THE FOXBORO COMPANY

NAUGATUCK, WATERBURY AND FOXBORO · 1859–1944

On Gauges, Pyrometers, Conscience Buses and Such

Regina's mother was a Bristol, and the Bristols were a family of tinkerers. They came from Naugatuck, Connecticut, a few miles below Waterbury, where Benjamin Hiel Bristol and his wife, Pauline Spaulding Phelps, raised their sons. On both sides, a family biographer wrote, the line ran back to early New England, through Henry Bristol of New Haven and, on the mother's side, to Edward Fuller, who came over on the *Mayflower*; and the family records indicated "a penchant for mechanics" among the ancestors. Four of the sons turned the penchant into a trade. William Henry was the eldest of them, born in Waterbury on July 5, 1859; then Franklin; then Edgar Hiel, born at Naugatuck on March 7, 1871; and Bennet Beri. Between them, and their father, they would found two of the great instrument companies of the twentieth century, and they would fill a fair part of the Patent Office's annual index with the name Bristol.

William went to the Stevens Institute of Technology in Hoboken, New Jersey, graduated in engineering in 1884, came back in 1886 to teach, and was a professor of mathematics there by 1899. He was also, from the start, an inventor. The Patent Office's index for 1888 lists William H. Bristol of Hoboken with a "pressure indicator and recorder" and, with a colleague, a "differential expansion device for galvanometers." The recorder was the important one.

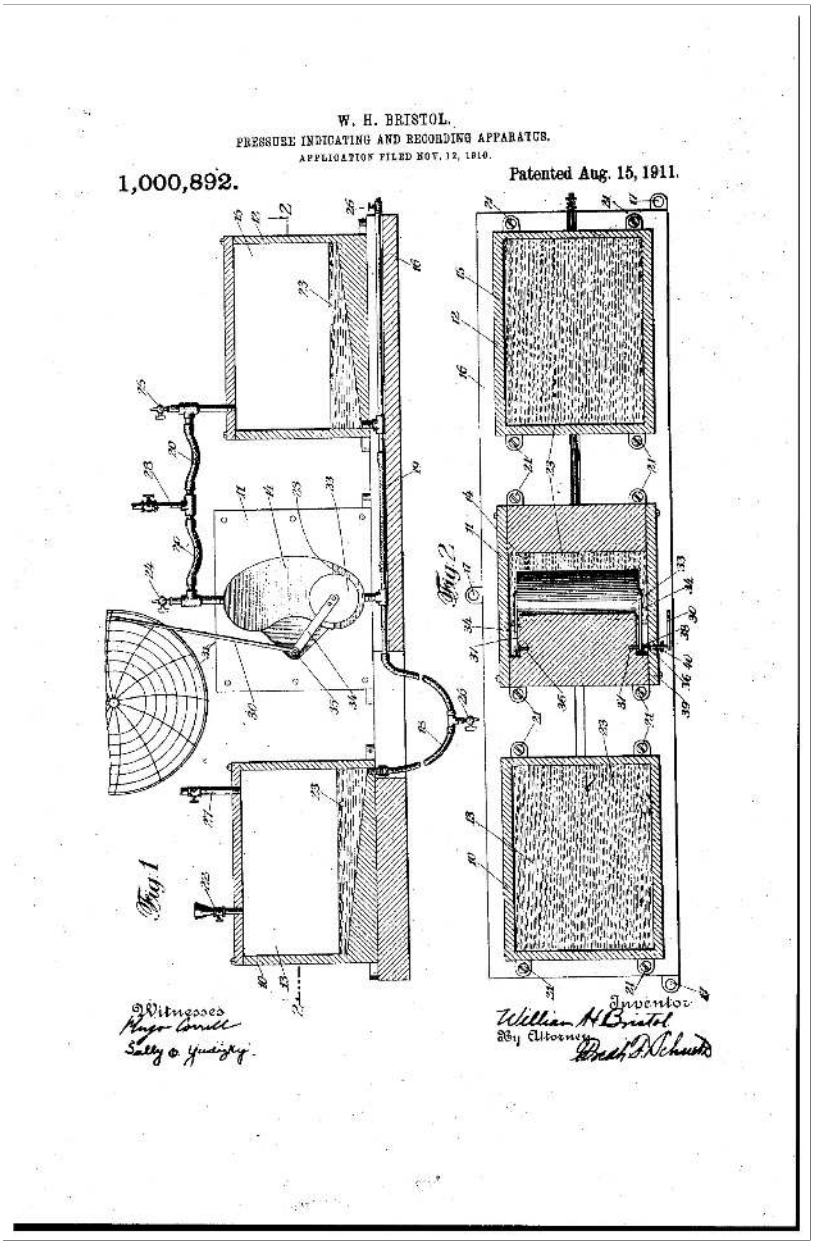
It drew a continuous line on a paper chart as the pressure in a boiler or a pipe rose and fell, so that an engineer could see, the next morning, everything that had happened in the night. With it, and with a patent for a steel lacing to join industrial belts, William needed a factory, and in 1889 he, his brother Franklin and their father founded the Bristol Company, which the Patent Office was soon listing at Waterbury.

