The present application is a continuation in part of applicants' prior application dated March 4, 1952, filed May 23, 1952, Serial No. 289,498 now abandoned.

This invention relates to an automatic telegraph key apparatus and is more particularly concerned with an electronic device of this nature, which will automatically key an electrical circuit producing any desired combination of dots and dashes, as for example, keying in International Morse code a radio telegraph transmitter.

In the transmission of telegraph signals by wire or radio telegraph signals by radio, it is desirable to transmit messages by means of automatic instruments. Hand keying has a limited use. The degree of proficiency of the operator depends on many factors. Hand keying is particularly undesirable where long transmissions are required, or where high speeds must be maintained. Physically, the hand operator is limited to short transmissions as well as to low speeds. Speeds in excess of 45 w.p.m. are very rare and speeds above 50 w.p.m. are practically unknown by the hand operator.

Therefore, automatic keyers have been devised which permit transmitting signals at rates as high as 600 w.p.m. Automatic telegraph instruments are used not only for the purposes hereinabove stated, but are used in schools where radio telegraph operators are taught International Morse code. For such purposes, it is essential to have the transmission performed by automatic keyers, as the signals are required to be transmitted at varying rates of speed for periods ranging from two to twenty-four hours per day. The automatic telegraph keyer performs this function, transmitting the code signals with uniform perfection.

Therefore, there have been two types of instruments used (one), a photoelectric type keyer which uses an inked tape, inked according to the telegraphic code. This device has the disadvantage of requiring a high tape speed and thin translucent tape. The high tape speed results in the use of a much greater length of tape than does the present device, and because the light beam must pass through the tape to reach the photo cell, a thin translucent tape must be used. This results in short tape life and tape breakage. The tiny light beam must be accurately positioned and frequently readjusted. It is a characteristic of this type keyer, to produce characters which are not sharp and well defined. Other keyers using Wheatstone perforated tape and power driven reciprocating keyers often damage or destroy the tape in the midst of a transmission. For training radio operators in schools, where it is desirable to obtain as much use as possible out of a single tape, these keyers are limited to between five and twenty re-runs before a new tape must be provided. Furthermore, if the tape making device does not make a perfect tape, these keyers are unable to pass the tape. For example, the sprocket wheel driven used in other keyers will tear the tape should the free passage of the tape be prevented by improper patches or free turning of the supply reel.

It is accordingly, the general object of the present invention, to improve over existing devices for automatic keying and provide a device adaptable for the purposes above indicated, which can provide constant speed at any rate desired, while providing sharp, clean cut signals and a tape life far greater than any heretofore provided by the present known devices.

For a better understanding of the present invention, together with other and further objects thereof, reference is made to the following description, taken in connection with the accompanying drawings, its scope will be pointed out in the appended claim. The accompanying drawings referred to herein and constituting a part hereof, illustrate an embodiment of the invention and together with the description, serve to explain the principles of the invention.

FIGURE 1 is a front elevation of one embodiment of the keying apparatus according to the present invention.

FIGURE 2 is a top elevation of the keying apparatus according to the present invention.

FIGURE 3 is a front elevation of the keying head.

FIGURE 4 is a side elevation of the keying head.

FIGURE 5 is a schematic wiring diagram of electrical elements used in the apparatus.

FIGURE 6 is a perspective of a modified form of anvil having conical recesses.

FIGURE 7 is a fragmentary section on an enlarged scale, taken on line 7—7 of FIGURE 6, showing the cooperation of one of the pecker points with the conical recesses of the anvil.

Referring now to the drawings, the elements comprising our improved instrument may be seen in FIGURE 1. Secured to the outer side of wall 2 thereof, is provided spindle 3 arranged to receive tape supply reel 4. Takeup spindle 5 is arranged to receive takeup reel 6. Takeup spindle 5 is arranged to be rotated by spring belt 7 and driven by synchronous motor 8 from capstan drive shaft 9. Capstan drive shaft 9 is arranged to receive capstan drive wheel 10, and capstan drive wheel 10 is arranged to be driven by synchronous motor 8 through reduction gears 11 and 12.

Bushing 18 is mounted on the inside of wall 2 and arranged to take idler shaft 14, to which is fastened idler arm 15. Idler roller 16 is mounted so as to be freely rotatable on idler arm 15. Tension spring 17 is attached to the shaft 14 and to the inside of wall 2 and arranged to keep idler 16 in firm contact with capstan drive wheel 10.

