Some mention should be made of the actual method of constructing the tunnel. Studies of the soil structure in the Berlin area showed a high percentage of sand. For this reason it was decided that the tunnel should be lined with steel. The same sand content contributed greatly to the danger of cave-ins at the face of the tunnel, and to eliminate this risk a shield was devised (see figs. 7 and 8) with horizontal "blinds" so arranged across its face that should even dry sand be encountered the danger of cave-ins was virtually eliminated. The tunnel liner was formed of sections of heavy steel plate so constructed that, when bolted together, five sections formed a steel ring approximately six feet in diameter and 15 inches long. Provision was made for bolting these rings together to form a continuous tube of solid steel. The men worked under cover of the shield described above (which was slightly larger in diameter than the steel liner) and when sufficient material had been excavated, the shield was forced forward with hydraulic jacks and a new section of liner was bolted in place. Since this method left a void of approximately one and one-half inches around the liner (remembering that the diameter of the shield was greater than that of the liner), screw-type removable plugs were built into every third section of tunnel liner. This permitted removal of the plugs and the forcing of grouting material under high pressure to fill the void

Figure 7 - Blinds on the Shield

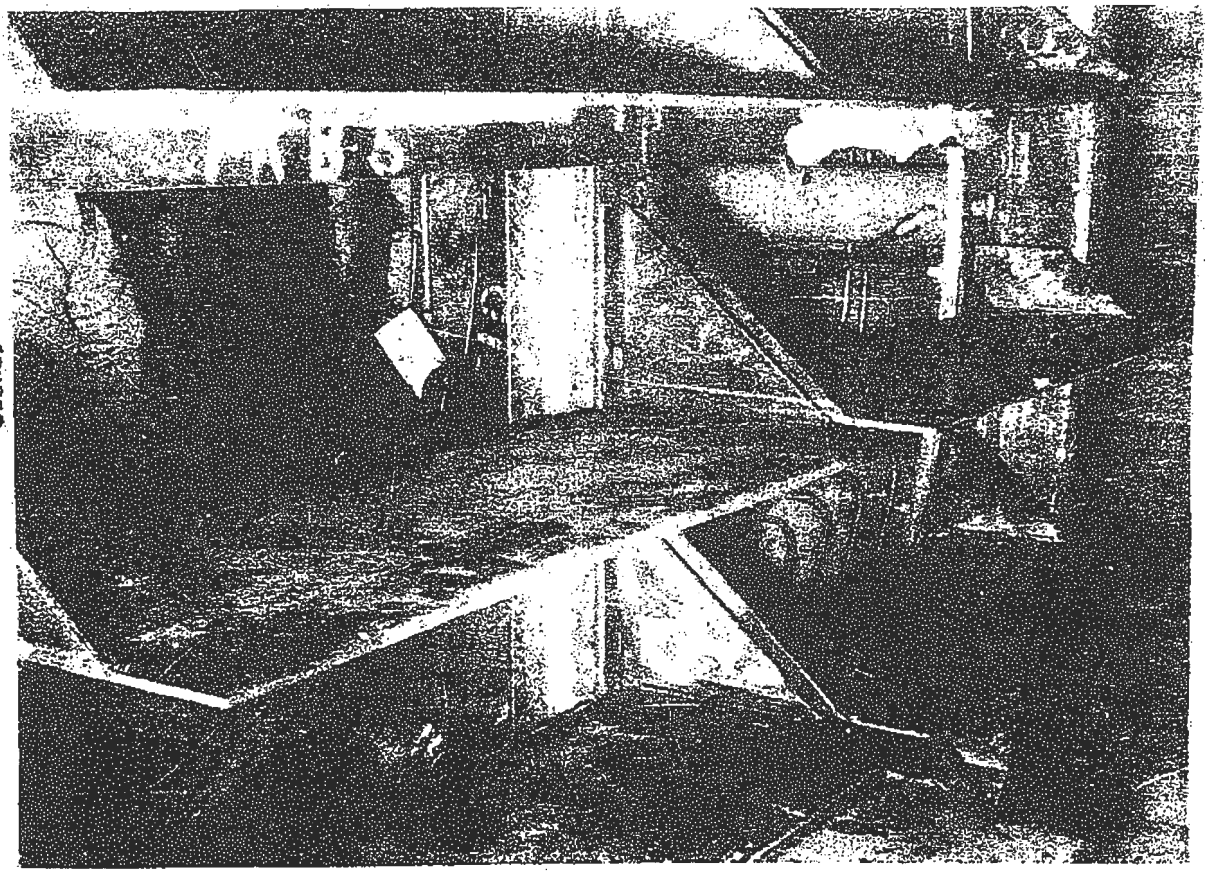


Figure 7 - Blinds on the Shield

Figure 8 - Excavating Using the Blinds

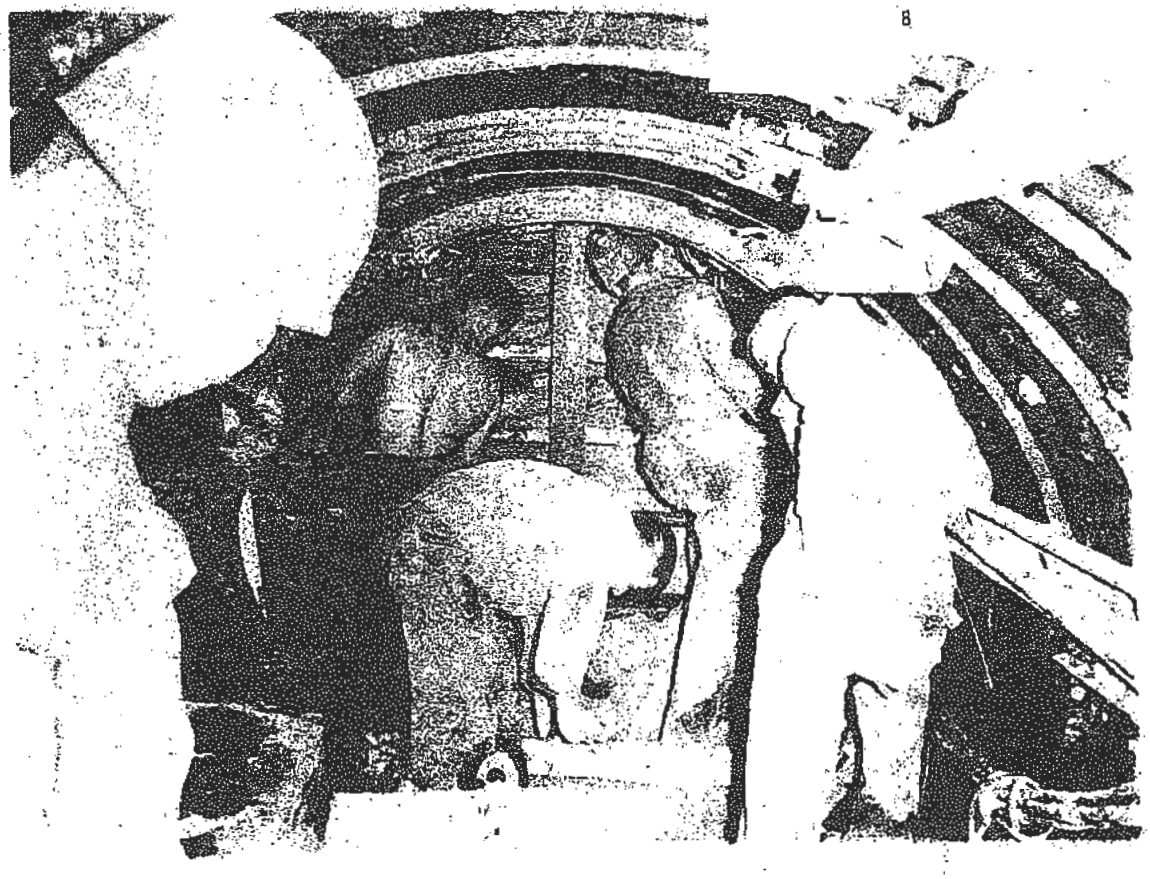


Figure 8 - Excavating Using the Blinds

after the liner was in place. It was calculated (and subsequently proven to be true) that this method of construction would not permit settling of the soil and detection of the tunnel from the surface. (See fig. 9.)

Meantime in the U.K. British engineers constructed a mock-up of the tunnel's terminal end and fabricated an ingenious device which worked in principle like the tunnel "shield" described above, with the difference, of course, that the blinds (which closely resembled a conventional venetian blind) were horizontal but so hinged as to permit vertical excavation. This permitted excavating cautiously across the upper face of the vertical shaft in small areas and then jacking the entire structure up at the optimum rate. (See fig. 10.) Available plans indicated that the cables were buried some 27 inches deep along the side of a heavily traveled highway. The top of the vertical shaft (see fig. 11) then needed to be approximately 12 to 14 inches below the surface of the highway in order to give the tapping crew room to work below the ceiling of the shaft, and the whole structure had to be capable of supporting the weight of heavy trucks since the tunnel and tap chamber lay directly beneath the highway. (See fig. 12.) Considerable care was devoted to insulating the

