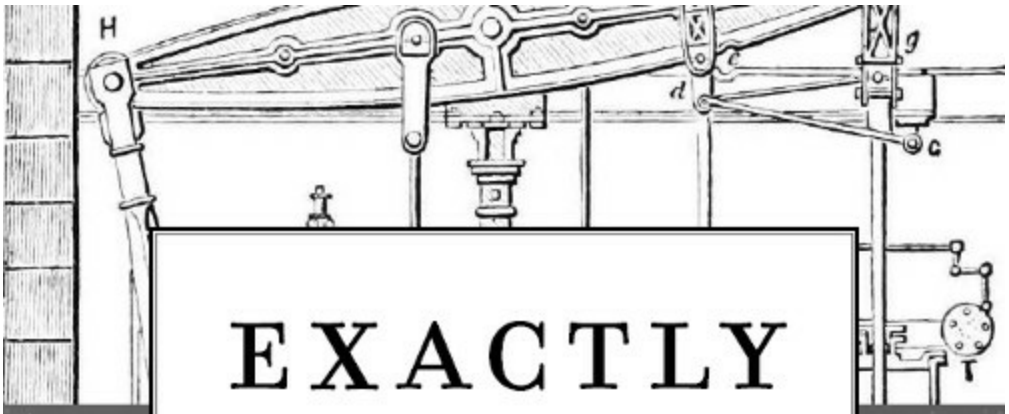
SIMON WINCHESTER

HOW PRECISION ENGINEERS CREATED THE MODERN WORLD



EXACTLY

HOW PRECISION ENGINEERS CREATED THE MODERN WORLD

SIMON WINCHESTER

WILLIAM COLLINS

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Dedication

For Setsuko

And in loving memory of my father,
Bernard Austin William Winchester, 1921–2011,
a most meticulous man

Epigraph

These brief passages from works by the writer Lewis Mumford (1895–1990) might usefully be borne in mind while reading the pages that follow.

> *The cycle of the machine is now coming to an end. Man has learned much in the hard discipline and the shrewd, unflinching grasp of practical possibilities that the machine has provided in the last three centuries: but we can no more continue to live in the world of the machine than we could live successfully on the barren surface of the moon.*
>
> —*THE CULTURE OF CITIES* (1938)

> *We must give as much weight to the arousal of the emotions and to the expression of moral and esthetic values as we now give to science, to invention, to practical organization. One without the other is impotent.*
>
> —*VALUES FOR SURVIVAL* (1946)

> *Forget the damned motor car and build the cities for lovers and friends.*
>
> —*MY WORKS AND DAYS* (1979)

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Prologue

The aim of science is not to open the door to infinite wisdom, but to set a limit to infinite error.

—BERTOLT BRECHT, *LIFE OF GALILEO* (1939)

We were just about to sit down to dinner when my father, a conspiratorial twinkle in his eye, said that he had something to show me. He opened his briefcase and from it drew a large and evidently very heavy wooden box.

It was a London winter evening in the mid-1950s, almost certainly wretched, with cold and yellowish smog. I was about ten years old, home from boarding school for the Christmas holidays. My father had come in from his factory in North London, brushing flecks of gray industrial sleet from the shoulders of his army officer's greatcoat. He was standing in front of the coal fire to warm himself, his pipe between his teeth. My mother was bustling about in the kitchen, and in time she carried the dishes into the dining room.

But first there was the matter of the box.

I remember the box very well, even at this remove of more than sixty years. It was about ten inches square and three deep, about the size of a biscuit tin. It was evidently an object of some quality, well worn and cared for, and made of varnished oak. My father's name and initials and style of address, B. A. W. WINCHESTER ESQ., were engraved on a brass plate on the top. Just like the much humbler pinewood case in which I kept my pencils and crayons, his box had a sliding top secured with a small brass hasp, and there was a recess to allow you to open it with a single finger.

This my father did, to reveal inside a thick lining of deep red velvet with a series of wide valleys, or grooves. Firmly secured within the grooves were a large number of highly polished pieces of metal, some of them cubes, most of them rectangles, like tiny tablets, dominoes, or billets. I could see that each