The early patents show what kind of family business it was. In the index for 1890, William assigns two-thirds of his "pressure indicator and recorder" to his father and Franklin, and Franklin assigns two-thirds of his own patents, for a button and for a punch and die, to his father and William: three men holding each other's inventions in thirds. William's interests ran everywhere.

In the 1890s the index gives him a camera, a photographic camera, two camera shutters, an electric meter, a recording ampere-meter, a recording steam-pressure gauge, a thermometer, a belt-fastener and a device for compensating instruments against changes in temperature. The Franklin Institute gave him its John Scott Medal in 1890 and its Edward Longstreth Medal in 1894, and his instruments took medals at the world's fairs in Chicago in 1893, Paris in 1900 and St. Louis in 1904.

In 1904 William invented what his company called the first practical pyrometer, a thermometer for the heat of furnaces, and the index for that year is thick with it: thermo-electric couples, a thermo-electric element, a thermo-electric apparatus, a record sheet, a temperature-compensating device. A William H. Bristol Pyrometer Company followed in New York. By 1915, his biographer says, the Bristol Company made "the largest and most complete line of industrial instruments in the world," for temperature, electricity, pressure, motion, time, flow and humidity.

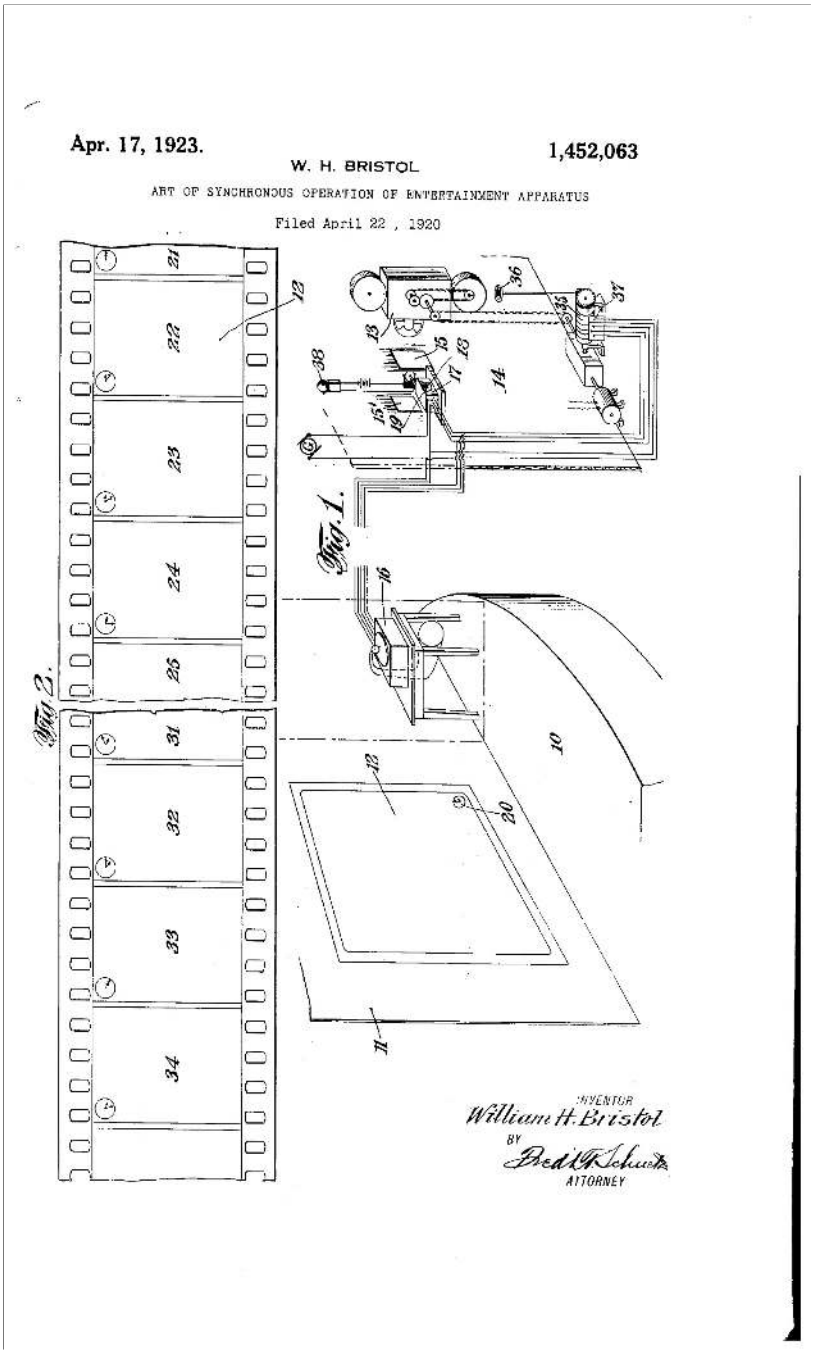
And in 1915 William turned to the movies. His "Bristolphone" recorded sound on a phonograph and kept it in step with the film, and the index for the early 1920s records the patents: "synchronized motion-picture apparatus," "synchronous operation of entertainment apparatus,"


