ON BYPASS

Remembering Kimray

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Introduction

Like me, Garman Kimmell (see Figure 1) was a Kansan. He grew up in Wichita, the son of a land speculator for oil and gas drilling projects. Garman attended Wichita State University for two years, but transferred to Oklahoma University because of its renowned petroleum engineering program. Garman had a knack for creative and "out of the box" thinking. He once glued feathers to a crow that had suffered a wing injury. Upon tossing the bird into the air, it spiraled briefly in all directions looking like it would surely crash. Garman's glue did the trick however, and the crow soared gracefully beyond the trees and eventually out of sight. In 1948, he founded Kimray, a manufacturing company in Oklahoma City specializing in oil and gas equipment. Along the way, Garman met and befriended Dr. Allen Greer, the first American Board-certified thoracic surgeon in Oklahoma. This unlikely acquaintance would prove worthwhile in a way no one could possibly have predicted.

Figure 1
Garman Kimmell, founder of Kimray.

Enter Dr. Nazih Zudhi

In 1957, Dr. Greer was part of the search team that brought Dr. Nazih Zuhdi to Oklahoma City to help build an open-heart surgery program. Dr. Zuhdi was more than qualified. He had spent time in Dr. Clarence Dennis' laboratory from 1952 to 1956. He then joined Dr. C. Walton Lillehei's team in Minneapolis helping refine Dr. Richard DeWall's helical coil bubble oxygenator and Dr. Vincent Gott's disposable plastic sheet oxygenator. In Zuhdi's mind, Oklahoma was a faraway place known largely for hot summer winds and red clay soil. And yet it reminded him of his upbringing in Syria; a land vast in size and respite from the noisy bustling cities. And so, in the fall of 1957, Zudhi boarded a train in Minneapolis and headed south to his new position at the Oklahoma University Medical College. Greer was waiting for him at the station, as was Dr. John Carey. Within months, the three formed a medical partnership.

Enter Kimray

In 1957, the most accepted methodology for perfusion was normothermia using DeWall's helical bubble oxygenator. As such, this is what Zudhi assembled and tested in early 1958 as a starting point for his new open-heart program. And as DeWall had done before him, Zuhdi immersed the helical coil in a vat of warm water. Thermal regulation (namely cooling) of the patient was desired by many investigators, but external heat exchangers were cumbersome and increased the overall priming volume of the circuit. In 1952, Dr. Frank Gollan devised a crude bubble oxygenator that included an integral venous-side heat exchanger. Zuhdi came up with a

brilliant, if not similar, idea. Why not place a heat exchanger inside the plastic coil of the DeWall helical oxygenator? In doing so, the patient could be heated or cooled by a heat exchanger that also served to volume-reduce the circuit. Greer suggested to Zuhdi that he contact his old friend Garman Kimmell. If the Kimray Company could produce pumps, valves, and piping for the oil industry, then surely it could fashion a piece of metal to fit inside a coil of mayon tubing. Within days, Kimray machinists presented Zuhdi with a gleaming, polished heat exchanger made of 22-gauge stainless steel measuring 325 centimeters in length (see Figure 2).

