

The Saturday Evening
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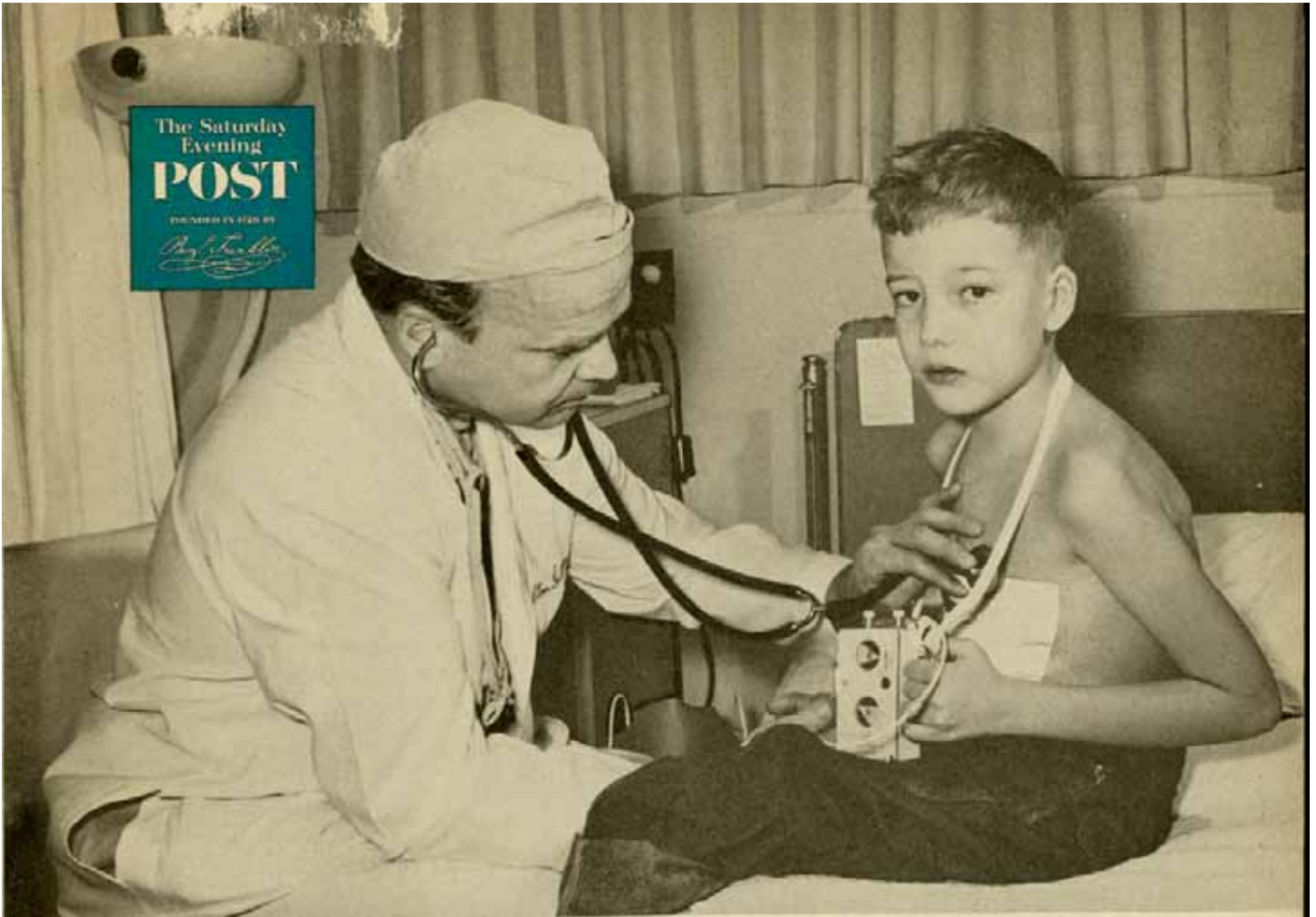
March 4, 1961 - 15¢

**Artificial "Pacemaker"
for Faltering Heartbeats**

THE EARLY-MANHOOD OF ABE LINCOLN

By PAUL HORGAN





David Williams's heart is kept ticking on schedule by the electronic pacemaker in his hand. Examining David is Dr. C. Walton Lillehei, who helped develop the device.

Making a Heartbeat Behave

An amazing new pocket-size ticker
sparks hesitant heartbeats and provides added years
of near-normal life for many cardiac patients.