The keying head, FIGURES 3 and 4, is attached to the front of wall 2 and consists of pecker arms 19 and 20 arranged to be pivoted on shaft 21. Pecker points 23 and 22 are mounted on the pecker arms 19 and 20 respectively. Contact points 25 and 24 are mounted on the opposite ends of pecker arms 19 and 20 so that all electrical circuit making and breaking is through the contacts 24 and 25 and none through the pecker points 22 and 23. Contact points 26 and 27 are mounted in insulating block 28; contact tension springs 30 and 29 are arranged to apply tension to the contact arms 19 and 20 so that contact points 24 and 26, and 25 and 27 remain normally closed.

Anvil 18 is rigidly affixed to the outer side of wall 2 and arranged thereon so that pecker points 22 and 23 are normally in contact therewith, and, as shown in FIGS. 1 and 3, the pivotal supports 21 are located relative to the arms 19 and 20 and the anvil 18 so as to place the arms 19 and 20 substantially tangential to the surface of the anvil at the point of contact of the pecker points 22 and 23 with the anvil. Also, as is shown in FIGS. 3 and 4, the axis of the pivotal supports 21 is located substantially twice as far from the contacts 24 and 25 as from the pecker points 22 and 23, thus amplifying the movement of the pecker points 22 and 23 about twice, as the movements thereof are transmitted to the contacts. This amplification reduces the critical adjustment which otherwise is necessary for the mounting of the contacts 24 and 25. The tape guide 31 is rigidly mounted on the front of wall 2 and serves to accurately guide the tape from supply wheel 4 to anvil 18. Referring further to FIGURE 2, there is mounted on chassis 32, power trans-
formers 33, output transformer 34 and vacuum tube and condenser complement 35. Referring now to FIGURE 5; unit 70 comprises a conventional tone source; unit 71 is a conventional tone amplifier; unit 72 is a conventional power supply and unit 73 is the keying control.

Specifically, unit 70 comprises two audio oscillator circuits consisting of tapped inductances 36 and 37; resistors 38 and 39; and condensers 40 and 41. These are connected in a conventional circuit well known to the art, providing an output of two fixed frequencies, each of different pitch. Combined in the mixer potentiometer 42, the output of unit 70 is amplified by unit 71 in the following manner. The output is fed through mixer 42 to volume control potentiometer 43, which in turn increases the signal on the grid cathode circuit of unit 71. Amplification of the signal is performed in the tetrode 44, in a conventional manner well known to the art. In this connection, cathode resistor 45 and by-pass condenser 46 are placed in the cathode circuit. The output of unit 71 is transferred across the secondary of impedance matching transformer 47, and is available for signal tone at jack 48. Output for signal tone is available at jack 48, only during the period when contact points 49 of relay 50 are closed. The control of relay 50 is performed by unit 73 in the following manner:

Contact points 24 and 25 are opposite contact points 26 and 27, and by the motion of pecker arms 19 and 20 can be caused to come in contact. Contact 27 is electrically connected to the control grid of thyatron 51. Contact 26 is electrically connected to the coil of relay 50, which forms part of the anode circuit of thyatron 51. Resistor 52 is a current limiting resistor. Resistors 53 and 54 comprise a voltage divider circuit connected across the D.C. power source, unit 72. The voltage drop across resistor 54 produces a bias voltage which prevents ionization of the arc between cathode 51, when the anode potential is applied through relay coil 50 and current limiting resistor 52. Shaft 21 is electrically connected to the cathode of thyatron. When contact point 25 is in contact with contact point 27, the control grid of thyatron 51 is electrically connected to its cathode, thereby reducing the bias voltage between control grid and cathode to zero, firing thyatron 51, rendering it conductive, energizing relay coil 50 from the D.C. power source unit 72. When the coil of relay 50 is thus energized, contacts 49 close, completing the output circuit in unit 71 and producing a tone signal at jack 48. Contacts 49 will remain closed until thyatron 51 is re-ionized. When contact point 24 is in contact with contact point 26, the anode potential of thyatron 51 is diverted to its cathode, with the resultant effect of deionizing thyatron 51, interrupting the flow of current to relay 50, permitting contacts 49 to open and cutting off the tone signal from unit 71 at jack 48.

Unit 72 is a conventional power supply, utilizing vacuum tube rectifier 55, power transformer 56, filter coils 57 and 58, and filter condensers 59 and 60. When the perforated tape 61 passes under the pecker points 22 and 23, the row of perforations 62 will activate pecker point 23, producing movement of pecker arm 19. The row of perforations 63 will activate pecker point 22 and pecker arm 20.

