2.1 STATUS OF ANL 12-FT HYDROGEN BUBBLE CHAMBER

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The general features of the 12-ft hydrogen bubble chamber design are given in other papers to this meeting. I would like to present the evolution and the present status of the project. The proposal was submitted in 1964; the project was authorized and funds made available in May of 1965. At that time the basic design concept was as shown in Fig. 1. We had not yet decided whether we should use a superconducting coil or a conventional coil, or the exact position of the cameras. We had decided that the chamber would be viewed by four cameras located in the top head of the chamber and expanded by means of a bottom expander incorporating a toroidal bellows with a diameter approaching that of the chamber. The design was fixed with a two-pole iron yoke and, at that time, we decided to carry out parallel designs of superconducting and conventional coils compatible with the same iron design. This decision essentially limited the field at 18-20 kG and constrained the superconducting coils to have their own vacuum container. In the summer of 1966 we made the decision for a superconducting coil and moved the cameras to a 7-ft diameter circle. We received authorization to purchase hardware for this design in August 1966. We have proceeded since that time with the procurement of the major items; orders have been placed for such items as the chamber body, vacuum container, magnet iron, and the coil cryostat.

With this introduction, it is clear that the chamber is basically a "66 model" with only the design of the "trim" to be added in '67. Now, let me outline the status of various systems of the 12-ft chamber.

As mentioned above, the iron yoke for the magnet has been ordered and several of the 100-ton pieces have been cast. A wooden casting pattern for one of the return legs of the magnet iron is shown in Fig. 2. The material for the cryostat is on hand and the superconductor for the winding is expected to start arriving at ANL in June of this year. The coils will be wound at ANL and this is scheduled to start in July of this year. The design of the superconducting coil assembly is nearly complete; the final design decisions on the coil clamping will be made after modeling tests which will be complete in late summer of this year.

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The expansion system of the chamber consists of a near-full diameter piston connected to the chamber walls by a toroidal bellows. The piston is connected by means of a rod to a resonant hydraulic system located beneath the iron. This consists of a large room temperature, piston-cylinder combination and hydraulic accumulators. This oscillating system is controlled by a 5-in. orifice poppet valve. A detailed description of this system is given by J. D. Simpson in a later paper. The bellows will be hydraulically free-formed at ANL. Forming of the first full size unit, shown in Fig. 3, has been completed; although this bellows is not acceptable, the results are very encouraging. The large chamber piston as well as the hydraulic piston and cylinder are in the final stages of design. The 5-in. clamping valve has been manufactured and dynamic testing will begin in June of this year.

In the optics and photography area, the mockup of the final film drive will be ready for testing late in the summer of this year. The general features and state of the lens design are described in later papers by A. Tamosaitis and W. T. Welford. The design details of the seals of the hemispherical windows have not been finalized and represent our most lengthy development program. Our approach is to incorporate a solder bond between the glass and the metal flange. We are presently working out the details of withdrawing and servicing the camera cartridge for flash-tube replacement and film platen cleaning. The Scotchlite attachment to the internal shroud and the details of fiducial marks within the chamber have yet to be finalized.

Another area in which design work is continuing is in the temperature control of the chamber. Our general approach is that all the heat conduction leaks are intercepted by hydrogen heat exchangers. The dynamic heat input is removed by a heat exchanger located at the top of the chamber. The design utilizes a shroud arrangement to direct the flow and to route the heat (arising from the bottom expander) to the top of the chamber and not through the useful volume. Another heat exchanger is located in the bellows region for removing a portion of the heat generated in that region. We planned initially to overcool the bellows region, but we have not been able to conceive of a simple design which "insulates" the cold region from the chamber proper. A model has been used to study this problem. The problem in the design of these heat exchangers has been the lack of knowledge of the dynamic heat load. The major contribution to dynamic heat load will undoubtedly be parasitic boiling; however, the determination of this heat load has perhaps an order of magnitude of uncertainty.

The buildings and cryogenic supply system are presently out for bid and we expect to start construction on these within one month. The first pieces of major equipment are expected to arrive at the beginning of 1968. We are scheduled to take possession of the cryogenic supply system in about June of 1968. The superconducting coils are expected to be installed in the magnet iron in August 1968. If all goes as scheduled, cooldown of the completed assembly will be in the summer of 1969.

