

Aug. 18, 1942.

L. M. POTTS

2,293,077

TELEGRAPH TRANSMITTER

Filed Feb. 15, 1940

2 Sheets-Sheet 1

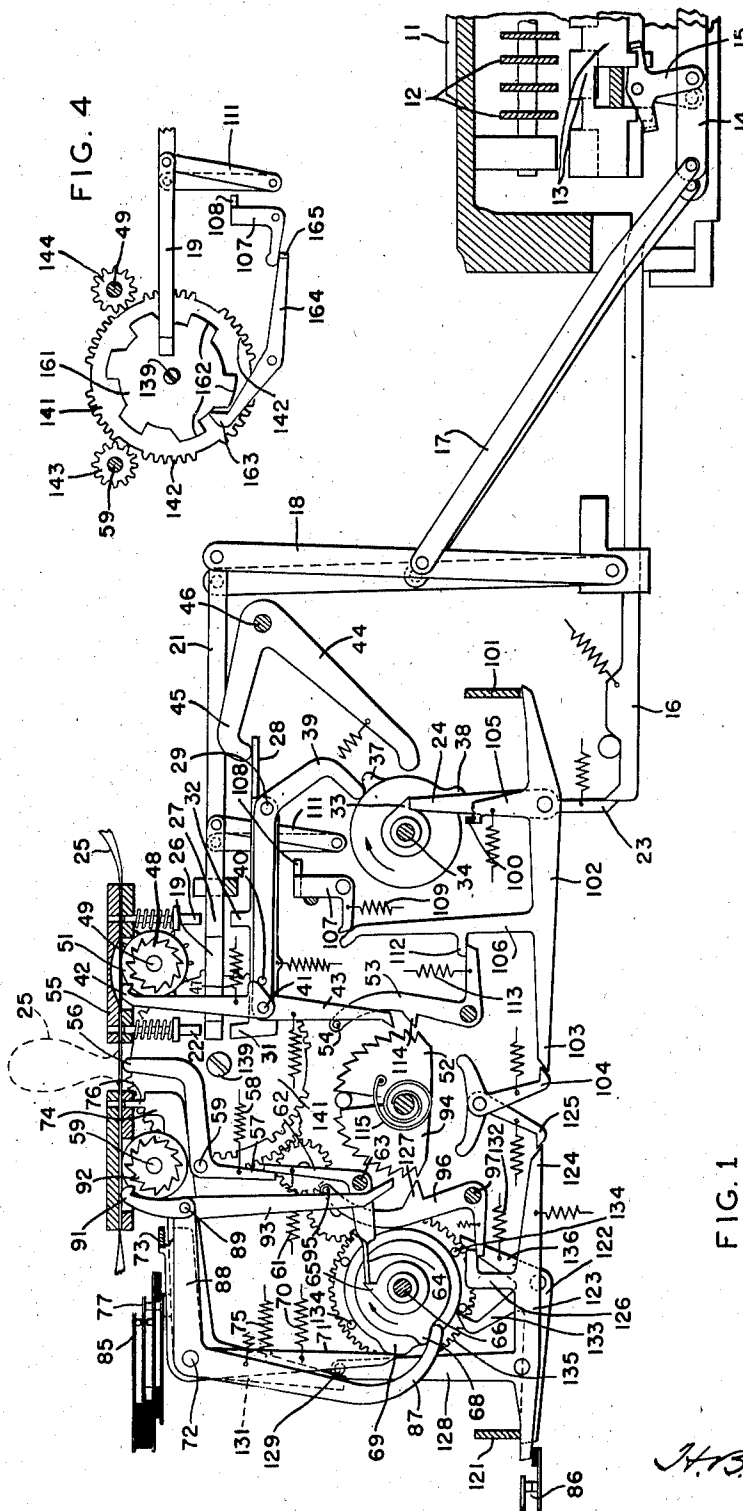


FIG. 1

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FIG. 2

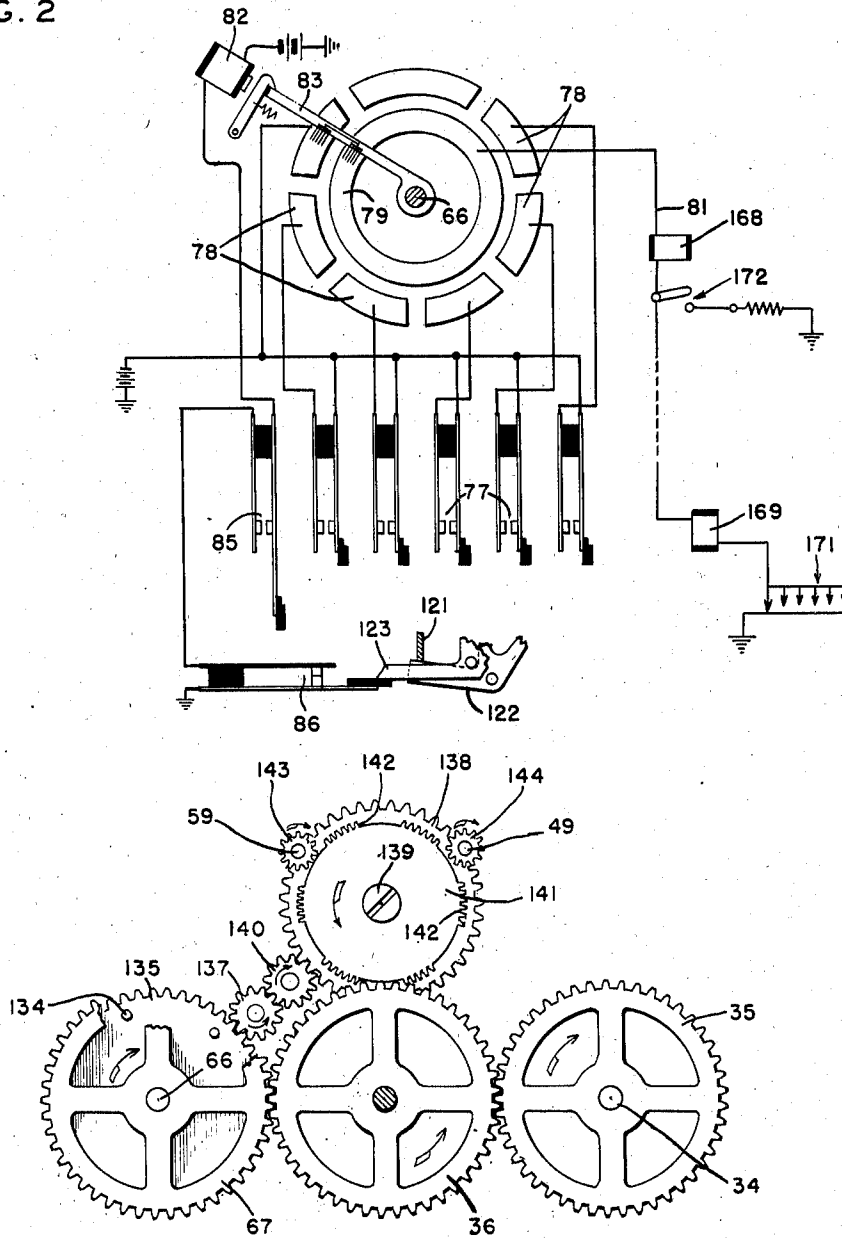


FIG. 3

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TELEGRAPH TRANSMITTER

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36 Claims. (Cl. 178-17)

The present invention relates to telegraph transmitters and particularly to keyboard controlled record preparing apparatus and record controlled signal transmitters.

In order to utilize line time efficiently, record controlled transmitting apparatus is employed in preference to direct manual keyboard signal transmitters. Perforated tape used for this purpose conventionally consists of a continuous ribbon or web provided with longitudinally arranged tape advancing perforations and with transversely arranged permutative distributions of code perforations. In the preparation of transmission tape conventionally, a keyboard is employed to control the operation of punches which respond to the depression of character key levers to perforate code perforations in the tape correspondingly.

As the code perforated tape is issued from the preparing machine it is customarily threaded into a tape transmitting apparatus which, in response to the arrangement of perforations in each transverse code alignment, causes to be electrically conditioned a set of distributor segments or contacts. The latter are traversed sequentially and through their control are generated permutation code line signals corresponding impulse for impulse to the distribution of perforations in the tape. It is herewith proposed to combine the aforesaid tape preparing or perforating mechanism with said tape controlled transmitting apparatus within a single unit for the purpose of utilizing the prepared tape for transmission as soon after its preparation as is practical, with minimum slack tape accumulation intervening the point of tape preparation and the point of signal transmission.

While combined apparatus for perforating a tape and for transmitting signals over a line under the control of the perforated tape has been known before it is now proposed in accordance with the present invention to enable the transmission of line signals so as to utilize promptly all of the prepared tape up to and including the very last transverse row of perforations notwithstanding the distance which intervenes the perforating punches and the tape transmitting feelers and yet without incurring loss of line time.

Accordingly, the main object of the present invention resides in the provision of a combined tape perforating apparatus with an automatic transmitter which may be automatically started upon the accumulation of a perforated tape surplus, and automatically arrested upon the exhaustion of a perforated tape surplus and the

transmission of the group of signals for the last transverse row of code perforations in the tape.

Another object of the present invention is the provision of apparatus for back stepping perforated tape through both preparing and sensing apparatus simultaneously and for disabling the transmitting apparatus commensurately to prevent duplicate transmission of those signals thus back stepped.

A feature of the invention resides in the provision of mechanism which will permit a full and complete transmission of message material including that which intervenes the two essential components of the apparatus without incurring waste incident to the feeding of blank tape in order to advance the final or concluding signals of a message to the tape transmission feelers.

