. A recent photograph of the Linac Building work, looking from the high-energy end.

Fig. 3. Work on the rough roads. The view is toward the northeast. Batavia Road is in front of the farmhouse.

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Fig. 4. The Main-Ring Prototype Enclosure in the village. The closer section is concrete and the further section corrugated steel. The prototype utility building is behind, to the left of the inflatable building.

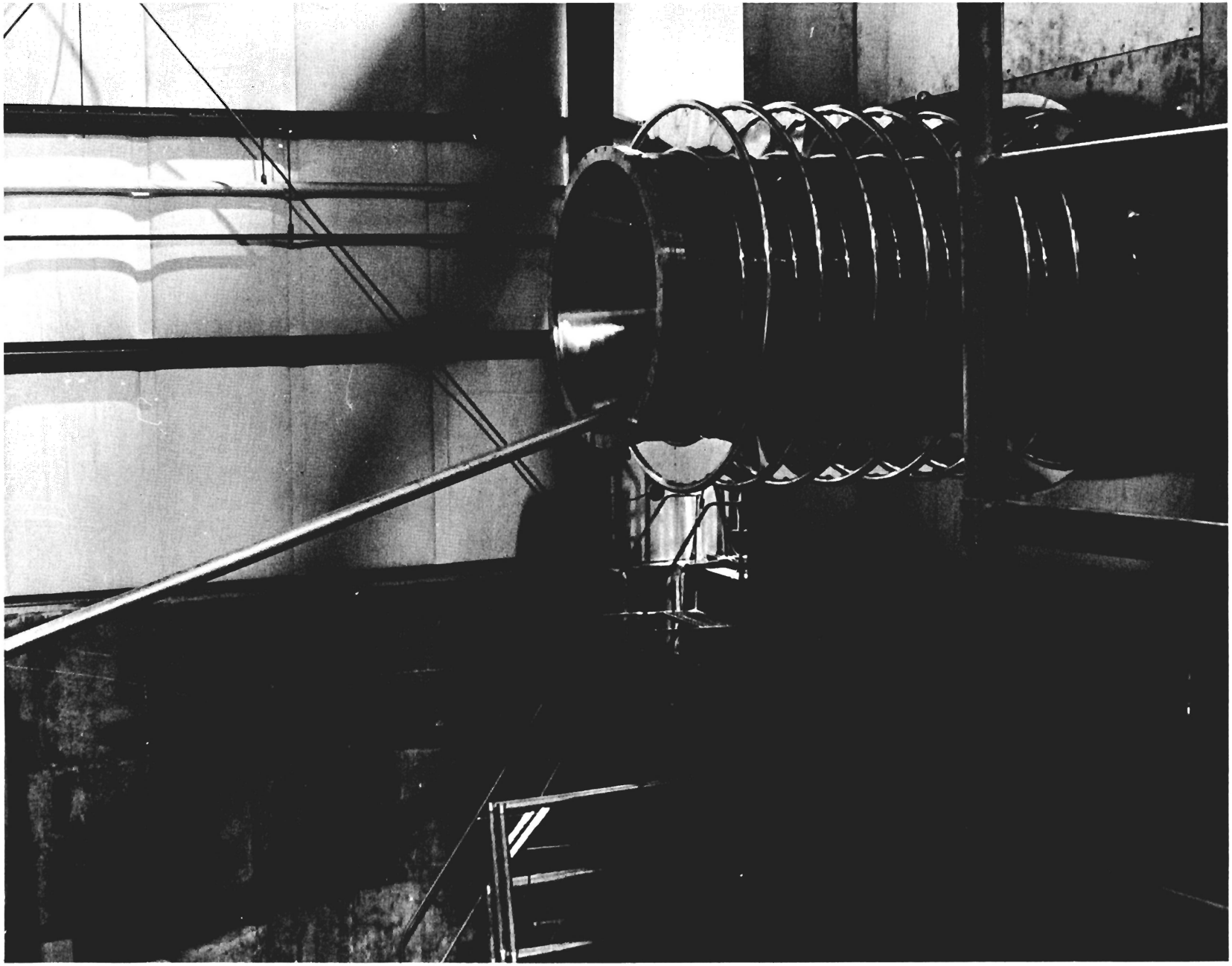

Fig. 5. The high-gradient accelerating column in place. The high-voltage supply is to the left and the prototype 10 MeV cavity behind the wall to the right.