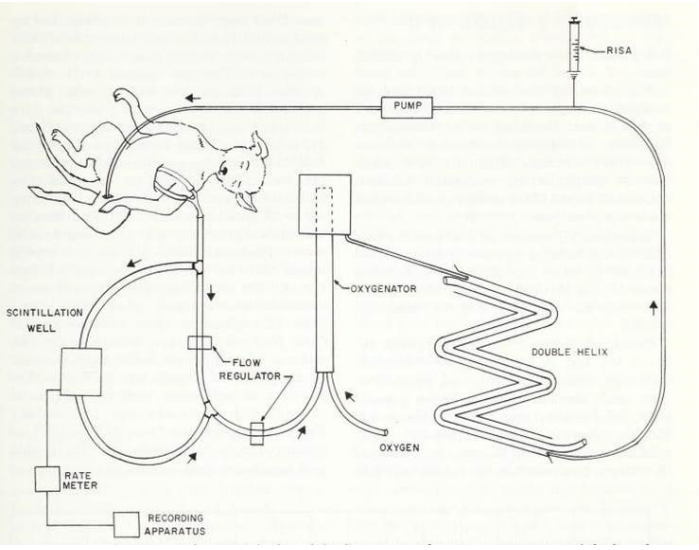

Figure 2
Schematic of early CPB circuit showing Kimray heat exchanger inside helical coil (lower right).

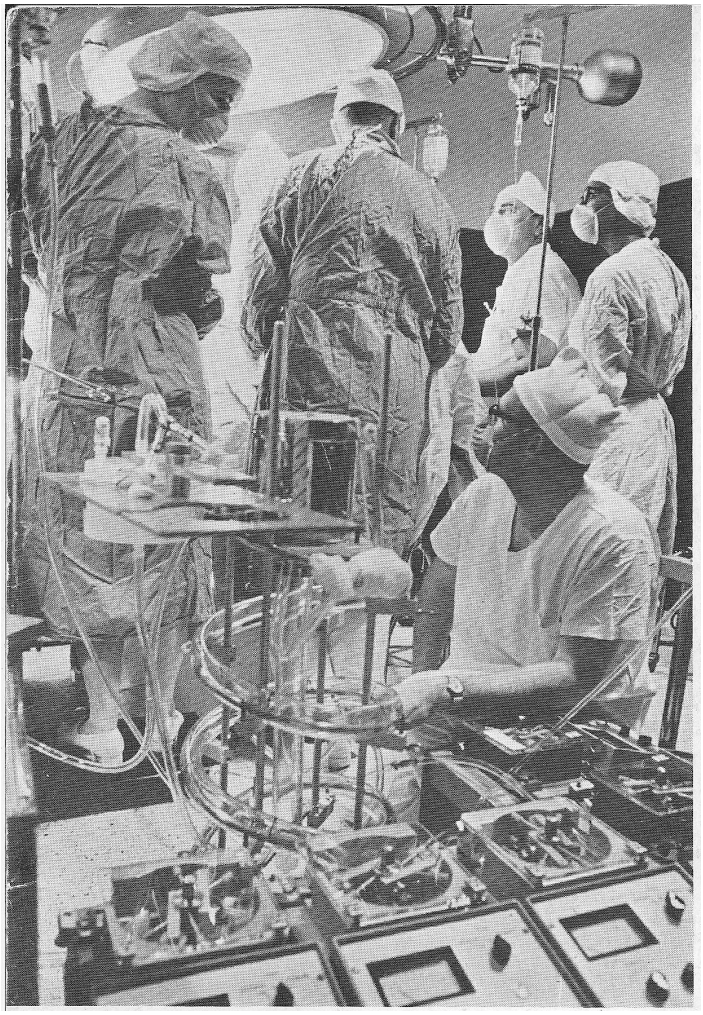

Figure 3
DeWall helical coil oxygenator with Kimray heat exchanger inside (center of photo).

As an aside, the first issue of the Journal of Extra-Corporeal Technology published in 1968 featured a cover photo of a young Minnesota perfusionist named Ed Berger running a DeWall helical bubble oxygenator with the Kimray heat exchanger (see Figure 3). Next, Kimray assembled two 30-gallon insulated trash cans to serve as reservoirs for the hot and cold water necessary to regulate the patient's temperature (see Figure 4). On occasion, a leak would spring from one or both reservoirs, flooding the operating room floor. The enormity of one such incident caused Zuhdi's perfusionist to perch herself atop her stool to avoid getting wet. Undeterred, Zudhi challenged Kimray to produce a self-contained unit that could deliver thermostatically-controlled water in a re-circulating fashion. Appearing on the market around 1960, the Kimray heater-cooler (see Figure 5) enjoyed mostly regional success until around 1980. For a brief time, Texas Medical Products served as the sole distributor. The device required ice chips for cooling and featured three water baths (warm, tepid, and cold). Kimray also devised de-bubbling chambers from stainless steel canisters, and made precise determinations for how much Dow Corning Antifoam A should be applied. For his company's efforts, Garman Kimmell was named "technical physicist" of the open-heart team and was often present during early surgeries performed by Zudhi, Greer, and Carey (see Figure 6).

