

Feb. 6, 1940.

W. A. AYRES

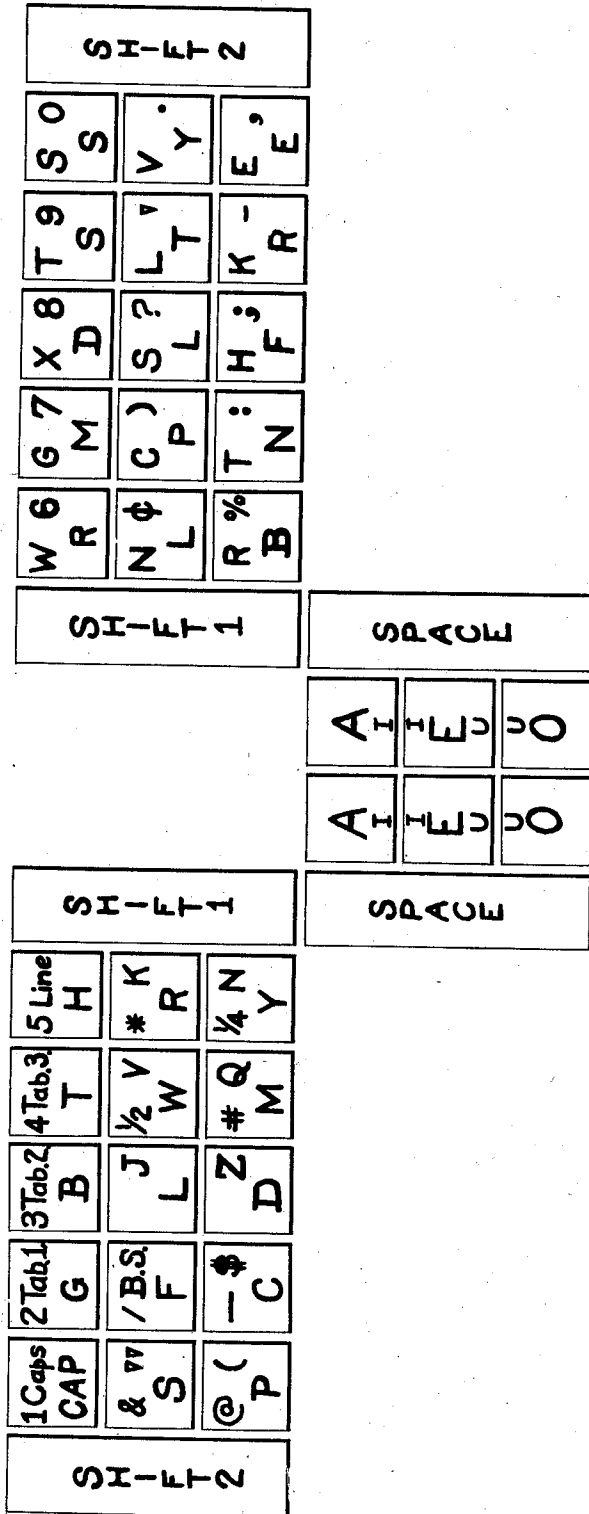
2,189,023

PUNCHING AND PRINTING DEVICE

Filed Dec. 19, 1936

7 Sheets-Sheet 1

FIG. 1.



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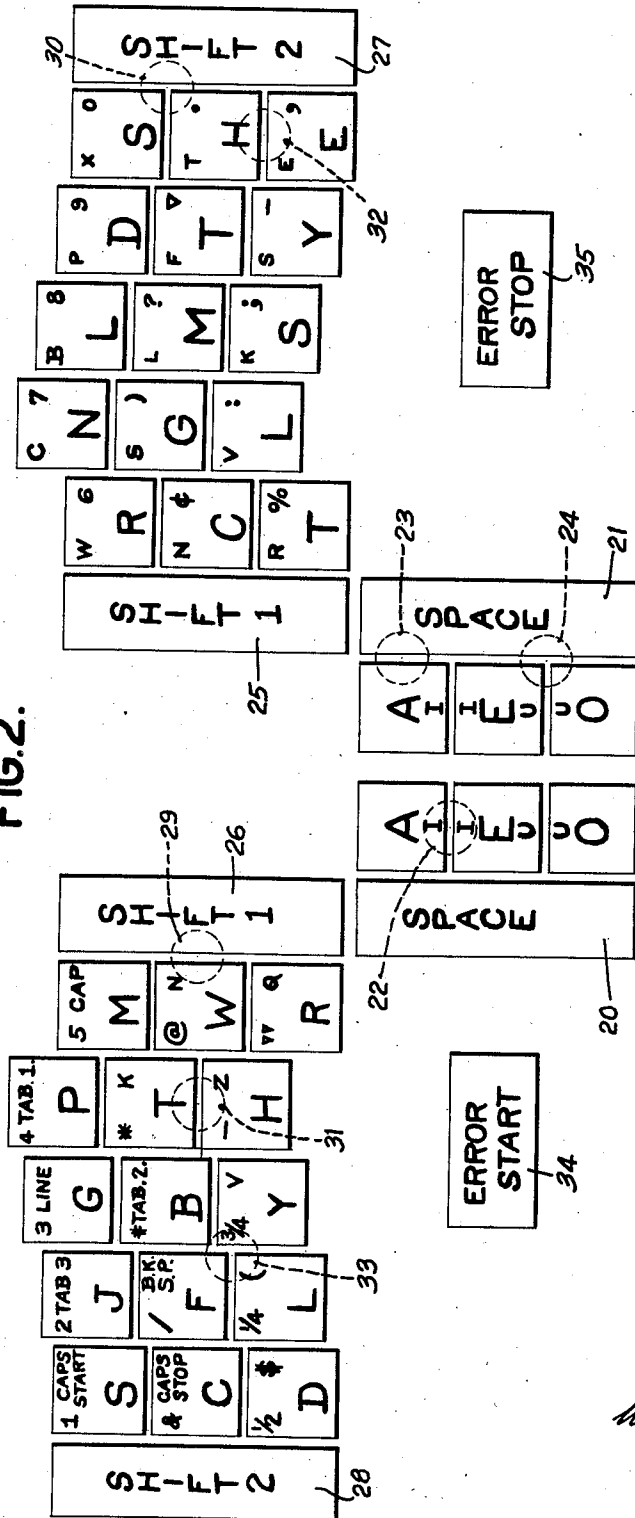
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PUNCHING AND PRINTING DEVICE

Filed Dec. 19, 1936

7 Sheets-Sheet 2

FIG. 2.



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2,189,023

PUNCHING AND PRINTING DEVICE

Filed Dec. 19, 1936

7 Sheets-Sheet 3

FIG. 3.

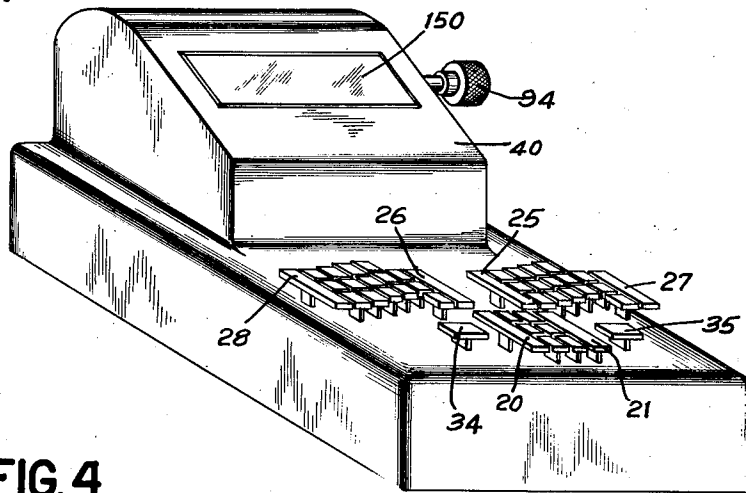


FIG. 4.

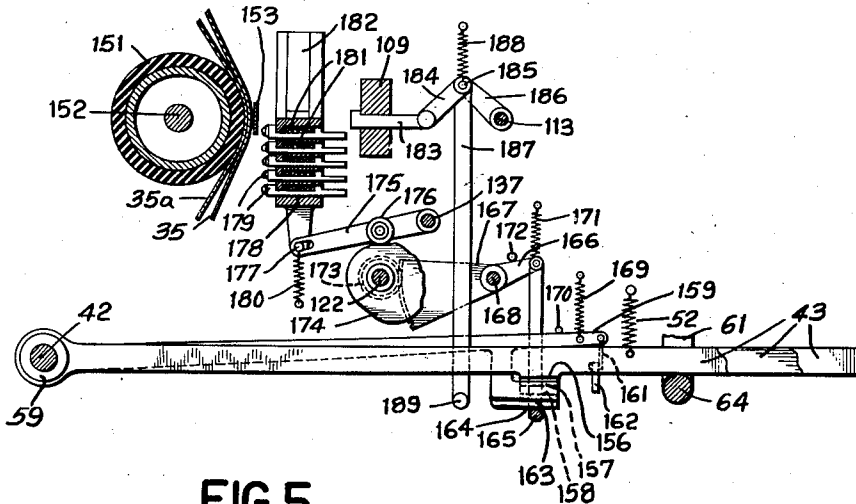
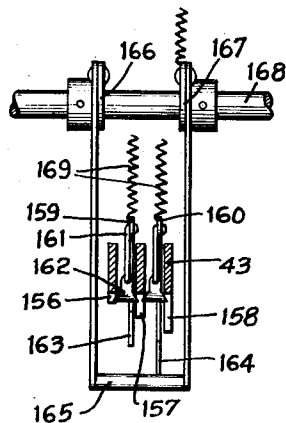


FIG. 5.