By STEVEN M. SPENCER

In the marvelously integrated pattern of action that maintains life in the human body, one movement is central, paramount and indispensable—the beating of the heart. If it stops for five to fifteen seconds you become lightheaded or fall in a faint. A longer pause, further depriving the brain of oxygen, may produce convulsions. A halt of two minutes or more usually ends in death.

The heartbeat starts in a small network of fibers, called the “pacemaker,” lying in the wall of the upper right chamber, or auricle. From here the rhythm is transmitted over the auricle to a secondary center, then through a band of specialized fibers to the lower and most important chambers, the ventricles. Day after day, year upon year, the pacemaker, like a tireless orchestra conductor, taps out the vital tempo of life’s long and sometimes discordant symphony. It is a peculiarly autonomous process.

It is also electrical in nature; and upon this fact rests hope for many individuals suffering from certain types of heart trouble. Many interruptions of the beat are, of course, final and irreversible. But in some situations a lagging cardiac spark may be restored to near normal and the heart kept heating by an almost imperceptible tickle of current from a pocket-size assembly of batteries and transistors. Among the achievements of today’s engineering wizards this is one of the most dramatic, an electronic “heart” you can hold in your hand, a transistorized “spark of life.” From a lifesaving standpoint it is more important than the familiar electronic brain, and at a cost of \$385 and a weight of eight or ten ounces it is certainly cheaper and more convenient to operate.

There are now upward of 100 individuals, ranging in age from eight to the upper seventies, mostly in the United States, but including several in Europe, South Africa and Australia, whose lives hang by a thin pair of insulated wires attached to portable pacemakers. Surgeons who have made the hookup, inserting the electrodes directly into the heart muscle, estimate several thousand more in this country alone might be helped by these new instruments. Some of the patients have been wired to their cardiac batteries continuously for [13]nearly two years, without any harmful reaction, and so far as the doctors can determine the devices may be worn for many more years.

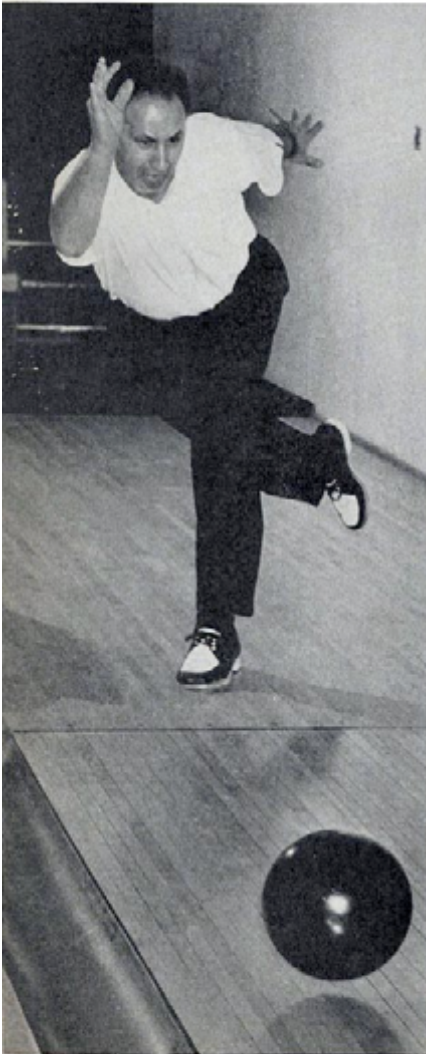
The attachment is remarkably strong and reliable. A confirmed golfer in Phoenix, refusing to let his battery and heart wires hamper his swing, entered an Arizona handicap tournament, spotted his opponent seven strokes and lost the match by only one stroke. A tool-and-die maker in Los Angeles has been back on the job for more than a year with an electronic pacemaker ticking away quietly under his shirt. Carl Barker, thirty-eight, has a professional interest in his cardiac sparker. He’s an engineer with the AC Spark Plug Division of General Motors, in Milwaukee. Five days a week he’s busy in the laboratory, or walking around the plant on business. He played some golf last summer, hiked through the north woods last fall and all in all leads a near-normal life.

Most of the patients carry their electric “hearts” in the pocket of a cloth belt or in a holster slung from the shoulder. Dials permit variation of the pulse rate and current output, and this is usually done by the doctor. Engineer Barker, a “do-it-yourselfer,” slows his own heart down to sixty or seventy beats per minute at night—he says it helps him get to sleep—and then dials it up to a snappy ninety when he gets out of bed in the morning.

