This transforms the state $|s\rangle$ into a state very close (as in the original algorithm) to the state \[ \frac{1}{\sqrt{m}} \sum_{i} |w_i\rangle = |\tilde{w}\rangle, \]
as can be seen from the following argument. Look at the subspace spanned by $|s\rangle$ and $|\tilde{w}\rangle$:

\[ = \frac{1}{\sqrt{m}} \sum_{x \in \tilde{w}} |x\rangle \]

This is preserved by $U_s$, $U_{\tilde{w}}$, and $U_s U_{\tilde{w}}$ is easily seen to be a rotation by $\Theta = 4 \sqrt{\frac{M}{N}}$.

Accordingly, after \( \approx \frac{\pi}{4} \sqrt{\frac{W}{M}} \) iterations, the initial state $|s\rangle \approx |\tilde{s}\rangle$ is mapped into $|\tilde{w}\rangle$. Measurement of the state at this point will reveal one of the $|w_i\rangle$ such that $\mathcal{F}(w_i) = 1$. 

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