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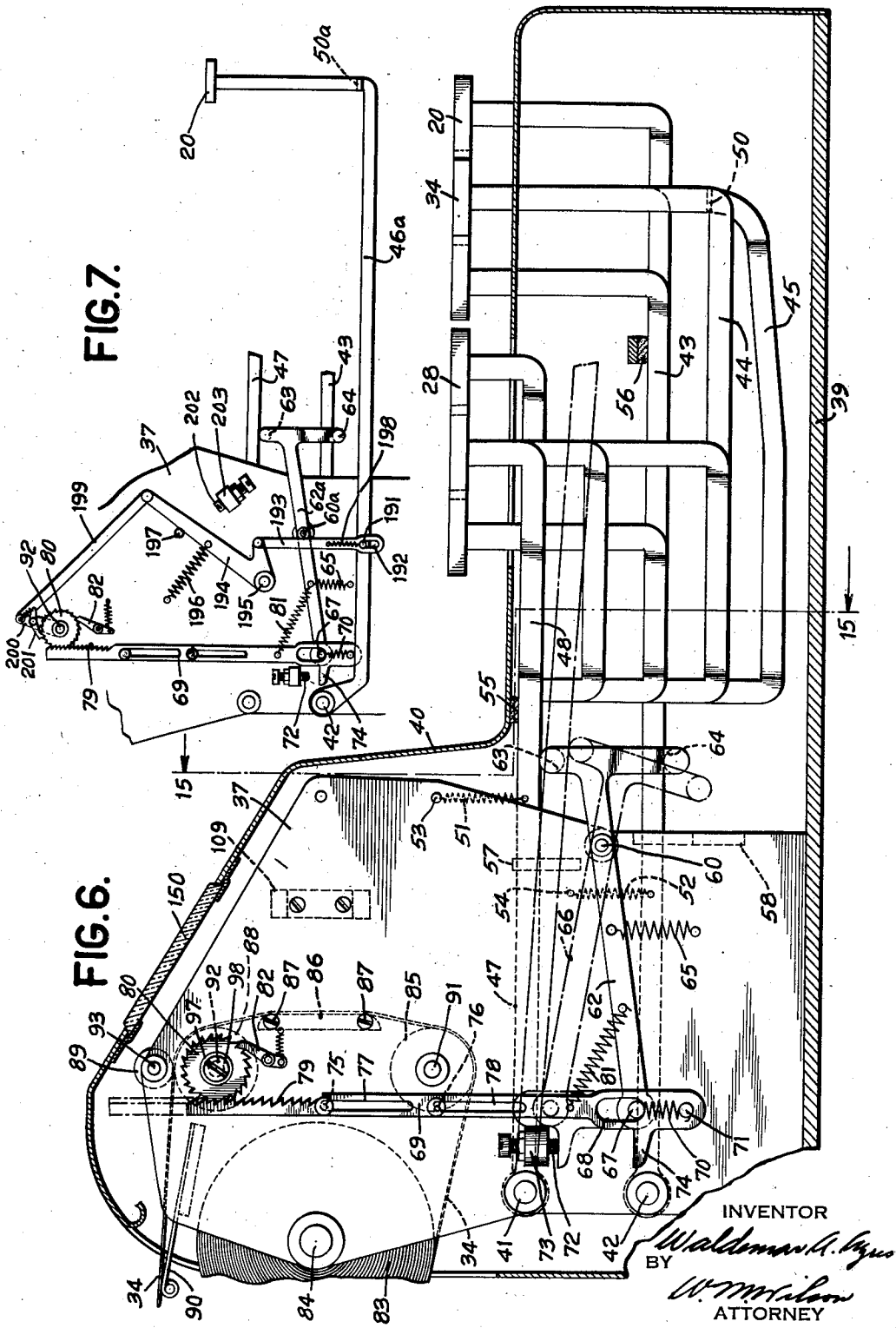
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2,189,023

PUNCHING AND PRINTING DEVICE

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W. A. AYRES

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PUNCHING AND PRINTING DEVICE

Filed Dec. 19, 1936

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FIG. 8.

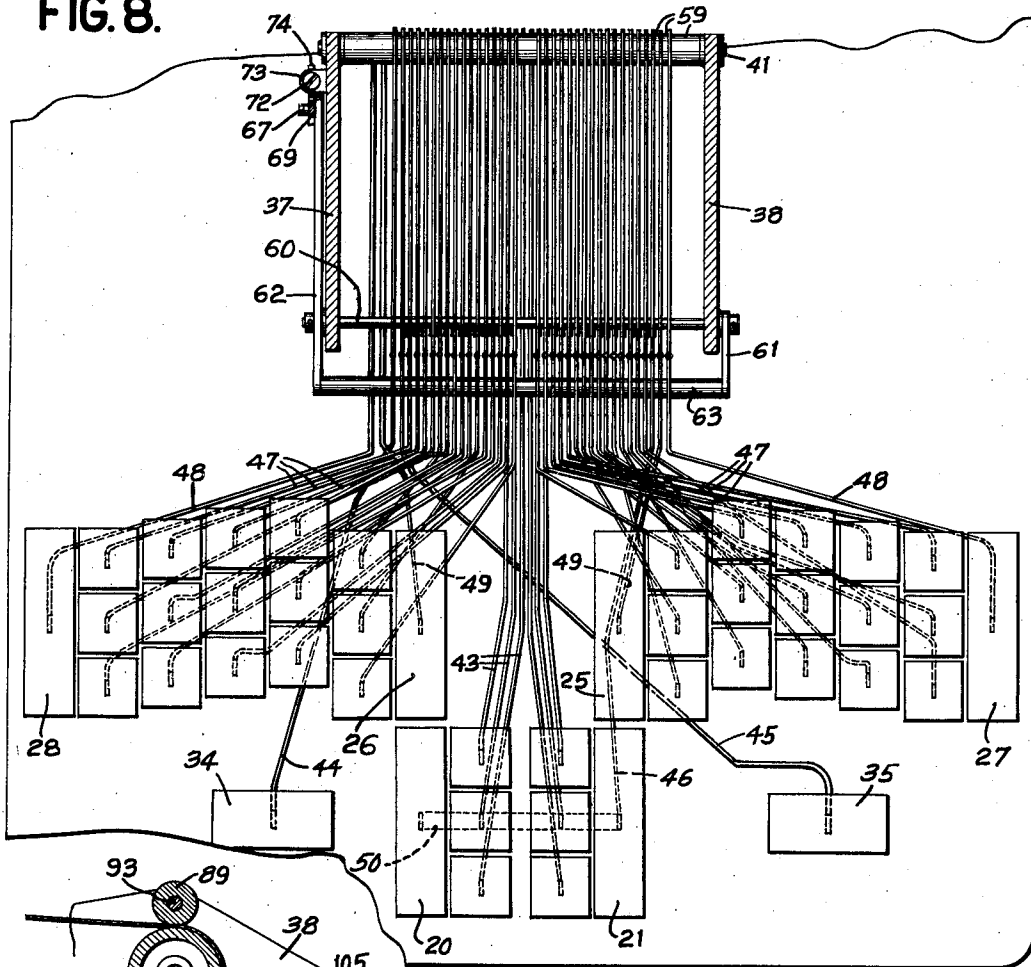
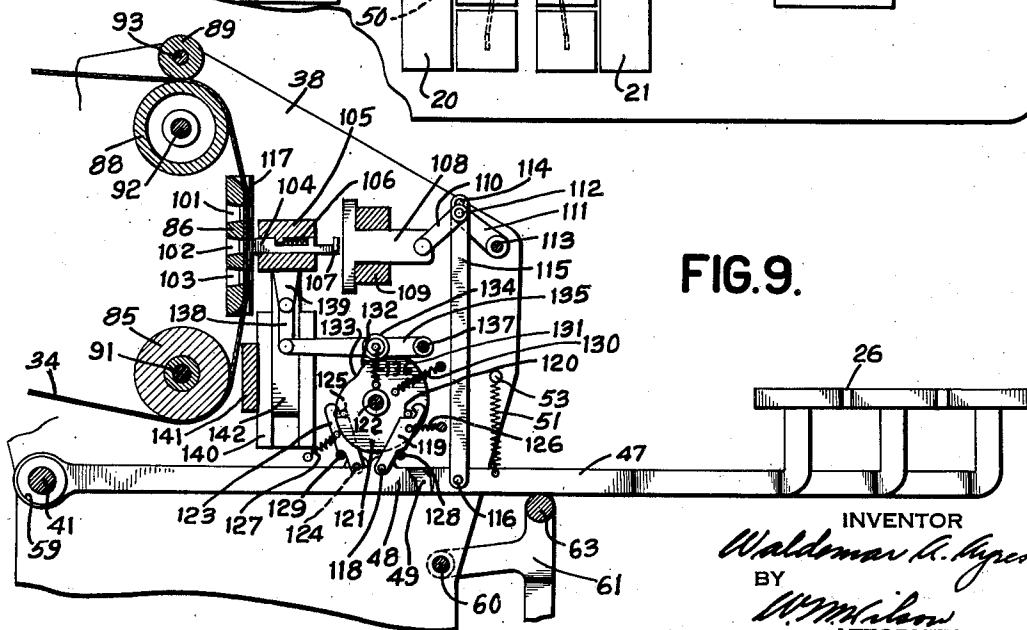


FIG. 9.