In its essential embodiment, the present invention features a unitary supporting structure having two principal apparatus components. One is a keyboard perforator in which a conventional keyboard mechanism conditions a set of punches which are then operated by a power source to make code combination and feed hole perforations in a tape. A second component is a tape transmitter with its sensing apparatus arranged so as to align with the perforating punches for the purpose of maintaining continuous co-operation with the tape as it emerges from the perforating component. Between the two components is a space wherein prepared tape may be permitted to accumulate so long as the keyboard perforator is operating at a greater rate than is the transmitter unit. As the surplus accumulation of tape between the two components is exhausted, a lever, especially responsive to this condition, acts to arrest further operation of the transmitter as well as the transmitter tape feed apparatus.

In order to permit that portion of the tape which intervenes the two components to be advanced through the transmitter, as when no further message matter is being prepared by the keyboard, a special key lever is provided which establishes conditions to feed out a predetermined amount of tape from the perforator, permitting thereby feeding out of more of the tape and of the restarting of the transmitter which thereupon continues in operation until the additional tape is exhausted. Subsequently, and for the purpose of retracting that portion of the tape which has been fed out in response to the operation of the aforesaid special key lever, a tape retracting apparatus may be set into operation in response to a further special key lever restor-

ing the condition of the tape which prevailed before the first mentioned special key lever was operated while also disabling the signal transmitting apparatus to a limited extent commensurate with the retracted portion of the message so that upon starting transmission of a succeeding message, the tail end of the preceding message will not again be transmitted.

By means of a circuit switching arrangement utilized in conjunction with the present system, transmission tape may be prepared locally, and immediately tested at the local station through the use of a monitoring printer which may also serve as a home recorder. Under the control of a ground switch, transmission may be directed to a remote station after test or, if desired, instantly upon the preparation of the tape. In the event of any errors discovered in the tape, mechanism is herewith provided for retracting portions of the tape through the use of power driven apparatus for feeding out unperforated sections of tape, and for resuming tape transmission following a retraction operation together with a limited safeguard against the retransmission of retracted signals, thereby avoiding undesirable duplication and waste.

For a more comprehensive understanding of the present invention, reference will now be had to the more detailed description following hereinafter and to the accompanying drawings in which like reference characters designate corresponding parts throughout and, in which

Fig. 1 is a transverse sectional view through a combined keyboard perforating and tape transmitting apparatus fashioned in accordance with the principles of the present invention;

Fig. 2 is a schematic circuit illustration of a transmission system having a preferred embodiment of the present invention applied thereto;

Fig. 3 is a diagrammatic outline of a gear train and power distribution system such as may be employed for the purpose of operating the preferred structure illustrated in Fig. 1, and

Fig. 4 is a detailed sectional view of a modified embodiment of the apparatus driving train and auxiliary mechanism.

