Oct. 20, 1942. L. M. POTTS 2,299,107

KEYBOARD CODE PRINTER

Filed Nov. 4, 1938 3 Sheets-Sheet 1

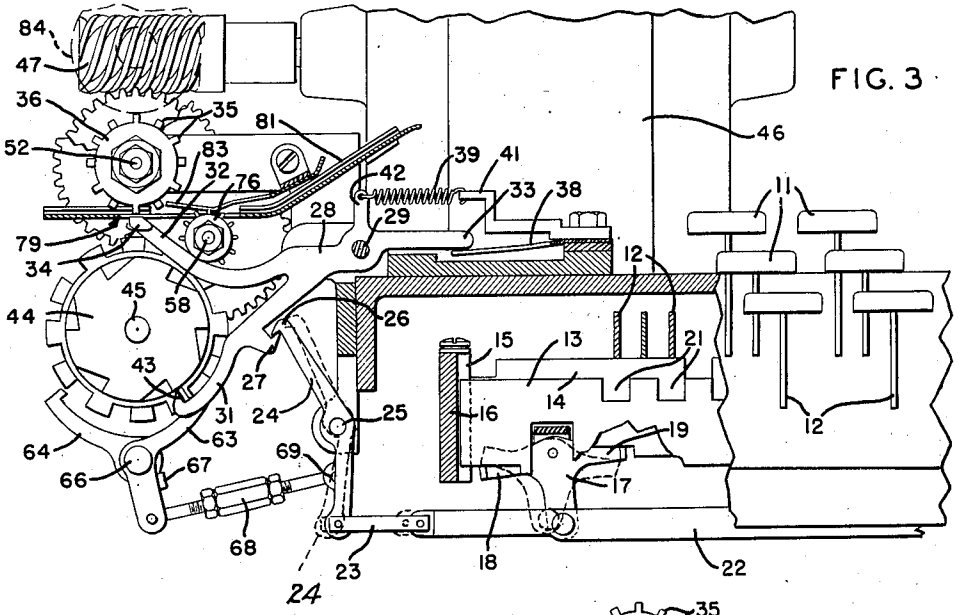


FIG. 3

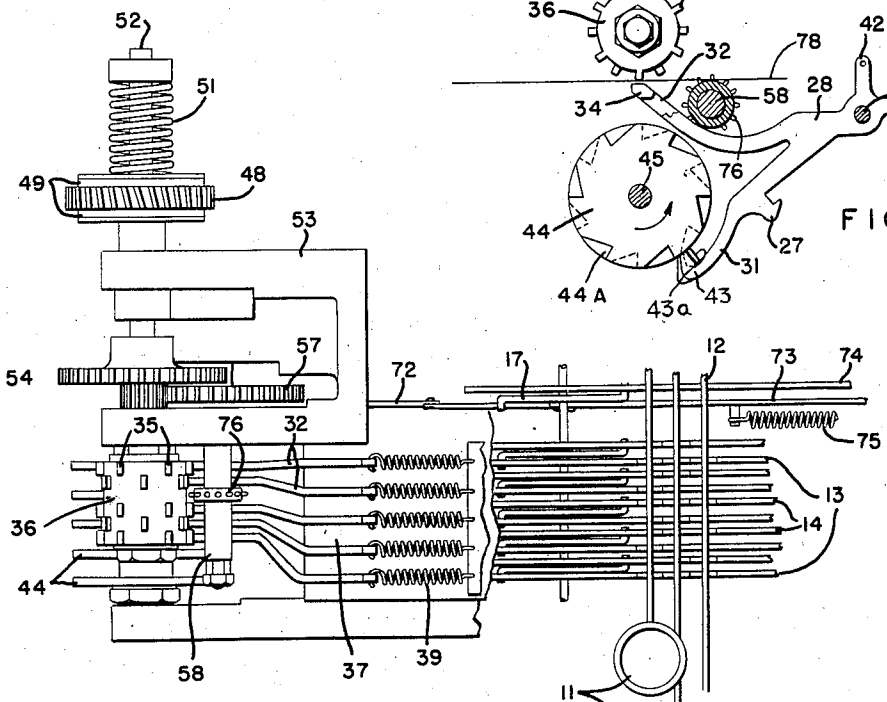


FIG. 1

FIG. 7

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FIG. 2

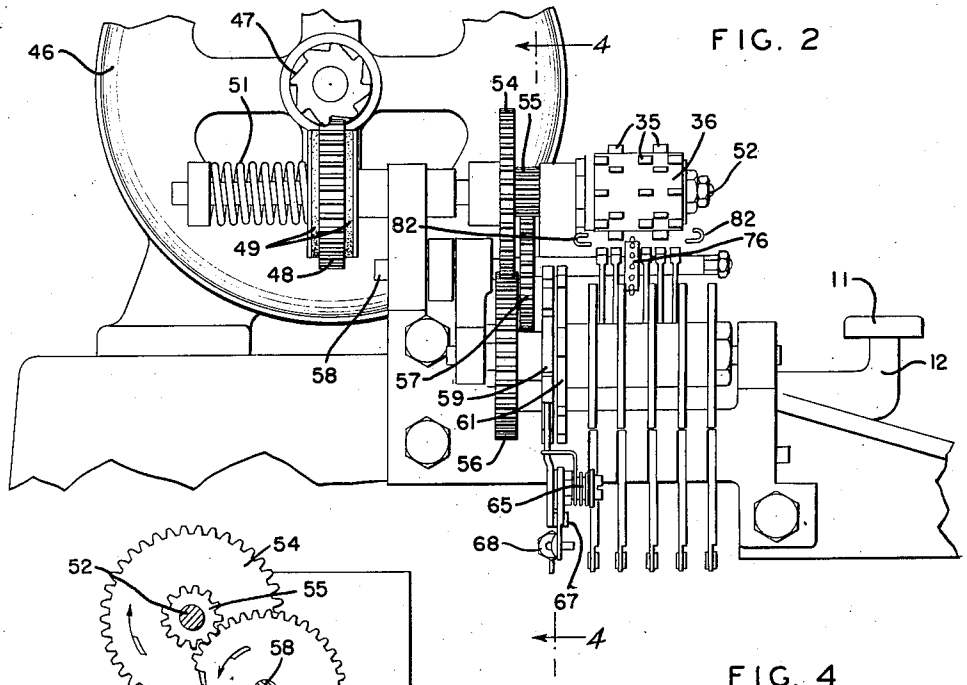


FIG. 4

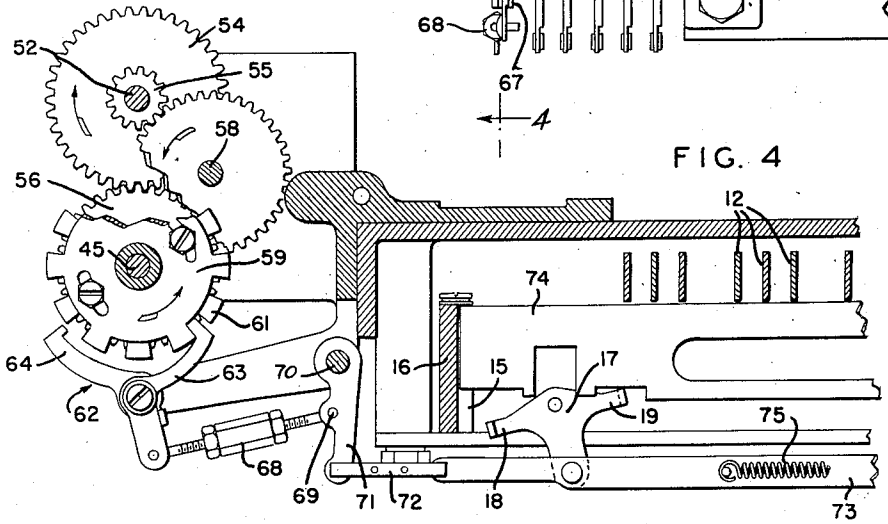


FIG. 5



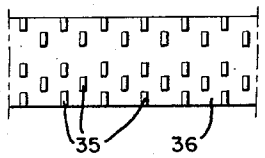


FIG. 6

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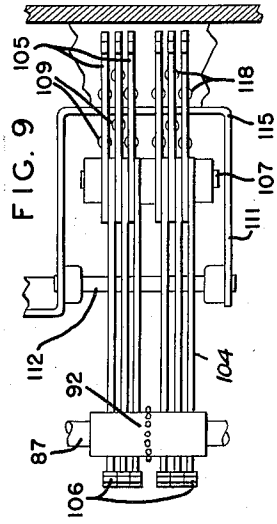


FIG. 9

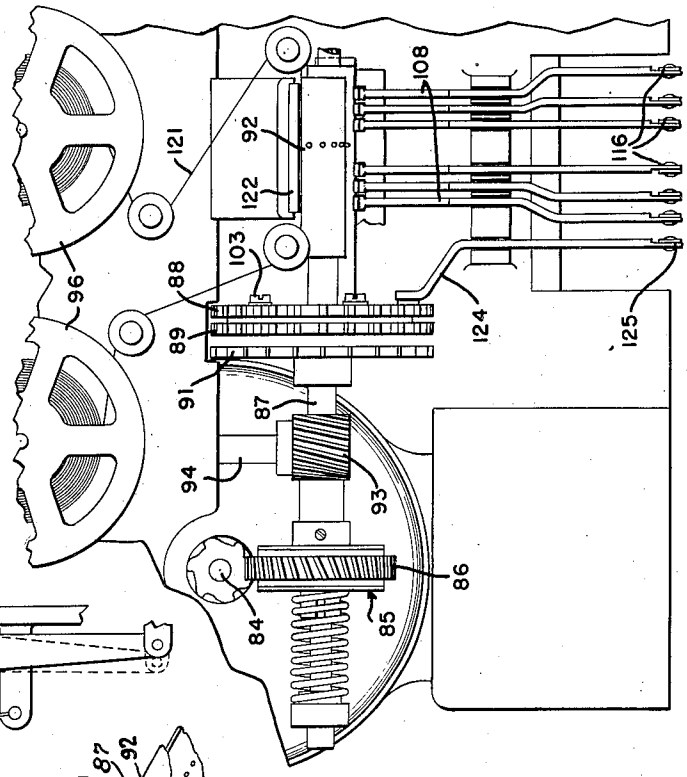


FIG. 8

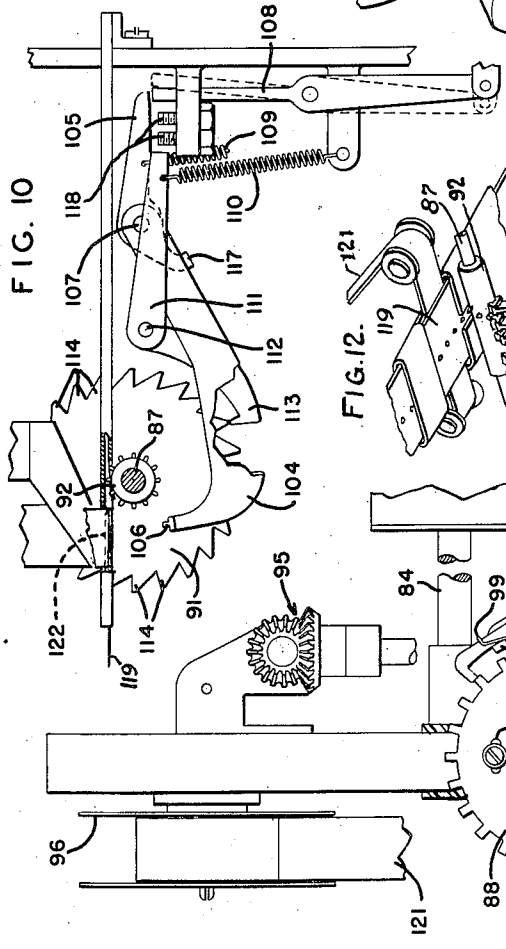


FIG. 10

FIG. 12.

FIG. 11

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Patented Oct. 20, 1942 2,299,107

UNITED STATES PATENT OFFICE

2,299,107

KEYBOARD CODE PRINTER

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Application November 4, 1938, Serial No. 238,763

27 Claims. (Cl. 197—1)

The present invention relates to control form preparing apparatus and more particularly to keyboard mechanism for making printed permutation code control tape for telegraphic communication.

An object of the present invention is to provide a manual keyboard apparatus for applying permutation code markings upon the surface of a control strip which may then be utilized in the supervision of telegraph apparatus having record reading facilities.