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2,189,023

PUNCHING AND PRINTING DEVICE

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FIG. 10.

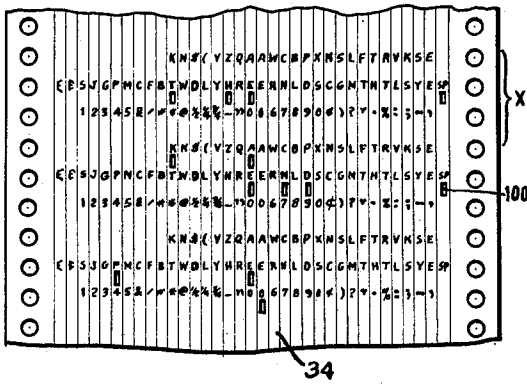


FIG. 11.

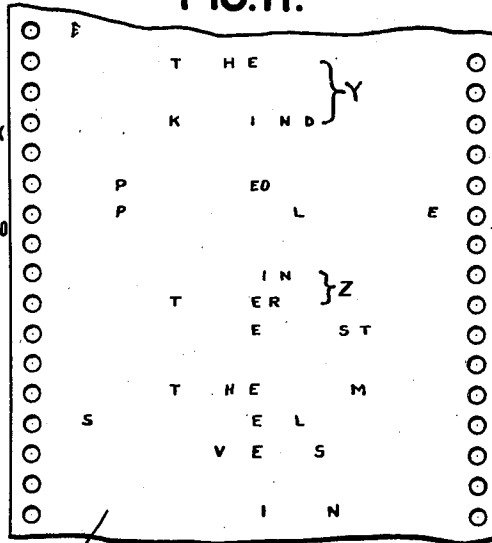


FIG. 12.

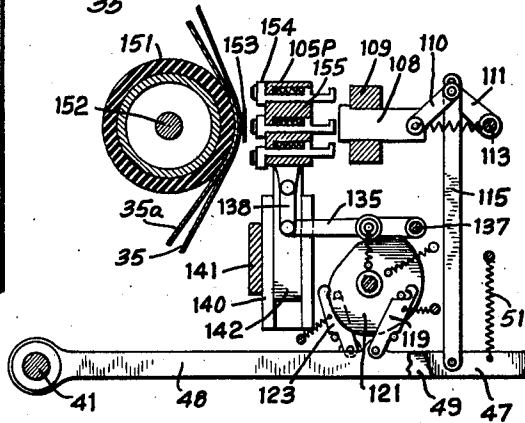
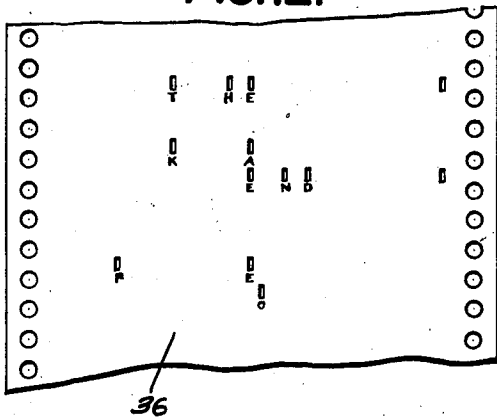


FIG. 14.

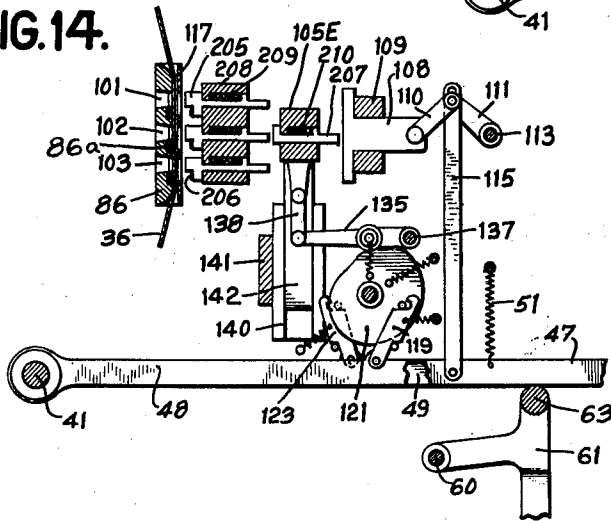


FIG. 13.

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2,189,023

PUNCHING AND PRINTING DEVICE

Filed Dec. 19, 1936

7 Sheets—Sheet 7

FIG. 15.

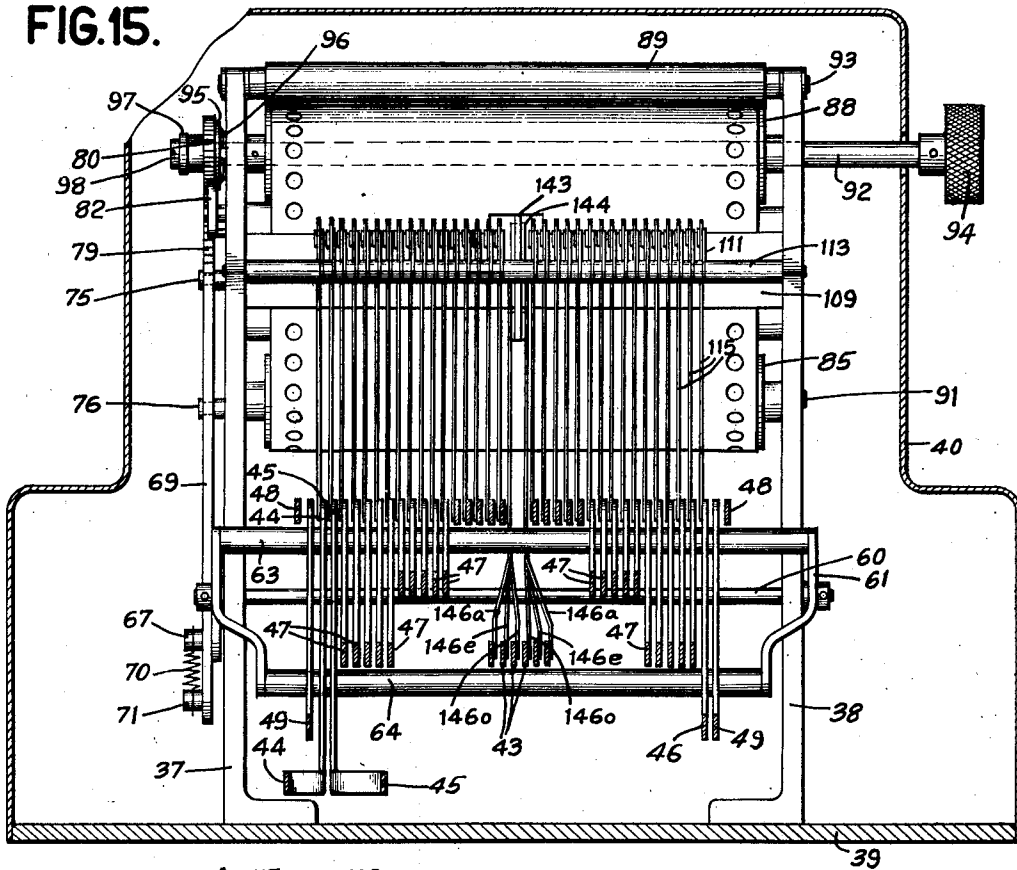
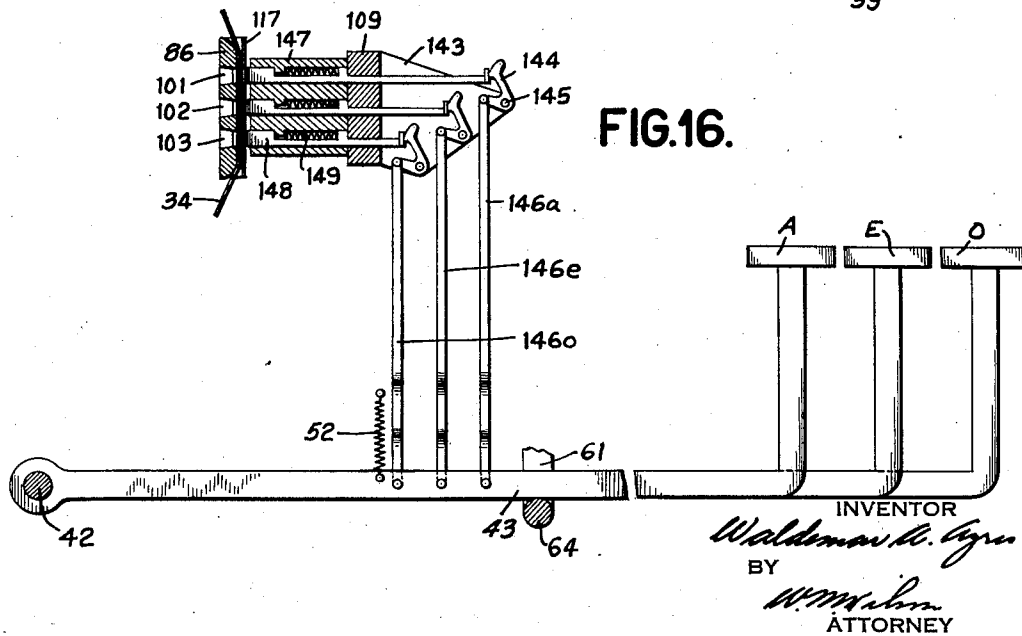


FIG. 16.



