moon for some time to come. Some of the work being done now will undoubtedly not come to fruition for a good many years. But someday we will be able to move a man and analyze the surface just as they do on earth.

The CHAIRMAN. Do you have any questions of Dr. Hibbard?

Senator ANDERSON. No.

The CHAIRMAN. Senator Moss.

Senator Moss. Dr. Hibbard, I enjoyed your presentation very much. This is a fascinating project you were talking about. Would this tunneling machine be able to go up and go down as well as across?

Dr. HIBBARD. Yes. It will go straight down and bore a hole at any angle.

Senator Moss. Do they use anything like this in all those extension tunnels in Montreal? I have been through them, too.

Dr. HIBBARD. There are some cutting machines used today. I was up in the Coeur d'Alene area and there they have a reamer which will drill a hole 6 feet in diameter. They just finished a ventilation rise 500 feet long which they did at a rate of 30 feet per shift. It is just amazing when you see these things. They did have problems of muck disposal. They let the muck fall into the bottom of the hole and it took them about 2 weeks to remove it.

Senator Moss. After they moved ahead?

Dr. HIBBARD. Yes, after they moved ahead. There was so much muck as they moved ahead that they could not handle it. This is why it would take a whole new system to remove this much muck as it is generated.

Senator Moss. I was impressed. We encounter big trucks every morning taking the fill out of the cut in the Mall and the trucks are moving the fill every morning. I think there ought to be some better way to get rid of it instead of running all around all the time.

Dr. HIBBARD. Oh, there is. We could do that with a rapid underground excavation or tunneling system.

Senator Moss. If they had a boring machine working there maybe it would do better.

One other question. You said you deal with soft rock. I just wondered, is that in the current machines you are talking about?

Dr. HIBBARD. Yes, sir.

Senator Moss. What is soft, what kind of rock?

Dr. HIBBARD. Soft is sandstone. Let me put it another way. One of these machines was tried on one of the recent tunnels on Long Island and could not cut it. The rock was too hard. We believe we can advance the cutter design to a point where we will have a boring machine to cut through any rock we are likely to encounter. This is one of the new advances that must follow from this program.

Senator Moss. The drilling bit used for drilling oil wells and shafts like that are diamond bits. Could they be fitted into the face of this so they would cut hard rock?

Dr. HIBBARD. The cone-shaped bits like those used for oil wells can be used. Part of the problem is the design of the carbide inserts, the location of these cutters on the rotating members and sequence of the cutters. But this, I think, is well within the grasp of today's science and technology.