The reference character 11 denotes a keyboard base casting in which are pivotally supported an alignment of key levers 12, the keytops of which are in the foreportion which is omitted from view in Fig. 1. The depression of any key lever 12 causes an individual placement of a set of five pairs of coded bars 13 each pair articulated with a corresponding longitudinally movable bar 14 through the intermediate agency of a T-lever 15 in a manner now well known in the keyboard telegraph art. There being five longitudinally shiftable bars 14 as well as a common release bar generally similar to one of the bars 14, it is to be accepted that the five bars 14 may be moved towards the right or left in accordance with each individual code combination but that the common release bar which is connected to the trip rod 16 is invariably shifted towards the left for each keyboard operation.

The five bars 14 are connected through individual links 17 with five vertically supported pivot levers 18 causing their motion to be translated into a longitudinal shifting of a corresponding set of five interponents 19, to which the vertical levers 18 are connected through the intermediate agency of connecting links 21. As the several interponents 19 are placed for each operation of a key lever 12, their leftward extremities may be made to align with or to avoid the lowermost

extremities of a set of five punches 22 at the same time that invariably shifted trip 16 is moved leftwardly to engage the lowermost extremity 23 of a release pawl 24.

In addition to the five punches 22 which are arranged in transverse alignment and which are operable permutably to make the code perforations in a tape 25, a single punch element 26 is provided a short distance to the right of and therefore in advance of the punches 22 which single punch is invariably operated to perforate feed holes in the tape because its interponent 27 is presented at all times beneath the punch extremity 26 so as to be operated together with any of the punches 22 whose interponents are engaged by the common perforating hammer 28 pivoted at 29 whose lugs 31 and 32 strike against the interponent extremities just beneath the punches 22 and 26, respectively.

As has been said, the operation of any key lever 12 not only causes the permutative placement of the several interponents 19 but also through trip 16 causes the withdrawal of stop pawl 24 from clutch disc shoulder 33. Shaft 34 is thereupon permitted to rotate clockwise, it being frictionally associated (not shown) with a driven gear 35 which meshes with a driver 36, Fig. 3. Shaft 34 carries two operating cams indicated 37 and 38, the former for actuating one arm 39 of a bell crank whose other arm is pivotally articulated at 41 to the tape advancing pawl 42 as well as to the counting pawl 43 which depends from the same pivot 41. Attention is directed to pawl 42 which is illustrated in its rest position in Fig. 1. Under this circumstance, its tooth is clear of the ratchet wheel 48 so that the latter could be rotated without any interference to or by the pawl 42, but yet upon moving said pawl 42 downwardly its tooth is adapted to enter into engagement with an awaiting ratchet wheel tooth and to thereby effect a one tooth-step motion to the wheel 48 and its associated elements for a purpose to be discussed. Upon its return movement the pawl 42 slips over the intervening tooth because of its sloping or camming surface engagement therewith, whereas the shaft 49 is prevented from following by the action of any well known tensioning or detenting element (not illustrated). The other cam 38 actuates with its brief-interval apex one arm 44 of a power bell crank whose other arm 45 overlies the punch operating hammer 28 so that upon its actuation counterclockwise about pivot 46, hammer 28 will be struck and rocked clockwise, thrusting its abutments 31 and 32 upwardly and against interponents 19 and 27, respectively. The apices of both cams 37 and 38 are located so as to perform their respective functions towards the end of the rotary cycle of shaft 34 with cam 38 causing the punching operation to be executed in advance of the time that cam 37 depresses pawl 42 and causes the advance of the tape 25 for the presentation of a succeeding surface area in punching position.

Pawl 42 is urged clockwise about its pivot 41 by a spring 47 and is normally maintained by a stop pin 49 with its tooth out of engagement with its ratchet wheel 48, a suitable detent apparatus (not shown) being contemplated for holding the shaft 49 in set position. Shaft 49 carries not only the pawl ratchet wheel 48 but also a conventional tape feed sprocket 51 whose teeth are adapted to align with the tape feed perforations made by punch 26.

From the foregoing explanation it follows that

as a result of depression of a character key lever 12, shaft 34 is permitted to rotate throughout one revolution, and its cams 37 and 38 will, during this time, cause to be actuated certain ones of the code perforating punches 22 depending upon the character of the signal which relates to the particularly actuated key lever 12, but punch 26, because its interponent 27 is ever in the effective position, at all times causes to be made the tape advancing perforation utilized by the teeth of sprocket 51. Moreover, as a result of the actuation of bell crank 39, pawl 42 causes the tape 25 to advance to a succeeding recording area, but pawl 43 which also pivots at 41 may engage a counting segment 52 under certain conditions of operation only, to be discussed later. At this time said pawl 43 is withheld by the engaging pin 54 of retractile lever 53.

As tape 25 issues from the punch block 55 it tends to accumulate in a loop formation as indicated (dotted outline) in Fig. 1. When the proportions of this tape accumulation are greater than that of a minimum loop, such as is just sufficient to urge against the extremity 56 of bell crank 57, the latter member is permitted to respond to the urge of its spring 58 and rotate counterclockwise about shaft 59 whereat it is conveniently pivoted. Because spring 58 is more powerful than is spring 61 of clutch stop bell crank 62, the latter member is rotated clockwise about pivot 63 causing to be withdrawn its interfering arm 64 from the tooth 65 of a friction clutch disc carried by a frictionally driven sleeve assembly which surrounds and is propelled by constantly rotating transmitter shaft 66 freeing said sleeve for rotation.

Since gear 67 (Fig. 3) of shaft 66 is driven by driving gear 36, it, too, tends to rotate in a clockwise direction, as viewed in Fig. 1, imparting a similar movement to the driven shaft 66 whose driven sleeve carries a pair of cam elements designated by their apices 68 and 69. Apex 69 is one which, during the rest position of the sleeve assembly, engages the vertical arm of a bell crank lever 71 pivoted at 72 and normally urged counterclockwise by spring 70, whose horizontal arm carries integrally therewith a transversely extending retraction bar 73. Bar 73 overlies a set of five feeler levers 74 which members are also pivoted at 72 and are urged by individual springs 75 in a counterclockwise direction so as to endeavor to present their several feeler pins 76 against the surface of the perforated tape 25, those pins 76 which encounter perforations in their corresponding positions being permitted to rotate to a further extent in a counterclockwise direction than the remaining ones of said levers 74 which do not so encounter perforations. The extent to which levers 74 are permitted to rotate by the presence or absence of perforations in the tape manifests itself by the corresponding disposition of a set of individual contacts 77, Fig. 2, that is to say, the more fully rotated feeler levers 74 responding to perforations in the tape effect the closure of said contact pairs 77 while those whose pins 76 encounter no perforations fail to effect the closure of their individual contact pairs.