Fig. 6. Joseph Otavka and Arthur Gilbertson of Main-Ring Section stacking laminations of the model quadrupole.

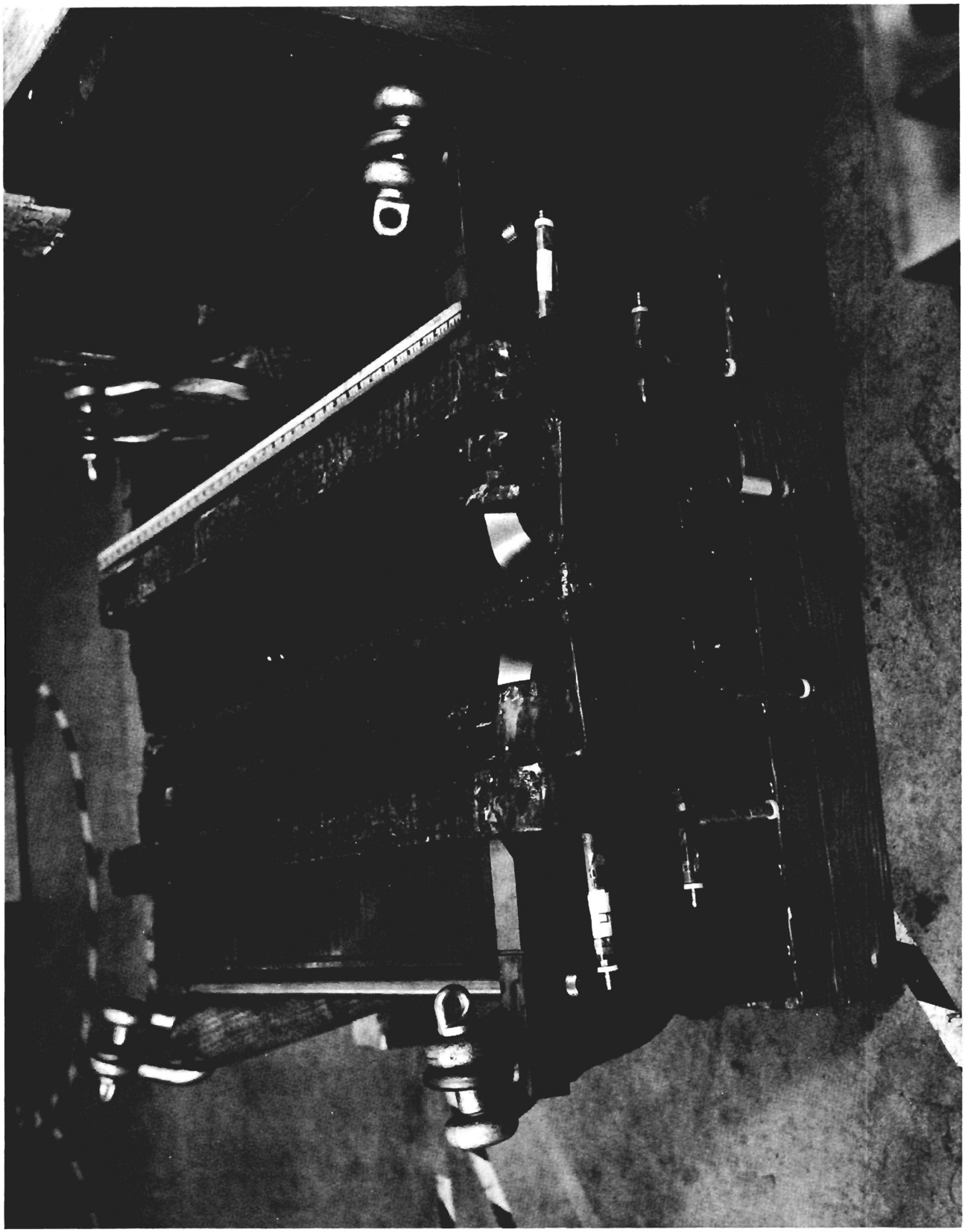

Fig. 7. One half of the model quadrupole with coils in place.