LIST OF FIGURES

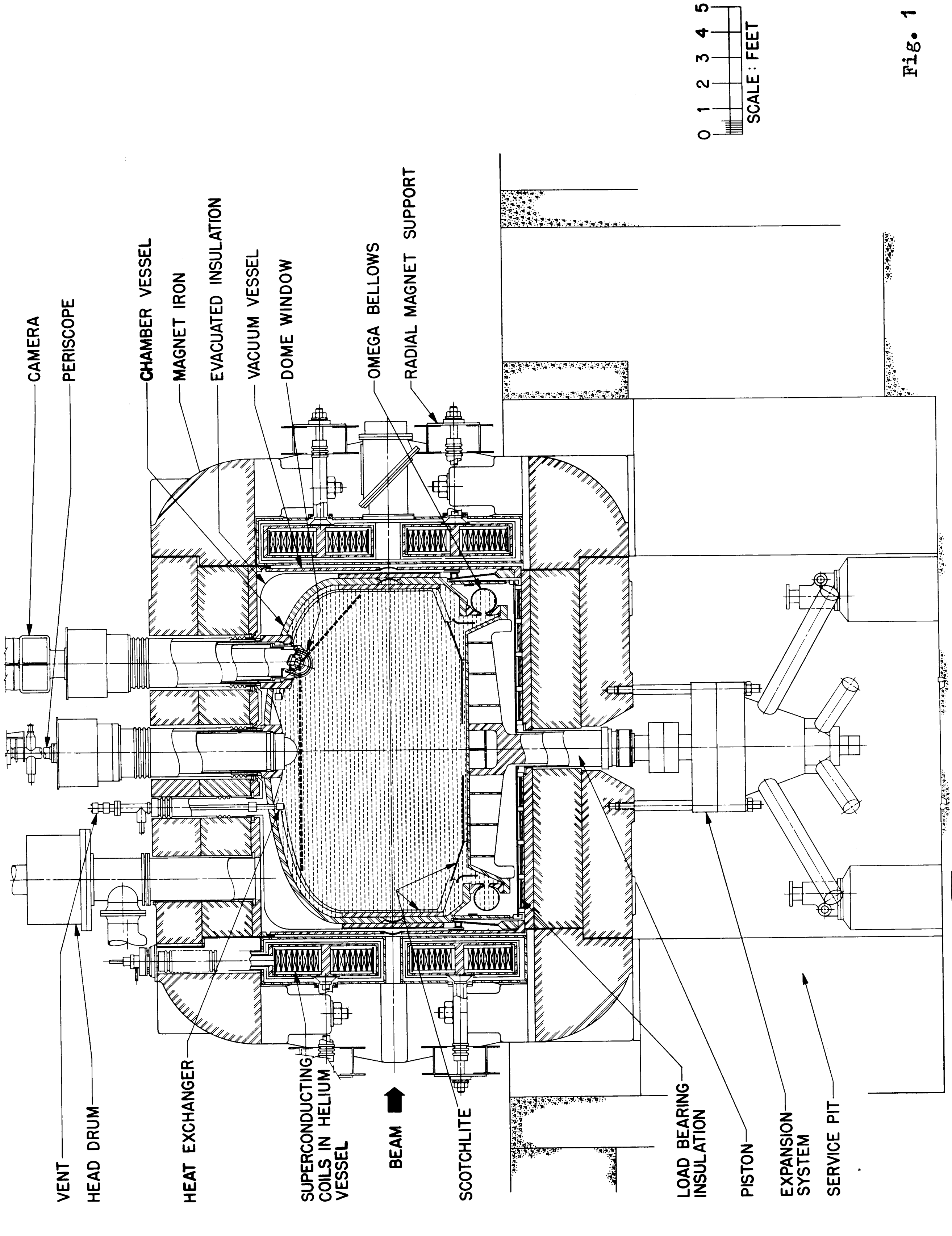
CAMERA
PERISCOPE
CHAMBER VESSEL
MAGNET IRON
EVACUATED INSULATION
VACUUM VESSEL
DOME WINDOW
OMEGA BELLOWS
RADIAL MAGNET SUPPORT
VENT
HEAD DRUM
HEAT EXCHANGER
SUPERCONDUCTING COILS IN HELIUM VESSEL
BEAM
SCOTCHLITE
LOAD BEARING INSULATION
PISTON
EXPANSION SYSTEM
SERVICE PIT
0 1 2 3 4 5
SCALE : FEET

