

first trip under the Hudson.

The credit of the final success is due to an English engineer who has gained most of his experience in America. In

1880 Charles M. Jacobs came to New York for the English company which then had the project in hand. After its failure he re-

turned to England where he thought of combining the compressed air method used to some extent on the previous work and the

shield invented by Brunel as far back as 1843, and improved by Barlow and Gresthead in the sixties when it was used in a tun-

nel constructed under London Tower. In 1892 Mr. Jacobs re-

turned to this country and since then has pushed the work to a successful completion. He is now also Chief Engineer of the

Pennsylvania Tunnels and Consulting Engineer on other pieces of work both here and abroad.

The Penna. Tunnels are of greater magnitude than the

first Hudson River work; they will be a trifle under six miles in extent when completed and reach from the Hackensack marshes

in Jersey under Manhattan Island and its river boundaries to

the yards on Long Island. With the terminal improvements in

New York they will cost over 70 millions of dollars.

The North River Division which reaches from the Hacken-

sack Portal to the terminal station at 10th Avenue and 32nd

Street is the only part of this work on which this article will

touch. The map on plate I gives a general plan of the work,

while the sketch is an approximate profile. From the Portal to