Figure 9 - View of the Completed Tunnel

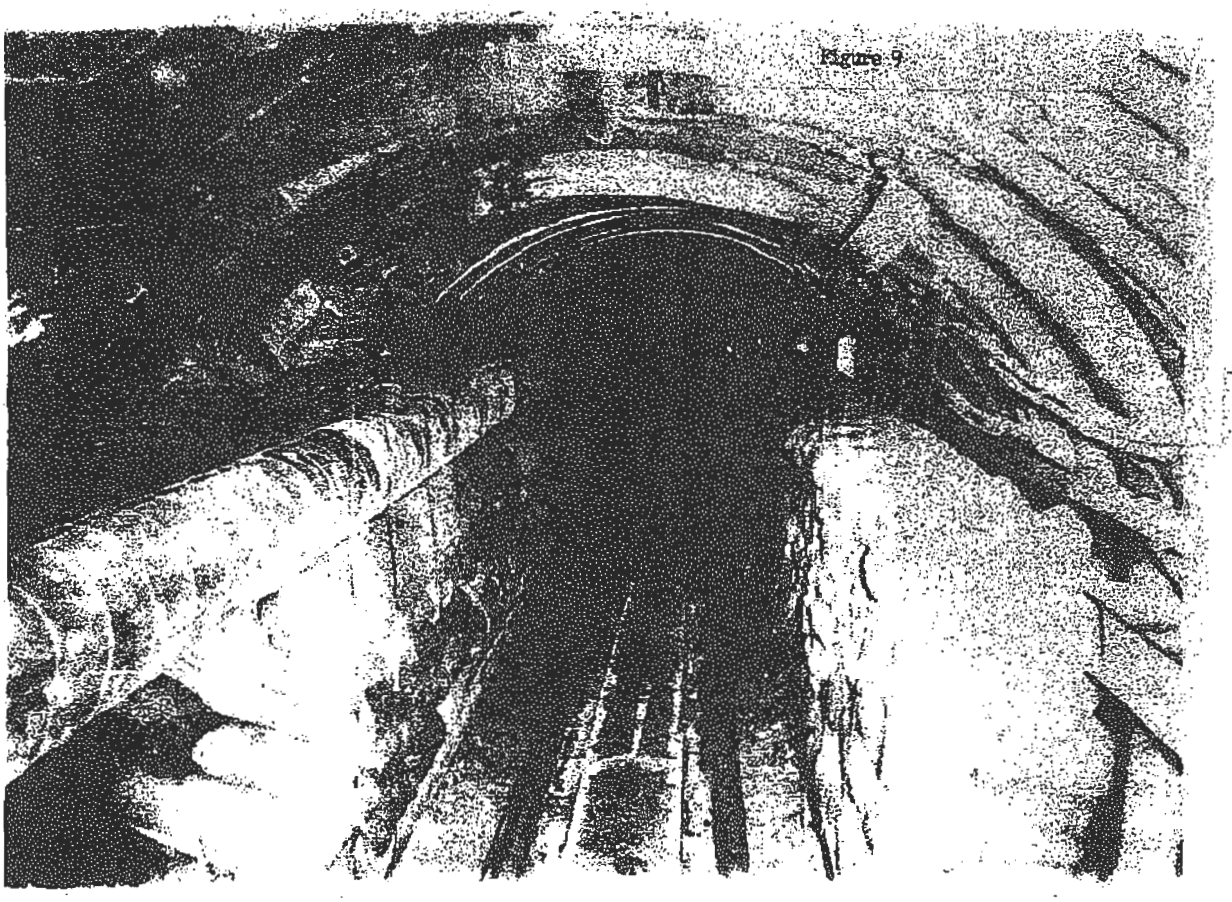


Figure 9 - View of the Completed Tunnel

Figure 10 - Construction of the Vertical Shaft

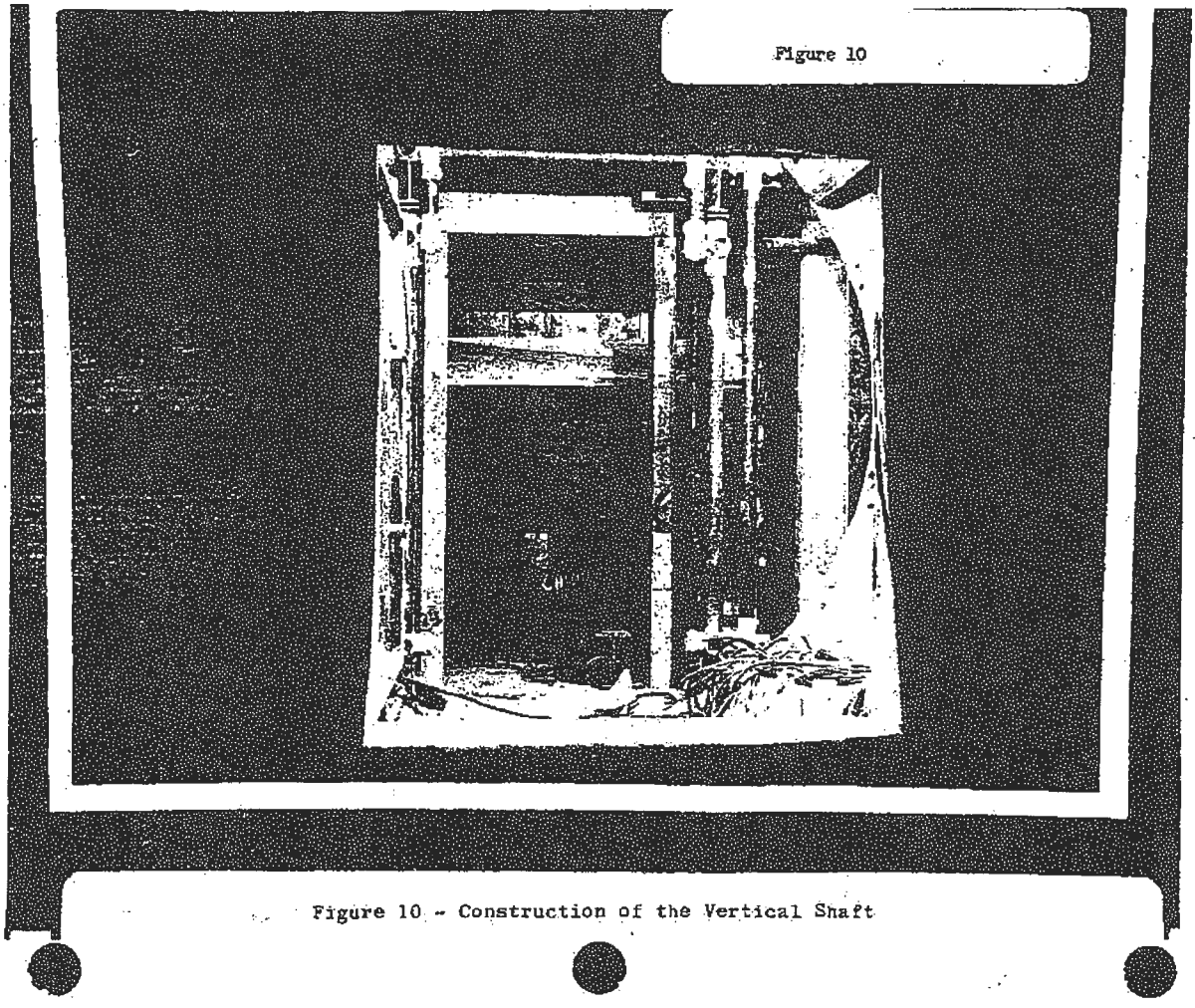


Figure 10 - Construction of the Vertical Shaft

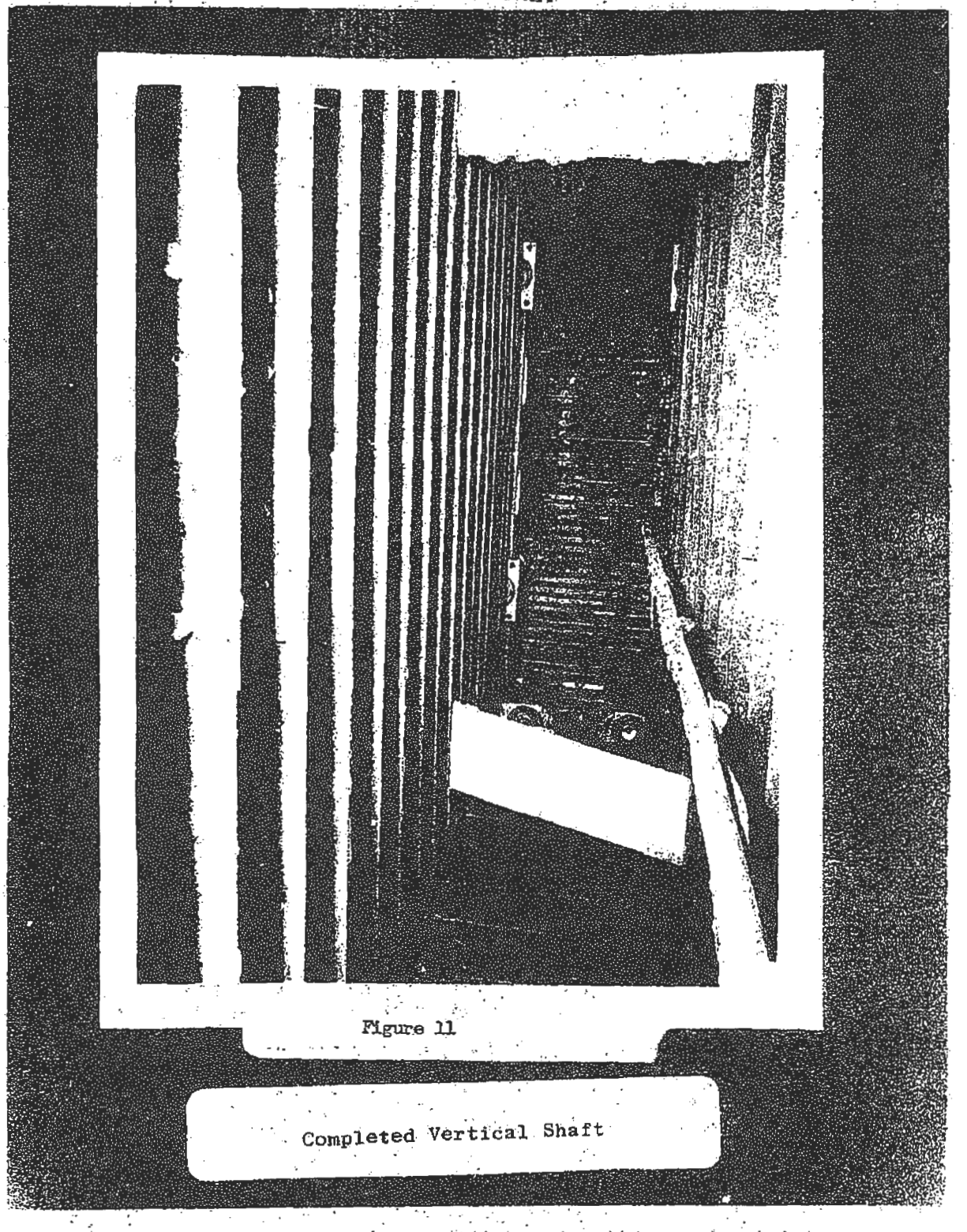


Figure 11

Completed Vertical Shaft

Figure 12

View of Cables and Taps

tap chamber to prevent its acting like a huge drum.[3/]

Considerable thought was given to the quantity and content of the material available from the target and the manner in which it was to be processed. It was in this field, perhaps, that we experienced some of our greatest problems. It had been decided very early in the project's planning stages to maintain the strictest possible security measures. As a minimum precaution security checks were made on each individual who in any way became knowledgeable of the project's mission, and the same standards in force for clearances for Special Intelligence were utilized. A list of briefed personnel was maintained, special secrecy agreements were executed, and special briefings were given to all knowledgeable personnel. It was in the assemblage of a processing team that we experienced our greatest problem in maintaining security standards. Since the material to be processed was largely Russian voice, it was thought that we would need linguists with near native fluency in Russian. It is axiomatic that native fluency is usually available only in natives, and