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UNITED STATES PATENT OFFICE

2,189,023

PUNCHING AND PRINTING DEVICE

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York

Application December 19, 1936, Serial No. 116,695

36 Claims. (Cl. 197—9)

This invention relates generally to improve-
ments in stenographic recording devices and more
particularly to an improved key arrangement and
mechanism controlled thereby for perforating or
printing a record strip at high speed.

An object of the invention is to provide a
stenographic machine wherein alphabetic and
numerical operating keys are situated in a novel
and advantageous arrangement whereby printed
or perforated representations may be recorded in
a rapid manner.

Another object of the invention is to so ar-
range the alphabet keys and the recording mech-
anisms controlled thereby so that the sequence
of letter representation from left to right agrees
with the actual letter sequences in words, thereby
producing correctly spelled representations of
words.

Another object of the invention is the provision
of punching or printing means controlled by a
stenographic keyboard to record a plurality of
letters in correctly spelled formation in one opera-
tion. A feature of the invention lies in the
means whereby a single downward stroke of one
or both hands operates keys to record complete
correctly spelled words.

Another object of the invention is to provide a
stenographic keyboard wherein a plurality of
designations are represented by each key with a
selective shifting means for choosing the signs,
numbers or letters desired. Thus there is pro-
vided a small number of keys with a large range
of choice of letters so that correctly spelled words
or syllables thereof may be recorded in one
operation.

A further object of the invention is to furnish
a double set of vowel keys between sets of initial
and final consonant keys so that words such as
"feed" or "door" may be recorded in one opera-
tion. The number of vowel keys is reduced by
using three keys in combination to record the five
characters. A feature of the invention is the
compact arrangement of the three vowel keys
whereby one finger may depress two keys to rep-
resent a third character; for example, the A and E
keys may be depressed together by one finger to
represent an I, and the E and O keys together
represent a U.

A feature of the invention is the arrangement
of the space bars near the vowel keys so that
a vowel key and space bar may be depressed to-
gether with one finger. Two vowel keys and a
space bar may be operated by a single finger in
a simultaneous representation of a combination
vowel and a space.

An object of the invention is the provision of a
keyboard controlled recording means wherein fre-
quently occurring sequences of letters may be
recorded simultaneously by the cooperation of one
finger with two or three closely spaced keys. The

combinations SC, TH, SH, GL and FLY may be
formed by the operation of one finger. Another
advantage lies in the arrangement of shift bars
close to a plurality of letter keys so that one or
two keys and a shift bar may be operated to-
gether by a single finger.

A still further object of the invention is to pro-
vide key controlled recording devices including
three sets of keys operable by the fingers of one
hand in natural positions; the sets being arranged
directly behind each other with the sequence of
recording control from left to right on the record
being first from left to right on the keys of the
set furthest removed from the operator, then
from left to right on the keys of the middle set,
and finally from left to right on the keys of the
front set.

A feature of the invention is the provision of
means for considering the final "e" which occurs
often in words and is therefore provided for sep-
arately in addition to the intermediate vowels.

It is also the object of this invention to provide
separate double shift mechanisms, two for each
hand, for greater selectivity of key selection.

The invention also provides means for feeding
a record strip single spaces between syllables or
parts of a word and double spaces between the
end of one word and the beginning of the next
word.

The invention is illustrated by a set of draw-
ings which form part of this specification.

In the drawings:

Fig. 1 is a plan view of a keyboard showing a
desirable arrangement of keys.

Fig. 2 is a plan view of a keyboard with an
improved key arrangement.

Fig. 3 is a perspective view showing the entire
machine.

Fig. 4 is a sectional elevation view of a vowel
printing mechanism.

Fig. 5 is an end view of three vowel key levers.

Fig. 6 is a side elevation view of the key levers
and the record feeding devices.

Fig. 7 is a side view of a double space record
feeding mechanism.

Fig. 8 is a plan view showing the various offsets
of the key levers.

Fig. 9 is a side view of the record perforating
mechanism.

Fig. 10 shows a sample of a preprinted strip
which is perforated in the machine.

Fig. 11 discloses an example of a record strip
which is printed by the devices of the present in-
vention.

Fig. 12 shows a portion of a strip which has been
perforated and embossed.

Fig. 13 is a side elevation view of a character
printing mechanism with double shifting connec-
tions to the type supports.

Fig. 14 is a side elevation view of perforating and embossing devices.

Fig. 15 is a front sectional elevation view taken along the line 15-15 in Fig. 6 and showing the key levers and connections to punch operating toggles.

Fig. 16 is an elevation view showing vowel key control over punching mechanism.

The key arrangements shown in Figs. 1 and 2 are the result of an exhaustive study of the occurrence of English words and the sequence of letters in the words that are used most in business, literature and other fields of human activity. Starting with the data on word occurrence counts revealed in the book "Relative Frequency of English Speech Sounds" by Godfrey Dewey, and noting the consonant and vowel arrangement in the most frequently used words, data were compiled resulting in the improved keyboards disclosed. By means of these novel key arrangements it is possible for an operator to record most small words with a single depression of one or both hands. Words such as "the" or "and" are recorded with a single movement of the fingers of one hand. Many larger words such as "through" or "found" are recorded with a single movement of both hands. Other words may be formed by two or three operations of the hands. Due to the ability to print a plurality of letters with a minimum amount of finger and hand movement, speedier operation results so that the disclosed keyboards may be operated so that a record is made more than twice as fast as the ordinary typewriter keyboard. Therefore, dictation may be taken directly as on a stenographic machine with the advantage thereover of a correctly spelled recording.

In the book mentioned hereinbefore there is given a basic vocabulary of 1,027 words comprising 78% of written and spoken English from the standpoint of frequency of use. In order to analyze the occurrence of letters singly and in combination, each word was divided into syllables keeping in mind that they are to be recorded by a keyboard providing for initial consonants, single and double intermediate vowels, final consonants and a final "e". Following this, a frequency count was made by me to determine the occurrence of consonants, vowels, consonant combinations or vowel combinations as they occur in 100,000 words of written or spoken text. These frequencies are given in the following tables which I have compiled.

Initial consonants and consonant combinations by frequency of use in list of 1,027 words comprising 78% of written and spoken English per 100,000 words of text

Table with 3 columns: consonant combination, frequency, and another frequency. Rows include th, t, w, h, b, m, s, f, n, c, y, l, p, wh, d, g, r, fr, sh, pr, tr, pl, kn, st, gr, ch, j, tw, thr, q.

Table with 3 columns: consonant combination, frequency, and another frequency. Rows include sp, str, cl, br, k, wr, dr, cr, sm, fl, my, z, bl, sch, gt, sf, spr, sw.

Intermediate vowels and vowel combinations by frequency of use in list of 1,027 words comprising 78% of written and spoken English per 100,000 words of text

Table with 3 columns: vowel combination, frequency, and another frequency. Rows include e, a, o, i, ou, u, ea, ee, ai, oo, io, ei, ie, au, ue, oi, ei, eo, oa, ia, oe, ua, iou, eau, eu.

Final consonants and consonant combinations by frequency of use in list of 1,027 words comprising 78% of written and spoken English per 100,000 words of text

Table with 3 columns: consonant combination, frequency, and another frequency. Rows include r, n, t, s, f, nd, m, d, y, v, ng, ll, th, w, nt, st, l, ld, c, ch, p, k, ry, ght, rs, ss, ny, ns, rt, ct, wn, gh, rd, bi, rn, ys, ts, nc, lf, nly, bl, x, ly, pl, ck, ttl, g, ty, rst, nk, rty, rk, rg, ft, nds, rld, ntry, lly, dy, ngs, sk, ws, nst, ps, sh, rm, lt, cts, nts, h, re, rts, ds, ks, rly, nty, pt, xt, ff, ls, rmy, lk, dg, sy, rth, nth, nths, rl, my, ms, gn, ntly, lp, nth, vy, ngth, bly, bt, fty, mpl, rls, rds, rms, lls, ncy, tly, sm, lv, mply, ndly, ngl, z, ckly, cks, rks, typ, np, rv.