W. H. BRISTOL.
PRESSURE INDICATING AND RECORDING APPARATUS.
APPLICATION FILED NOV. 12, 1910.
1,000,892. Patented Aug. 15, 1911.
Fig. 1
Fig. 2
Witnesses
Inventor
William H. Bristol
By Attorney

WILLIAM H. BRISTOL, "PRESSURE INDICATING AND RECORDING APPARATUS," U.S. PATENT 1,000,892 (1911)

"multiple sound-reproducing apparatus," "electric reproducing apparatus for phonographs." The William H. Bristol Talking Picture Corporation put the Bristolphone into nearly a hundred American theatres. William died on June 18, 1930, with nearly a hundred patents to his name.

Edgar, twelve years younger, came to the work by the shop floor. He went to school in Naugatuck, learned the machinist's trade in Waterbury with the firm of Cross & Spears, and then joined his brothers' company. On August 29, 1895, at Winsted, he married May C. Rexford, who could count her own *Mayflower* ancestors and three signers of the Connecticut Charter. For a dozen


Apr. 17, 1923. 1,452,063

W. H. BRISTOL

ART OF SYNCHRONOUS OPERATION OF ENTERTAINMENT APPARATUS

Filed April 22 , 1920

Fig. 1.

Fig. 2.

INVENTOR
William H. Bristol
BY
Fred'k P. Schuch
ATTORNEY

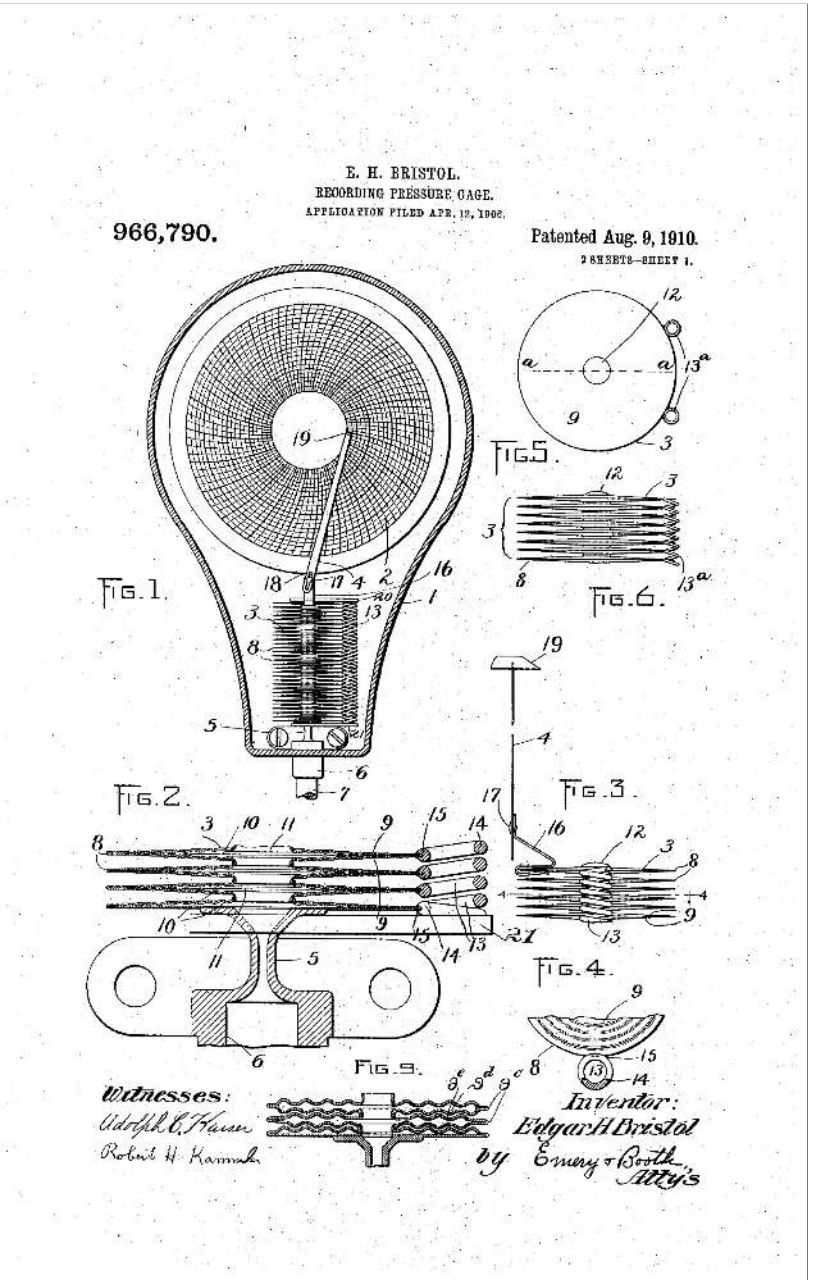
THE BRISTOLPHONE: "SYNCHRONOUS OPERATION OF ENTERTAINMENT APPARATUS," U.S. PATENT 1,452,063 (1923)

years his patents appeared jointly with William's. Then, in 1908, with his father and his brother Bennet, he left.

The three men set up on their own as the Industrial Instrument Company. They bought two small firms, the Standard Gauge Manufacturing Company of Syracuse and the Standard Electric Time Company of Waterbury, and looked for a place to build. They chose Foxboro, Massachusetts, a town of 3,500 people with "an unused set

of 12 sturdy brick industrial buildings." By the end of the year they had fifty-three employees, earning about thirteen cents an hour, making gauges for steam boilers, refrigeration plants and automobiles.

