

A CENTURY OF TELEGRAPH KEY DEVELOPMENT

By Louise Ramsey Moreau, W3WRE
Glenolden, Pa.

The history of communications is actually the record of man's many attempts to reach out beyond his visual and aural limits to receive and to send information. From simple fire beacons, drum signals, the earliest heliographs, and flags, through the mechanical semaphore that began in France and spread throughout Europe, and to the various needle telegraphs in England, each was effective for its time. And each was an improvement over earlier systems. However, except for the needle telegraph with its handle that could be twisted to the left or right, not one employed a simple easily operated instrument to transmit intelligence until May, 1844. At that time, only a few weeks before the Washington-Baltimore demonstration, Alfred Vail gave communications the first key as we now know it, or as Morse called it, "The Correspondent".

Vail, in the process of testing the wire in preparation for the experiment, discovered that it was much simpler to send the message by opening and closing the circuit. His first "key" was actually just a strap key, all brass, even to the contacts, but it was the one used on May 24, 1844.

During the next six months Vail experimented with the first crude "Correspondent", attempting to realize easier and smoother operation. By November, 1844, he had arrived at the basic pattern of every key made since, described as "a lever acting upon a fulcrum". It, too, was all brass, with a spring placed almost as an after-thought to keep the contacts from closing.

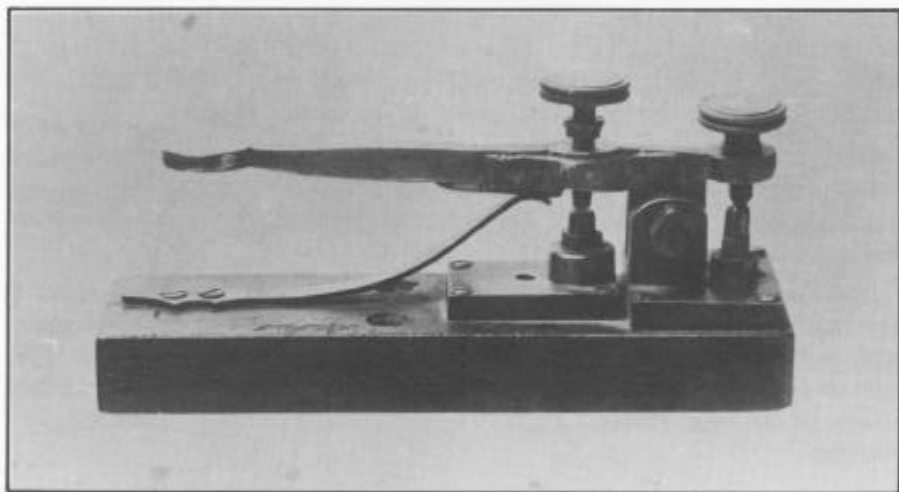


Fig. 1. Alfred Vail's "Lever Correspondent", November, 1844.

Photo: Smithsonian Institution

Interestingly, while that particular style with the straight lever lasted for just four years before new designs emerged, because of the personal preference of some operators, its use and manufacture continued throughout the 19th century.

In the United States the operators themselves influenced the design of this important tool of their profession, suggesting modifications for comfort and ease of operation. In 1848 the first change involved mainly the spring. In the original Vail key it was supposed to support the lever, but there was little resiliance and after some use it dropped the lever and the contacts closed. Three instrument makers, Thomas Hall of Boston, Hinde and Williams, also of Boston, and Charles Chubbuck of New York, made the first changes. Hall added weight to the lever at the rear and curved it down towards the table, mounting all components on a metal base with a much shorter spring. Chubbuck designed a heavy lever of solid brass, also curved, but eliminated the leaf spring and substituted a coil type, as proposed by Thomas Avery, at the rear of the lever. Hinde and Williams moved the leaf spring to the center of the key, thus placing less weight on it and giving better balance, and from these men we have the so-called "Camelback" design which would last for twelve years (although the coil spring supplanted the original leaf spring). Also, during this decade, the brass contacts were replaced with either platinum, or silver, which was much more durable.

While there were no further major physical changes in the telegraph key as such, by 1849 the need for a portable instrument to be used for field work outside of the office led to the consolidation of both the key and sounder mounted on a single base. Known as a K.O.B. (key on base), they were first used not only in operating but also as test instruments for a short time. By 1857 they were replaced as test sets by the small pocket relay, usually referred to as a "lineman's test set" by the trade. By the time of the Civil War both of these much more compact sets were adopted by the North and the South for military communications in the field.

In 1860, just one year before the war, George M. Phelps, Chief Machinist of the newly organized Western Union Co., originated the idea of adding an adjusting screw to vary the spring tension, giving a better match to the individual operator's needs. These lovely Phelps keys became the only instruments in the Western Union offices in this country and were used almost exclusively by Federal Military Telegraph operators throughout the Civil War.