Final "e" combinations with final consonants by frequency of use in list of 1,027 words comprising 78% of written and spoken English per 100,000 words of text

the.....	7,479	pre.....	90
re.....	2,277	nge.....	58
ve.....	1,226	rce.....	53
me.....	1,144	nre.....	48
10 se.....	665	nse.....	44
ne.....	566	pe.....	41
ce.....	488	rse.....	40
be.....	426	rge.....	38
de.....	421	whe.....	31
15 ke.....	318	dge.....	24
te.....	299	mple.....	18
she.....	188	ye.....	18
ple.....	187	lse.....	16
le.....	164	lve.....	13
tle.....	149	ngle.....	13
ble.....	128	ze.....	13
fe.....	115	dle.....	12
ge.....	99	type.....	12
nce.....	93	rve.....	11

25 Final consonant combinations with an apostrophe, by frequency of use in list of 1,027 words comprising 78% of written and spoken English per 100,000 words of text

30 n't.....	134
t's.....	78
'm.....	30
dn't.....	23
sn't.....	22
35 o'.....	21
'll.....	20
'v.....	20
'r.....	16
'd.....	11

We observe from these tables that, in this basic list of 1,027 words constituting 78% of written and spoken English, there are:

a. 49 differing initial consonants and consonant combinations.

b. 25 intermediate vowels and vowel combinations.

c. 119 different final consonants and consonant combinations.

d. 10 different final consonant combinations requiring an apostrophe (not including possessives).

e. 39 different final consonant combinations having a final "e".

55 The keyboards disclosed were designed with the foregoing requirements in mind. To keep the number of keys small, three cases are provided, a normal and two shifts giving three characters or controls per key.

60 Certain character keys are carefully repeated and arranged in sequential order so that varying sequences such as ST as well as TS, or LT instead of TL may be recorded with ease.

65 The results revealed in Figs. 1 and 2 were derived by printing the characters and combinations appearing in the tables and repetitions thereof on separate cards and then, by arranging and re-arranging the cards, the probable sequence, frequency and repetition were found with which the characters are most likely to be found 70 in words. The placement of the frequently required characters under the more dextrous fingers is also a factor that was considered. Dexterity was assumed to vary, with the index finger being the most facile, the second finger next, then the small finger, and finally the ring finger. Situa-

tions were encountered where a compromise was necessary between one or more of the factors, sequence, frequency, repetition, shift location and location for dexterity, hence the difference between Fig. 1 and Fig. 2. Generally speaking, the arrangement of Fig. 2 was planned with greater attention to the placement of the frequently required characters and combinations under the more dextrous fingers so that greater ease and speed of operation may be secured. The frequency tables show the need for the final "e" in almost 20% of the frequently used words. The provision of this "e" in the most advantageous place is a novel feature derived from the frequency tables and incorporated in both key arrangements. After considerable study, the arrangements set forth in Fig. 1 were produced. Further effort resulted in the production of the arrangement disclosed in Fig. 2 which retains many of the features of the key placement in Fig. 1.

The keys are arranged as simply as possible for ease in memorizing and ease of combinational fingering since writing speed is dependent upon these features.

In order that the fingers may easily reach all keys with short vertical movements, the keys and control are arranged in a compact formation.

Provision is made for numerals, special signs, capitalization, spacing, paragraphing, tabulation, punctuation and error correction as well as inserting or deleting sections of text.

The four fingers of the left hand must write 49 different initial consonants and consonant combinations. The two thumbs must write 25 vowels and vowel combinations. And the four fingers of the right hand must write 119 different final consonants and consonant combinations, 10 combinations including an apostrophe, and 39 combinations including a final "e".

The operating sequence of the consonant keys is from left to right and by rows from the top to the bottom row. Thus, in Fig. 2 it is seen that the left hand finger operating sequence is SJGPMCFBTWDLYHR. The printing or punching sequence from left to right across the paper tape (Figs. 10 and 11) is first an error start column, next an error stop column, then 15 columns of initial consonants, then a column for left vowels and a column for right vowels, next 15 columns of final consonants and at the right end a column for a space notation. From the foregoing it may be seen that a tape 35 columns wide is required to receive the perforated or printed data.

Although most of the letter combinations are recorded in one operating stroke, certain combinations require two strokes. However, the keyboards are designed so that the combinations requiring more than one stroke are ones that occur infrequently. The keyboard shown in Fig. 2 is adapted to record all initial consonant combinations with only one stroke. All except two of the intermediate vowel combinations may be recorded with one stroke. These vowel combinations are the three letter groups "iou" and "eau" which seldom occur in written or spoken words. Of the 119 final consonant combinations all except 13 may be recorded with one stroke. They are the infrequent combinations ys, ntry, ff, gn, lp, vy, bly, fty, mpl, mply, ckly, typ, and mp, any of which may be recorded with two strokes.

The two keyboards shown are similar in construction and operation, the only difference being in the character arrangement on the keys, the

preferred arrangement being the one in Fig. 2. The description that follows refers to the keyboard of Fig. 2 although it is clear that the other keyboard may be used in the same fashion.

5 In Fig. 2 the normal positions of the hands are such that the fingers of the left hand cover keys F, B, T and W, and the thumb is over the left E key. The fingers of the right hand cover keys C, G, M and T with the thumb over the right E key.
10 Short movements of any finger to the rear or forward places it in cooperation with other keys. Thus the right index finger may move from the C key to the R key or to the T key. The small finger of the right hand may be moved back and forth
15 and slightly to the right to depress the T, Y, D, H, E or S keys.

The thumb is shifted forward a short distance to coincide with both the E and A keys to designate an "I," and slightly further forward to depress the A key alone. In a similar manner, a short rearward movement of the thumb places it over both the E and O keys to record a "U," and further movement positions it to coincide with the O key alone.

25 Either of the thumbs is to be used to depress the space bar 20 or 21 when a complete word or the end of a word is recorded. This may be done along with the depression of vowel keys or independently thereof. Thus a thumb may depress a
30 single vowel key, two vowel keys to record a third vowel (as illustrated by the dotted circle 22) a vowel key and the space bar (circle 23) two vowel keys and the space bar (circle 24) or the space bar alone. Each thumb has eleven operating positions
35 to cover the combinations mentioned.

Each finger key may record any one of three characters, a normal character, or one of two shift characters selected by shift bars 25, 26, 27 and 28. The shift 1 bars 25 and 26 are operated
40 by the index fingers of the right and left hands, respectively; and the shift 2 bars 27 and 28 are depressed by the small fingers of the right and left hands, respectively. The shift bars may be operated alone or in combination with one (circle
45 29) or two (circle 30) of the consonant keys. Shift 2 bar 28 selects the characters depicted on the upper left corners of the consonant keys in the left group, while shift 1 bar 26 selects the characters shown on the upper right corners of
50 the same keys. For example, if the W key is depressed with the bar 28, an @ sign is recorded, if the same key is depressed when bar 26 is operated, an N letter is recorded, and of course if the W key is depressed without operating either shift
55 bar, a "W" is selected. If the F key is depressed with bar 26, a back space sign may be recorded, or such control may be selected, as denoted by the abbreviations

BK.
SP.

60 on the top right-hand corner of the F key. Shift 1 bar 25 selects the characters lettered on the upper left corners of the consonant keys in the right hand group, while shift 2 bar 27 associated with the same keys selects the characters
65 shown on the upper right corners. If the M key is depressed with the bar 25, an L is recorded, and if the same key is operated with bar 27 a ? is recorded.
70

There are places on the keyboard where a single finger cooperates with two or three letter keys to record syllables, letter combinations or simple words. For example, the second finger of the left
75 hand depresses the T and H keys together (circle

31) the small finger of the right hand may record HE (circle 32) and the third finger of the left hand may be positioned and operated to record the word FLY (circle 33).

An Error start bar 34 and an Error stop bar 35 are positioned to be operated by the heels of the left and right hands, respectively.

From the foregoing it may be noted that in the operation of the stenographic keyboards disclosed, the hands maintain their position while the finger
10 tips move short distances from home positions with a "touch system" form of operation. Such a fast mode of operation is impossible in prior art structures involving large numbers or keys and keys widely spaced, necessitating the operator's
15 visual supervision of the placement of the hands and fingers when such attention could be more profitably directed in another direction to a page of written matter or a speaker.

In Fig. 6 it is seen that the tops of all keys and bars are in the same horizontal plane so that the fingers may move rapidly back and forth over them.

The disclosed keyboard mechanism is adapted to operate different devices for forming various
25 kinds of perforated and printed records. Mechanisms are disclosed herein for the production of three forms of record strips; a pre-printed perforated strip 34 such as that shown in Fig. 10, a printed strip 35 as disclosed in Fig. 11, or a per-
30 forated and embossed sheet 36 such as the one revealed in Fig. 12. The machine for producing the perforated strip 34 shown in Fig. 10 will be described first.

The mechanism is mounted between a pair of
35 side frames 37 and 38 (Figs. 6, 8 and 15) fastened to a base plate 39 supporting a casing 40. Two sets of pivotally mounted key levers are fulcrumed on a pair of shafts 41 and 42 secured to the side frames. Vowel key levers 43, error start lever 44,
40 error stop lever 45 and a space lever 46 are pivoted on the lower shaft 42 while all the consonant key levers 47 and shift levers 48 and 49 are pivoted on the upper shaft 41. Because of the many crossings of the upper set of levers to bring their ends
45 into position for punch control, five offset positions are provided as shown in Fig. 15 which is a section taken on the line 15-15 in Fig. 6. A bail connection 50 is made between the left space bar 20 and the space operating lever 46.
50

The levers are raised and held in normal position by two sets of springs 51 and 52 attached thereto. These springs are suspended from rods 53 and 54 fixed between the side frames. The upper edges of the key levers abut against shock
55 absorbing stops 55 and 56 fastened to the casing. Slotted guide plates 57 and 58 confine and guide the levers and act as limiting stops for the downward movement thereof. Spacing collars 59 on the pivot shafts also serve to control the horizontal
60 position and the vertical movement of the levers.