According to the embodiments of the invention, a conventional keyboard is provided having a set of key levers pivotally supported and each operative in an individual manner upon a transversely disposed series of permutation members. In accordance with the operation of each key lever, the transverse members assume individual dispositions longitudinally with respect to each other, and through their articulation with a corresponding series of conditioning members prepare for operation a series of printing elements. As the print elements are operated, a pattern is produced transversely upon a preperforated (for feeding only) tape which consists of printed markings or dots in those positions of the code which correspond to marking signals and omissions of said markings or dots in those positions which correspond to the spacing signals. In this connection, it is to be understood that the correspondence between the markings and omissions is optional.

For a more comprehensive understanding, reference may be had to the detailed description following hereinafter and to the accompanying drawings in conjunction therewith wherein like reference characters designate corresponding parts throughout, and wherein

Fig. 1 illustrates a plan view of a keyboard apparatus having embodied therein the principles of the present invention;

Fig. 2 is a side elevation of the apparatus illustrated in Fig. 1;

Fig. 3 is a front elevation, partially in section, of the apparatus illustrated in Figs. 1 and 2;

Fig. 4 is a transverse sectional view taken approximately on line 4—4 of Fig. 2;

Fig. 5 is a fragmentary illustration of a printed control form illustrating the arrangement of code markings thereon;

Fig. 6 is a diagram of a development of the print cylinder;

Fig. 7 is a diagrammatic section of the cam and printing cylinder illustrating an arrangement of the timing;

Fig. 8 is an end elevation of a modified keyboard apparatus having embodied therein certain features of the present invention;

Fig. 9 is a fragmentary plan view of the apparatus shown in Fig. 8;

Fig. 10 is a transverse sectional view of the printing mechanism and allied details which are employed in the embodiment shown in Figs. 8 and 9;

Fig. 11 is a fragmentary detail sectional view looking in the same direction as that of Fig. 10 but in a plane which adjoins the pallet and ratchet wheel escape mechanism; and

Fig. 12 is a detailed perspective view of the paper feed supporting channel, printing ribbon guide system, and adjacent apparatus of a device such as that illustrated in Figs. 9 to 11.

In Figs. 1 to 4 of the accompanying drawings, the reference character 11 denotes a plurality of key tops, each labeled with a character designation and secured to a bar or lever section 12 pivoted remotely on a common pivot bar (not shown). Upon the depression of any key lever 12, its lower edge is brought into engagement with one or another of a plurality of complementary notched transverse permutation bars supported in pairs, the front ones of which are indicated 13, Fig. 1, and the rear ones 14. Each of the bars 13 and 14 is supported at its ends within grooves 15, Figs. 3 and 4, located in the rigid supporting members 16, the left-hand one only of which may be seen in Figs. 3 and 4, but the other one of which is symmetrically opposite.

Each pair of bars 13—14 is interrelated complementarily and by means of a pair of T-shaped levers 17, the left-hand ones only of which are illustrated in the drawings. The opposite arms 18 and 19 of each T-shaped lever terminate with a perpendicularly extending lug, the left-hand one of which is bent toward the observer in Fig. 3, so as to be disposed beneath its associated bar 13, and the right-hand one of which is bent in an opposite direction so as to be disposed beneath its associated bar 14. Further, each bar 13 and 14 is provided with an individual disposition of notches 21 transversely in alignment with that section of its companion bar whereat there are provided no notches, but instead solid sections. Accordingly, beneath each one of the key levers 12, there will be found a notch in one or the other but not both of each pair of bars 13—14.

For a more comprehensive understanding of the construction of the key levers and the transversely operating notched bars, reference may be

had to U. S. Patent No. 1,884,753 to H. L. Krum. For the purposes of the present disclosure, it suffices to say that upon the operation of any key lever 12 the several bars 13 and 14 are shifted in varying combinations and, accordingly, their several T levers 17 are rotated clockwise or counterclockwise causing to be displaced their associated slide bars 22, Fig. 3, to the right or to the left, causing through links 23 a corresponding setting of the latch pawls or interponents 24. Each one of the longitudinally shiftable bars 22 is provided with a connecting link 23 and a latch pawl 24, the latter being pivoted on a common shaft 25 with the other latch pawls 24 of which there is in the instant embodiment a total of five, one corresponding to each signal element of a five-unit code.

The free end of the latch pawl 24 terminates with an overhanging lip 26 and said pawl may assume either of two positions, one such as indicated in dotted lines, and another as shown in solid outline in Fig. 3. When the latch pawls 24 are disposed in their counterclockwise (solid outline) position, their lips 26 lie in the path of and block the cooperating lips 27 integrally formed with the percussion or printing levers 28 of which there are five pivoted on a common shaft 29. The percussion levers 28 are formed with three arms indicated 31, 32, and 33. Of these, arms 31 and 33 lie in the same plane with the main body portion of their levers 28 aligning substantially with their associated latching pawls 24, their associated links 23, as well as their longitudinally shiftable bars 22. The several arms 32 of said levers 28, however, are bent in a progressively offset relationship as may be noted in Fig. 1, so that their extremities, which are weighted as at 34, will be aligned transversely corresponding to the lugs 35 on the print cylinder 36. As may be seen in Fig. 6, the print lugs 35 are arranged upon the surface of cylinder 36 in such a manner that they form rows peripherally, longitudinally, and diagonally. For a complete code, two adjacent longitudinal rows are usable and this is so in order to permit ample clearance around each lug 35 to avoid unintentional overlapping of the printed spots. Thus, when the paper is brought into printing engagement with any lug 35, the lug or lugs adjoining it being in another row do not come into close proximity with the tape.

A multiple slotted journal frame 37, Fig. 1, through which passes the pivot shaft 29 maintains the several levers 28 in spaced and aligned position. The arms 33 of levers 28 extend horizontally, as illustrated in Fig. 3, resting closely above the flat steel rebound springs 38 in which position they are maintained by virtue of their action springs 39, each of which is anchored to a common anchor frame 41, with its free end secured to an upright lug 42 with which each lever 28 is provided. The arms 31 of the several levers 28 terminate with an inwardly extending cam follower projection 43 or 43A and when the several levers 28 are in the position illustrated in Fig. 3 by the foremost lever, the follower projections 43 are resting against the apices of their disc cams 44, while the weighted extremities of the arms 32 are disposed with a slight clearance between their printing platen surfaces and the projections 35 of the printing cylinder 36.