In the newest and perhaps most promising development, a number of patients are wearing their artificial pacemakers under the skin, just above the beltline. Once installed, these cannot be adjusted without a minor operation. But Dr. William M. Chardack, of the University of Buffalo School of Medicine and the Veterans Hospital in Buffalo, who pioneered in this approach, finds that patients get along all right with a fixed pulse rate. For adults this is around fifty to fifty-five. A child’s heart normally beats faster. So Larry Graves, an eight-year-old from Fairmont, West Virginia, the first child patient with an implanted pacemaker has his set at eighty-five to ninety. Larry, whose difficulty was a complication of a heart operation, had his pacemaker installed by Drs. Samuel R. Schuster and Howard A. Frank at the Boston Children’s Hospital.

The implanted pacer that Doctor Chardack has now placed in eight patients was designed and built by a Buffalo electronics consultant, Wilson Greatbatch. It is powered by ten thimble-size mercury batteries, specially developed by the Mallory company and rated to last five years. When the batteries begin to wear out, they cause a warning increase in the pulse rate. The surgeon will then simply make an incision in the skin and, under a local anesthetic, lift the old pacemaker out, disconnect it and replace it with a new one. This is done under sterile conditions, and the junction is sealed with silicone rubber.

THEY WEAR ELECTRONIC TIMERS ON THEIR HEARTS



Anthony Tascia, 36, had to stop working as a laborer two years ago when heart block slowed his heartbeat. Now he has a surgically implanted pacemaker. He is studying to be a hairdresser and is again an active bowler.



Mrs. Gladys Pearson of Buffalo, N.Y. A pacemaker keeps her heartbeat regular, and she can go about her house without fear of fainting or falling unconscious.



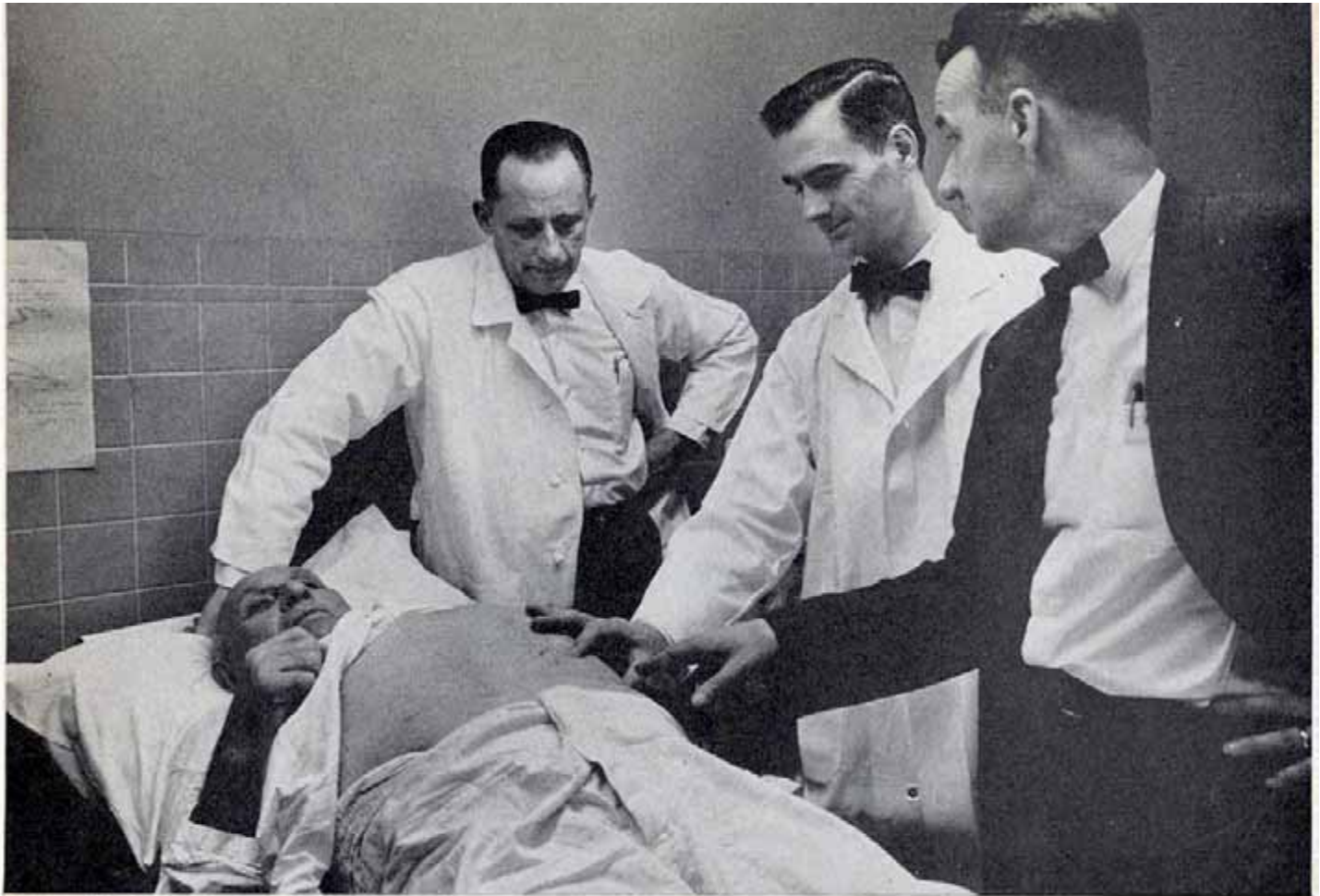
Frank Benzelt, 77, had the first "implanted" pacemaker installed a year ago. Before then, he fainted so often he wore a football helmet to protect his head.