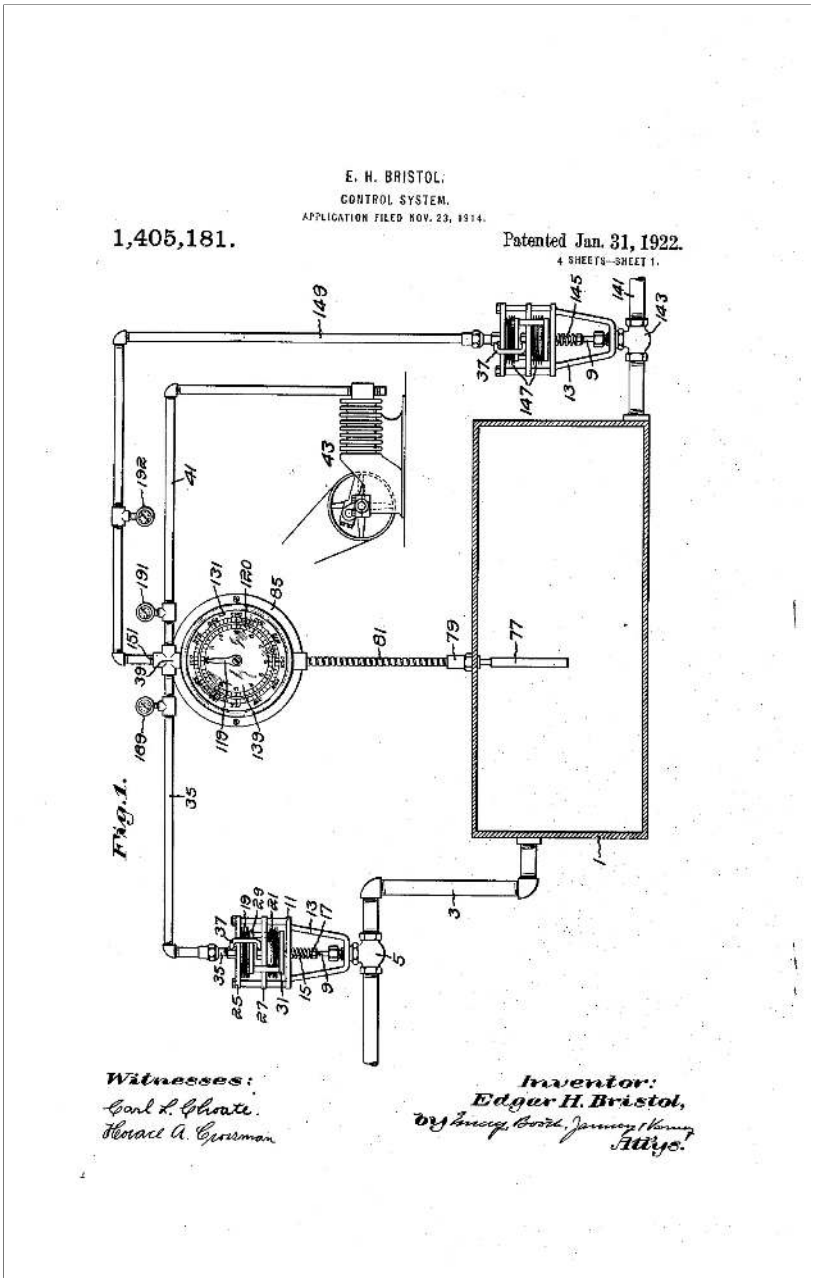
The new firm went fast. Edgar's first patent under its name, a "recording pressure-gage," was granted in 1910. By 1911 it had the first multiple-pen recorder, drawing several lines on one chart, and that year a Pennsylvania engineer named Thomas Weymouth took up again the work that would become the Foxboro orifice meter, the device that measured gas in a pipe by the drop in pressure across a thin plate with a hole in it, and



EDGAR H. BRISTOL, "RECORDING PRESSURE-GAGE," FILED 1906, U.S. PATENT 966,790 (1910): THE FIRST PATENT OF THE FOXBORO BUSINESS

that made the company's name in the oil and gas fields.

In 1912 the company put the name of its town on its trademark, and on January 1, 1914, it became the Foxboro Company. That year Edgar built a pneumatic controller, a machine that did not only record the temperature in a paper mill but adjusted it, and installed it in a New England mill. His biographer, writing thirty years later, noted that the company still had it, and that its principle was "basically similar to that used in Foxboro control instruments at the time of writing." The patent, filed in November 1914 under the plain title "Control system," was granted in 1922.


E. H. BRISTOL.
CONTROL SYSTEM.
APPLICATION FILED NOV. 23, 1914.

1,405,181. Patented Jan. 31, 1922.

4 SHEETS—SHEET 1.

Fig. 1.

Witnesses:
Carl L. Choate.
Horace A. Grossman

Inventor:
Edgar H. Bristol,
by Emery, Booth, Janney & Varney
Attys.

EDGAR H. BRISTOL, "CONTROL SYSTEM," FILED 1914, U.S. PATENT 1,405,181 (1922)

❧

The First World War brought the first big order. The company adapted its automobile temperature gauge for aeroplanes and sold it to the British, who were fighting the Germans and needed to know whether their engines were about to seize. After the war the patents came in a steady stream, almost all of them Edgar's and almost all of them assigned to the Foxboro Company: a measuring instrument, a mounting for instruments, a liquid-head gauge, a chart holder, a pressure gauge, a controlling instrument, a separable arm for measuring instruments, a recorder.

With Bennet he patented a latch for instrument cases. The biographer credited him with more than forty patents and with some that were "so basic in their nature as to represent actual turning-points in instrument development": the helical spring that became the measuring element in the company's temperature and pressure recorders, the recording controller, and a micropositioner for control valves that he called the valvactor. He was president of the company, of its Canadian branch and of the Foxboro National Bank, a director of a related firm in England, and a trustee of Bradford Junior College.

He also had ideas about how people ought to live together, and in 1922 he tried one out on the town. He founded an organisation he called New Civilization, whose declaration announced that "the old civilization is constantly breaking down in spots where it has not conformed to the laws of the universe," and he started a newspaper to discuss "What Does Foxboro Most Need?" The answer, it turned out, was a bus.