All cam wheels 44 are rotated as will be described hereinafter and as each moves from a position whereat one of its apices engages a projection 43 to a position whereat an intervening clearance is brought into registration with said projection 43, and provided that at the same time latch lever 24 is moved into its clockwise or dotted outline position, then the corresponding lever 28 is released, responding to the urge of its action spring 39 which rotates said lever 28 clockwise about pivot 29 throughout a short distance or until the end of arm 33 engages its rebound spring 38 at which time the weighted extremity 34 executes a sharp staccato blow against one of the printing projections 35. As indicated by the arrow around shaft 45, the assembly of cams 44 rotates in a counterclockwise direction so that the rising surfaces which introduce cam apices engage projections 43 restoring the levers 28 to their counterclockwise position in contemplation of an ensuing signal interval.

Power for rotating the cam and print shaft 45 originates at the electric motor 46 upon whose armature shaft there is secured the driving worm 47. Motor 46 rotates in a clockwise direction, as viewed in Fig. 2, imparting clockwise rotation to the driven gear 48, the latter being frictionally held between the felt discs 49 of a slip clutch assembly which includes the tensioning spring 51. Shaft 52 is thereby enabled to rotate in a clockwise direction as viewed in Fig. 3 when it is released as will be explained later. Shaft 52 is journaled in a U-shaped bearing bracket 53, Fig. 1, and at its right end, Fig. 2, it carries splined and secured with lock nuts to it, the aforementioned printing cylinder 36 which, in the instant embodiment, has provided on its surface six spiral rows of printing studs 35, Fig. 6. Each row peripherally consists of five individual studs 35 though it is to be understood that where the system contemplates a basic code having a different number of units, a corresponding number of peripheral rows of studs 35 will be provided.

Also keyed to shaft 52 is a gear and pinion assembly consisting of the gear wheel 54, Fig. 2, and its concentric and integrally associated pinion 55, the former meshing with an identical gear wheel 56 on shaft 45, while the latter meshes with a considerably larger gear wheel 57 carried by the tape feed shaft 58. It will be observed from Fig. 4, therefore, that since shaft 52 rotates clockwise, shafts 58 and 45 which are driven thereby rotate counterclockwise. Through the aforedescribed train of gears, the several shafts 52, 45, and 58 are driven together and in view of the frictional driving coupling at gear 48, the arrestment of any one of the shafts causes a cessation in the movement of the others. It is notable at this time that in accordance with the preferred showing, Fig. 5, there are twice as many rows of code signals in the tape 78 as there are feed perforations 77 therein. Also, that the printed spots, because they do not weaken the tape as do perforations can abut one another diminishing thereby from the length of the tape per given number of signals. It has been proved experimentally that with the use of rectangular marks, as herewith disclosed, the dimensions of a scanning beam may be smaller than those of a practical mechanical feeler. Control of the assembly is vested in shaft 45 which is provided with a pair of integrally associated escape wheels 59 and 61. Each wheel 59 and 61 is peripherally studded with escape wheel teeth and the two wheels are displaced with respect to each other radially, as well, so that the teeth of one intervene those of the other. An escape pallet generally indicated 62 consists of a positively actuated lever 63 and a spring urged cooperating arm 64. The torque spring 65, Fig. 2, suitably anchored and wound

around the pivot screw 66 urges arm 64 clockwise until the stop lug 67 integrally formed therewith, encounters the vertical arm of member 63.

The purpose of providing a spring yield in arm 64 is so that upon clockwise actuation of the pallet assembly consisting of members 63 and 64, the pallet projection of arm 64 may be permitted to yield under spring tension when it encounters a pallet tooth in wheel 59, but upon the further rotation of the pallet wheel assembly 59—61 and when the particular tooth passes beyond point of encounter with the projection of arm 64, spring 65 then operates to urge said arm 64 into the ensuing space. By dividing the escape wheel into two sections in this manner and having the yield spring in the pallet, it has been found that the escape teeth of the wheels may be made as full as necessary to withstand the stresses of frequent stopping. Otherwise, that is, with the teeth all in a single wheel, in order to give necessary clearance for the action of the pallet arms, the width of the escape teeth would have to be reduced to such an extent as to constitute an impairment to their strength. The cooperation between escape pallet 62 and the double pallet wheel 59—61 is not unlike that of conventional single plane escape and pallet mechanisms. The teeth of each pallet wheel 59 and 61 are served by one of the arms 63 or 64 exclusively. For this purpose, one arm of said escape pallet is offset with respect to the other as may be noted best in Fig. 2. To the downwardly extending arm of pallet lever 63 is connected one pivot of a turnbuckle connecting link 68, the other end of which is pivoted at 69, Fig. 4, to a third class lever arm 71, the latter being pivotally supported upon a stud shaft 70.

The working arm of lever 71 is pivotally articulated by means of a rigid connecting link 72 to one end of a longitudinally shiftable bar 73 supported in the same manner as is the general class of such bars 22, that is, by a pair of T-levers 17. Only one arm 19 of the T-lever 17 is effective in this instance, and it supports and is operated by a universal bar 74, the assembly being maintained in the position indicated in Fig. 4 because of the retractile spring 75, one end of which is anchored to a stationary part of the frame and the other end to the longitudinally shiftable bar 73, urging the latter rightwardly causing T-lever 17 to be maintained in a counterclockwise position, and bar 74 in its elevated condition at all times when not actuated by any one of the key levers 12.

Upon actuation of any of the key bars 12, in addition to shifting the combination bars 13—14 in the manner described above, each bar also causes the universal bar 74 to be depressed, rotating its associated T-lever 17 in a clockwise direction and shifting the longitudinally displaceable bar 73 which, through link 72, causes lever arm 71 to be rocked clockwise. As a result link 68 is moved to the left and through it escape pallet 62, or at least arm 63 thereof, is rocked in a clockwise direction. Arm 64 thereof being associated with it only through the spring connection 65, it may upon encountering a tooth in its associated pallet wheel 59 yield momentarily until said wheel has rotated beyond the point at which its tooth engages the projection of said arm 64. During the operation of a key lever as aforedescribed and following the release thereof, the operation of escape pallet 62 is accordingly clockwise and then counterclockwise. As a result of this, shaft 45 is permitted to rotate throughout a limited degree of rotation during which the printing of a complete character code is executed as will now be described.