All the keys cooperate with a sheet feeding means for moving the record strip 34, Fig. 10, a distance equal to the space including three of the
65 pre-printed lines of characters every time a combination of keys is depressed. For this purpose a rod 60 (Figs. 6 and 8) turning on bearings in the side frames 37 and 38, carries a short arm 61 and a long lever 62, both attached to the rod. Be-
70 tween arm 61 and lever 62 are fixed a pair of ball bars 63 and 64; the first underlying the upper set of key levers and the second appearing below the lower set of key levers. A spring 65 drawn between the lever 62 and stud on the side frame 31, 75

tends to urge the lever and ball bars in a counterclockwise direction (Fig. 6) so that the bars abut against the bottom edge of the key levers.

Operation of any of the keys serves to depress one of the ball bars and rock the strip feeding lever 62 in a clockwise direction to the dotted line position 66. The rear end of lever 62 carries a stud 67 protruding through a slot 68 in a vertically movable feed ratchet slide 69. A spring 70 attached to stud 67 at one end and fixed to a stud 71 on the bottom of slide 69 at the other end, tends to make the slide follow the upward movement of the lever 62 whenever a key or combination of keys is depressed. The upward movement of the slide 69 is limited by a set screw 72 which passes through a lug 73 on the left frame 37. The end of screw 72 forms a variable abutment for an extension 74 on the side of the lower end of slide 69.

The feed operating slide 69 is guided in its vertical movement by a pair of studs 75 and 76 extending through slots 77 and 78 in the slide. These slots are slightly wider than the stud shoulder with much free play between them. This is done so that ratchet teeth 79 on the side of the slide 69 may escape freely over the teeth on a ratchet wheel 80 on the upstroke of the slide. There is provided a spring 81 tensioned between the slide and lever 62 for the purpose of drawing ratchet teeth 79 into engagement with the strip feeding wheel 80.

A stop pawl 82 cooperates with wheel 80 to prevent it from turning in a clockwise direction along with the upward movement of slide 69; but on the downstroke of slide 69, teeth 79 engage in a positive way with the teeth on wheel 80 and turn said wheel in a counterclockwise direction under the influence of the strong spring 65. At the same time, the spring, through the lever 62 and bars 63 and 64, acts to lift the key levers and restore them to the normal position.

The paper strip 34 (Fig. 6) is drawn from a roll 83 mounted on a shaft 84 removably held in the side frames. From the roll the paper passes around a guide roller 85 and then up in front of a die plate 86 fixed between the side frames with screws 87. The strip continues upward and then back between a feed roller 88 and a pressure roller 89 and out over a paper table 90 and through an opening in the rear of the cover 40.

The paper rollers 85, 88 and 89 are mounted on shafts 91, 92 and 93 that pass through the two side frames, shafts 91 and 93 being fixed in the frames (Fig. 15) and shaft 92 turning therein so that feed roller 88 may be operated either automatically by the ratchet wheel 80 on the left end of the shaft, or manually by a hand knob 94 at the right end of the shaft.

Ratchet wheel 80 does not operate feed shaft 92 directly; instead it turns the shaft through frictional engagement with a clutch disk 95 keyed to a slot in the shaft. A spring cup washer 92 presses the disk into constant engagement with the ratchet wheel 80. The wheel is held on the shaft by a washer 96 fastened with a screw 98 in the end of the shaft. Whenever wheel 80 is turned in a counterclockwise direction by slide 69, the wheel turns disk 95 which is fastened to the shaft 92 also fixed to roller 88 for feeding the tape.

Because of the slip clutch connection to the paper feed drive, the record strip may be turned backward even though the pawl 82 (Fig. 6) prevents clockwise movement of the ratchet wheel 80. Whenever it is desired to retract the strip for the purpose of punching an error start or error stop

signal, for making written notes over table 90, or for any other reason, knob 94 may be manipulated to turn shaft 92 directly. The knob may also be turned to feed the strip forward if it is desired to skip certain areas on the strip. There is no hindrance to such counterclockwise movement (Fig. 6) of wheel 80 because both slide 69 and pawl 82 move out of the path of the ratchet teeth when the wheel moves that way. When the strip is retracted, roll 83 may be turned by hand to keep the paper taut against die plate 86 and around roller 85.

In Fig. 9 there is shown the mechanism for punching thirty-three of the thirty-five columns of character positions shown on the strip 34 in Fig. 10. This mechanism also includes the shifting control devices for selectively punching in one of three places along each column. The other two of the thirty-five columns on the strip are the two center columns devoted to the representations of vowels, the controlling mechanism for which is described herein after first considering the punching of consonant and special sign designations.

In Fig. 10, the distance X is the extent of strip feed after each key depression. It is seen that within this space of feed there are three lines of preprinted characters under which one or more perforations 100 may be punched. These perforations may appear under any or all of the three lines of characters to represent a word or part of a word registered with one depression of the operator's hands. Each perforation may be identified by the character directly above it. Thus the word "The" and a space may be recognized by noting the four characters above the first four perforations in the sample strip shown in Fig. 10.

The strip feeding devices are adjusted by turning the set screw 72 (Fig. 6) to limit the feed to the extent X (Fig. 10) and by starting punch operation with the strip positioned so that the top line of characters thereon appears directly above a top row of die openings 101 (Fig. 9) in the die plate 86. Two other rows of die openings 102 and 103 are cut in the die plate, there being thirty-five openings in each row. Normally cooperating with the center row of die openings is a series of thirty-three punch plungers 104 divided into two sets with seventeen plungers in the left set in a guide block 105 shifted by the shift keys 26 and 28 operated by the left hand, and sixteen plungers in the right set in a similar guide block which is shifted by the shift keys 25 and 27 associated with the right hand. The left set of plungers represent the fifteen initial consonant keys, the error start and the error stop keys; while the right set of plungers represent the fifteen final consonant keys and the space bar. Cooperating with the two center sets of die openings is a vowel representation punching mechanism (Fig. 16) which differs from the consonant punching devices of Fig. 9 in a manner described hereinafter.

Turning again to consideration of the consonant punches (Fig. 9) it is noted that each plunger 104 is normally retracted by a coil spring 106 which presses between a shoulder on the plunger and a stop extension forming an abutment in the slot through which the plunger slides. The front part of each plunger 104 is widened into a foot 107 in the path of an operating slide 108 loosely mounted in a rectangular bar 109 fixed between the side frames. There is one such slide 108 for each punch plunger. Pivotaly mounted on the end of each slide 108 is one link 110 of a pair of toggle links 110 and 111 loosely

joined by a pivot at 112. The other end of link 111 turns on a fixed fulcrum rod 113 mounted between the main side frames. Encircling the pivot 112 of the toggle is the slotted end 114 of an operating link 115 attached to a related key lever 47 by a stud 116. There is provided a separate link 115 and connected pair of toggle links 110 and 111 between each of the consonant, error and space keys and the related punch operating slides 108 as clearly shown in Fig. 15.

Whenever a consonant lever 47 is operated, the related link 115 is pulled down with the result that the connected toggle links are straightened out and the operating slide 108 is moved to the left to push the punch plunger 104 through the record strip 34 and the die opening 102. As the key is released, spring 51 lifts the lever 47 and link 115 which then lifts the toggle center 112 to retract the slide 108 and allow the plunger 104 to move back out of the die plate 86. A stripper plate 117 holds the record strip 34 against the die plate so that it does not follow a retracted plunger.

Slot 114 is provided at the upper end of each link 115 to allow an interval of time to elapse before the link is effective to operate the toggle and push the plunger through the strip. It is during this time interval that a shift mechanism may be made effective to move plungers 104 so they line up with the die openings 101 or 103 instead of the middle openings 102.

There are two shifting mechanisms provided, one for each hand. Although only one set of connections appear in Fig. 9, it will be remembered that another similar mechanism is directly behind it in position for operation by the right hand shift levers while the shift parts shown are operated by the left hand shift levers 48 and 49.

Pivoted at 118 on lever 48 is a shift operating pawl 119 with a hooked end that is adapted to engage a pin 120 extending from the side of a shift cam 121 rockable on a shaft 122 between the side frames. A similar oppositely facing pawl 123 is pivoted at 124 on shift lever 49 and adapted to engage a pin 125 extending from the side of the cam 121 opposite to the side from which the other pin 120 extends. Springs 126 and 127 pull the pawls 119 and 123 against cam rods 128 and 129, respectively, so that normally the upper ends of both pawls are out of the path of the upward swing of pins 120 and 125. Therefore either pawl may engage its associated pin to pull it down and rock the cam 121 without interference by the other pawl.

55 A spring 130 attached to cam 121 tends to hold it in a centralized position and draw it back there when rocked in either direction by the pawls.

The cam has three concentric cam surfaces, an upper surface 131, a normal central surface 132 and a lower surface 133. A roll 134 on a cam follower arm 135 normally rests on the central surface 132 as urged by a spring 136. The fixed end of the follower arm 135 is pivoted on a shaft 137 while the swinging end of the arm is articulated 60 to a link 138 pivoted to a depending extension 139 on the punch guide block 105.