Effectively, contact pairs 77 each operate to present or withhold battery from an associated one of a set of distributor segments 78 of a conventional start-stop rotary transmitting distributor whose collector ring 79 is connected to outgoing line 81. In observing Fig. 2 one may note that the distributor start magnet 82 whose ar-

mature retains the distributor arm 83 lies in a supervisory circuit which includes in series the contact pairs 85 and 86 which are shown also in Fig. 1 and which are under the mechanical supervision of bell crank lever 71 and multi-arm lever 123 so that magnet 82 may be energized only when bell crank 71 is in its counterclockwise extremity with retraction bar 73 having released the several feeler levers 74 and lever 123 is normal.

Assembly sleeve of shaft 66 when released for rotation by the withdrawal of bell crank arm 64 from its stop disc 65 may continue to rotate so long as the tape slack probing arm 56 is permitted to rise above the taut-tape level which condition has already been defined above. As each rotary cycle is started from the position indicated in Fig. 1, apex 69 rides off the extremity of bell crank 71 closing the contact pair 85 and permitting the several feeler levers 74 to rise as already discussed. As a result of the closure of contact pair 85, contact 86 being normally closed, the energizing circuit for magnet 82 is completed causing its armature to be withdrawn and starting the distributor arm 83 into rotation. In Fig. 2 this arm has been indicated as driven from shaft 66, it being understood that a separate friction clutch be provided therefor or, if preferred, another shaft having the same rate of speed as has shaft 66 may be provided therefor.

Toward the end of the cycle of revolution of cams 69 and 68, the transmitting distributor brush arm 83, Fig. 2, having had time to traverse all of the transmitting segments 78, cam apex 68 encounters and rocks the follower arm 87 of a bell crank lever whose opposite arm 88 carries the pawl pivot 89 causing said bell crank lever to be rotated clockwise about the pivot 72. This operation lowers the tape advancing pawl 91 which thereupon, engaging one of the teeth in the ratchet wheel 92, rotates the transmitter tape feed shaft 59 one tooth-step distance in a counterclockwise direction as viewed in Fig. 1. Here, too, it will be noted as in the case of perforator shaft 49 the normal position of feed pawl 91 is raised and is clear of the teeth of said ratchet 92 for a purpose which will be indicated later. When the cam apex 68 passes beyond the follower arm extremity it permits the bell crank 87—88 to return counterclockwise to its normal position as indicated.

Also, as in the case of the perforator assembly, the depending pawl 93, spring urged in a counterclockwise direction, is pendulously supported from a pivot 89 but is prevented from engaging its counting ratchet 94 by the restraining pin 95 of a latchable bell crank 96 pivoted at 97. The rotation of the shaft 66 cam assembly is continuous until the tape slack probing bell crank 56—57 encounters a taut-tape condition at which time the latter is rocked in a clockwise direction by said tape and thereupon no longer exerting an influence on bell crank arrestor 62—64 permits the latter member to again present its interfering extremity 64 in the path of clutch disc 65. However, in the event of a taut-tape condition shaft 66 cam assembly will be arrested in the manner described and further transmission will be prevented because in its arrested condition apex 69, holding bell crank arm 71 in the indicated position maintains the energizing circuit for start magnet 82 broken.

The space which intervenes the keyboard perforating mechanism and the tape sensors 74 is

such that an intervening strip of tape 25 which is sufficiently taut to arrest further transmission will preferably contain, in the instant embodiment, six code signals. Upon the resumption of operation of the keyboard mechanism additional slack will be introduced, the transmitter started, and these signals will issue in the customary manner already described. However, in the event that the keyboard operator has completed the perforation of a message and has no further signalling to do and therefore no perforations made in the tape 25, means are provided whereby under but a single supervisory key manipulation the last six signals which are found in the intervening strip portion of the tape may be advanced for the purpose of completing the message transmission.

Message end run-off

To transmit the final six signals as discussed above the operator depresses a key lever 101 and as a result the multiple armed lever 102 is rotated clockwise against the tendency of its return spring until its remote extremity 103 passing over the tooth of latch pawl 104 is held thereat. In consequence of this the sidewardly extending lip 100 of its arm 105 retracts the clutch release pawl 24 permitting shaft 34 to enter upon several continuous cycles of rotation. As a result of the movement of arm 106 of lever 102 bell crank lever 107 together with its retraction bail 108 is rotated clockwise against the tendency of a spring 109 which effects the rocking of all of the supporting levers 111 to the right, thereby withdrawing the interponents 19 so that none of them underlies its code perforating punch 22. Incidentally, the holding of all interponents 19 in their right-hand position under the action of bell crank lever 107—108 serves also to lock the keyboard against operation.

As a further result of the movement of arm 106 projection 112 thereof is moved clockwise and latch 53 is released to the influence of its spring 113. In consequence thereof, dependent pawl 43 is freed and permitted to engage the teeth of counting segment 52. A tooth 114 integral with latch 53 acts meanwhile as a detent to resist the restorative influence of involute return spring 115 of segment 52 as the latter proceeds to toll six operation cycles.

There follows six complete revolutions of shaft 34 during which the effect of its cam 38 on bell crank lever 44—45 is idle because all of the interponents 19 are withdrawn from effective position. The special interponent 27 which acts upon punch 26 in making the tape feed perforations, however, continues in effect as before. Under these circumstances of operation, cam 37 acting on the follower arm 39 not only operates the tape feed pawl 42 as described in connection with the ordinary keyboard operation, but also at this time dependent pawl 43 rotates ratchet segment 52 one tooth step at a time until the bottom surface thereof engages the waiting arm of bell crank latch 104. This encounter releases said latch 104 thereby freeing the multi-arm lever 102 whose spring thereupon returns the several dependent elements to the normal position as indicated in Fig. 1.