Referring to Fig. 7, it will be noted that the six spiral rows of printing lugs 35 on type wheel 36 occur also as twelve longitudinal rows. Conforming with a five-unit code, these twelve rows consist of alternate ones comprised of two and three printing lugs each. This arrangement is clear from the development in Fig. 6. During the printing of each code combination of dots on the form, the cylinder 36 will describe one-sixth of a complete revolution presenting before the weighted extremities 34 two of the twelve longitudinal rows of lugs, one of three component lugs and the other of two. Obviously, therefore, the print hammers 34 must all be exercised during one-sixth of a revolution or the period occupied by the print cylinder 36 in passing through two rows of studs 35. Attention is now directed to the spring fingers of a tension plate 83 more about which is described later. Each spring strand aligns with one of the peripheral rows of print lugs 35 and serves to repel the tape from the surfaces of said lugs 35 except upon the instance of an overt force such as the flow of the print levers 28. Even then, the effect of adjacent spring fingers is to prevent the paper from touching correspondingly adjacent lugs when any one or ones of the levers 28 is operated, otherwise, a smudging or overlapping of the printed images might result. Another factor which insures the clear cut separation of the dots is the staggering of consecutive lugs of the same character group alternately among two longitudinal rows.

Attention is directed again to shaft 58, Figs. 3 and 7. Since this shaft is driven by the pinion 55 through its driving gear 57, it will be understood that the speed of shaft 58 is therefore considerably slower than that of either shaft 45 or 52 which are driven at the same rate of speed. At a point midway between the third and fourth rows (peripherally) of studs 35 on the printing cylinder 36 and carried integrally with shaft 58 is a tape feed wheel 76, the periphery of which is studded with equally spaced feed teeth each rounded at its end in order to be easily received within the central row of perforations 77 which is provided in the tape 78 expressly for this purpose. As the feed wheel 76 is rotated, the tape 78 is fed evenly and continuously past the printing zone generally indicated by the reference character 79. Because of the instantaneous or staccato printing impact exercised by the printing levers 28, it has been found that notwithstanding the continuous movement of the tape 78, there may be obtained nevertheless sharp and clear printed images corresponding to the surfaces of the printing lugs 35. In addition to the embodiment of control form here disclosed other variations are contemplated, such as have been more detailedly illustrated in U. S. copending application Serial No. 90,747.

Because shafts 52 and 58 are geared together, there will be a slight movement of shaft 58 and hence an advance of the tape 78 during the interval in which shaft 52 is moving from one longitudinal row of printing studs 35 to the next. If no compensation or correction were to be made for this movement, there would result an offset condition of the printing images relating to the #2 and the #4 printing intervals or elements. This discrepancy could be tolerated or adjusted for in the record sensing unit. However, it is deemed preferable here to make adjustments in

the tape preparing apparatus whereby the printing mechanism may operate in such manner that the row of printing impressions be made to occur in an exact alignment transverse to the tape 78.

One manner in which this adjustment has been made is illustrated in Fig. 7, where it will be noted that the foremost projection 43 of the extending lever arm 31 is slightly displaced with respect to another such projection indicated 43—A just behind it, the two projections having otherwise substantially the same general contour. In this illustration the foremost projection 43 and its arm 31 represent those levers 28, say for example, which correspond to the signal elements 1, 3, and 5, while the rearmost visible projection 43—A and its lever arm 31 represent those levers 28 which correspond to the remaining signal components; namely, 2 and 4.

Viewing now the foremost cam 44 in this illustration, it will be noted that its apices and intervening drop-offs or spaces, are staggered so as to intervene exactly those of the next adjacent cam indicated in this illustration 44—A. The cams 44 and 44—A relate to the signal intervals in the same manner as aforedescribed in connection with the levers 28, that is, the foremost cam 44 and alternate ones behind it relate to signals 1, 3, and 5, while the rearmost visible cam 44—A and the alternate cam behind it relate to the signals 2 and 4. Since each one of the cams 44 and 44—A is provided with six apices and six drop-offs or space portions intervening said apices, and since two of the five cams are spaced at intermediate angular positions with respect to the remaining three, it will be understood that, generally speaking, there are twelve intervals during which the projections 43 and 43—A may be permitted to drop off so that their associated levers 28 may effect a printing operation. Of these, two consecutive intervals relate to each cycle. Also, it will be noted from Fig. 7 that the weighted extremities 34, each one of which constitutes a printing hammer, extend lengthwise through a considerable distance in excess of the width of each printing lug 35. This is to permit the first operated printing levers 28 to engage their row of lugs 35 at a point relatively rightward, as viewed in Fig. 7, while the second actuated ones of said levers 28 engage their lugs 35 at a point with respect to the weighted extremities 34 relatively leftward, as viewed in this illustration. Recalling that meanwhile the tape 78 is progressing leftwardly there will result a bringing into transverse alignment of the markings by reason of this offset relationship in the instant of printing engagement.

It is recognized that an equivalent correction to that aforedescribed may be effected by displacing the cams 44—A angularly with respect to the cams 44 under which circumstance the extremities 31 and their projections 43 need not be made of variant lengths and that in this way, alternate levers 28 may be made to execute their function at a time which will permit the engagement of the weight of extremities 34 in a relative offset position from that of which the remaining ones of said levers are operated.

In the copending application Serial No. 90,747, referred to above, a still further method of introducing a correction factor for this purpose is explained and illustrated having to do with the displacement of the printing lugs 35 on the periphery of the cylinder 36.

The tape 78 is supplied with the feed perforations 77 previously made therein and is preferably supported upon a freely rotatable turn table in the form of a cylindrical supply roll. As illustrated in Fig. 3, the tape is threaded through a sheet metallic guide plate 81 whose cross section conforms substantially to the transverse dimensions of the tape and after passing over the roller 76, it is again guided onwardly and leftwardly, as viewed in Fig. 3, through an egress guide 82. A plurality of light flat metallic tensioning springs 82 prevent the paper from buckling just before the printing zone 79, since it will be recalled that beyond this point the paper is fed by pushing through the egress guide 82.

Ink may be supplied to the printing unit in any of several well-known manners. One such expedient is to provide winding and unwinding rolls and a ribbon feed mechanism of any type such as is well-known in the art of manual typewriters. A simpler form of ink supply is obtained by providing an ink-saturated fibrous roller 84 illustrated in dotted outline in Fig. 3, the peripheral surface of which is free to roll as it engages the projection 35 but without sufficient tension against said projection 35 to incur the hazard of bringing excessive quantities of the ink onto the surface of the projections or around them.

Operations

The motor 46 is continuously operating and its shaft carrying the driving pinion 47 rotates continuously together with the driving gear 48 which slips between its friction discs 49 that are tensioned by the spring 51. The operator depresses one key top 11 after another in the manner of conventional keyboard devices and in so doing each key lever 12 rotates about its common pivot (not shown) and, in accordance with its individual engagement with the combination bars 13—14, certain ones of them are depressed permitting the remaining ones of them to rise as already explained on account of the train of elements including the T-shaped levers 17. In addition, the depression of each key lever 12 invariably depresses the universal bar 74 causing its T-lever 17 invariably to be rotated clockwise.

