direction of the second cathode region 320. The electroplating solution in any adjacent sub-regions of the second cathode region 320 circulates with each other, which enhances the fluidity of the flow field in the second cathode region 320 and reduces the flow-field dead zones in the second cathode region 320.

According to FIG. 15, FIG. 15 shows a flow field distribution view of the lower layer of the cathode chamber after the electroplating apparatus uses the membrane frame of Embodiment 1. Compared with the flow field distribution of the lower layer of the cathode chamber 300' shown in FIG. 5, the light-colored area in the flow field region in FIG. 15 is significantly increased, indicating that the overall fluidity of the flow field in the lower layer of the cathode chamber 300 is significantly enhanced.

According to FIG. 16, FIG. 16 shows a voltage curve graph between the anode and the substrate measured after running 14 substrates on the electroplating apparatus adopting the membrane frame of this embodiment. Compared with the voltage curve between the anode and the substrate shown in FIG. 2, the voltage curves during running all substrates shown in FIG. 16 are basically similar, and after running 14 substrates, the voltage is stably maintained at approximately 22 V.

Therefore, according to FIG. 15 and FIG. 16, it can be seen that after the electroplating apparatus adopts the membrane frame of Embodiment 1, the fluidity of the flow field in the lower layer of the cathode chamber 300 is significantly enhanced, which can reduce the crystalline precipitation on the ion-exchange membrane 200, thereby reducing the voltage increase between the anode and the substrate after running multiple substrates.

As shown in FIG. 15, in the first cathode region 310, the fluidity of the flow field at the positions of the plurality of first grooves disposed at the bottom of the first ends of the branch pipes (refer to the position indicated by a1) is slightly weak. Based on this situation, to further improve the fluidity of the fluid, a through hole can be disposed at the first end of each branch pipe. According to FIG. 17 and FIG. 18, a through hole 1231 is disposed at the first end of each branch pipe 120. The through hole 1231 connects the liquid supply channel 140 to the first groove 123 at the bottom of the first end of the corresponding branch pipe 120, so that the cathode liquid in the liquid supply channel 140 flows downward to flush the ion-exchange membrane 200 below the first