---

3/ In spite of the insulation, it was a weird sensation to be in the chamber when an iron-shod horse trotted across it. We also suffered some anxious moments one foggy morning when the microphone in the tap chamber gave forth with a continuous series of dull thuds. After the sun burned away the fog, visual observation showed that the East German police had set up a temporary automobile checkpoint directly over the chamber. The "thuds" the microphone picked up were caused by the police officer in charge stomping his feet on the road surface to keep warm.

natives were not clearable for the project. Although we were never successful in obtaining as many linguists as we needed, we were successful, through careful screening and intensive language training, in assembling a minimum crew for the job. This necessitated screening each personnel file in the Agency of those individuals who claimed any knowledge of German or Russian, arranging interviews and language tests, and negotiating transfers to the project. The Agency's language capabilities then were considerably less than now and some of the negotiations proved, to say the least, difficult.

III. IMPLEMENTATION

By 17 August 1954 things were beginning to take shape and the situation was as follows:

a. The German contractors had completed the compound and we were in possession.

b. All of the basic supplies, equipment, and personnel were in Berlin ready to start construction on the tunnel. This in itself involved transporting 125 tons of steel tunnel liner from the ZI to Berlin. The initial shipment across the East Zone to Berlin consisted of one and one-half freight trains, the loss of any package of which could have blown the project. For security purposes all sensitive items, such as the tunnel liner, were double crated and banded and subjected to severe drop tests before they left the ZI. Similar items were differently packaged for deception purposes.

c. Space at Headquarters was secured and the Office of Communications had assembled a crew and was well under way in fabricating the unique equipment necessary to process the anticipated telegraphic traffic.

d. Initial personnel had been selected and were being processed for both the Main Processing Unit (MPU) in London and the Technical Processing Unit (TPU) in

Washington. It should be noted that personnel and equipment were programmed initially to exploit approximately ten percent of the anticipated take. In retrospect, perhaps this could be considered overly cautious. In justification of this decision it should be said that no one had ever tunneled 1,476 feet under clandestine conditions with the expectation of hitting a target two inches in diameter and 27 inches below a main German/Soviet highway. There were those who manifested certain reservations on the feasibility of so doing, and it is greatly to the credit of those senior officials, both civilian and military, that, in spite of these reservations, the project was permitted to proceed.

In late August a vertical shaft some 16 feet in diameter was started in the warehouse basement floor (see fig. 13) and ground water was encountered at 16 feet instead of at the predicted 32 feet. Such examination as could be safely undertaken under the steady observation of East German border guards and Soviet officials indicated that a clay lens existed in this particular spot, creating a "perched water table" the magnitude of which was unknown. Available information indicated that the clay lens possibly sloped down in the direction of the target and it was decided to proceed with the tunnel even though the top cover was to be less than half what had been anticipated.

Figure 13 - Shaft and Tunnel Entrance in Warehouse Basement

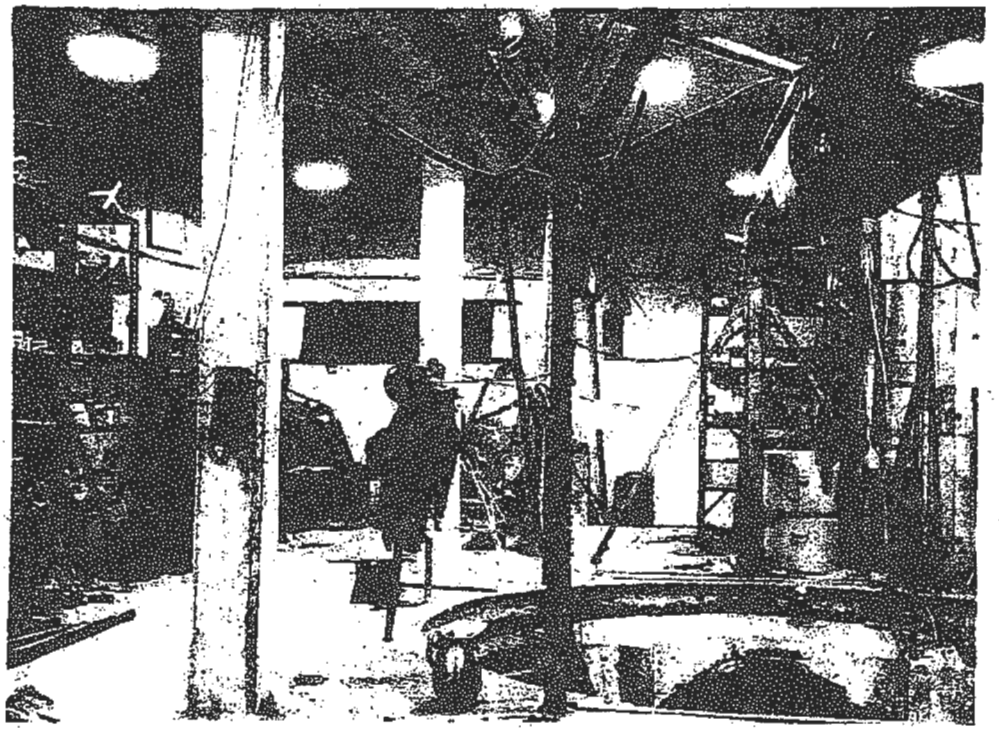


Figure 13

Shaft and Tunnel Entrance in Warehouse Basement

Careful visual observation was maintained and tunneling operations stopped each time the German guards walked over the tunnel on their regular patrols. Pumps were installed to take care of the excess water. Observation logs were maintained, and since the highway under observation was the main road from East Berlin to the Schoenfeld Airport, considerable Order of Battle information was obtained. It was also possible to estimate quite accurately the relative importance of individuals visiting East Berlin by observing the security precautions taken by the East Germans and the Soviets.

Both sides of the tunnel were lined with sand in bags as the tunnel proceeded and the excess spoil was hauled back to the basement of the warehouse. To facilitate movement, a wooden track was laid on the floor of the tunnel and a converted electric fork lift was used to pull a string of rubber-tired trailers back and forth in the tunnel. (See fig. 14.) Cool air was supplied to the face of the tunnel through ductwork from an air conditioning unit located in the warehouse. The tunnel was completed on 28 February 1955. Construction of the tap chamber commenced 10 March 1955 and was completed, with the three target cables exposed, on 28 March 1955. (See fig. 15.)