As a result of the variable movements of the T-levers 17 their associated longitudinally slidable bars 22 are shifted some to the left and some to the right causing the latch levers 24 to be correspondingly positioned either as indicated in dotted or in solid outline, Fig. 3. As a result of the movement of the universal slidable bar 73 leftwardly as indicated by the arrow, lever arm 71 is rocked clockwise and connecting rod 68 is moved leftwardly causing to be withdrawn the retaining projection integrally formed with the pallet lever arm 63 and causing to be presented the momentary blocking projection of arm 64 under tension of spring 65. The projection of arm 64 is first encountered by one of the teeth in escape wheel 59, but immediately that the particular tooth passes over the projection of said arm 64, said projection drops into the space intervening the particular tooth and a succeeding one, causing the assembly including shaft 45 to be momentarily arrested upon encountering the oncoming tooth.

As the operator's finger is withdrawn from a particular lever 12, the several elements which are subordinated to the universal bar 74 including shiftable bar 73, link 68, and the escape pallet 63—64, are permitted to resume their normal condition as illustrated in Fig. 4, during which the holding projection of lever arm 63 blocks a

tooth in its pallet wheel 61. Meanwhile, shaft 45 has been permitted to rotate throughout one-sixth of a revolution (in the instant embodiment). Because shaft 45 and shaft 54 are geared together positively through the gears 54 and 56, printing shaft 52 will therefore rotate a like distance, but in the opposite direction.

During this cycle, two longitudinal rows of projections 35 will be presented into the printing position which is that occupied by the bottom row of lugs in Fig. 3. At the instant when the first of two consecutive rows of lugs (longitudinally) is placed in his position, three of the printing levers 28 will at the same instant be freed by reason of the three drop-offs in cams 44. Of these three any whose latch levers 24 will in accordance with a particular code combination be placed in the dotted outline position, Fig. 3, will be released to respond to the urge of their springs 39, their weighted extremities 34, functioning as printing hammers, are impacted against the particular printing lugs 35 with which they are in alignment. The impact between each printing hammer or weighted extremity 34 and its associated lug 35 is of instantaneous duration, however, and this is assured and accentuated by the individual rebound springs 38, one of which lies beneath each extremity 33 and which is spaced just far enough from said extremity 33 to be effective at the final instant of percussion.

Following shortly the operation in unison of the first, third, and fifth printing levers 28 or any combination of them, the second and fourth levers operate likewise if the proper combination occurs. It will be recalled that a correction factor is made by providing the extremities of certain levers indicated 43—A somewhat offset from those of the other levers, so that the printing of either or both of the code marks by said certain levers will be at a different corresponding interval with respect to the printing cylinder. Thus, it will be understood that though the feeding of the tape 78 is conducted as a regular and continuous rather than as an intermittent operation, the printing of the permutation code dots is arranged to occur in a manner which will cause the transverse rows to be placed upon the surface of the tape 78 in substantial alignment transversely of the tape. It is to be understood also that while the instant embodiment contemplates the use of preperforated tape this is not an essential prerequisite, since by providing any of several well-known feed hole perforating devices in the proximity of the printing mechanism, feed hole perforations may be made concurrently with, before, or after the printing of the code markings. In the same way other conventional practices in the instant embodiment may be replaced or modified for attaining the same or equally satisfactory results.

Modification

Figures 8 to 11 illustrate a variant adaptation of the present invention in which the typing elements are carried by the impacting members or print hammers. To illustrate a further variation, this modification has embodied in it the ribbon type of ink supply mechanism which passes through the printing locus between the print hammers and the recording tape.

The reference character 84 indicates a motor drive shaft similar to the one illustrated in the preferred embodiment. Through a friction clutch generally indicated 85, a driven gear 86 imparts clockwise rotation (Fig. 11) to a main operating shaft 87. Upon shaft 87 are carried the escape wheels 88 and 89, Figs. 8 and 11, the multiple apex loading cam 91, and the tape feed sprocket cylinder 92. A driving worm 93 also secured to shaft 87 imparts rotation at a reduced speed to the tributary shaft 94, which, through the beveled gears 95, drives the ink ribbon spool 96 preferably through a direction changing gearing in any well known manner.

The rotation of shaft 87 is controlled through the supervised engagement of an escape pallet comprised of the levers 97 and 98, the latter being urged by a torsion spring 99 which is coiled about the pivotal axis 101 and which serves to urge the yieldable lever 98 against the stop lug 102 of the rigid pallet lever 97. Escape pallet 97—98 functions in precisely the same manner as the first described pallet 62. Similarly, its escape wheels 88 and 89 are disposed as a split unit for the same purpose as was described above. It will be noted that adjustment screws 103 extending through arcuate slots in one of the wheels are secured in the other. These assist in obtaining a relative adjustment between the two wheels after which the pair operate as an integral member.

The printing levers 104—105 are six in number (in this case), all being of the same contour as may be seen in Fig. 10 and pivoted upon a common shaft 107. Each lever 104—105 is comprised of two separate arms, the foremost one 104 of which terminates in the weighted extremity 106 which carries the typing elements and the rear arm 105 disposed in horizontal positions and terminating in a region which overlies a set of vertically disposed levers 108. The arms 104 and 105 which comprise the printing levers are urged in clockwise direction by the individual springs 109. All of the levers 104—105 are loaded simultaneously when a universal bail 111 pivoted at 112 is rocked counterclockwise on account of its downwardly and leftwardly extending arm 113, Fig. 10, which is engaged at frequent intervals by the successive cam projections 114 of the wheel 91.

As the universal bail 111 is rocked by an oncoming cam apex 114, the transverse bar 115 thereof lifts all of the arms 105 of the printing levers against the tendencies of their several action springs 109, but as each particular apex 114 passes beyond the saw tooth extremity of arm 113, the abrupt drop-off following said tooth permits said arm 113 to snap in a clockwise direction under impetus of its individual spring 110, Fig. 10. Thus, it will be seen that the levers 108 function for precisely the same purpose as the latch levers 24 in the preferred embodiment. Moreover, the lower end of each of said levers 108 is connected through a rigid link 116 to a longitudinally shiftable rod generally similar and functioning identically to the several rods 22 described above. Upon closer observation it may be noted that each cam apex 114 has a flattened top of slight extent. This surface supports the nose of the projection on arm 113 during the rest intervals and by so doing holds the ends of lever arms 105 clear of the interposition levers 108 so that they may freely respond to the influence of the keyboard.