If this all sounds almost too easy, and if the patients are amazingly calm and confident as I found them to be, credit should go to the engineering and surgical skills which have brought the electronic pacemakers to their present stage of perfection. Back of these neat little pocket tickets, however, were many years of difficult and sometimes disappointing research. And those who wear the devices today [14] shudder as they recall the blackouts, head-cracking falls and other near-fatal experiences they suffered before they got their hearts on a dependable electric schedule.



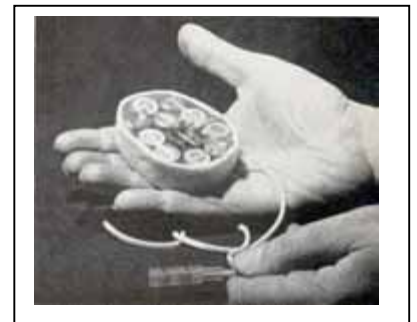
Warren Mauston, 74, holding the external pacemaker that has been regulating his heartbeat for two years.

Consider the story of Carl Barker, whose first intimation that he had a balky heart came when he fainted during a softball game in 1950. He was then living in Menominee, Michigan.



The team which developed the implantable type of pacemaker: From left, Dr. William Chardack, Dr. Andrew Gage (indicating the pacemaker's location beneath the patient's skin) and engineer Wilson Greatbatch.

Right: the implantable pacemaker. It is impervious to body fluids and is powered by ten five-year batteries. The two-pronged electrode in the foreground is "plugged" directly into the patient's heart muscle and transmits the vital impulses from the pacemaker.



"It was an early-evening game," he told me. "I had got on first on a walk and was running for second when I suddenly passed out. Friends helped me off the field, and I sat on the bench awhile. But one of the fellows, Al Doran, convinced me I should go to the hospital. The doctor there said I'd had a coronary attack."

The plugging of an artery nourishing his was apparently not too severe, and Barker, like many other coronary patients, made a good recovery. He returned to his job and to his golf and fishing and hunting. Then, in 1953, while walking, he suffered a second blackout. In September, 1957, his wife found him lying unconscious in the yard of their home in Milwaukee, where he'd been tossing a football over his head and catching it.

He was taken to a hospital and there had several convulsive seizures. His heart rate had dropped to between twenty-four and thirty. This and other signs, including the electrocardiographic tracing, showed that Barker was suffering from the condition known as heart block. The heartbeat signal from his own natural pacemaker was not getting through to the ventricles which do the main blood-pumping job. The ventricles do have a built-in beat of their own that comes into action when the impulses from the master pacemaker in the auricle are blocked. This rate is fast enough in some people to serve them well. But it was too slow for Barker's health. And there was always the danger of further stoppages, the Stokes-Adams attacks, as they are called, which might at any time be fatal.

In heart block the interference occurs in the cord of specialized muscle fibers known as the bundle of His. Named for the German physician Wilhelm His, who discovered it in 1893, and pronounced "hiss," the bundle arises in the floor of the right auricle, passes down through the septum dividing the left ventricle from the right, and then splits into two branches, one for each ventricle. Because of its location the bundle of His or one of its main branches is occasionally damaged by a coronary attack, as in Barker's case, or by heart surgery, or by infection or certain drugs. Whatever the cause, the injured bundle of fibers fails to function as a message carrier, and the heart-rate orders are not transmitted. The auricles may continue to contract at a normal seventy to eighty beats per minute, while the ventricles plod along at a slow twenty-to-forty tempo.