To appreciate this accomplishment it is necessary to remember that the tunnel was 1,476 feet long (roughly the

Figure 14 - Converted Fork Lift and Dirt Box

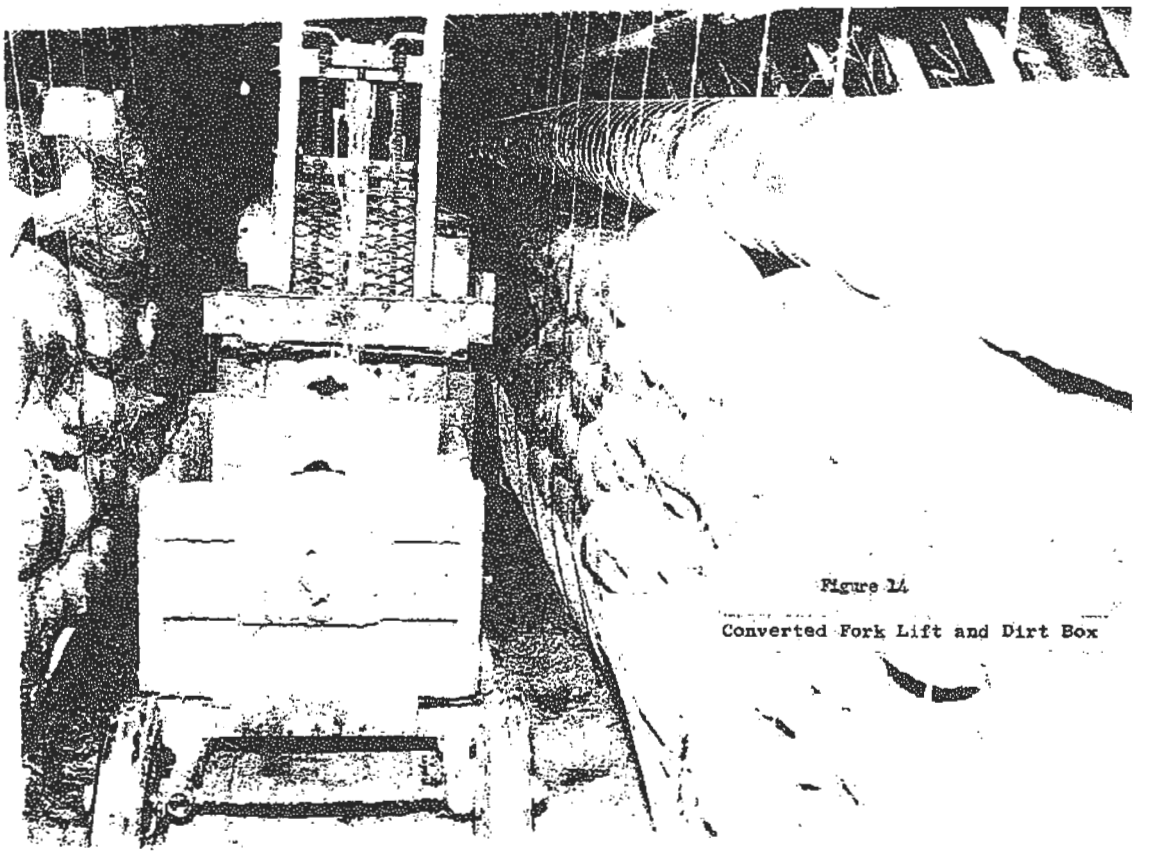


Figure 14

Converted Fork Lift and Dirt Box

Figure 15 - Target Cables Exposed

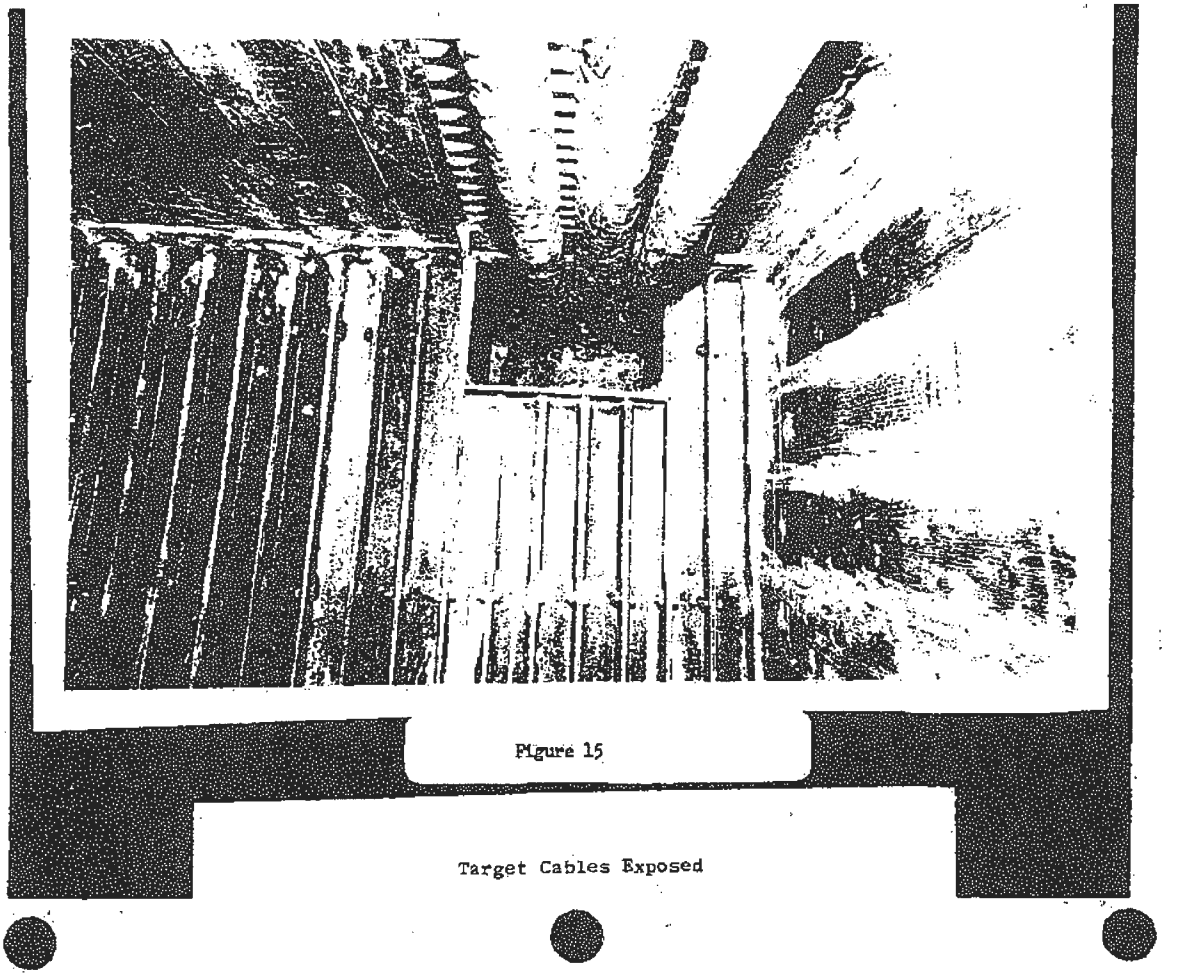


Figure 15

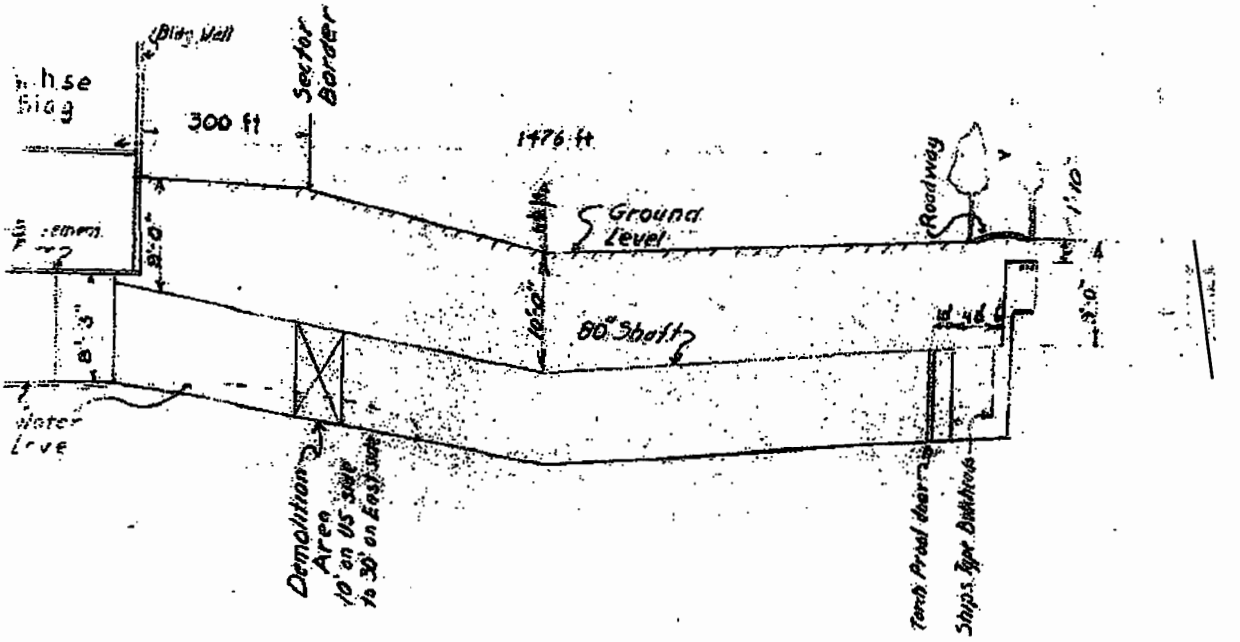
Target Cables Exposed

length of the Lincoln Memorial reflecting pool) and that the first half sloped down and the second half sloped up. (See fig. 16.) The lack of an adequate base line made the surveying problem especially difficult. The engineers decided at one point that an object of known size in the East Zone would be useful as a reference point, so a baseball game was organized with the objective of knocking a baseball as far into the East Zone as possible. This scheme was frustrated by the friendliness of the East German guards who kept returning the baseball. Nonetheless, the engineers expressed confidence that they knew their position when the tunnel was completed to a point which could be contained in a six-inch cube. They were correct.