Referring again to the spring loading operation of the universal bail 111, it will be seen that the camming of arm 113 by each apex 114 restores the universal bail 111 to its clockwise position, against the tendencies of its return

spring 110. During operation, any of the arms 105 of such levers which are not barred by the upper ends of the blocking levers 108 are then permitted to rotate in clockwise direction together with their arms 104 urged by the underlying projections 117 formed with an integral extension of each of said arms 105. The projections 117 stop each arm 104 in the latter's relative movement in a counterclockwise direction only, however, and as each arm 105, even though it misses the upper projection of its associated conditioning lever 108, encounters a limiting screw 118 individual thereto, it is brought to rest. The arm 104 thereof is not instantaneously arrested but is permitted to continue until it engages the paper then to rebound sharply. The purpose is one of obtaining a sharp and instantaneous printing action so that its type projection 106 is instantaneously brought against the surface of the paper 119 behind which is the inking ribbon 121 backed up by a rigid platen 122. In contradistinction to the preferred embodiment, it is to be observed that all of the printing impressions are thus applied at the same instant, giving rise to no relative condition of displacement of the printing dots with respect to each other.

The tape feed roller 92 is driven at such a speed that the printing impression will not be blurred and because wheel 92 is carried on shaft 87 together with the escape wheels 88 and 89 as well as the loading cam 91, the peripheries of the latter members are supplied with a large number of escape and cam projections, respectively. Accordingly, ratchet wheels 88 and 89 and cam wheel 91 may be permitted to rotate at a slow speed corresponding to that of the tape feed sprocket 92, the printing cycle occupying but a small angle of the peripheries of these elements.

The operative cycle is initiated by the actuation of the escape pallet 97—98, the former of which is connected to a link 123 with a first-class lever 124, the lower end of which is connected as at 125 with longitudinally shiftable bar controlled by the universal member under the actuation of any one of a plurality of key levers.

Operation

A keyboard having the modified features illustrated in Figs. 8 to 11 is operated in precisely the same manner as that described above. Upon the depression of any one of a standard set of key levers which extend transversely across a set of parallelly movable (or other types of) permutation bars, there is caused to be shifted longitudinally a set of bars 116 and a single bar which is pivoted at 125. Thus, simultaneously with a positioning of the interposition levers 108, pallet lever 97—98 is made to reciprocate throughout one cycle releasing shaft 87 and permitting the latter to describe a definite portion of a revolution which relates to a complete cycle of operation.

During this rotation of shaft 87, several things occur. First, sprocket wheel 92 advances the tape 119 in a slow and regularly moving manner. Cam wheel 91, through one of its cam teeth, loads and then releases the universal bail 111, actuating those of the levers 104—105 which are not obstructed by the interponent levers 108; while through the worm 93 the inking ribbon 121 is advanced a slight amount in order to present a new or unused area in the proximity of printing.

All of the printing arms 104 are designed to engage for printing the paper tape 119 instantaneously. In the event that certain ones of the actuating arms 105 are blocked by the upper extremities of the interposition levers 108, those of said arms 105 will not be permitted to rotate in a clockwise direction a sufficient amount to cause their projections 117 to impart a substantial impetus to the arms 104 of such lever combinations. As a result the code combinations of spots will be imprinted on the surface of the tape in an exact transverse alignment or in any other alignment dependent upon the arrangement of the lever extremities 106.

While the present invention has been explained and described with contemplation of specific embodiments, as illustrated in the accompanying drawings, it is to be understood nevertheless that numerous changes and variations may be incorporated without departing from the spirit or scope of the present invention. Accordingly, it is intended not to be limited by any of the specific details illustrated in the drawings nor by the language contained in the detailed specification above but to be permitted instead a latitude of interpretation as indicated by the hereinto appended claims.

What is claimed is:

1. In a code printing apparatus, a plurality of printing lugs, a cyclically operating source of power, a supplying medium for treating said lugs with transferable marking substance, a plurality of percussion devices operated sequentially for bringing a tape into contactual engagements with said lugs, and a plurality of conditioning devices set during a cycle of operation of said source of power for causing said plurality of percussion devices to be operated variously during each cycle thereby to print transverse codes on a tape.

2. In a printing telegraph apparatus, a type carrier having thereon type faces arranged in a plurality of rows with successive type faces relating to a single code disposed in different rows, a keyboard having a plurality of key levers for manual actuation, a power driven mechanism, and means under the control of said keyboard and said power driven mechanism for effecting printing engagement of a plurality of the faces of said rows successively and in the same cycle of operation.

3. In a keyboard printing apparatus, a cylindrical type carrier having distributed thereon a plurality of rows of printing lugs with consecutive lugs of a row assigned to alternate components for printing the component markings of a code, a plurality of print hammers one relating to each character component of a code, a keyboard for conditioning said print hammers, and motor driven means for controlling conditioned ones of said hammers to bring them into printing engagement with the corresponding printing lugs in two rows of said type carrier in each printing cycle.

4. In a device for making permutative markings transversely upon a record control strip, the combination of a cylindrical platen having peripherally thereon spiral distributions of printing lugs, a plurality of printing hammers under spring tension to engage said lugs of said platen, cam means individual to each of said hammers for loading and releasing said hammers, gear means for driving and maintaining constant a

phase relationship between said platen and said plurality of cams, and impact rebound means for accentuating the instant of percussion between said hammers and said lugs to prevent the attenuation of markings upon printing engagement.

5. In a keyboard device for preparing control strips, means for supporting a record receiving material through a printing locus, means to print on said material in said locus an alignment of spots permutably distributed in accordance with the characteristics of a code, means for advancing the material during the time that the spots are printed thereon and a power train having tributary driving branches at predetermined ratio between the operating rate of said printing means and that of said material advancing means.

6. In a recorder, a plurality of recording members, spring means for urging each of said members into record making condition, a plurality of conditioning interponents each one related to one of said recording members and adapted by its alternative positionment to prevent or permit the operation of its associated recording member, means to place the control members into varying positions in accordance with a permutation code, cam means for restraining said recording members, and portions on each of said recording members responsive to predetermined settings on its cam means and on its associated control members for permitting said recording members to move into record making position.

7. In a percussion printing apparatus, a plurality of type carrying members, spring means for urging each of said members into printing position, cam means having peripherally thereof permissive and preventive surface characteristics for regulating the period of effectiveness of each of said printing members, and manipulation means effective with said cam means for determining the operative condition of each of said printing members.