Various medicines—molar lactate solution, epinephrine and especially isoproterenol—are often helpful. Isoproterenol—better known by its trade name of Isuprel—works by increasing the irritability of the heart so that the ventricular beat speeds up. Barker received this medical treatment for a time, but he nevertheless suffered several more Stokes-Adams attacks. They were so severe that he had to stop work, and his wife, Geraldine, took a job to help support the family, which included four small children.

In the meantime, Barker had read a newspaper report on the portable, transistorized pacemaker developed by the noted University of Minnesota heart surgeon, Dr. C. Walton Lillehei, and two electrical [(continued on Page 48)] [15] [Making a Heartbeat Behave (Continued from Page 15)] engineers, Earl E. Baaken [sic] and Norman A. Roth. He went to Minneapolis to consult Doctor Lillehei about it, was advised to wait awhile and eventually returned in January, 1960, to have a pacemaker installed.

This is an operation of varying magnitude, depending on circumstances and the surgeon's choice of procedure. In Barker's case, the surgeon made a small incision between the patient's ribs, near the breastbone, to expose a portion of the heart—the outside of one ventricle. Then he pushed into the heart muscle the bare ends of two braided stainless-steel wires, placing them a fraction of an inch apart. These were the electrodes, and across them would jump the tiny, rhythmic pulses of electricity—a few thousandths of an ampere—that would stimulate the entire heart muscle to contract. The remaining length of the wire pair, insulated with a silicone plastic resistant to body fluids, was led out through a small hole in the chest wall and attached to two terminals of the pacemaker, which is a trifle larger than a deck of cards.

As a matter of fact, because Doctor Lillehei expected Barker to be wearing a pacemaker for many years, he attached a second set of electrodes to his heart wall and coiled the rest of the wire under the skin for future use if the first lead should break. A few months later one of Barker's heart wires did fail—though this has been a rare occurrence—and his family doctor easily connected the pacemaker to the spare lead.

"I change the battery about once a month," Barker says. "They are very reliable—and cost four dollars and fifty cents apiece. One time I did feel faint, realized my pulse had slowed down, and began to check my wiring. My wife and I soon found the trouble—a loose connection on the pacemaker. I tightened that up and everything was all right again."

"Aren't you afraid you'll accidentally brush against the switch and turn your battery off?" I asked,

“No,” said. “There isn’t much chance of that. You see, the controls are recessed and are arranged so that it takes two hands to shut off the pacemaker.”

“What do you do with it when you take a bath?”

“I have a waterproof extension cord and I lay the pacemaker on a stool beside the tub. Some people, I understand, wrap it in a plastic food bag and hang it on the shower curtain,”

The artificial pacemaker, with direct attachments to the heart, was originally devised in a concentrated research effort to combat the fatal heart block that occurred in some of the children operated on for septal defects. These are congenital holes in the partition between the right and left sides of the heart. Most troublesome, from the standpoint of heart block, are the defects lying in the part of the septum separating the ventricles. For here the surgeon must work close to the branching bundle of His, which he cannot see because it is buried beneath the surface. No matter how delicately and cautiously he makes his stitches, in sewing up the opening or putting a patch over it, the message-carrying fibers are occasionally injured. The heart then suddenly slows down, and the patient, requiring in the critical postoperative period even more blood than usual, may die.

This is a hazard that has plagued all heart surgeons. Doctor Lillehei and his associates encountered it when they began to do open-heart surgery—with the heart-lung machine taking over the circulation—in 1954. Heart block occurred in about 10 per cent of the children and young adults in whom they were repairing ventricular septal defects. Of the first seven patients who developed this complication in 1954 and 1955, all died during the immediate postoperative period.

The doctors tried everything to restore the heart rate—epinephrine, ephedrine, atropine, sodium lactate, and even a large external pacemaker, wheeled to the bedside on a cart. When they started to use Isuprel, they were able to reduce the mortality in these surgical heart-block cases from 100 per cent to 40 per cent. But this was still far too high.

The powerful external pacemaker had been invented in 1952 by Dr. Paul M. Zoll of Beth Israel Hospital and Harvard Medical School, and produced by the Electrodyne Company of Norwood, Massachusetts. Used with flat electrodes held against the chest, or in some surgical conditions held directly on the heart, the Zoll instruments have been of tremendous benefit in emergency treatment of stopped heart or of ventricular fibrillation—a disorganized and ineffectual squirming movement of the heart muscle.

But this type of apparatus produced an electrical potential of fifty or sixty volts or more, which gave a distinct shock and made the muscles of the chest twitch. It was difficult to keep patients on it for an extended period. “Children were terrified by it,” Doctor Lillehei explained, “and we couldn’t keep it attached for more than an hour or so without burning the skin.”