By the mid-1860's the era of the Camelbacks was coming to an end. Despite their very elegant construction and almost perfect balance they had one glaring fault, and that was the fulcrum, or trunnion. The lever was made of red brass while the trunnion was steel, and after much use the steel caused the softer red brass to wear and slide off center. Over a period of ten years there were many attempts to correct the problem.

One of the first changes in the Camelbacks came in 1869 when the lever was smoothed into the present-day curve of the Bradley style, but still made of brass and still with the steel trunnion. In 1875 Western Electric introduced their Lewis Key, entirely nickel plated on an ornate base.

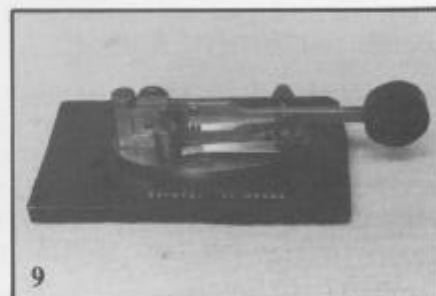
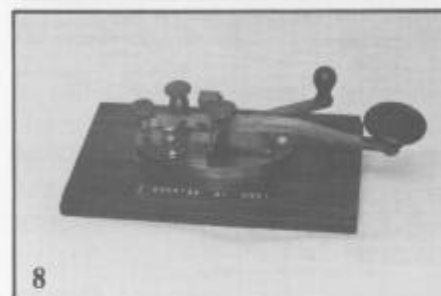
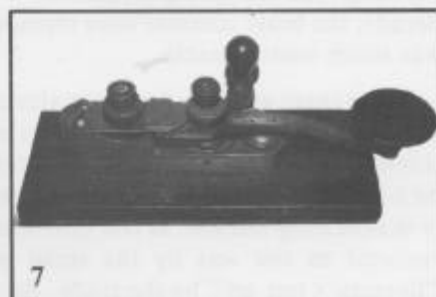
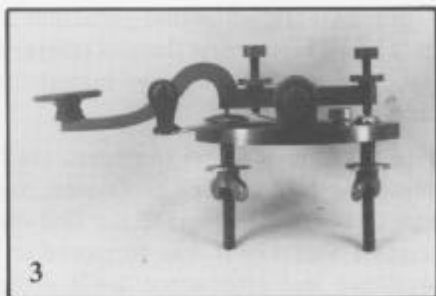


Fig. 2-9: 2. Thomas Hall Camelback, with curved lever and weight in the rear; 3. G.M. Phelps Camelback with spring adjustment; 4. 1859-60 "Pocket Relay" as used by linemen to test wires; 5. C.W. Lewis Key by Western Electric—a shallower lever curve and separate trunnion; 6. 1851 Bunnell Steel Lever—hollow, oval frame with single, one-piece lever; 7. 1886 Steiner Key—Western Electric patent—strip spring and no trunnion; 8. 1883 Victor Key (Hamilton patent)—all brass w/one piece lever made for L.G. Tillotson Co. Advertised through 1920; 9. 1888 Bunnell Double Speed Key—with horizontal action to alleviate "telegraphers' paralysis". Photos: 2, 3, 5, 6, 8, 9—R.O. Williams; 4—Western Union Co.; 7—L.R. Moreau

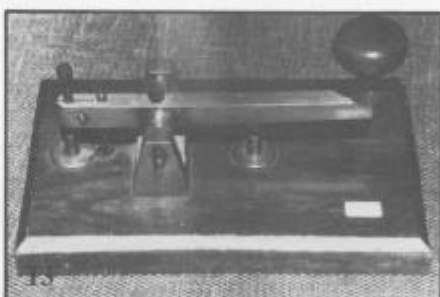


Fig. 10-13: 10. 1900 "Twentieth-Century Key" designed by Skirrow and Shirley, made by Foote Pierson Co., for operators with a "glass arm"; 11. ca 1900 submarine cable key (alternating key) with 2 levers to utilize the full curve of the alternating current; 12. "Grasshopper Key" used by Marconi and Kemp in early wireless experiments; 13. 1905 Slaby-Arco key ("Door Knob Key")—used with high-power spark transmitters.

Photos: 10—Western Union Co.; 11—National Museum of Canada, Ottawa; 12—London Science Museum; 13—A.W.A. Museum

In the meantime, others were still vainly trying to find the answer to stop the lever from slipping, but the trunnion remained a problem throughout the 1870's. Then, in 1881, Jesse H. Bunnell startled the operators and the industry with the key design that solved the problem and has never been surpassed, when he gave us the well-known "Steel Lever" that the Bunnell Co. has since advertised as "The Triumph".

By the following year it had been accepted by all the companies and all the railroads, since this design with the solid steel trunnion formed as a part of the lever was the answer to the puzzle. Most manufacturers followed suit. The Altoona shops of the Pennsylvania Railroad made some excellent keys of this design, while the L.G. Tillotson Co. came up with a variation of the single one-piece lever and trunnion in the Hamilton Patent of 1883. This was their "Victor Key" which employed a knife fitting for the solid trunnion. It was, and still is, an excellent instrument, and in fact, Bunnell was still producing the Victor key in 1920.