8. In a manually operated recorder, a plurality of individual print hammers, a plurality of character levers, a set of springs each associated with one of said hammers, and means under the control of each of said levers to release a variable plurality of said hammers to the influence of their individual springs for recording code patterns on a tape.

9. In a recording device, a continuously rotating driving shaft, an intermittently rotatable driven shaft, means to couple said continuously rotating and said intermittently rotatable shafts during a plurality of part-revolutions of said intermittently rotatable shaft, each of said part-revolutions constituting a recording cycle, a set of percussion recorders, and means controlled by said intermittently rotatable shaft effective a plurality of times during each recording cycle for operating said recorders.

10. In an automatic recording device, a continuously rotating driving shaft, a driven shaft, means to couple said continuously rotating driving shaft to said driven shaft throughout a limited angle of rotation corresponding to a character recording period, record material feeding apparatus actuated by said driven shaft, a cam carried by said driven shaft, and means operated by said cam to make a record on said material concurrently with the operation of said material feeding apparatus by said driven shaft.

11. In a recording apparatus, a carrier for a plurality of type faces, means to move a record receiving material evenly across a printing locus, a set of recording members for printing in transverse lines on said material by engaging in permutable groups against said type faces in said printing locus, and conditioning means for actuating said set of recording members successively during corresponding instants of a cycle of rotation of said carrier.

12. The combination set forth in claim 11 including compensating means for causing all printing impressions of a single transverse line to be recorded without evidence of the progressive displacement representative of the even movement of the tape.

13. In a code printing machine, a set of print lug carrying members, a set of impellers each associated with one of said members, a priming apparatus common to said set of impellers, and a keyboard mechanism for conditioning certain ones of said set of print lug carrying members permutably in accordance with a code for subsequent operation by said impellers.

14. In a code printing machine, a set of print lug carrying members, a set of impellers each associated with one of said members, a source of operating power, and a plurality of keys each for conditioning said set of print lug carrying members during a cycle of operation of said source of power for permitting various combinations of said impellers to actuate their associated members.

15. In a code printing mechanism, a series of print lugs each corresponding to an element of a permutation code, a series of hammers each associated with one of said lugs, means for predeterminedly establishing an operative condition for ones of said hammers to accord with code combinations, and power means individual to each of said hammers for then operating those of said hammers thus conditioned to engage their corresponding lugs to effect printing.

16. In a code combination recording apparatus, a keyboard comprising a plurality of individually actuable keys each representing a character, a plurality of strikers, means tending to operate said strikers in predetermined varying permutations under the control of said character keys and a rotary device having permissive clearances arranged at characteristic intervals in its rotary cycle for permitting said striker operating means to operate said strikers in said predetermined permutations.

17. In a recording apparatus of permutation signals, a plurality of key levers each representing an individual signal of a code system, a set of signal component strikers, spring means individual to each of said strikers for urging them into recording position, a rotary element for withholding said strikers against the tendencies of their individual springs, and means responsive to each of said key levers for releasing characteristic combinations of said strikers at intervals determined by said rotary element into recording positions.

18. In combination with a recorder including a keyboard, apparatus for advancing a ribbon of record receiving material having longitudinally thereof a succession of feed perforations, means under the control of said keyboard to print on said material groups of spots in permutations according to a character to be represented, and means to operate said ribbon advancing mechanism in synchronism with said printing means to cause said ribbon to be moved in the direction of said succession of perforations during the time that each group of spots is being recorded.

19. In a recorder, apparatus for advancing a record receiving material, means to record on said material groups of markings arranged in accordance with a permutation code, said recording means comprising an independent recording element for each code component to produce a code pattern on said material, and means to operate said material advancing apparatus and said recording means synchronously.

20. In a recorder apparatus, a type wheel carrying a plurality of series of type faces, each face corresponding to a component element of a permutation code, means to reproduce an individual code pattern from said type faces, and means to rotate said type wheel in each printing cycle to present a predetermined number of said series of type faces to the printing position to cause the recording of a complete signal combination therefrom in each printing cycle.

21. In a keyboard apparatus, a set of manipulation keys, a plurality of type face elements, spring means for urging each of said elements into printing position, a source of power for restoring operated ones of said elements, and means under the control of said keys to permit said spring means to operate said type face elements in permutational combination in response to the depression of a single key.

22. In a code recording mechanism, a plurality of recording elements, one for each component of a code to be recorded, a plurality of hammers one associated with each of said recording elements, a cam associated with each of said hammers to control the operation thereof, and a selecting mechanism to render said hammers permutably responsive to the control of said cams in accordance with the code to be recorded.

23. In a mechanism to record code combinations, a plurality of recording elements, a plurality of strikers associated with said recording elements and having a rest position and an operated position, one striker for each component of a code to be recorded, power means to operate said strikers individually, a selector mechanism to render certain of said strikers responsive to said power means to operate their associated recording elements in accordance with a code to be recorded, and means common to each striker to return it to its rest position at the end of each printing cycle.

24. In a permutation code recording machine, a set of component recording elements, a corresponding set of variously timed actuators one actuator associated with each one of said set of recording elements, and means to selectively enable said actuators to act upon their associated recording elements during a permutation code recording cycle.

25. In a keyboard printing apparatus, a cylindrical type carrier having distributed thereon rows of printing lugs with lugs of a plurality of said rows assigned to the components of a code combination, means to rotate said carrier, a plurality of print hammers one relating to each component of a code combination, a keyboard for conditioning said print hammers, and power means for actuating conditioned ones of said hammers to bring them into printing engagement with the corresponding printing lugs in said plurality of rows on said type carrier in each code printing cycle.

26. In a code recording apparatus, a cylindrical type carrier having distributed thereon rows of printing lugs with lugs of a plurality of said rows assigned to the components of a code combination, means to rotate said type carrier, a plurality of print hammers one relating to each component of a code combination, a selecting mechanism for conditioning said print hammers, and power means for actuating conditioned ones of said hammers to bring them into printing engagement with the corresponding printing lugs in said plurality of rows on said type carrier in each code printing cycle.

27. In a code recording apparatus, a type carrier comprising groups of type elements with the elements of a plurality of said groups assigned to the components of a code combination to be recorded, a plurality of hammers, one associated with each component of a code combination, a selection device to permutably condition said hammers, and power means for actuating conditioned ones of said hammers to bring them into printing engagement with the corresponding type elements in said plurality of groups of type elements in each code printing cycle.

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