$$\left|\mathbf{W}_{n}^{2}\right\rangle = \sum_{i=0}^{n-2} \sum_{j=0}^{n-2-i} \left|\uparrow\right\rangle^{i} \left|\downarrow\right\rangle \left|\uparrow\right\rangle^{j} \left|\downarrow\right\rangle \left|\uparrow\right\rangle^{n-i-j-2}$$