Meanwhile shaft 34 has been permitted to rotate throughout six cycles as determined by the distance between the contacting surface of ratchet segment 52 and its instant of effective operation upon release latch 104. Accordingly, tape feed pawl 42 has been permitted to advance the tape 25 and to form a slack loop in the ac-

cumulation space which intervenes the two principal apparatuses thereby permitting the probing arm 56 of bell crank lever 56—57 to rotate in a counterclockwise direction and initiate transmission as before. The transmitter apparatus will then resume transmission for six additional cycles of rotation (commensurate with the then available surplus of signals) whereupon the tape 25 will again become taut and arrest transmission by reason of its effect upon probing arm 56. The intervening strip of tape 25 now found between the two apparatuses will contain no transmission signals but instead six blank (unperforated except for the feed holes) signal areas. Under the circumstances, if tape preparation were to be resumed six blank line signals would necessarily intervene between the preceding message and the succeeding one.

In order to forestall this possible waste of line time and for the further reason that a succession of blank signals might, as in the case of certain receiving station apparatus, initiate special responses predeterminately intended to be operated in the event of a succession of purposefully prepared blank signals (such as remote motor control, send-receive break control, etc.), which responses would not be intended at a message starting period, means are provided for retracting the unperforated intervening area into the tape perforator, and restoring the final six perforated signals of the preceding message to the intervening area so as to permit the installation of succeeding message signals to occupy the otherwise blank positions.

Tape-out back feed

To backfeed the tape six signal positions, an operator depresses the key lever indicated 121 (at the left of Fig. 1) as a result of which there are rotated counterclockwise two multiple arm levers 122 and 123. In consequence of the movement of lever 123, its remote extremity 124 overrides the latching tooth of a pawl 125, symmetrical and opposite to latch 104 causing said lever 123 to be latched in its counterclockwise position pending subsequent release. Further, as a result of the withdrawal of one of its arms 126, bell crank 96 is permitted to respond to the urge of its spring, rotating clockwise about its pivot 97 and shifting its restraining pin 95 out of holding position with respect to dependent pawl 93. Also, a detent tooth 127 integral with bell crank 96 is permitted along with dependent pawl 94 to engage the teeth of a counting ratchet segment 94 already described. As a result of the movement of arm 128 of lever 123, restraining pin 129 engaging the dependent arms 131 of the several feeler levers 74, is caused to move the latter members clockwise withdrawing the several feeler pins 76 for the effective interval of operation of the instant back feeding apparatus.

As a result of the counterclockwise rotation of multiple arm lever 122, the influence of its spring 132 is overcome and the arresting tooth of arm 133 is moved out of the path of a particular one of the six equidistant stop pins 134, in escape wheel and gear 135, see also Fig. 3. This permits shaft 66, which is frictionally coupled thereto, to rotate gear 135 to a limited extent, but another arm 136 of lever 122, being interposed in the path of an oncoming pin 134, will prevent the rotation of gear wheel 135 beyond a distance somewhat less than 120 degrees, awaiting the release of manually operable lever 121. After this, the arresting tooth of arm 133 will again become effective at precisely 120 de-

grees. Arms 133 and 136 act in a complementary fashion in the manner of an escapement pallet, wheel 135, by virtue of its pins 134, being the counterpart of a conventional pallet wheel.

At this time, attention will be given to the distribution of power which, in accordance with the preferred contemplation, originates with driving gear 36, Fig. 3. As has already been said, through gear 35 and a clutch mechanism represented by release disc 33, power is communicated to the cam assembly carried by shaft 34. Through gear 67, which is also in mesh with driving gear 36, power is communicated to shaft 66, and by means of the clutches represented by stop element 65, and a secondary clutch controlled by the escape arms 133 and 136, power is communicated to the driving gear 135. Gear 135 in turn drives intermediate idler gears 137 and 140 in train, and of these the latter gear meshes with a driven gear 138 carried by a stub shaft 139, appropriately mounted in a stationary portion of the supporting structure. On the same shaft 139, and integrally associated with driven gear 138 is a driving gear 141 which consists of six component driving segments 142 with intervening mutilated or toothless sections, the gear segments 142 of said driving gear 141 being adapted to mesh simultaneously with driven pinions 143 and 144 secured to shafts 59 and 49, respectively, of said transmitting and perforating units. Thus, when gear 135 is permitted to describe one-sixth of a revolution in a clockwise direction under the control of escape pins 134 and pallet arms 133 and 136, as already stated, a measured degree of rotation in the opposite direction is imparted to the driving gear 141 through the intermediate agency of idlers 137 and 140 and gear wheel 138, and in so doing, associated segments 142 of said wheel 141 are brought into meshing engagement with driven pinions 143 and 144 and causing shafts 59 and 49, respectively, to be rotated clockwise simultaneously a distance corresponding to six perforated signals. This will cause the tape to be fed backward in both the record reader as well as on the perforator.

In connection with mutilated gear wheel 141, it may be observed that each group of teeth 142 has been arbitrarily indicated as comprising a certain number of teeth. It is to be understood that this number of teeth may vary in accordance with the proportioning thereof with respect to the peripheral surface which contacts the tape, that is to say, where smaller teeth are preferred a larger number of them may correspond to the distance of movement required to backfeed the tape six code perforations, and where larger teeth are preferred a fewer number of them will so correspond. In each case, the number of teeth in each group 142 for a given condition will be the same, so that during repeated operations of wheel 141 the same relationship of shafts 49 and 59 will be maintained.

Meanwhile, however, and for the reason that the intervening tape portion is maintained taut, transmission is prevented on account of the effective condition of bell crank stop lever 62-64 which is holding apex 69 in place to permit contact pair 85 to spring ajar. Accordingly, distributor magnet 82 will remain de-energized, causing to be restrained the distributor brush arm 83. Following the actuation of backstep control lever 121, the tape 25 is fed backwardly to an extent commensurate with six code signals,

for the purpose of presenting the unperforated areas before the punches 22. Thereafter six code perforations are made in the tape to fill in the blank areas and prevent waste, shaft 66 is released pursuant to the control effected by bell crank member 56-57, but no signals will be transmitted for the six codes relating to the previous message, because the transmitting distributor release relay 82 cannot yet be energized due to the open circuit condition at contact 86. As a result of the operation of cam apex 68, however, tape feed lever 88 will be reciprocated together with tape step pawl 91 and its associated dependent pawl 93, with the effect of advancing the tape 25 in the usual manner and with the effect of stepping the counting segment 94 until its lowermost portion collides with and actuates release latch 125.