Three years after the introduction of the Tillotson key, Western Electric followed with their "Steiner Key", which, while it was acceptable, unfortunately required considerable skill to adjust the tension correctly.

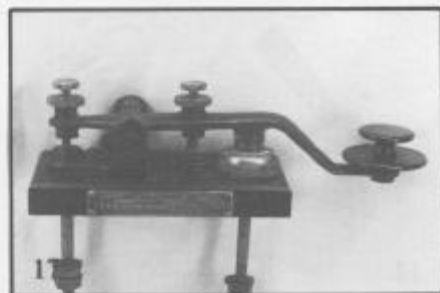


Fig. 14-17: 14. 1904 "Oil-Break Key" with contacts in oil to control arcing, and with protective disc under knob; 15. 1905 American deForest 10-kW Navy key—1-inch, coin-silver contacts with brass cooling fins; 16. 1911-12 Marconi Co. heavy open-circuit key with closing switch; 17. 1915 U.S. Navy 35-ampere key with $\frac{1}{2}$ -inch silver contacts and brass cooling fin—slate base.

Photos: 14, 17—L.R. Moreau; 15, 16—A.W.A. Museum

Because from the beginning company policy throughout the industry permitted an operator to work with a key of his choice, many railroads still provided the straight lever key, while the Western Union shops in Ithaca continued to manufacture camelbacks. These styles of keys continued in use right up to the turn of the century, although the steel lever - the fastest and most efficient of the hand keys - was appearing as a replacement in more and more offices. The "Pole Changer" keys for Quadruplex or Duplex turned out thousands of words of copy daily. By 1900 the camelbacks were no longer advertised.

As the volume of telegraph traffic increased, the occupational hazard known as "telegraphers' paralysis" began appearing more and more among the operators, and much thought was given to try to find means to alleviate or prevent the crippling problem. In 1886 two telegraphers, A.J. Maloney and A.G. Johnson, produced a "Convertible Key" as they termed it, by which the vertical action of the key could be changed to a horizontal movement by turning the straight lever and locking it into position. Following this, in 1888 Bunnell announced an improved model, known today as the "Sideswiper", and advertised by them as the "Double Speed Key". This key was instantly popular with those suffering with the telegraphers' affliction.

The year 1900 opened with the introduction by the Foote Pierson Co. of Skirrow and Shirley's "Twentieth-Century Key." This was promptly nicknam-

ed the 'pump handle' and became quite popular with the B & O operators.

In 1902, Charles Yetman, a millionaire with some forward thinking ideas, was inspired by the typewriter that had begun to be used in offices. Using its principles, he devised and patented the Yetman transmitter which enabled the operator to type Morse characters on a wire. For two significant reasons it was not well received by the telegraph fraternity. First, the telegrapher had to know how to type with a steady, even touch to be able to maintain smooth transmission, and second, while a typist could transmit, a professional telegrapher was still needed at the receiving office to read the sounder.

By this time there was an even greater need for higher sending speeds. A code of abbreviations, known as the "Phillips Code", standardized by Walter Phillips in 1879, had cut transmitting time by one-third, so that it was possible for a single operator to clear from ten to eighteen thousand words in a single duty shift. While the operators could, *and did*, handle those mountainous loads of traffic each day, it became increasingly obvious that an improved, higher-speed, easily operated key was required.

There had been attempts at developing types of vibrating keys as early as the 1870's, but because of little or no provisions for damping in their construction, the kings of the wire who were so proud of their ability to clear thousands of words in a day would have nothing to do with them, and condemned them all as "fit-only-for-a-bug-to-use", or "sounds-like-a-bug." By way of explanation, at the end of the 19th century the word "bug" was used by the profession to describe poor operators who interfered, were 'rotten' senders, or who broke with infuriating frequency. And because the attempts at developing speed keys were so ineffective, and reminded the outspoken, crack operators of the lousy 'plugs', another derogatory term, they condemned all such keys as "bugs", and the name stuck.

In 1902, the same year that Charles Yetman received his patent, a Western Union telegrapher, Horace G. Martin, applied for a patent for a speed key that became the archetype of all semiautomatic keys. The "Autoplex", as it was called, used a pair of dry batteries to activate two coils or magnets which held the pendulum stationary for the manually-created dashes, but then released it to make the automatic dots.

With this patent Martin literally slammed the door on everyone else. In the eight pages of drawings and specifications for the first attempt at a semiautomatic key, he included almost all possible methods of creating dots automatically and dashes manually. Thus he virtually had the field to himself, as would-be competitors were soon to learn.

Two years later, in 1904, Martin introduced his "Vibroplex", an original design that has never been surpassed and has been copied by every company that has manufactured speed keys. The "Original" was so perfectly designed that there has been only one significant change in the past eighty years. In 1906 the dot contact on the pendulum was modified to the familiar "U" type mounting. Otherwise there has been no reason to change any of the original design.