Excess humidity is probably one of the greatest enemies of electronic equipment. To guard against this problem the section of the tunnel immediately adjacent to the tap chamber was insulated and sealed with marine-type plywood to form, in effect, a closed room. (See figs. 17 and 18.) Vapor barriers were erected and, in addition, a heavy "anti-personnel" door of steel and concrete was constructed to seal off the tunnel some 15 yards from its terminal end. From the beginning it was realized that the duration of this operation was finite. Considerable thought was given to the posture the U.S. Government would adopt upon the tunnel's discovery and to those

Figure 16 - Schematic View of Tunnel

(NOT TO SCALE - VERTICAL EXAGGERATED - DIMENSIONS APPROXIMATE)



SCHEMATIC VIEW

NOT TO SCALE
VERTICAL EXAGGERATED
DIMENSIONS APPROXIMATE

Figure 16

Schematic View of Tunnel

Figure 17 - Initial Stage of Construction of Pre-Amp Chamber

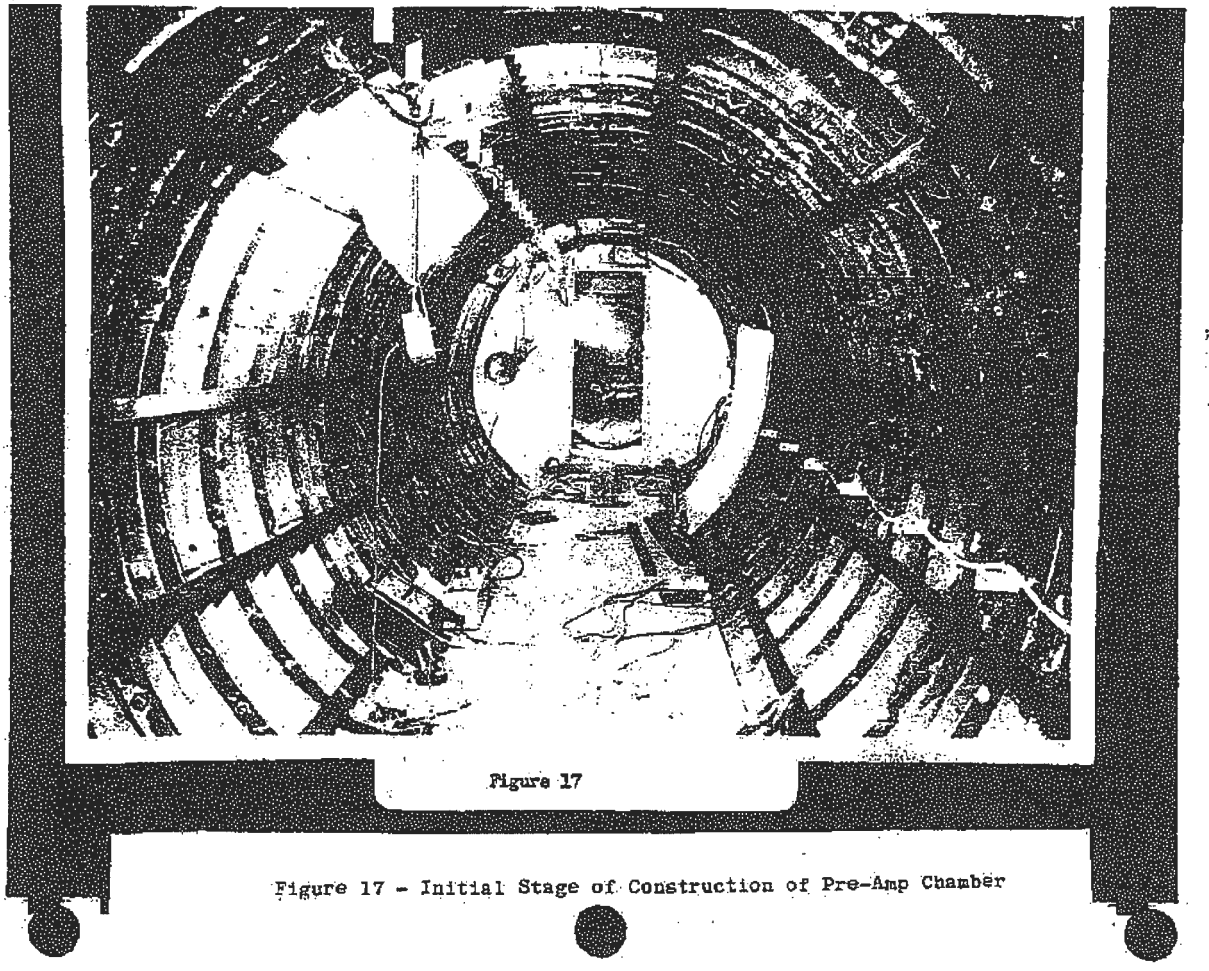


Figure 17

Figure 17 - Initial Stage of Construction of Pre-Amp Chamber

measures which would be taken at the site. The following position was finally approved:

a. The posture of the U.S. would be one of flat denial of any knowledge of the tunnel.