Foxboro was badly served by trains, and on July 12, 1922, the first New Civilization Service Car went into service, a beach-wagon that ran to the neighbouring towns, with a locked box for fares and a sign estimating the cost of the ride at ten cents a mile. Members joined for ten cents a year. What each rider paid was up to him. "A man may pay his way with plugged nickels if he has a plugged conscience," Edgar said.

The town called them "cuckoo cars," and the *Literary Digest* sent a reporter, who found the townspeople divided: one man thought it "a great idea," and another allowed that "Mr. Bristol is sincere in this, but just the same I don't think it's exactly the way to do it. It ought to be a business proposition." The magazine printed the organisation's fourteen rules for conduct in a box, from "Get all the joy out of life you can; give it to the first person you meet and then repeat" to "Have open hands, open mind, open heart," and reported that the bus had done what the meetings had not: membership, which had stood at two hundred and fifty, jumped by nine hundred in a month, and a quarter of the town now belonged. Edgar himself, the reporter noted, would rather have been left out of the story altogether, and preferred to call himself not the inventor of the idea but its "experimenter."

❧

Edgar and May had five children: a son, Benjamin Hiel, named for his grandfather, who went into the company, and four daughters. The youngest, Justine Rexford Bristol, was born on February 10, 1906. The family spent its summers at Falmouth Heights, on Cape Cod, and it was there, a local history says, that Justine met the Harvard actor she was "later to marry." On May 5, 1934, she married Kingsley Perry, whose story is the next chapter's. Their youngest child was Regina, who would marry Daniel.

The Second World War made the Foxboro Company a war plant. In June 1941, six months before Pearl Harbor, it began making torpedo mechanisms for the British Admiralty, and it went on to work for the American armed forces, among other things on the mechanisms that steered a torpedo's course. The payroll doubled, and the company hired women in large numbers for the first time; its British branch doubled too. Bennet Bristol died in the early years of the war. In September 1942 the British sent an admiral to say thank you.

Rear Admiral E. J. O'Brien Croker, chief of the British Admiralty Technical Mission in Ottawa, came down to Foxboro, and Edgar introduced him on the lawn where the company's brass band gave its weekly noon-hour concerts. The trade press could say only that the company was "separately engaged in work of a confidential nature in which the Royal Navy has reason to be interested." The admiral was more vivid.



"PAY-AS-YOU-PLEASE": THE NEW CIVILIZATION CARS, FOXBORO, 1922

"Let me remind you," he told the workers, "that almost within sight of the British Isles stretch 4000 miles of hostile shore, all the way from the Arctic Ocean to the Bay of Biscay." The band played "God Save the King" and "The Star Spangled Banner," and a dozen employees of British birth went up afterwards to shake his hand. By the following summer the company's advertisements carried a new line: "For outstanding production," The Foxboro Company had been awarded the Army-Navy "E." Edgar died on July 24, 1944, at the summer house at Falmouth Heights, at seventy-three. Foxboro half-staffed every flag on its buildings and the one on the Common, and the shops and offices closed for the funeral. "'E.H.,' as he was known to all," wrote the local paper, "was a true humanitarian and philanthropist," and "in the concrete line of his inventions and mechanical ability he was a genius."