To use this apparatus at a telegraph key, it is only necessary to mount the supply reel 4, containing a supply of standard Wheatstone perforated tape, upon spindle 3 and thread the tape under tape guide 31 over anvil 18 and under pecker points 22 and 23, and in a clockwise direction between capstan 10 and idler 16 continuing to take up reel 6. The small tone grid of the Wheatstone tape will fall exactly beneath pecker points 22 and 23.

In the International Morse code, two dots represent the letter "i." According to the Wheatstone perforation system, and well known to the art, tape perforated for the lead of the International Morse code, will consist of four perforations in two rows of two perforations each 64. The top perforations of the letter "i" 64 and 65 will permit pecker point 23 to fall into the perforation 64, closing contacts 25 and 27, connecting the control grid of the thyatron 51 to its cathode, thus reducing its bias to zero, causing it to ionize and rendering it conductive.

The resulting flow of current from the D.C. power supply through the resistor 52 and relay coil 50 energizes the relay, closing its contact 49. This circuit closes feeds the tone from the tone amplifier 44 to the listening or output circuit 48. The tape passes beneath the pecker points, pecker point 23 will then ride on the paper separations between the perforations 64 and 65 thus opening and holding open contact 25 and 27. This reestablishes the bias voltage of the thyatron control grid.

Because of the characteristic of a thyatron, the gas therein is not deionized and the current continues to flow, holding relay contacts 49 closed, and continuing the tone from the tone amplifier, unit 71. Since pecker arm 20 is slightly longer than pecker arm 19, contact points 24 and 26 will be closed slightly later by the tape perforation 66.

Therefore, the tone is continued until the perforations 66 cause pecker point 22 to fall into perforation 66 closing contacts 24 and 26, diverting thyatron anode potential to its cathode, deionizing the thyatron, opening the relay contacts 49 and turning off the tone. This above described action produces a tone of sufficient duration to constitute one dot. The second dot is produced in a like manner by perforations 65 and 67.

A dash, which is a continuous tone three times longer than a dot is produced exactly as is the one described dot, except that the longitudinal spacing of the tape perforations is three times greater than the dot spacing.

In the species of the invention illustrated in FIGS. 1-5, inclusive, and described above, the motion of pecker arms 19 and 20 is limited by the thickness of the tape 61. The standard commercial tapes are .004" thickness, and critical adjustments is required of contact adjustment screws 26 and 27. In a modified form of the invention illustrated in FIGS. 6 and 7, elements which are the same as those in FIGS. 1-5, inclusive, have the same reference numerals, while elements modified in form have the same reference numerals increased by 100 to avoid confusion. In this form of the invention, the anvil 118 is provided with conical recesses 80, 81 which constitute a means whereby the lateral, reciprocating motion of pecker arms 19 and 20 is greatly increased, thereby reducing the critical adjustment heretofore required of contacts 26 and 27.

The operation of the modified form of the invention shown in FIGS. 6 and 7 is similar to that described above in connection with FIGS. 1-5, inclusive. The addition of the conical recesses 80 and 81 in the anvil 118, permits a larger movement of pecker arms 19 and 20 thus facilitating the opening and closing of the switch contacts without holding such close manufacturing tolerances and the conical surfaces of the points 22 and 23, shown in FIG. 7, cooperate with the force exerted thereon when the tape 61 is moved forwardly so as to minimize the force necessary wedgingly to move the pecker points out of the anvil recesses 80 and 81 and the tape recesses 62, thus greatly minimizing wear on the tape beyond the anvil.

While we have described in detail a modification of the present invention illustrated as embodied in an auto-
matic telegraph keyer apparatus, it is to be understood that changes may occur to those skilled in this art.

The invention in its broader aspects is not limited to the specific mechanism shown and described but departures may be made therefrom within the scope of the accompanying claim without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

A telegraph keyer for operation with a keying circuit and a signal tape having two parallel rows of perforations, one representative of the initiation of signal characters and the other representative of the termination thereof, comprising: an anvil means for continuously translating a signal tape thereacross; a tape-sensitive relay including a pair of contact operating arms each having a contact element and a conical feeler element at opposite ends thereof; means intermediate the ends of said arms substantially twice as far from said contact elements as from said feeler elements for pivotally mounting said arms with one of said feeler elements positioned in advance of the other feeler element in the direction of tape movement a distance of the order of one-half the minimum center-to-center perforation spacing in a row in said tape and with each of said feeler elements disposed transversely to register with a different one of said rows of tape perforations; a pair of stationary contacts each arranged to register with a different one of said arm contacts; and said anvil having a pair of recesses therein with sloping sides and spaced to register with said feeler elements and each of said arm and feeler elements being proportioned to close its respective contacts upon registry of its feeler element with a tape perforation.

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