Fig. 1

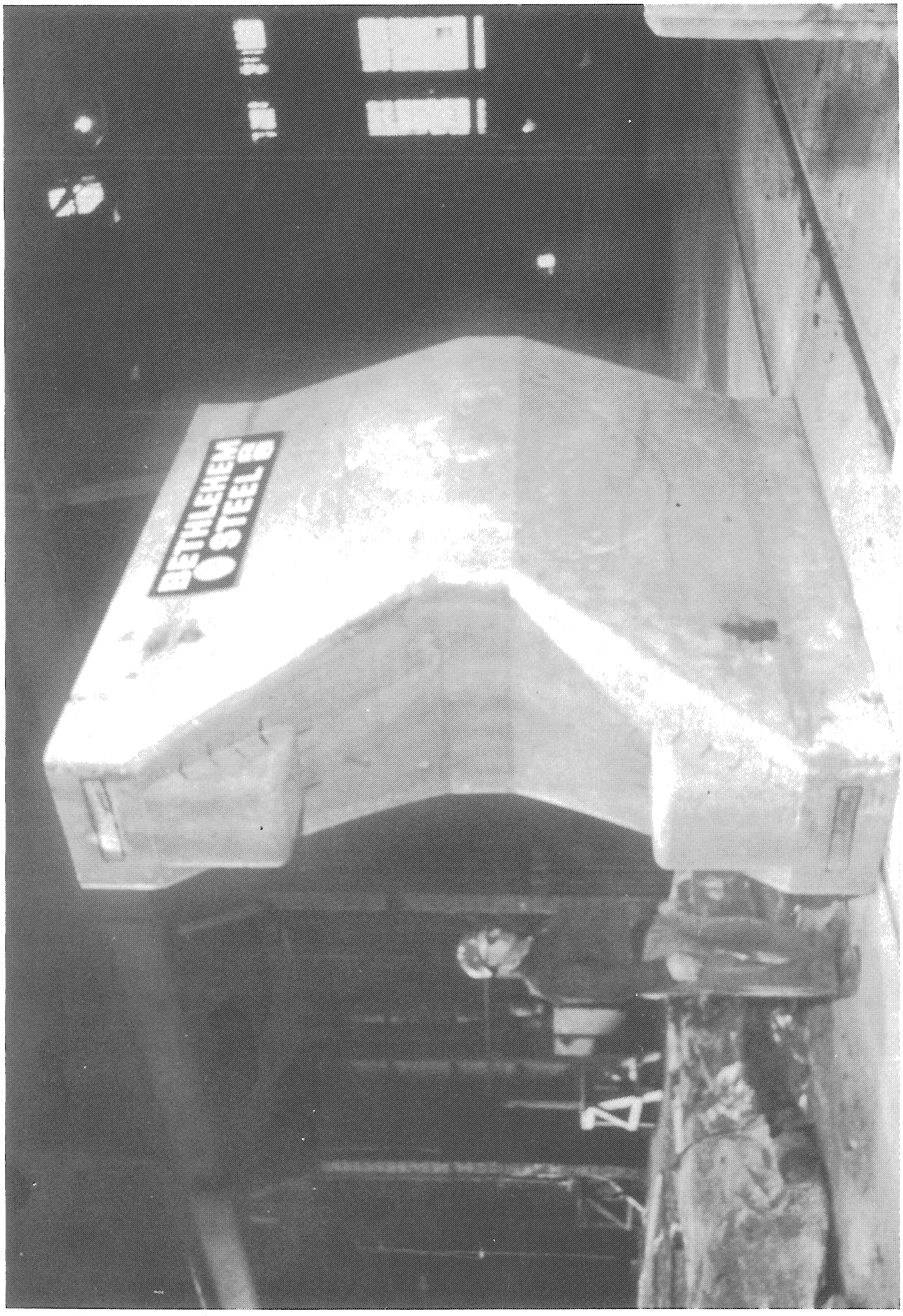