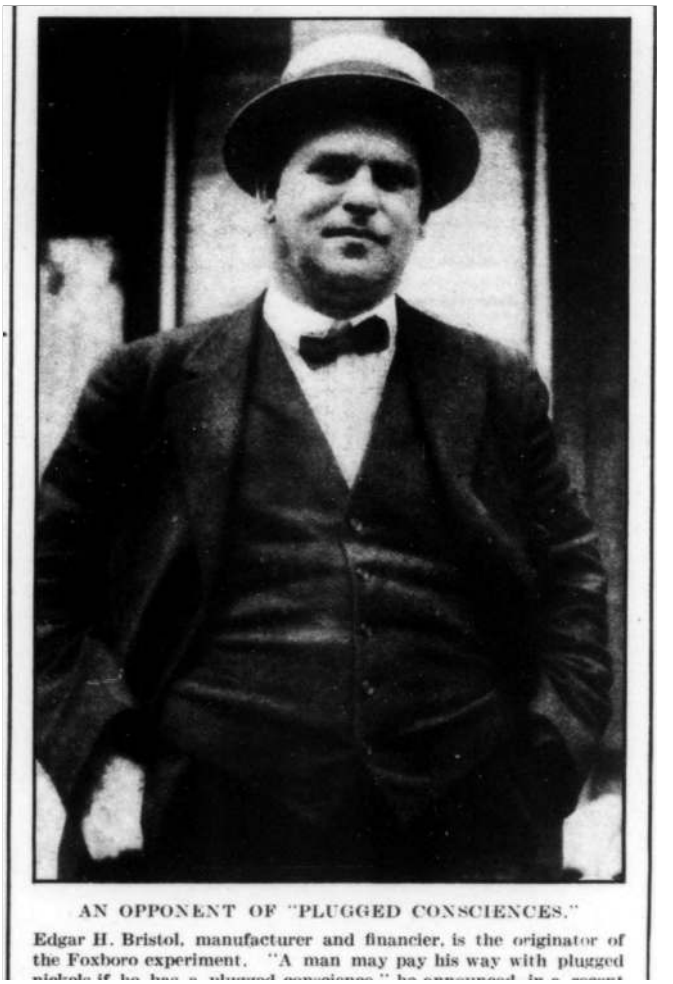
The family kept the company. Edgar's son Benjamin became president and another Bristol, Rexford, treasurer, and when the company sold shares to the public in 1958 the heirs held on to a third of them. Foxboro went on from pneumatic controllers to electronic ones, and in 1964 to direct digital control by computer. A grandson, Edgar H. Bristol II, spent his career there as a research engineer in the same line of work. And Edgar's patents, the chart holder, the latch, the recorder, are still in the Patent Office's files under his name, with the Foxboro Company beside it as assignee, which is the way the old man would have wanted to be remembered: as the fellow who made the thing, with the town's name on the dial.

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The patents. The tables below list every patent granted to one of the four brothers that could be found in the Patent Office's annual indexes for 1881 to 1969 and on Google Patents. Years are years of grant. Before 1910 the scanned indexes keep the subject but lose the number. The indexes for 1912 to 1919 are not online, and those for 1921 and 1925 could not be read, so the list is incomplete: William's biographers credit him with nearly a hundred patents and Edgar's with more than forty. A Franklin B. Bristol of Middlebury, who patented telemetering apparatus for the Bristol Company from 1934 to 1964 and appears in 1964 as "Sr.," may be the founder or his son; his patents are marked.

WILLIAM H. BRISTOL

Year	No.	Subject (with others, or assignee)
1888		Pressure indicator and recorder
1888		Differential expansion device for galvanometers *(with W. E. Geyer)*



AN OPPONENT OF "PLUGGED CONSCIENCES."

Edgar H. Bristol, manufacturer and financier, is the originator of the Foxboro experiment. "A man may pay his way with plugged

"AN OPPONENT OF 'PLUGGED CONSCIENCES'": EDGAR H. BRISTOL, 1922

1889		(subject not legible) *(assignor to himself and B. H. and F. B. Bristol)*
1890		Camera
1890		Electric meter
1890		Pressure indicator and recorder *(two-thirds to B. H. and F. B. Bristol)*
1892		Photographic camera
1892		Camera-shutter (two patents)
1894		Temperature-compensating device
1894		Recording steam-pressure gage
1894		(subject not legible) *(with E. H. Bristol)*
1895		Recording ampere-meter
1896		Thermometer *(Bristol Company)*
1898		Belt-fastener
1899		Case for recording-gages
1899		Multiplying device for recording instruments
1899		(subject not legible) *(with E. H. Bristol)*
1900		(subject not legible) *(with E. H. Bristol)*
1900		(subject not legible) *(with F. B. Bristol)*
1903		(subject not legible) *(with E. H. Bristol)*
1904		Record-sheet for recording instruments
1904		Temperature-compensating device for electrical measuring instruments
1904		Thermo-electric apparatus
1904		Thermo-electric couple (two patents)
1904		Thermo-electric element
1905		Insulating electrical conductors
1905		Thermometric rheostat
1905		Temperature-compensating device for thermo-electric measuring instruments
1906		Pressure indicator and recorder
1906		Thermo-electric couple
1907		Pressure indicator and recorder
1907		Pressure-gage
1907		Electric furnace
1907		Thermo-electric generator (two patents)
1907		Clamp
1911	1,000,146	Temperature-compensating device
1911	1,000,147	Combined clock and shock-recorder
1911	1,000,148	Speed-recorder
1911	1,000,149	Belt-fastener
1911	1,000,892	Pressure indicating and recording apparatus
1911	1,003,229	Differential-pressure gage
1911	1,004,356	Belt-fastener
1922	1,431,626	Measuring instrument
1922	1,431,627	Remote-control system *(with M. J. Johnson; Bristol Company)*
1922	1,431,628	Synchronized motion-picture apparatus
1923	1,452,063	Synchronous operation of entertainment apparatus
1923	1,468,455	Multiple sound-reproducing apparatus
1923	1,468,456	Thermoelectric couple