Thereupon, lever 123 will be restored in response to its spring and the tape feelers 74 will be permitted to resume their normal manner of operation, that is, of variously impressing current on the transmitting segments 78. It will be understood then that following the advancement of the six code perforations, relating to a preceding message or group of signals, beyond the sensing unit (feelers 74), subsequent perforations will cause the tape feelers 74 to actuate their contact pairs 77 while contact pair 85 will also be closed to effect transmission by the distributor in the conventional manner.

If it should be desired to backstep the tape to an extent more than six code perforations, as just described, this may be done in multiples of six code signal steps by repeated depression of the backstep lever 121.

Operation of backstep key lever 121 in excess of the first operation in a sequence, as just described, causes multiple arm lever 122 to be operated repeatedly, but not so with lever 123, which is maintained latched by the action of latching bell crank 125. The effect of operating lever 121 repeatedly causes arm 133 to be withdrawn from the particular escapement pin 134 against which it had been resting, and presenting its arm 136 into the path of the oncoming pin 134. As the operator's finger is withdrawn from key lever 121, spring 132 restores multiple arm lever 122 to its normal position whereat arm 133 is again interposed into the path of the pin 134 which had been held by arm 136, as the latter is withdrawn to its clearance position as indicated in Fig. 1.

Repeated backstepping operations, in accordance with the particular disclosure, will not prevent resumption of signal transmission save for the first six signals. Thereafter, lever 123 being released by latching bell crank 125, in a manner as already described, signal transmission will resume unless manually prevented as by manually withholding the feeler levers 74, or by otherwise introducing spacing signal conditions to the distributor segments 78. It is to be understood, therefore, that while, in accordance with the instant embodiment, repeat transmission of signals in the case of retracted tape operation is prevented only for a limited number of signal conditions, the indicated principle of operation may, if desired, be structurally enlarged so as to embrace effectively a larger quantity of retracted signal conditions. Likewise, in the operation of signal retracting apparatus, the indicated principles of construction may be so enlarged as to embrace any other number of signal operations differing from that indicated arbitrarily above,

Modification of tape-out back feed

In Fig. 4 there is illustrated the essential arrangement of tape advancing shafts 49 and 59 not unlike that shown in the preferred embodiment, Fig. 1, but having in addition upon stub shaft 139, a locking cam 161 for operating the locking bell crank lever 107—108 during the interim of back feeding the tape 25. It will be observed that as in the case of the preferred embodiment the mutilated gear wheel 141 being provided with groups of teeth 142 designed to engage simultaneously the driven gear wheels 143 and 144 of shafts 59 and 49, respectively, for the purpose of rotating them clockwise to back feed the tape, causes said cam 161 to interpose one of its six apices 162 against the follower tooth 163 of a lever 164 whose opposite end is bent at right angles indicated 165 to engage the sidewardly extending arm of said blocking bell crank lever 107—108. As a result, this bell crank lever becomes effective in the same manner and for the same purpose as discussed above in connection with the operation of multiple arm lever 102 in response to the manipulation of key 101. Thus, keying is prevented during the interim of back feeding operation for the obvious purpose of avoiding inadvertent tape perforating at a time when this operation is inconsistent with the immediate performance of the machine.

Calling attention now to Fig. 2, there will be observed in outgoing line 81 a relay 168 which is symbolic of a home recorder and monitoring printer. This instrument may be of the same type as that provided at the remote station and thereat indicated 169. Under conventional set-up, as illustrated in this figure, the two printers are connected in series along with the transmitting distributor of the home station and its corresponding device 171 at the remote station. By closing the manual switch 172, however, the outgoing circuit is grounded for the purpose of preventing transmission to the remote station, whereby the home printer 168 serves as a monitoring instrument to apprise an operator who may not be able to read directly from the perforated tape as to whether the perforations correspond with the intended text. In the event of error, the tape may be retracted, as above described, through the use of key lever 121 until the erroneous portion is in line with the perforation made, affording an opportunity in this manner of deleting portions of the text, which may be done by superimposing all marking signals (perforations in each position) which portions of the text are to be deleted. From this it will be seen that the conveniences of the instant apparatus in affording means for rapidly retracting the tape serves as an aid in obtaining efficiency as against the heretofore known methods of single-step retraction.

While the present invention has been illustrated and described in contemplation of a specific embodiment as noted in the detailed foregoing description, and in the specific drawings accompanying herewith, it is to be understood, nevertheless, that certain changes and modifications may be instituted without departing from the spirit or scope herein outlined. Accordingly, it is expressly reserved not to be limited by the specific language in the foregoing specification nor by the structure indicated in the accompanying drawings, except as limited by the hereinafter appended claims.

What is claimed is:

1. In a perforated-tape controlling mechanism, a tape feed device having means for meshing engagement with perforations in a signal bearing tape, means for actuating said device one signal-step distance coincident with each signal control operation of said mechanism, and means responsive to a single manual supervisory operation for advancing said tape through a predetermined number of signal positions.
2. In a tape perforating key lever apparatus, a sprocket wheel having teeth adapted to mesh with perforations in a control form, a pawl and ratchet actuating mechanism for stepping said wheel one tooth distance for each signal operation, a power source, and means responsive to a single manual key lever control actuation for coupling said power source to said sprocket wheel for moving said wheel a plural tooth distance.
3. In a tape perforating apparatus, a tape advancing shaft comprising a sprocket wheel for engaging perforations in a tape, a ratchet wheel integral with said sprocket wheel, a pawl for engaging said ratchet wheel, a power source, cam mechanism driven by said source for actuating said ratchet wheel one tooth distance, and means for clutching said power source to said shaft directly for imparting rotary movement to said shaft for obtaining a plural tooth distance of operation.
4. In combination, a set of perforating punches corresponding in number to the components of a permutation code, a perforating punch for making tape feed holes in advance of said set of permutation code punches, a tape feed sprocket and ratchet wheel integral therewith a pawl for actuating said ratchet wheel for single step tape-advancing operations, a driven gear integrally associated with said ratchet wheel and tape feed sprocket wheels, and means for coupling power to said driven gear for actuating said tape feed sprocket to perform a plurality of single step operations.
5. In a keyboard perforator, a set of key levers, a set of punches, a power driven shaft, means under the control of said key levers for conditioning said set of punches for operation by said power driven shaft, means for advancing a tape one step distance for each manipulation of one of said key levers, a special key lever, and means for advancing said tape a distance greater than one step in response to the operation of said special key lever.
6. In a combined keyboard perforator and tape transmitter unit, means for advancing a tape step by step with each keyboard perforator operation, means for advancing a tape step by step with each signal transmission operation, and means to retract said tape in both said transmitting and perforating apparatuses comprising a power source, a gear train communicating with said power source and having meshing engagement with both said advancing means and a manually controllable clutch for effecting engagement between said power source and said tape advancing means to drive them in a tape retracting direction.
7. In combination, a keyboard perforating apparatus and a tape transmitting apparatus, said keyboard perforating apparatus including a tape advancing shaft having thereon a tape engaging sprocket, a pawl actuated ratchet wheel and a driven gear, said tape transmitting apparatus including a shaft having thereon a tape engag-