Fig. 2

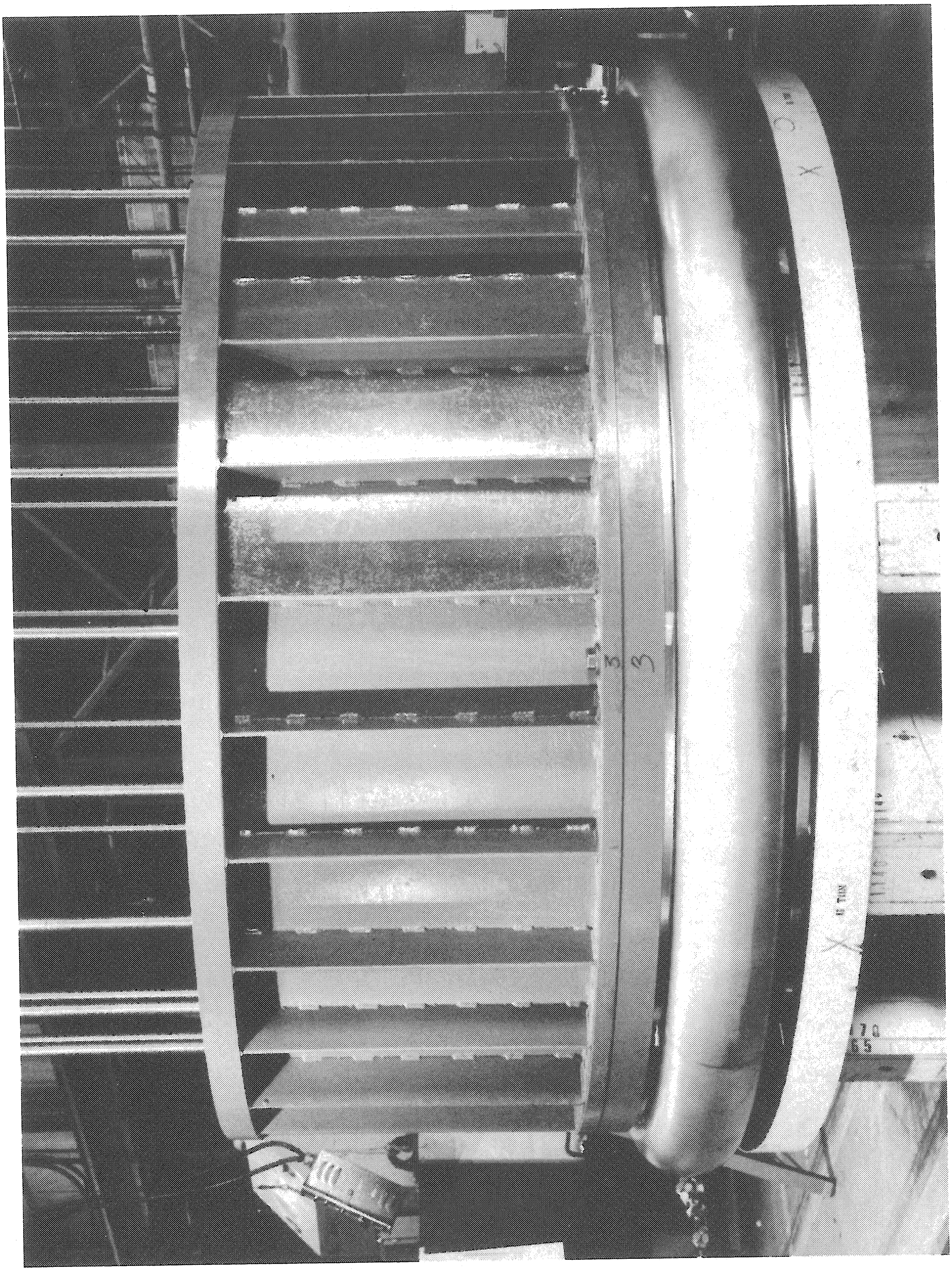

Fig. 3