b. The tunnel was mined at the point it crossed the East-West Zone border with demolition charges capable of caving in the tunnel liner should the Soviets attempt forcible entry into the cover installation.

c. The "anti-Personnel" door described above was installed. 4/

d. It was agreed that the installation would be defended against forcible entry with all means at hand.

The three cables were tapped on 11 May 1955, 21 May 1955, and 2 August 1955. All equipment for isolating and preamplifying the signals and passing them down the tunnel for recording was in place before each tap was made so that monitoring of each pair could begin as soon as it was tapped. (See figs. 19 and 20.) Careful check was kept of the temperature and

4/This door bore the following inscription neatly lettered in German and Cyrillic: "Entry is forbidden by order of the Commanding General." It was reasoned that this sign might give pause to Soviet and/or German officials and gain time. As a matter of fact, there were those Communist individuals who considered the posting of this sign as one of the most audacious aspects of the entire undertaking.

Figure 18 - Pre-Amp Chamber

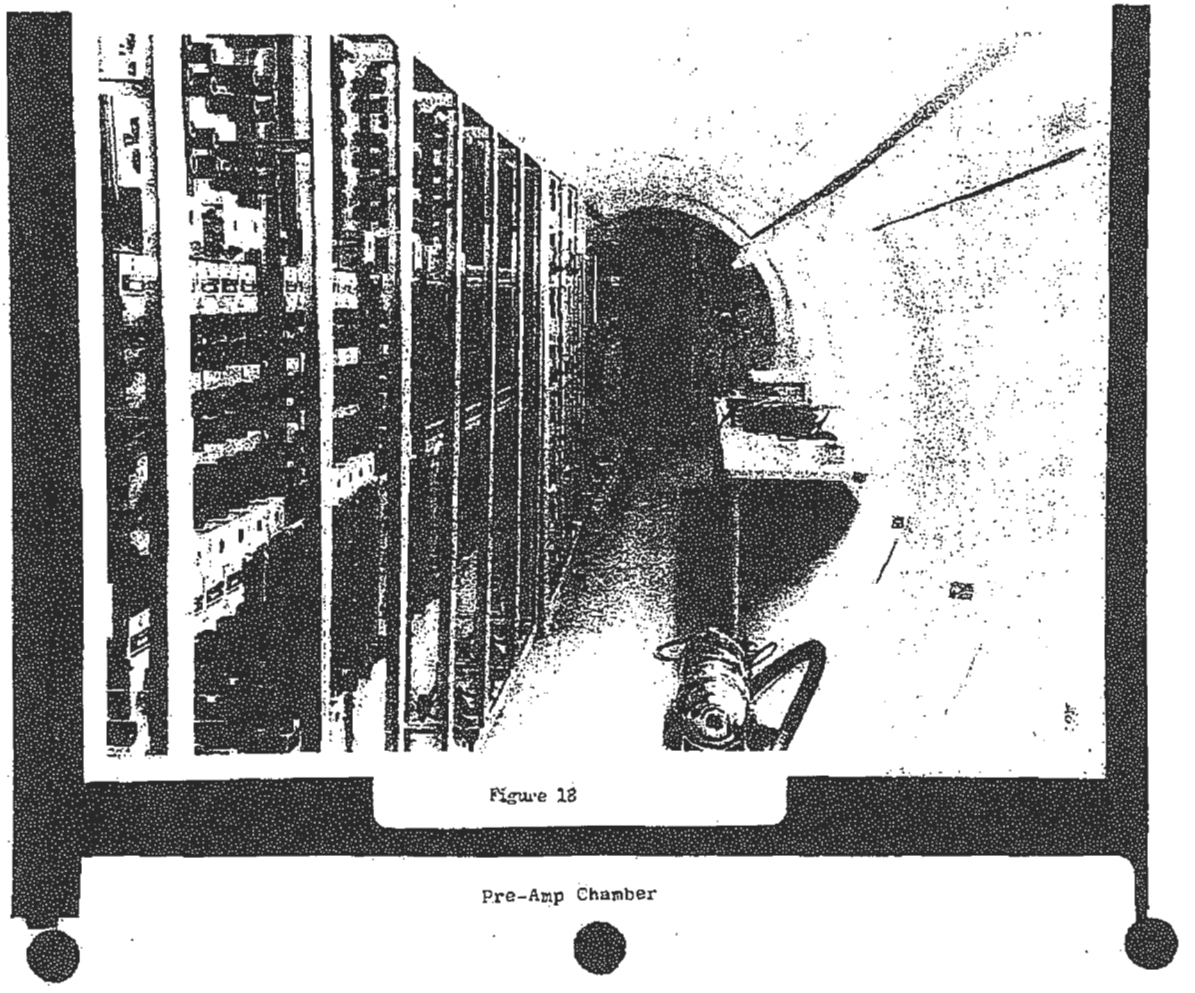


Figure 18

Pre-Amp Chamber

Figure 19 - Tapping Bridle

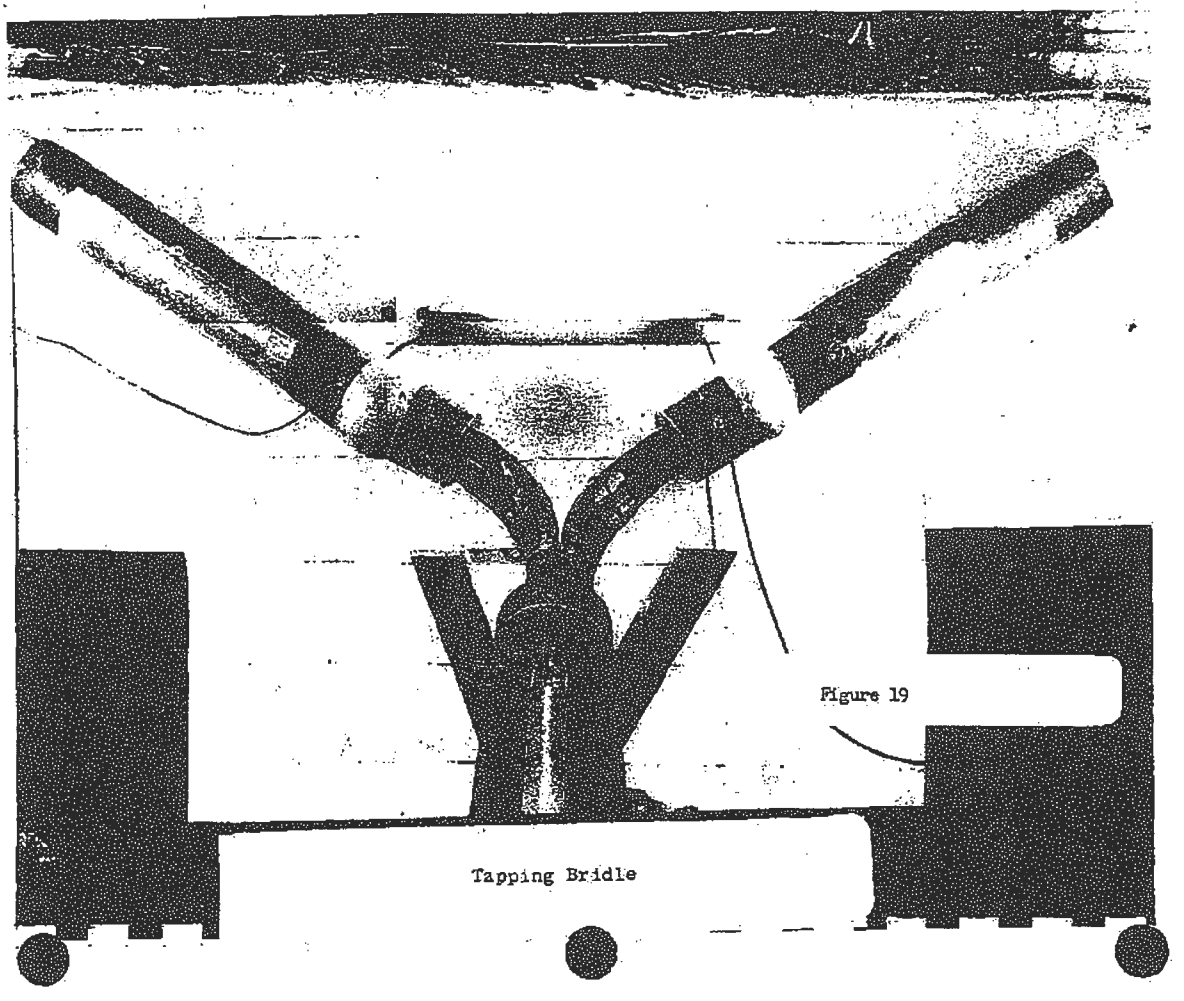


Figure 19

Tapping Bridle

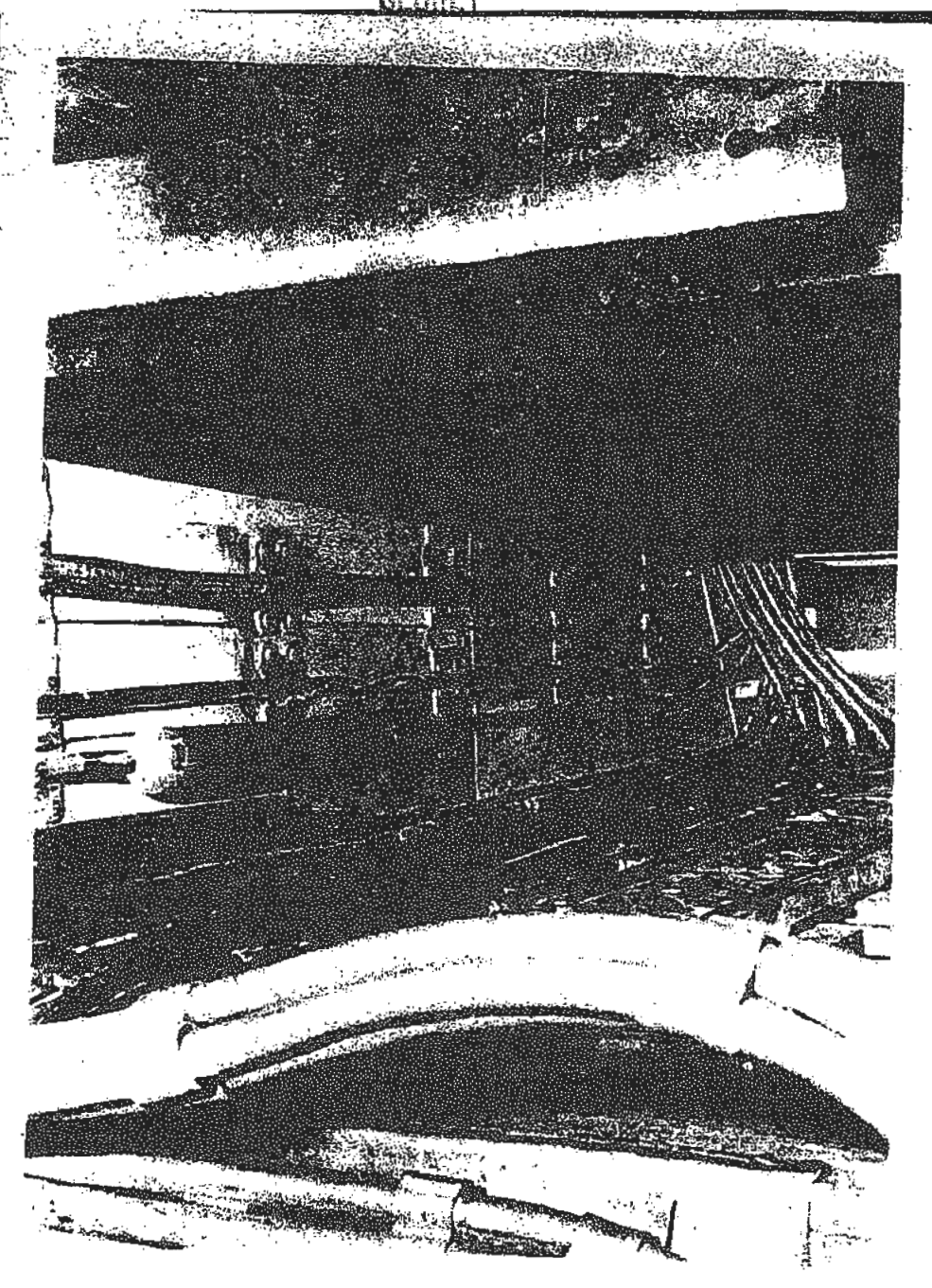


Figure 20

Lead-Away Lines

humidity in the tap chamber to prevent the possibility of the introduction of moisture into the target cables thus causing faults. The moisture in the air caused by the breathing and perspiration of the technicians doing the tapping operation forced the suspension of the operation several times to permit the air conditioning equipment to dehumidify the chamber. All the components in the electrical isolation networks were individually selected and subjected to rigorous tests to insure maximum reliability, and the lead-away cables were constructed of the best available materials, sheathed in lead, and handled in accordance with the highest telephone company standards. The strictest possible visual watch was maintained with the tap crew. In short, in this, as in all aspects of the operation, every effort was made to guarantee success even though in many instances it meant delay in achieving the objective.