

settled this matter as from Central Shaft the muck was to be hauled over a mile through the city streets, while at the portal it is hauled out on dump cars and used to make the fill across the marshes and at Weehawken it is moved on Erie R. R. cars.

The work was carried on from the Portal and Weehawken by the heading and bench method which is diagrammed on plate I showing position of drills, direction of holes and method of handling muck in heading.

Drilling.

Percussion drills of the Ingersoll-Sargeant type are being used. They are driven by compressed air at 100# pressure. In this machine the bit is partly rotated every blow and is fed forward by a screw which is turned by the "helper". The hole is begun with an $1\frac{1}{2}$ inch "starter". The last bit used being about $3/4$ ". At the shaft a smith and helper are kept busy sharpening bits during each shift and the efficiency of their work largely controls the progress, as a poorly tempered steel causes a great deal of delay.

At the Portal an Ajax machine driven by compressed air did the work of two smiths in about half the time required by the ordinary methods.

Heading.

Referring to Plate I, and looking at the heading, it may be seen that the "cut holes" are driven in at an angle so as to nearly meet at their ends. This is done so as to concentrate the charge at the apex of a wedge which is blown out. The "side holes" are driven in straight. Thus a narrow heading about 8' x 16 ft. is driven first. This is widened out as shown in the sketch, to form the crown of the arch.