So Doctor Lillehei, with Dr. William L. Weirich—now of the University of California medical center in San Francisco—and Dr. Vincent L. Gott, went to work in the research laboratory to develop a gentler method of keeping a child’s heart going.

“We recalled the classic experiment that every medical student performs in his physiology course,” Doctor Lillehei said, “placing an electric wire in a turtle’s heart, after removal from the body, and seeing it continue to beat for hours. We decided to carry out a similar experiment in dogs after surgically producing heart block in them. One electrode was inserted in the dog’s heart and the other in the skin of the animal’s chest.”

Whereas fifty or sixty volts had been required to trigger the heartbeat through external electrodes, the direct attachment to the heart worked with only eight tenths of a volt to nine volts—an average of 2.25 volts in a series of tests. And in nearly all of the fifty dogs, stimulating the heart to beat at a rate of ninety to 160 per minute brought the blood pressure and cardiac output back up to normal levels.

Encouraged by these results in dogs, the Minnesota surgeons began in January, 1957, to apply it to young heart-surgery patients—with marked success. With the low voltage and amperage, the children felt nothing at

all as the pacemaker clicked away. There was no burning of the skin and no muscular contraction. And among the first eighteen heart-block cases so treated there was only one death. This death occurred when the second electrode, which was taped to the skin, accidentally became dislodged. To obviate such difficulties henceforth, this second electrode was placed *under* the skin or directly into the heart muscle, alongside the first electrode.

Now, the instrument used to supply an electrical heartbeat for these first Minnesota patients was still a bulky bedside apparatus, plugged into the house current, with transformers stepping down the voltage. To help develop a lightweight pacemaker the patient could carry around, the doctors sought the help of Earl Baaken [sic], a young University of Minnesota electrical engineering graduate. Baaken and a classmate, Palmer J. Hermundslie, had organized a small company, Medtronics [sic], Inc., to handle electrocardiographs and other electronic equipment used in medicine. They were also beginning to manufacture specialized apparatus, having survived a period, as Baaken put it, "when we had to service TV sets to keep eating."

Using a small 9.4-volt mercury battery with a life of 1000 hours and a transistorized oscillator transformer that generates a pulse of one to twenty milliamperes, the Medtronics [sic] engineers designed a pacemaker measuring only four by two-and-a-half inches and one inch thick. The inner parts are "potted" in a rubbery plastic to keep them from shaking loose and to seal them against moisture. The case is of white plastic and has two terminals on top, two adjustment dials on the face—one for rate and one for current output—handles on the sides for attachment by belts or tapes and a red neon light that flashes with each heartbeat.

"You can turn the flasher off to save the battery," one of the engineers told me. "Actually we considered omitting it entirely, but many patients seem to want it. They can see it flashing through their undershirt, and it gives them a feeling of assurance."

In the last six and a half years approximately 1500 patients have undergone open-heart surgery in the University of Minnesota Hospitals. Since January, 1957, the direct heart-wire types of pacemakers, large or small, have been employed on 140 who suffered from the heart-block complication. In most instances the instruments were attached only temporarily, and these patients are not to be confused with the 100 or more around the world with chronic heart block who are wearing them for extended periods. As a matter of fact, 60 per cent of the Minnesota surgery patients who were given the electronic assist regained their own natural rhythm within a few days to a few weeks and could be "weaned" from the electrical pacer. A quarter of them still had the characteristic slow beat and were sent home for continued treatment, with Isuprel or, in a few instances, with the portable pacemakers. "These have also got along fairly well," Doctor Lillehei reported. "In some it may be advisable to install a permanent pacemaker." The remaining 15 per cent died, from various complications incident to the extensive surgery required for their heart lesions, or from respiratory difficulties, multiple congenital defects or other causes. While these latter patients were still in heart block at the time of death, their failure to recover was in *(continued on Page 50) (Continued from Page 48)* virtually all instances related to these other factors; their pacemakers were effectively continuing their heartbeat until death intervened.

"When a patient is recovering from the block and returning to a normal pulse rate, we turn off the pacemaker, but leave it in place," Doctor Lillehei explained, "with a companion transistorized monitoring device hooked into the circuit. If the heart should slow down again, the monitor sounds an alarm and also switches the pacemaker back into action. If the heart maintains its natural rhythm unassisted for several days, we then disconnect the artificial pacemaker completely."