1924	1,488,227	Method and apparatus for applying belt hooks
1924	1,490,764	Electric reproducing apparatus for phonographs
1928	1,659,388	Valve *(Bristol Company)*
1931	1,809,578	Cone type loud speaker *(with F. B. Bristol; Wm. H. Bristol Talking Picture Corp.)*
1933	1,914,106	Cross-link for tire chains (granted after his death; filed 1930) *(with F. A. Smith; Bristol Company)*

FRANKLIN B. BRISTOL

Year	No.	Subject (with others, or assignee)
1890		Button *(two-thirds to B. H. and W. H. Bristol)*
1890		Punch and die *(two-thirds to B. H. and W. H. Bristol)*
1900		(subject not legible) *(with W. H. Bristol)*
1931	1,809,578	Cone type loud speaker *(with W. H. Bristol)*
1934	1,958,813	Hygrometer *(Bristol Company (Franklin B. of Middlebury: brother or a son? REVIEW))*
1940	2,214,159	Impulse transmitter for telemetering systems *(Bristol Company (Middlebury; REVIEW))*
1943	2,320,0?6	Self-balancing circuit mechanism *(Bristol Company (Middlebury; REVIEW))*
1943	2,326,200	Telemetric apparatus *(Bristol Company (Middlebury; REVIEW))*
1950	2,516,952	Insulated thermocouple with metallic coating *(Bristol Company (Middlebury; REVIEW))*
1950	2,528,336	Relay system *(Bristol Company (Middlebury; REVIEW))*
1964	3,142,989	Liquid seal for differential pressure apparatus *("Franklin B. Bristol, Sr."; REVIEW)*

EDGAR H. BRISTOL

Year	No.	Subject (with others, or assignee)
1894		(subject not legible) *(with W. H. Bristol)*
1899		(subject not legible) *(with W. H. Bristol)*
1900		(subject not legible) *(with W. H. Bristol)*
1903		(subject not legible) *(with W. H. Bristol)*
1910	966,790	Recording pressure-gage (filed 1906) *(Industrial Instrument Company)*
1920	1,338,766	Mounting for instruments *(Foxboro Company)*
1920	1,340,148	Measuring instrument *(Foxboro Company)*
1922	1,405,181	Control system (filed 1914) *(Foxboro Company)*
1923	1,452,142	Liquid head gauge *(Foxboro Company)*
1924	1,481,047	Chart-holding device for recorders *(Foxboro Company)*
1926	1,582,865	Retainer for glazings and the like *(Foxboro Company)*
1926	1,592,415	Pressure gauge (filed 1917) *(Foxboro Company)*
1927	1,624,887	Measuring and controlling instrument *(Foxboro Company)*
1927	1,641,944	Controlling instrument *(Foxboro Company)*
1928	1,686,263	Measuring instrument *(Foxboro Company)*
1928	1,689,182	Separable-arm construction for measuring instruments *(Foxboro Company)*
1929	1,709,772	Latch for instrument casings *(with Bennet B. Bristol; Foxboro Company)*
1930	1,752,059	Recording instrument *(Foxboro Company)*
1930	1,781,212	Measuring instrument *(Foxboro Company)*
1931	1,811,417	Recording instrument (filed 1925) *(Foxboro Company)*
1932	1,840,830	Chart holder for recording instruments *(Foxboro Company)*
1932	1,880,755	Recorder *(Foxboro Company)*
1933	1,917,092	Control system *(Foxboro Company)*
1936	Re. 19,944	Control system (reissue) *(Foxboro Company)*

BENNET B. BRISTOL

Year	No.	Subject (with others, or assignee)
c.1915		(subject not legible; Naugatuck) *(assignor, by mesne assignments)*
1929	1,709,772	Latch for instrument casings *(with Edgar H. Bristol; Foxboro Company)*

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