In 1906 William Coffe designed one of the few keys, the "Mecograph", that

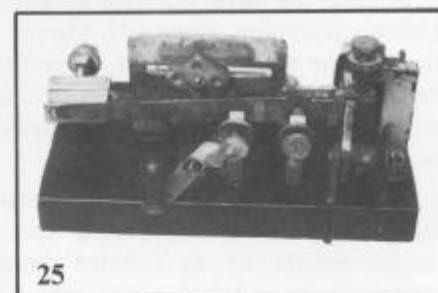
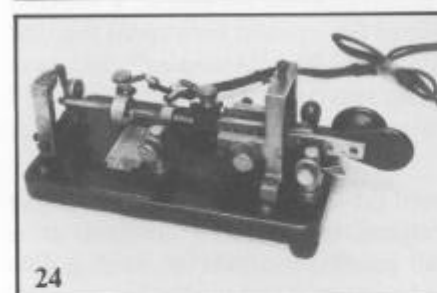
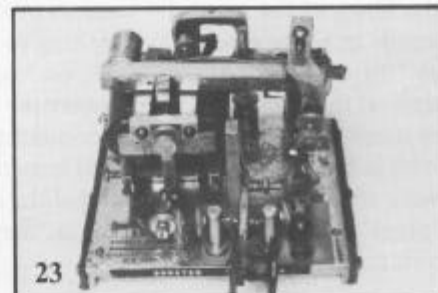
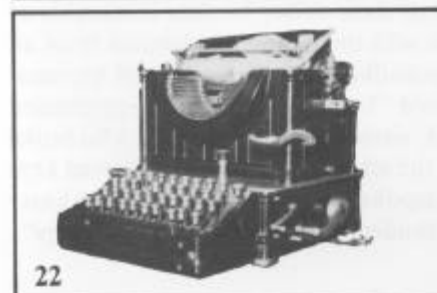
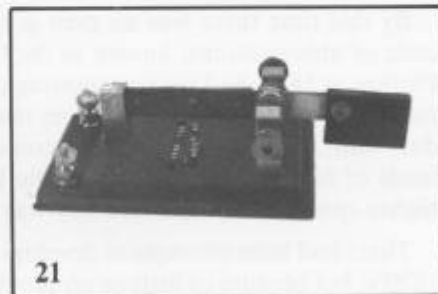
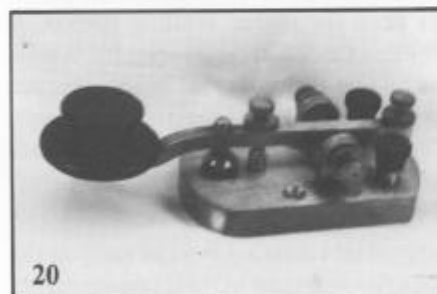
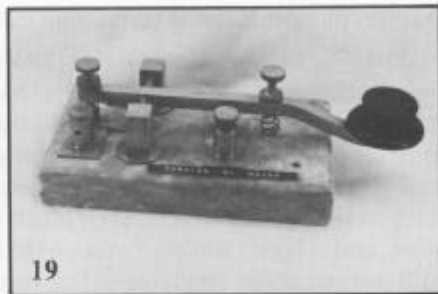


Fig. 18-25: 18. 1910 radio amateur "Dime Key"; 19. 1915 Clapp-Eastham "Boston Key" with marble base and german-silver-plated working parts; 20. 1916/1917 Signal Electric rectangular brass key w/1/4"-, 3/8"-, or 1/2"-contacts; 21. 1920 Homemade "sideswiper" spark key with 1/2"-contacts; 22. 1902 Yetman keyboard transmitter; 23. 1903 "Autoplex" by H.G. Martin. His 1st semiautomatic, powered by 2 batteries; 24. 1904 Vibroplex "Original" prototype by Martin; 25. 1907 "Mecograph" by Benjamin Bellows—the "right-angle bug".

Photos: 18, 20, 21, 22, 23, 24—L.R. Moreau; 19, 25—R.O. Williams

were able to compete with the Martin patents. His vertical style was revised the following year by Benjamin Bellows and Ambrose Behner into the more recognizable horizontal form that the telegraphers promptly nicknamed 'the right-angle bug', because of the position of the thumb and fingerpieces in relation to the pendulum. In 1909 Bellows changed the layout for a more easily adjusted dot speed. The right angle position and the spring action were the main reasons that they were able to bypass the Martin patent, since Mecograph operates on a release of spring tension, while the Vibroplex uses the creation of tension. Thus the Mecograph Co. remained in business as a competitor.

The only other competition in the field of semiautomatic keys arrived in 1909 when the Hulit Co. of Topeka, Kansas, introduced the "Hulit Transmitter", two completely separate keying units housed in a metal case. As with the others, the dashes were manual, while the automatic dots were governed by a key-wound spring that required rewinding by the operator when it ran down. Because of this the Hulit was not popular as compared with the instant and continuous fast action of the Vibroplex and the Mecograph, and by 1912 it was no longer on the market.