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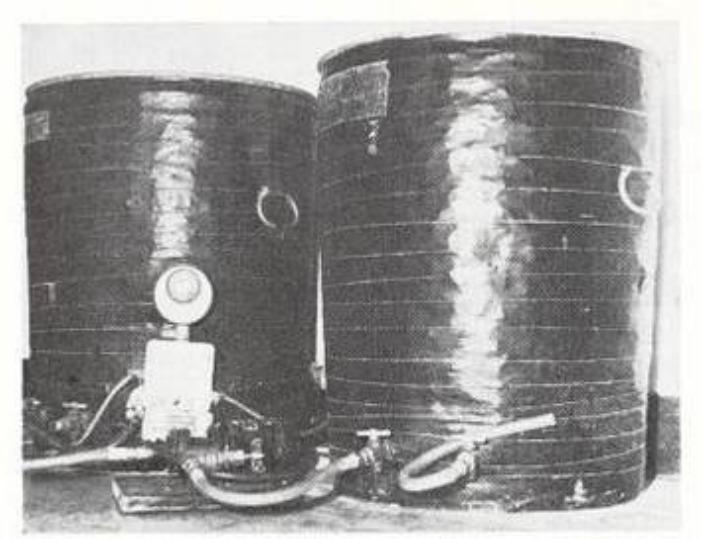

Figure 4
Insulated trash cans used as hot and cold water reservoirs (constructed by Kimray).

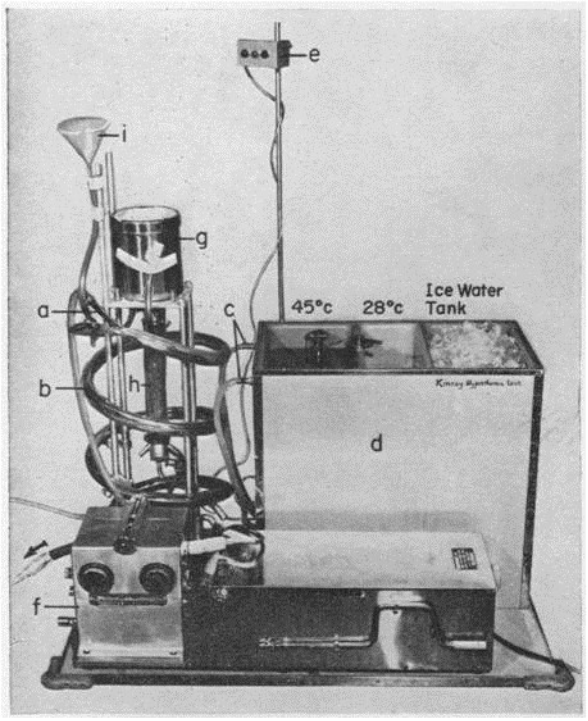

Figure 5
Kimray heater-cooler (labeled as "d") shown along side the DeWall oxygenator and pump.

Figure 6
Garman Kimmell checking the de-bubbling chamber he devised for use with the DeWall helical coil oxygenator in 1959.

Conclusion

How fascinating that the science of early heart lung machines often rested at the steps of companies like Kimray. Researchers often found solutions to problems in the most unusual or obscure places. And while Kimray's contributions to our field are but a distant memory, it's worth remembering that historical developments in medicine rarely follow the direct path that hindsight often assumes.

References

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