Fascinated as they are by mechanical gadgets, the child patients from eight or nine on have a remarkably good concept of what the pacemaker is all about. "They'll tell us at once if we have cut down the voltage," one of the surgeons said, "and they are very good about not pulling out the wires. They know how much depends on those wires."

Especially grateful for the cardiac booster are the adults with heart block from nonsurgical causes. Plagued by that slow and erratic ventricular beat, they had experienced serious fainting spells and were living under the constant threat of sudden death. Now, with their hearts firmly linked to the electronic pacemakers, “that threat has been removed,” as Doctor Lillehei has stated, “and their physical and emotional rehabilitation has been dramatic.”

For some individuals, like Carl Barker, the Milwaukee engineer, the threat had been present for years. Others were struck by a single, acute, near-fatal episode and were then rescued. This was the story of Warren Mauston, seventy-four, who has a lubricating-oil business in St. Paul. In March, 1959, while on a motor trip to visit a son, in Iowa, he was seized with an attack of bleeding ulcer. He was brought back at once to St. Paul and entered Bethesda Lutheran Hospital for treatment of the ulcer. “I had so many transfusions it was like a complete oil change,” he quipped. But the ulcer then provoked a heart attack and that, in turn, brought on a complete heart block, all within a few weeks. The heart stopped for a full two and a half minutes, as registered on the hospital electrocardiograph, and in one twenty-four-hour period he had forty convulsions. There was also a slight stroke that caused some weakness in his left leg.

When medical treatment failed to check the patient’s downhill course, a pacemaker was suggested. “After what I’d been through and after my family doctor, Larry Noble—I’ve known him since he was a kid—explained it to me, it took me just eight minutes to make up my mind,” Mauston said. The operation was performed by Dr. Samuel W. Hunter, assistant professor of surgery at the University of Minnesota and director of cardiac research at St. Joseph’s Hospital, St. Paul. He attached the wires to the heart with a new type of electrode which he and Norman A. Roth, then of Medtronics, Inc., had designed to reduce the amount of current necessary to drive the heart. It consists of two short stainless-steel prongs protruding from the under surface of a small block of Silastic silicone rubber.

Mr. Mauston has now been wearing his pacemaker continuously for nearly two years—something of a record. “They tied it on me on Good Friday, March 27, 1959,” he said, “and that was a day I’ll never forget.” He’s had no cardiac difficulties since; and although he occasionally frets at being unable to go out on the golf course as he used to, he putts on the living-room rug or in the back yard when the weather is good, gets up and downstairs and walks around the neighborhood. “Considering what might have happened without this,” he remarked, tapping the ticker beneath his shirt, “I’m the luckiest man in ten states.”

While the experiences of Mauston, Barker and scores of other patients have firmly established the value of artificial pacemakers, various engineers and doctors are still experimenting with different models and different ways of installing them. Considerable interest has recently focused on the type now being worn beneath the skin by eight patients in the Buffalo area and by several elsewhere.

The pacemaker used by the Buffalo group was designed by Wilson Greatbatch, the Buffalo engineer mentioned earlier in this article, and was assembled by him in the barn-loft workshop behind the 130-year-old remodeled farmhouse in suburban Clarence, where he and his wife and five children live.

A former associate professor of electrical engineering at the University of Buffalo, and now an electronics consultant with a firm heavily engaged in defense work, Greatbatch finds the pacemaker project a morally satisfying change of emphasis.

“Most engineers get fed up with making electronic gadgets for killing people,” he confided. “That’s one reason we like to do this work with the doctors, on the side. In fact, in the Institute of Radio Engineers we have a professional group in biomedical electronics, with 2000 engineer and scientist members around the country, organized to assist in devising instruments and apparatus for medical use.” Greatbatch was one of the original members, and he helped form the Buffalo-Niagara chapter.

He began the pacemaker project in 1955, but had trouble getting doctors interested in it, he said, until he met Doctor Chardack, chief of surgical service at the VA hospital in Buffalo, in 1957. Doctor Chardack, who is also associate professor of surgery at the University of Buffalo School of Medicine, immediately saw the possible advantages of a pacemaker reliable and long-lived enough to be trusted inside the body.

“By implanting the device one avoids the danger of a wire being snagged and disconnected from the heart,” he observed. “And more important, there is less chance of infection, a hazard where the wire emerges through the chest wall. And the patient with his pacemaker under his skin can bathe and swim without worrying about a short circuit.”