Although semiautomatic keys were born at the same time that radio appeared as a communications medium, they were designed solely for landline use. A few radio operators experimented with their use, but the high current-handling requirements of the spark transmitters required that a keying relay be used, and the receiving equipment had trouble following the strings of fast dots. Keys had to change radically to accommodate the more powerful system involving much higher currents.

In 1896 Marconi initially had used the so-called "Grasshopper Key", which automatically cut out the receiver to prevent its being disabled by the transmitter. As the transmitters became more powerful, the keys and the contacts became larger and heavier. Safeguards had to be added. The Walter Massie Co., for example, produced one of the largest of these with an all-cast brass lever, a slate base, and a brass cooling surface. This monster key weighed some eighteen pounds.

Others, such as the American deForest keys, had contacts that ran to one inch in diameter for a ten-kW transmitter, while the United Wireless instrument had long curved levers mounted on marble or slate bases. Another safeguard was the flat disc under the knob which was inserted to protect the operator's fingers from touching the metal lever, which was alive with high voltage. This device, incorrectly known as a "Navy Knob", should more correctly be termed a 'skirted knob'. In many of the large coastal stations with extremely high power the transmitter was keyed through a "Relay Key", and many of the Navy keys had half-inch contacts, rated to handle current as high as thirty-five amperes.

Almost simultaneously with the advent of commercial radio communications the amateur radio operators entered the picture. Joe Hamm could not afford the big commercially manufactured keys, so, as with most of the rest of his equipment, he built his own by soldering dimes onto a telegraph key and mounting it on a slate or a thick wooden base. Other hams scrounged bits of

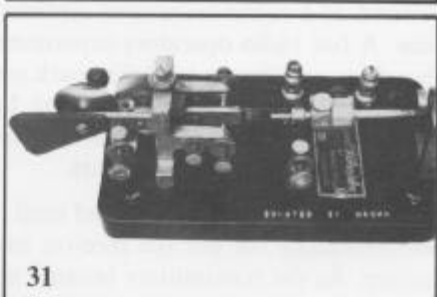
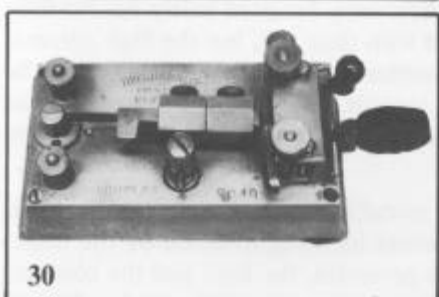
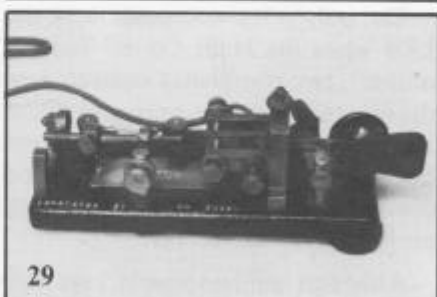
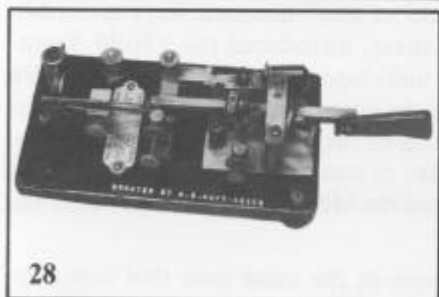
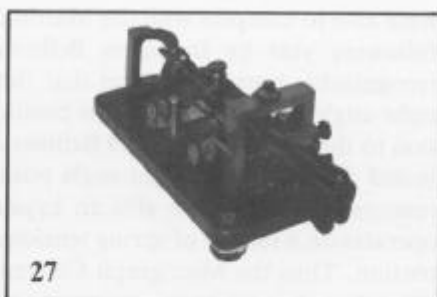
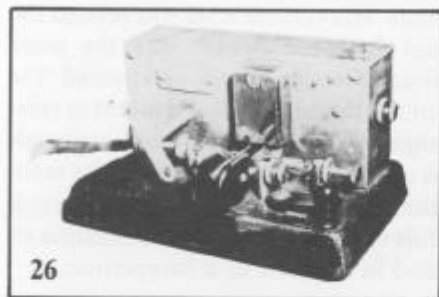


Fig. 26-33: 26. 1909 "Hulit Transmitter"—dots created by a key-wound spring; 27. 1911 Martin two-lever Vibroplex—the 2nd Vibroplex; 28. 1912 "X Model" Vibroplex—Martin's 3rd design, using a single contact for both dots and dashes; 29. 1914 Vibroplex "Number Four"—Martin's half-size automatic, later called "The Blue Racer"; 30. 1909 Thomas J. Dunn Co. "Dunduplex"; 31. 1914 A-to-Z Novelty Co. "bootleg bug", sold as "The Improved Vibroplex"; 32. 1914 "Albright License" brass plate affixed to a "bootleg bug"; 33. 1917 Vibroplex "Upright", Martin's 5th patent—the "Wire Chief's Key". Photo: 26, 30—L.R. Moreau; 27, 28, 29, 31, 33—R.O. Williams; 32—C.S. Moore

wood, some brass hardware, a knob from a dresser drawer, and used nuts and bolts for contacts. Such 'home-brew' keys sometimes worked well enough for the ideas to be described in the newly appearing wireless magazines.