ing sprocket, a pawl actuated ratchet wheel and a driven gear, a driver for engaging both said tape transmitting and keyboard perforating apparatuses, driven gears comprising a disc having groups of teeth engageable one group with each of said apparatuses, driven gears, a power source, and key lever controlled clutching mechanism for engaging said power source to said driver to operate said tape transmitting and keyboard perforating apparatuses.

8. The combination set forth in claim 7 including means for suspending subsequent transmission by said tape transmitting apparatus for a limited interval upon the actuation of said clutching mechanism.

9. In a tape transmitting apparatus, a transmitting distributor, a tape sensing and advancing mechanism, a power source for imparting motion to said distributor and said mechanism, said power source including cam means for imparting step by step movement to a tape for moving it in one direction and gear means for movement of said tape in an opposite direction to obtain multiple step backspace operation.

10. In combination, a tape transmitting apparatus including, a transmitting distributor, a tape sensing mechanism, a tape advancing mechanism, a tape perforating apparatus comprising a keyboard, a set of tape punches, means under the control of said keyboard for preconditioning said punches permutably, means for advancing said tape following each keyboard operation, and a special keyboard control member responsive to a single manipulation impulse for disabling said punch preconditioning apparatus and for operating said tape advancing mechanism a plurality of times.

11. A perforator-transmitter unit apparatus including, a keyboard comprising a plurality of manually operable key levers, a punch block associated with said keyboard including a set of permutation code punches, a tape feed hole punch, interponents for enabling the operation of said code punches under the control of said keyboard, a tape advancing sprocket, a power shaft including means for actuating said sprocket for single step feed operation, a tape sensing apparatus spaced from said tape punch block to permit of tape accumulation therebetween, means controlled by the tape accumulation between said punch block and said transmitter sensing mechanism for initiating the performance of said transmitter, and manual control means for retracting said tape from both said sensing mechanism and said block.

12. In a combined perforator and transmitter unit, a step-by-step tape feed apparatus in the perforator portion of said unit, a step-by-step tape feed apparatus in the transmitting portion of said unit, and power driven tape moving apparatus for feeding the tape a distance corresponding to a plurality of steps at a time in a direction reverse to that of said tape feed apparatuses.

13. In combination, a permutation code perforating apparatus, a permutation code transmitting distributor, and a permutation code tape sensing apparatus, a rotary power source for actuating said tape perforating and sensing apparatuses and said distributor, means responsive to a predetermined accumulation of perforated tape between said tape perforating and tape sensing apparatuses for initiating the operation of said transmitting distributor, and means responsive to a special operation of said tape sens-

ing apparatus for preventing the initiation of said transmitting distributor by said tape perforating apparatus.

14. In combination, a control form preparing mechanism, a control form sensing mechanism, a control form feeding means associated with said preparing mechanism, a control form feeding means associated with said sensing mechanism, and common operating means to simultaneously operate both said feeding means to retract the form the same number of unit spaces.

15. In an apparatus for conveying control form, a sprocket wheel having teeth for engaging perforations in said form, a ratchet wheel integrally associated with said sprocket wheel, a driven gear integrally associated with said sprocket wheel, a power shaft, cam means operable by said power shaft for reciprocating a ratchet wheel actuator to advance said form in one direction step-by-step, a gear train for rotating said sprocket wheel in a direction opposite to that of said step-by-step actuating means, a single revolution clutch means for imparting motion to said cam actuator, and means for maintaining the driving relation of said gear train and said power shaft for extended intervals of time.

16. In a keyboard perforating apparatus, a set of principal key levers, a special key lever, a group of code perforating punches, means under the control of any one of said set of principal key levers for conditioning said punches permutably, means for advancing a tape one step distance following each actuation of one of said principal key levers, and means for retracting said tape a distance corresponding to a plurality of steps in response to the actuation of said special key lever.

17. In a keyboard control perforating apparatus, a sprocket wheel carrying shaft for moving a perforated tape during process of preparation, pawl and ratchet actuating mechanism for rotating said sprocket wheel and said shaft in one direction, and a gear train for rotating said shaft in the opposite direction for retracting said perforated tape.

18. In a key lever controlled tape preparing machine, a sprocket having meshing engagement with a tape under process of code preparation, means for operating said sprocket intermittently, means for operating said sprocket continuously during limited time intervals, and a common power source selectively coupled to either of said operating means under the control of certain key levers of said machine to propell said tape in either direction corresponding to the coupling of said power source.

19. In a key lever operated machine, an intermittent motion apparatus, a power source for motivating said apparatus, coupling means for connecting said power source and said apparatus, a key lever for initiating said coupling means, a tolling device for measuring the number of operations of said apparatus, and a declutching means for uncoupling said power source and said apparatus under control of said tolling device.

20. In a keyboard control device, a manipulator, a response device, power means for operating said response device once for each actuation of said manipulator, a second manipulator, and means for latching said power means and said response device to effect a plurality of operations of said response device under the control of said second manipulator.

21. In a keyboard control device, a first key, a second key, a response device, a power source

responsive to the actuation of either of said keys for initiating said response device, a latch for holding said second key in actuating condition upon its being depressed, and a tolling apparatus responsive to a certain number of operations of said response device to release said second key.