Doctor Chardack, his associate, Dr. Andrew A. Gage, and Engineer Greatbatch carried out nearly two years of experimental work and testing on dogs before they were ready to place their miniature pacemaker inside a human patient. Their first patient to have an implanted pacemaker is a lively, ruddy-cheeked gentleman of seventy-seven named Frank Henefelt. Before his retirement he'd been a parts inspector with an optical company, and for many years before that he was chief tester for the old Pierce-Arrow Company.

Henefelt had suffered an attack of pneumonia in 1957, but had apparently made a complete recovery. “I was one hundred per cent,” he remarked, “and could work around the yard, climb a ladder to put up screens and do most anything.”

“Then in 1959 I began having blackouts. I had one while I was in the bank, another down in the cellar. I'd fall without warning, and I bumped my head so hard a few times—actually fractured my skull once—that I got a football helmet to wear.”

Henefelt's heart was “wired” in April, 1960, in an operation at the Millard Fillmore Hospital in Buffalo. For the first few weeks it was connected to an external pacemaker, so the doctors could adjust the current strength and pulse rate to his requirements. On June sixth the surgeons transferred the wires to the miniature pacemaker, coated it with a Dow Corning silicone rubber to protect it from body fluids, sterilized it in a bag of ethylene oxide gas and slipped it through a skin incision made in the left side of the abdomen. There it rests, in a sort of anatomical watch pocket, making only a slight bulge at the waistline and causing no discomfort.

With a heart rate as regular as clockwork, a steady but reliable fifty-five per minute, Henefelt has got along fine. He enjoys a moderately active life. He raked the leaves in his yard last fall and can putter around the house or walk to the neighborhood stores. He has had no more fainting spells, and his wife says she is no longer on edge all the time for fear he'll fall.

Henefelt and several other patients on whom Doctor Chardack and Doctor Gage operated last spring and summer represent, in the words of their doctors' report in *Surgery*, “the first recorded successful instances of correction of a physiologic disorder by an implanted and self-contained electronic device carrying its own source of power.”

Inability to speed up the pulse rate to meet the demands of exercise, as the normal heart does, might be considered a shortcoming of the implanted and preset pacemaker, and this at first bothered Doctor Chardack and others concerned with the development. Fortunately, however, the heart has two ways of putting out more blood. It can (1) beat faster, or (2) squeeze harder at each stroke. In some ways the second method is the better. “The mark of a trained athlete,” Doctor Chardack observed, “is a slower-than-average pulse, about sixty, and a big stroke volume. This is the most efficient arrangement because it gives the heart a longer rest period between contractions. Of course, if the pulse is too slow, as it was in these heart-block patients before treatment, the heart tries too hard to increase its stroke volume and becomes enlarged and weakened. But patients on the pacemaker, set at a moderate rate, compensate, something like the athlete in training, by a slightly increased output per stroke.”

This is not to say that members of the electronic heart club are encouraged to play touch football. They must remember they are still heart patients, not athletes. It should also be emphasized that the pacemaker, outside or inside model, is not the answer to all heart diseases. The Buffalo doctors would limit the implanted type to those whose chronic and persistent heart block is severely disabling and cannot be controlled by drugs. And they advise setting the pulse rate “just fast enough to prevent disabling attacks and to permit very moderate physical activity.”

Moderation these men and women are glad to accept. For they have gained at the same time a tremendous amount of self-confidence. This is perhaps the most important contribution the pacemakers have made to their lives. One sees it in almost every patient he talks with.

Mrs. Louise Kreher, a sweet, brown-eyed woman in her fifties whose husband died of a heart attack three years ago, had been suffering from the typical fainting spells for many years. “I used to dread going outdoors alone,” she told me, “because I was always afraid I’d faint and fall. I’d go across the street to the store and then wonder why I had come and would feel like crying. Now I go out often; I can shop for an hour or two and only feel a little tired, nothing to worry about.”

Anthony Tasca, thirty-six, who enjoyed athletics and bowled two or three times a week, had begun to feel unusually tired about two years ago. He blacked out at the races one afternoon—his horse had just run second. Further fainting spells, and the eventual diagnosis of heart block forced him to give up his job in the shipping and loading department of a Buffalo tire company. But with his new electronic heart in place, life is beginning to brighten up again. Tasca has not been able to return to the heavy work at the tire plant and has been training for a new vocation, hairdressing. But he is bowling again and has played golf. “With the wires under my skin, I don’t have to worry about snagging them when I swing.” he remarked.

“Don’t you worry about your battery going dead?” I asked.

“No. If the pacemaker should stop, my heart would simply drop back to its former slow beat, and I’d have plenty of time to call the doctor.”

So now Tony Tasca bets on the pacemaker instead of the pacers. He’s convinced he has a sure thing.

THE END