As spark transmitter design developed, the necessity for the large, heavy-current keys declined, with the result that in 1915 Clapp-Eastham introduced a new key for the radio amateur and the private yacht trade. This was the so-called "Boston Key" with a marble base and german-silver-plated working parts, and every amateur yearned to own one. This 'dream key' cost \$15.00, but there were other marble-base keys such as the RECO which cost a lot less, and while not of the 'status' as the "Boston", were just as attractive and much more affordable. Also, the Bunnell Co. began making keys with replaceable contacts for spark transmitters; these were available to amateurs, and the design was picked up and copied by the Signal Electric Co. Eventually, in the 1930's, it became the Johnson hand key.

Radio operators quickly discovered that the 'glass arm' was not limited to the telegraph, and the 'sideswipers' were adapted for spark transmitter use by adding larger contacts. By 1920 there was the "Cootie" key, a Bunnell horizontal key, Montgomery Ward keys, and even a Sears and Roebuck key. However, when CW was introduced in the early 1920's there was no longer any need for the heavy, cumbersome spark keys, and at last the lighter, speedier telegraph instruments, including the speed keys and the semiautomatics, could be used in wireless communication.

In 1911 Martin had adapted the Hulit dual-lever idea for his "Double Lever" Vibroplex. It prevented any possibility of 'split dots', a problem he was determined to solve. The following year he had another idea and created the "X Model", which used the same single contact for dots as well as for the dashes, with a stop that caught and held the pendulum stationary while the dashes were being made.

In 1914, the need for a smaller key which could be easily carried to sports events or conventions brought the half-size "Vibroplex Number Four" into being. Later called the "Blue Racer", it became a familiar sight on news desks everywhere.

After the death of Benjamin Bellows in 1913, Martin picked up the Mecograph patents and by 1914 was advertising his company as "The Martin Vibroplex and Mecograph Company". J.E. Albright was listed as the sole agent for Vibroplex. Martin by then was 'king-of-the-hill', had no competition, and had, he thought, literally cornered the market.

But there was competition. There was nothing difficult about making one of these keys, and homemade models abounded as did those from the mushrooming commercial manufacturers, for here was a potential market that showed signs of a golden harvest. One of those who tried to profit from the new technology, as early as 1909, was the Thomas J. Dunn Co. with its "Dunduplex". This key provided hand-sent semiautomatic capability at the top of the bridge, with standard horizontal operation below. There were others such as the "Vail-O-Graph", the "Double Lever Key" of the William MacDonald Co., designs from the Mt. Auburn Specialty Co., and versions of the

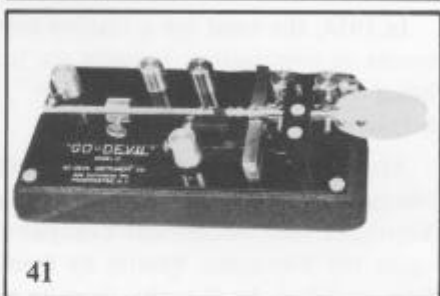
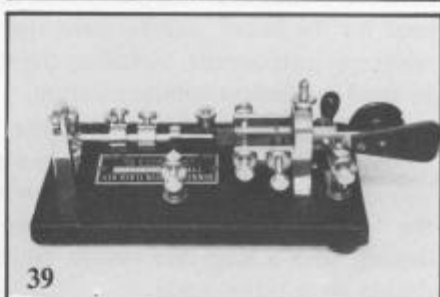
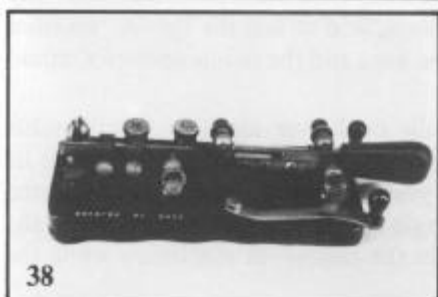
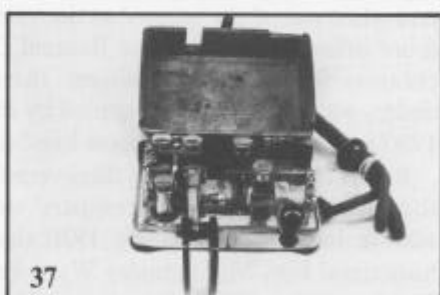
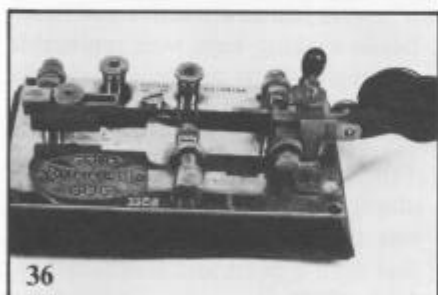
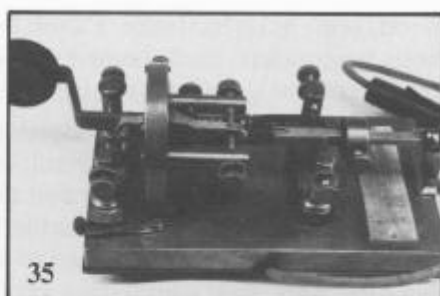
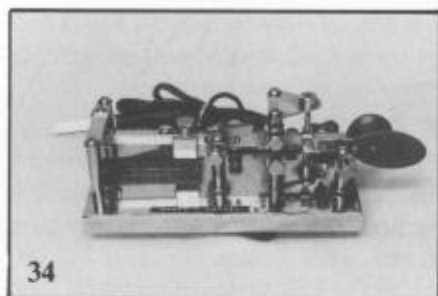