22. In a tape transmitter, a tape feed shaft, a tape sensor, a driven means for operating both said shaft and said sensor, a driving means for said driven means, a controller responsive to a slack condition in the tape for coupling said driving and driven means together, and a manipulator for coupling said driving means to said tape feed shaft alone for effecting the feeding out of tape during a dormant condition of said sensor.

23. The combination set forth in claim 22 including an operation tolling device responsive to a predetermined number of tape feed shaft operations under control of said driven means for releasing said manipulator and for thereby uncoupling said driving means from said tape feed shaft.

24. In a tape transmitter, a tape feed shaft, a set of tape sensing levers, a driven shaft having cam means thereon for actuating said tape feed shaft in tape advancing direction and said tape sensing levers, a gear train for rotating said tape feed shaft in tape retracting direction, a control lever for coupling said gear train to said tape feed shaft, latching means for holding said control lever in gear coupling condition, a bar under the supervision of said control lever for holding said tape sensing levers in retracted position, a tape slack responsive device for coupling said cam means to a driving source, and a tolling mechanism for counting the number of operations of said cam means and for thereafter releasing said latching means.

25. In a combined keyboard perforator and tape transmitter unit, a perforator tape feed shaft, a transmitter unit tape feed shaft, means responsive to a predetermined tape surplus between said shafts for releasing for rotation said transmitter tape feed shaft, a manually operable lever for initiating a plurality of operations of said perforator tape feed shaft, and a manipulation means for coupling a reverse direction driving source to both said transmitter and perforator tape feed shafts to move a tape in a reverse direction through said tape transmitter unit and keyboard perforator.

26. In combination, a keyboard perforator comprising a set of key levers manually depressible for making code combinations of perforations in a tape, a tape transmitter responsive to the perforations in the tape for issuing corresponding permutation code line signals, a supporting structure for holding said perforator and transmitter in spaced relation one to the other, a probing means for determining the amount of prepared tape accumulation between said transmitter and perforator, a transmitter initiating lever under the supervision of said probing means, a manual release for advancing the tape a distance commensurate with the space intervening said perforator and transmitter, a retracting device responsive to manual initiation for moving the tape in a retractile direction in both said transmitter and perforator devices, and a distributor arresting means conditioned by the operation of said retracting device for preventing the operation of said distributor during the subsequent effectiveness of said probing member.

27. In a keyboard controlled device, a manipulation key, a mechanism responsive to the oper-

ation of said key, means to latch said key in operated position following its manual operation, apparatus for tolling off a predetermined number of operations of said response mechanism, and means to render said latching means ineffective after said predetermined number of operations has been tolled off.

28. In a keyboard mechanism, a plurality of key levers, a set of code elements, means to operate said code elements in combinations according to the depression of any one of said key levers, means to make code markings in a record receiving material according to said code elements operated, a special key lever, means responsive to the operation of said special key lever to advance said record receiving material, and latching apparatus controlled by said special key lever for holding all of said code elements in the same position while said record receiving material is advanced thereby.

29. In a control form preparing machine, means to advance a web step by step, a set of key levers each effective to operate said form advancing means, a special key lever for retracting said form, and means controlled by said special key lever to disable said set of key levers during the time that said form is being retracted.

30. In a control form preparing machine, a special response mechanism, a tape advancing mechanism comprising a sprocket wheel having teeth for engaging perforations in a tape, a set of manipulators, means responsive to the actuation of any said manipulators for initiating said individual response mechanism and for concurrently actuating said tape advancing device to move said tape in a forward direction, a special key lever, and means responsive to the actuation of said special key lever for disabling said special response mechanism and for concurrently moving said tape in a reverse direction.

31. In combination, a tape perforator, a tape transmitter, key actuated means for controlling the operation of said tape perforator, means under the control of the record material between said perforator and transmitter for controlling the operation of said transmitter, means for feeding out a predetermined amount of tape for insuring that the last character perforated is transmitted, means for backfeeding said predetermined amount of tape to enable the perforation of a continuous record, and means for bringing said last perforated record to the transmitting position before transmission.

32. In a tape propelling apparatus, a shaft having a sprocket wheel for engaging perforations in a tape, a ratchet wheel, and a gear wheel, a pawl for imparting step-by-step rotation to said shaft by intermittent actuation of said ratchet wheel, a driving gear for imparting continuous rotation to said shaft by engagement with said gear wheel, a source of operating power, and means for coupling said source of power selectively to either said pawl or said driving gear for accordingly moving said tape in a step-by-step manner or in a continuous manner.

33. In a keyboard telegraph apparatus, a shaft having a sprocket wheel with peripheral teeth for engaging feed holes in a tape, a ratchet wheel integrally associated with said shaft, a pawl normally out of engagement with said ratchet wheel, mechanism responsive to a certain keyboard operation for bringing said pawl into engagement with and rotating said ratchet wheel and said shaft a single step distance to cor-

respondingly feed said tape, a gear wheel integrally associated with said shaft, and a driving gear responsive to a certain other keyboard operation for imparting rotation to said gear wheel and said shaft continuously to feed said tape correspondingly. 5

34. In a control form machine, mechanism for advancing a form intermittently during preparation a unit distance for each signal making operation of said machine, means for feeding said form continuously, and a manipulator device including means for initiating said form feeding means to cause a form to be moved a distance corresponding to a predetermined plurality of said unit distances in response to a single manipulation. 10 15

35. In a keyboard apparatus, a shaft driven from a continuous source of power, a set of key levers each operative to couple said driven shaft to a function element during a single cycle of operation of said shaft, a special key lever to 20

couple a function element to said shaft, means for latching said special key lever in operative position, and a release mechanism responsive to a predetermined number of cycles of operation of said shaft to release said latching means and thereby to uncouple said shaft from said function element.

36. In a keyboard control unit, a set of principal key levers, a special key lever, a form feeding mechanism actuated by each of said principal and special key levers comprising a pawl and ratchet feed for advancing the form one step coincident with each pawl actuation, a latch for holding said special key lever in depressed position following its manipulation, and a feed apparatus tolling device responsive to a predetermined number of pawl feeding operations for releasing said latch to permit said special key lever to return to nondepressed position.

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