Whenever the shift 1 key lever 49 is depressed, pawl 123 is pulled down and as it moves down a cam face thereon cooperates with rod 129 to rock 70 it slightly in a clockwise direction so that the hooked end engages over pin 125 to pull it down and rock cam 121 in a counterclockwise direction. The cam then acts to lift arm 135 until roller 134 rides on the top surface 131. With the arm 135 in a lifted position, link 138 is raised and the guide

block 105 is carried along therewith to bring the plungers 104 in alignment with the die openings 101. Since the shift operation of the guide block 105 occurs early in the depression of the key levers, plungers 104 are properly aligned with 5 the slides 108 push them through the record strip 34. It is noted that the rear upper and lower edges of slides 108 are extended to cooperate with plungers 104 in any of the three shift positions 10 they may occupy.

An example of the shift 1 control by bar 26 (Fig. 2) may be examined by assuming that the W key is depressed along with bar 26. Then cam 121 (Fig. 9) is operated and the block 105 15 is lifted, as already explained, so that the plunger in line with the twelfth column (Fig. 10) on the strip 34, instead of punching a hole under the W as it would without a shift, now punches a hole under the N.

Turning again to Fig. 9, it is apparent that the depression of shift 2 key lever 48 carries the attached pawl 119 along down therewith. A cam face on the lower end of the pawl cooperates with a rod 128 to rock the pawl in a counterclockwise direction so that the hooked end engages over pin 120 to pull it down and rock cam 121 in a clockwise direction. The follower arm 135 then drops until roller 134 rides on the lower concentric cam surface 133. With the arm 135 in a depressed position, a link 138 is lowered and guide block 105 follows along down to bring the plungers 104 opposite the die openings 103.

The shift operation may be disclosed further by a sample operation in which it is assumed that the J key (Fig. 2) is depressed along with the shift 2 bar 28. Then the cam 121 (Fig. 9) is operated and the block 105 is lowered, as already explained, so that the plunger 104 cooperating with the fourth column from the left of strip 34 (Fig. 10) instead of perforating under the printed J, punches a hole under the 2.

It is noted on Fig. 2 that each key in the consonant groups is designated with two selective shift characters printed near the two upper corners of the keys. These characters are placed on the side nearest the shift bar that selects them. Thus, on the W key, the @ sign near the upper left side is selected by the shift bar 28 at the left, and the N letter printed near the right side is selected by the shift 1 bar 26 at the right of the group. And in the right group on the M key, the L letter at the upper left is selected by the shift 1 bar 25 at the left and the ? is selected by the bar 27 at the right.

It is understood that in addition to the shift mechanism controlled by bars 26 and 28 appearing in Fig. 9, there is another similar and yet independently operated shift mechanism directly behind it. This other shift mechanism is provided 60 with a separate guide block 105 and connections to the right hand shift bars 25 and 27. Therefore, one hand may operate the related consonant keys for normal depression or depression with either shift bar, while the other hand independently selects a shift or normal operation in co- 65 operation with its consonant keys. Of the two sets of punch plungers, either may be aligned with one of the three rows of die openings, while the other set of plungers is opposite the same row or 70 either of the other two rows. In this way, by controlling with two independent sets of double shift mechanisms, the selectivity of consonant key operation is increased nine times instead of three times.

The plunger guide blocks 105, Fig. 9, are guided in a vertical direction by four slotted ways 140 fixed to a rectangular bar 141 fastened between the side frames. Each block has two depending extensions 142 which fit into the ways 140. The extensions may be of dovetail section to aid in aligning the punch plungers.

The vowel keys (Fig. 16) control another form of punching mechanism which is independent of the shift devices. The crossbar 109 is widened at the center and formed with a web 143 which carries six bellcranks 144, three on each side of the web. The bellcranks are arranged in a stepped formation on pivots 145 so that the top crank is connected to the A key lever 43 by a link 146a, the center crank is connected to the E key lever 43 by link 146e and the bottom crank is connected to the O key lever 43 by link 146o. Attached to the rear of bar 109 is a punch holder 147 carrying three pairs of vowel punch plungers 148 which extend to the right through bar 109 and into cooperation with the ends of the vertical arms on the bellcranks 144. The top pair of plungers are operable separately or together by the top pair of bellcranks connected to the two A keys, the center pair of plungers are operated by the connections to the E keys and the two lower punches are pushed by the O keys. Coil springs 149 press between shoulders on the plungers and shoulders in the holder 147 so that the punch plungers are restored in unison with the restoration of the key levers 43 by springs 52.

From the foregoing description of the vowel punch construction, it is made clear that any one or any combination of the six vowel plungers may be operated to pass through the die plate 86 and punch vowel representations in the record strip 34. In Fig. 10 it is seen that in the first word punched, the E perforation appears alone. In the second word, both an A and an E are punched in the same column in order to represent the I of the word KIND. And for the third word an E is punched in one column and an O in the next column to represent the EO of the word PEOPLE.

The space control perforation is placed in the extreme right hand column on the record strip 34, Fig. 10. It is punched under control of either of the space bars 20 or 21 (Fig. 2) by connections such as those shown in Fig. 9. Since the space punch plunger 104 is mounted in the right guide block 105, and since this block is shifted according to the selection of a final consonant perforation, the space perforation may appear in any one of the three punch positions.

The error start and error stop perforations appear in the first two columns at the left of the record strip. The two punch plungers for these designations are also controlled by operating connections such as those shown in Fig. 9 with levers terminating in the keys 34 and 35, Fig. 2. Usually, before the error start key is depressed to point out a place on the record strip 34 that should be omitted by the transcribing machine, it is necessary to turn the knob 94 (Fig. 15) to reverse the strip to bring it back to the place where the erroneous matter begins. For this purpose a glass window 150 (Fig. 6) is placed over an opening in the cover 40 so that the operator may watch for the place where an error start or error stop perforation is to be punched and then adjust the strip so that the place is arranged properly over the die plate 86.

Many words may be represented by perforations within the single space X devoted to three preprinted lines of index points. Such words are

recorded with a single stroke of one or both hands. The first word THE which is represented at the top of Fig. 10 is produced with one stroke of the fingers of one hand. The next word KIND is punched with one stroke of both hands. The third word must be divided into two parts; the first part PEO being perforated with a stroke of both hands, and the second part PLE is most easily fingered by the operation of both hands. Other longer words require variable numbers of strokes and hand operations according to the number of letters and the arrangement of them in the word.

A modification of the stenographic devices is also disclosed herein. In this second form of the machine a record strip 35 is printed such as the sheet shown in Fig. 11. There it is noted that instead of perforating holes in a strip 34 (Fig. 10) which may be used later to control a printing machine, the printed matter is placed directly on the strip under control of either of the keyboards shown in Figs. 1 and 2. In Fig. 13 it is seen that the key lever and shift mechanism for the printer modification is the same as it was for the perforating devices in Fig. 9, therefore there is no need to repeat much of this description. However, it may be noted in Fig. 13 that a shifting guide block 105P carries three sliding type slugs 154 with three type faces; also that a platen 151 has been substituted for the die plate. The platen 151 is loosely mounted on a shaft 152 between the side frames and it supports two record sheets, the top original strip 35 which may be backed with a carbon surface, and a second duplicate record strip 35a. An inking ribbon 153 is held in front of strip 35 to record the impressions of the type.

The type slug 154 slides in block 105P and has three extensions thereon, the middle one of which is formed with shoulders cooperating with a coil spring 155 and the end operating slide 108. There is provided three such slugs for each of the keys in the consonant groups and the error start, error stop, and space keys. All type slugs operated simultaneously, print in a single horizontal line in alignment with the center line of the platen. The slugs may be shifted up or down but the printing position is at the horizontal line behind the ribbon 153. Assuming that the W type slug is shown in Fig. 13, it is clear that operation of the shift 1 controls with the W key will serve to raise the block 105P to place the lower type face which depicts N opposite the ink ribbon. Operation of the shift 2 devices with the same W key serves to lower the type slug so that the upper type face @ is positioned to print. All shifting takes place before the operating link 115 has straightened out the toggle links 110 and 111 sufficiently to move slide 108 and push the slug 154 firmly against the ribbon 153 and record strip 35.

The typing mechanisms shown in Fig. 13 occupy all the column positions across the strip 35 except the two center vowel printing positions which contain vowel typing mechanisms such as that disclosed in Fig. 4. There it is seen that three associated vowel key levers 43 are formed with three successively longer shoulders; the A lever 43 having shoulder 156, the E lever 43 formed with shoulder 157, and a shoulder 158 extending down from the O key.

Pivoted on shaft 42 between the vowel levers are a pair of combination arms 159 and 160 (Fig. 5) each carrying pivoted thereon a wire 161 and a pendant 162 hanging therefrom. These pen-

dants are placed between the three vowel keys so that if two adjacent vowel keys are depressed together arm 159 or arm 160 is carried along therewith. For example, if the A and E levers are depressed together, the left pendant 162 (Fig. 5) is caught between them and the connected combination arm 159 is carried along down with the levers. So also, if the E and O levers are depressed together, the right pendant pulls arm 160 down. If any one of the vowel levers is operated alone, the pendants are swung aside and the combination arms remain undisturbed.