Fig. 34-41: 34. 1923 Vibroplex "Number Six". In the 1930's known as the "Lightning Bug". Model for the Signal Corps J-36 key; 35. 1922 Lytle "Triplex"—can be operated three ways; 36. 1925 J.H. Bunnell Co. "Gold Bug"; 37. 1925 "Ultimate" miniature bug; 38. 1926-27 Signal Electric "Sematic"—combination sideswiper/semiautomatic; 39. 1940 Bunnell-Martin "Flash Key"; 40. 1929 Les Logan Co. "SpeedX"; 41. 1951 "Go-Devil", originally designed in 1931.

Photos: 34, 35, 39, 41—R.O. Williams; 36, 37, 38, 40—L.R. Moreau

semiautomatic from O.J. Thomas.

These 'bootleg bugs' became a problem when Max Levy of the A-to-Z Novelty Co. introduced the most flagrant of all 'Chinese copies' in an attempt to buck the control of the market by Vibroplex. He advertised his key as the "Improved Vibroplex". It was almost an exact carbon copy, including the black japanned base with the gold carriage-style trim which was more or less an identity symbol of the Martin keys.

For Martin, that was provocation enough and through Albright, his sole agent, he fought back in the courts. In so doing he confirmed the validity of the Vibroplex and the Martin patents, and established that the use of any infringing products was grounds for legal action. This convinced both the railroads and the major telegraph operating companies, with the result that no semiautomatic key except a Vibroplex was permitted to be used on their wires.

Unfortunately for Vibroplex, many of these other keys were excellent instruments and equal in performance. From the beginning of the telegraph industry, company policy had always permitted the operator to use the key of his choice, and the operators refused to give up this prerogative. The rule caused considerable resentment and almost led to an operators' strike.

The impasse was solved through a compromise. All 'outlawed' keys were to be tested, and if their performance was comparable to the Vibroplex, with clean characters, no split dots, and could meet the Western Union specifications of eleven dots per second, the owner was permitted to purchase a brass plate that read, "THIS MACHINE NOT GUARANTEED, NOR MADE, BUT ONLY LICENSED BY J.E. ALBRIGHT", followed by a serial number. The owner paid two dollars for the plate, attached it to his key, and the key then became 'legal'. Such a key, with the license tag attached, was then known as either the "Legal Bug" or more often as the "Albright Bug".

By 1917, the problem of severely crowded operating space was critical, particularly for a wire chief, and Martin answered the need with "The Wire Chief's Key", also known as the "Upright Vibroplex". It was instantly renamed by the trade as the "Vertical Bug". As with the "X Model", this instrument used the single contact. Manufacture of both the Upright and the X Model was discontinued in 1925.

Signal Corps requirements during World War I put a stop to commercial manufacturing for the duration, but afterwards production and development resumed. By the early 1920's the "bug" came into its own as cw displaced spark and the vast opportunities of radio were opened to the semiautomatics. With the relaxation of the Vibroplex monopoly, other speed keys began to appear on the air and on the wires. In 1922 Walter Lytle of Philadelphia offered his "Triplex" which could be worked three ways, by rotating the circular disc on the bridge for either right or left-hand keying, or by locking it in the center for use as a straight key. J.H. Bunnell also advertised their "Gold Bug", with a novel method of preventing split dots.

By this time the profane definition of the word 'bug' had fallen into disuse, but the term remained with the telegraphers as the designation for a speed key. Vibroplex had already formalized it several years previously by registering it as