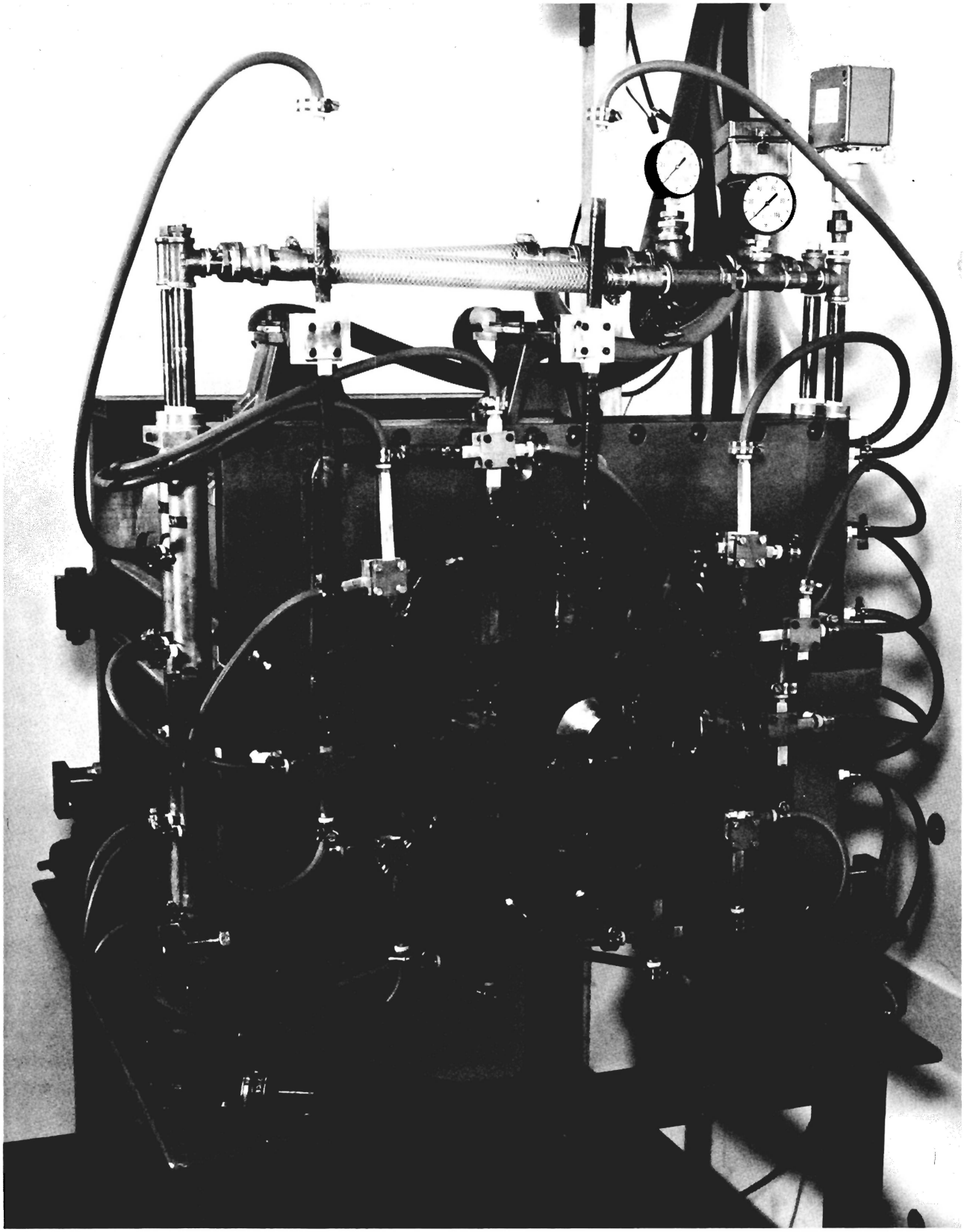

Fig. 8. The completed model quadrupole.