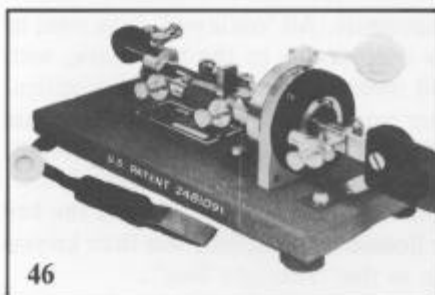
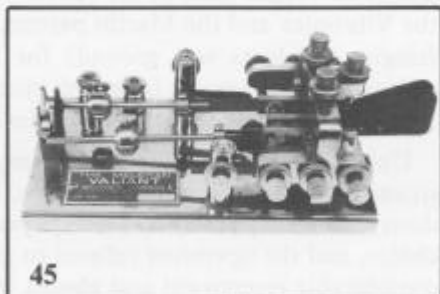
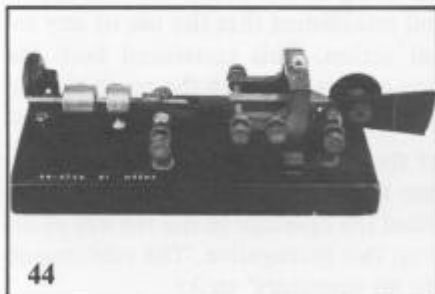
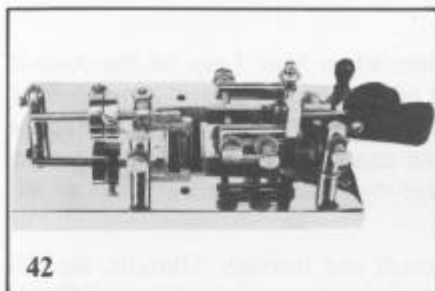


Fig. 42-46: 42. 1940 Telegraph Apparatus Co. "Speed Bug" which closely resembles the Logan Key; 43. Ted McElroy's "Mac Key" combination straight/semiautomatic; 44. 1929 "Radio Speed Bug"—the Depression Era kit key for under \$5; 45. 1938-39 Melehan "Valiant" fully automatic key; 46. 1950's "Dow Key"—a modernized Lytle Triplex.

Photos; R.O. Williams

one of their trademarks, with a stylized insect on the nameplate.

Then, in 1923, twenty years after the first semiautomatic key, Martin patented the best of all his speed keys, the great "Number Six". In the 1930's this was appropriately advertised as the "Lightning Bug."

Several other keys could be mentioned here. In 1925, one of the unusual designs was the "Ultimate," popularly called the 'miniature bug', reminiscent of the Mecograph, but small enough to be carried in the pocket for use in remote operation. Another was the "Sematic" by Signal Electric, which could double as either a semiautomatic or a sideswiper. Still another, the "Keen Kode Key," was different in that it used a keyboard for the dots and a hand key to manually create the dashes. Vibroplex also courted the amateur radio market by offering instruments with red, blue, green, black or nickle plated bases. In particular they offered the "Martin Junior", with larger contacts for radio operation.

Toward the mid-1930's Martin left Vibroplex and organized the Martin Research and Manufacturing Co., producing the Martin "Flash Key." This

design was acquired by Bunnell in the 1940's and subsequently sold as the "Bunnell-Martin Flash Key."

Also during the 1930's the Les Logan Co. originated the familiar line of "SpeedX" keys, including the often misnamed "Logan Bug." These were acquired by the E.F. Johnson Co. in the late 1940's, and "SpeedX" became synonymous with Johnson.

Some other names: The "Go-Devil", another attempt at combining the sideswiper and semiautomatic as a single instrument. The "Speed Bug" by the Telegraph Apparatus Co. was an all-chrome plated key, reminiscent of the Logan. And this was also the time of the undisputed "Speed King", T.R. McElroy and his well-known "Mac Key", which was popular for both commercial and amateur use. After his famous (and so far unbroken) record, he came out with the Deluxe model, the "Super Speed Stream" key, in both hand and semiautomatic versions.

The only key ever sold in kit form, the "Radio Speed Bug", was priced at under five dollars. The "Electro Bug" had a switching device on the base to adjust the dot relay to operate with various current strengths. Then, at the end of the 1930's, came the key that was the realization of the dreams of the inventors back to Martin, one that sent dashes as well as dots automatically. This was Melvin E. Hansen's "Melehan Valiant", but it was not too successful.

World War II brought a stop to all production for other than military needs, and after the war ended only a few new items appeared. In addition, a newer style of the "Go Devil" and a modernized version of the Lytle Triplex known as the "Dow Key" were introduced. Finally, using the basics of semi-automatic keys and the old sideswipers, the instruments which activated the new electronic keyers emerged; and Charles Yetman's dream was finally realized in the modern keyboard instruments.

CONCLUSION

This paper has attempted to document the development of American telegraph keys. For almost one hundred years they were an important and integral part of the communication industries. The original "Correspondent" never did pass out of the picture, since it still exists in the present-day "strap key" used by the police and fire services and the railroads.

There is much more to be told if one includes the development of telegraph keys which occurred simultaneously in other countries. Germany's Siemans-Halske, and Baumeister; Italy's Milano; Ducretet et Roger of France, and Ihili of Norway should all be mentioned. There was also Halder, Siemans, the GPO in England, and many manufacturers in Japan.

The story of the 'key' was a century-long, world-wide event, ranging from the closed-circuit instruments in the United States to the open-circuit systems of Europe and Asia. In the process of development, many men from many nationalities were represented; all were telegraphers seeking to provide faster and better communications.