The lower part of arm 159 extends down with a shoulder 163 and arm 160 is formed with a lowered shoulder 164. These shoulders complete a progression of five shoulders 156, 157, 158, 163 and 164 spaced differential distances from the horizontal portion of an operating bail 165 pivoted on an arm 166 and a sector 167 attached to a shaft 168. Springs 169 pull the arms 159 and 160 up against a fixed stop rod 170 to hold them raised in a normal position as levers 43 are raised by springs 52. Another spring 171 attached to sector 167 urges it upward against a fixed stop rod 172 to position the attached bail 165 so that the horizontal portion is directly under the lowest shoulder 164. The sector 167 meshes with a pinion 173 attached to a cam 174 loosely pivoted on shaft 122. A follower lever 175 loosely pivoted on shaft 137 carries a roller 176 resting on the periphery of the cam. The outline of cam 174 is raised in five successive concentric steps to correspond with the five varying extents of movement imparted to the cam through the connections to the five differentially spaced shoulders 156, 157, 158, 163 and 164. Shoulder 164 operates the cam through the largest angle, and shoulder 156, being normally the furthest removed from bail 165, operates the cam the least amount, while the other three shoulders cause varying spacing between the two extremes. Roller 176 follows the steps on the cam and accordingly lifts the end of lever 175 which has a pin and slot connection 177 to a vertically movable type bar 178 carrying five vowel type 179. Attached to pin 177 is a spring 180 which pulls the type bar down and holds the roller 176 against cam 174. Each of the type 179 is retracted by a small coil spring 181 pressed between extensions on the type and the type bar.

The top type is the A type, the second is an E type and the third is the O type. The type are so arranged because it is in that order that the shoulders 156, 157 and 158, respectively, cause upward movement of the type bar. When both the A and E keys are operated, the left pendant 162 pulls down the arm 159, and the shoulder 163 thereon pulls down bail 165 to swing sector 167 and turn cam 174 so that the fourth step on the cam profile underlies the roller 176. Arm 175 when so adjusted, lifts type bar 178 to put the I type in printing position opposite the center of the ribbon 153.

The bottom type member 178 which is the U-type is adjusted to an effective position when both the E and O keys are operated to depress the arm 160 which is formed with the bottom shoulder 164.

A stationary slotted member 182 forms a guide and retainer for the vowel type bar, a portion of which extends into the groove of the member.

The type 179 are impressed against the ribbon 163, duplicated strips 35 and 35a, and platen 151 by a plunger 183 sliding in bar 109. Pivoted on the end of the plunger is a link 184 which is articulated on a stud 185 with another link 186

rocking about the fixed shaft 113. The two links form a toggle connection from the center point of which there hangs an operating link 187. At the lower end, this link 187 is bent to form an offset projection 189 under all three vowel key levers 43. Operation of any one or any combination of the vowel keys will serve to pull down on link 187, straighten the toggle 184, 186, and push the plunger 183 to the left to press the selected type against the platen. It will be noted that there is quite a space between the lower edge of the key levers 43 and the top of the operating link offset 189. This space is provided so that the type bar may be positioned before the type are pushed to make an impression. A spring 188 pulls up on stud 185 to retract plunger 183 and condition the toggle and link 187 in readiness for another printing operation.

Two vowel printing mechanisms, such as shown in Fig. 4, are provided at the center of the stenographic printing machine between two consonant printing mechanisms like that shown in Fig. 13.

In Fig. 11 it may be seen that short words such as THE or KIND may be printed on one line, while the word PEOPLE requires two lines. Certain words or part of a word may be printed with a stroke of one hand while others call for the use of the fingers of both hands. It is also noted that the spacing Z between parts of a word is only one-half as wide as the spacing Y between words. The wider spacing is produced by a special feed mechanism for the printing modification of the stenographic recorder. It becomes effective whenever a space bar is depressed along with other keys for the printing of a complete word or the last part of a large rod.

Fig. 7 discloses the special feeding devices for separating printed words on the record strip. There it is seen that the paper feed ratchet wheel 80, the retaining pawl 82, the operating slide 69 and the adjustable stop 72 are all the same as the feeding elements described hereinbefore with reference to Fig. 6. However, the feed operating ball arm 62a is different because its pivot point on rod 60a is situated nearer the rear of the machine so that the arm has a narrower swing when the ball is operated by levers 43 and 47. This change is made because the ordinary spacing Z (Fig. 11) on the printed tape 35 is much narrower than the spacing X (Fig. 10) on the punched tape 34. A shorter swing of the end 67 (Fig. 13) of lever 62a results in a smaller upward movement of slide rack 69 and consequently a narrower rocking movement of ratchet wheel 80 and the feed shaft 32.

The devices for producing the wider spacing Y (Fig. 11) between words are also shown in Fig. 7. Whenever a space bar 20 or 21 is operated, with or without an accompanying operation of character levers, a printer space lever 46a is rocked downward about the lower pivot shaft 42. Bar 21 is connected to lever 46a through a crosspiece 50a. A stud 191 on lever 46a extends through a slot 192 in a link 193 hanging from a bellcrank 194 pivoted at 195. A spring 196 draws the bellcrank 194 back against a stop stud 197, while another spring 198 between link 193 and stud 191 tends to hold the lever 46a up and the stud 191 against the upper end of slot 192. Pivoted to the upper end of bellcrank 194 is a link 199 which is connected at its other end to an arm 200 loosely pivoted on feed shaft 92. The arm 200 carries a pawl 201 cooperating with the ratchet wheel 80. An adjustable stop for the

movement of crank 194 is provided in the form of a screw 202 in a boss 203 on the side frame 37.

Whenever space lever 46a is depressed, link 193 is pulled down, bellcrank 194 is rocked in a clockwise direction, link 199 is pulled down and to the right, arm 200 is rocked to the right, and pawl 201 ratchets idly over the teeth on wheel 80. Bellcrank 194 then stops against the end of screw 202, but lever 46a may be depressed further because of the pin 191 and slot 192 connection and the flexibility of spring 198. Release of the space bar permits lever 46a to rise and the entire linkage to be restored as urged by spring 196. During such restoration, the pawl 201 positively engages the teeth on the wheel 80 to turn it and the feed shaft 92 so that the printed strip 35, Fig. 11, is fed the distance Y. This amount of feed is about twice the spacing Z produced through the operation of slide 69 by the character keys. Although the space bar and character keys are operated and released together, and the pawl 201 (Fig. 13) and the rack 79 cooperate with wheel 80 together, there is no conflict in the operation because for part of the restoration cycle, both the pawl and the rack tend to turn the wheel and then, when the rack stops, the pawl continues to turn the wheel to feed two spaces instead of one.

At the end of sentences or other places where it may be desirable to feed three spaces or a distance on the strip 35 equivalent to space Y plus space Z, this may be accomplished by releasing the character keys and space bar seriatim. Either one may be released first and then the other directly thereafter with the result that pawl 201 will operate for two spaces and slide 79 for one space, separately, the total amount of feed equaling three ordinary spaces.

A third form of stenographic recording mechanism is disclosed herein for the production of a combination perforated and embossed record strip such as the strip 36 shown in Fig. 12. There it is noted that underneath each character perforation there appears an embossed letter showing what the perforation represents. Instead of all letters being preprinted on the strip as they are in the example of Fig. 10, only those letters pertinent to the data represented by the strip are recorded in Fig. 12. The perforations and embossings are recorded on the strip in one operation by punch plungers 205 (Fig. 14) with embossing faces 206. The devices for controlling the operation of the punch plungers 205, include the keyboard, keylevers, paper feed, shift devices and punching means, all of which are the same as the mechanisms described hereinbefore with reference to Fig. 9 and other figures disclosing means for making the record shown in Fig. 10. The only differences besides the shape of the punch plungers 205 is in the arrangement of these embossing plungers and the use of an interposer 207 to operate them. Instead of the plungers being mounted on a shifting guide block 105E, they are placed in a fixed bar 208 while the interposer 207 rides up or down according to the shift.

There are provided thirty-three columns of plungers 205 with three plungers in each column, in addition to two center columns of special vowel plungers described hereinafter. The three plungers of each column coincide with the die openings 101—103 in the plate 86 so that when any plunger is pushed to the left, Fig. 14, the front cutting edges will perforate a rectangular hole in the strip 36 and at the same time the

embossing face 206 will press the strip between it and a resilient insert 86a in the plate 86 to leave a character impression in the paper. Coil springs 209 in bar 208 restore the plungers.

The thirty-three interposer slides 207 are divided into two groups each mounted in a separate block 105E; seventeen of them being in the block associated with the left hand shift mechanism and initial consonant group of keys, and sixteen being in the other block moved by the right hand shift mechanism and the final consonant group of keys. The interposers are normally positioned between the middle plunger 205 and the operating slide 108. If a shift 1 type of operation is selected by depression of lever 49, pawl 123 is pulled down, cam 121 is turned counterclockwise and guide block 105E is lifted so that the interposers 207 are raised to make the top plungers effective. Should a shift 2 kind of operation be desired, lever 48 operates pawl 119, cam 121 is turned in a clockwise direction and block 105E is lowered so that the interposers are brought into alignment with the bottom row of punch plungers.

Operation of any character key serves to pull down the connected link 115 and straighten the toggle 110, 111 to push the slide 108 to the left, and push the interposer 207 and the selected plunger 205 before it. Springs 210 restore the interposers when the toggle mechanism is restored by spring 51.

Between the left and right sets of embossing plungers 205 there are mounted two columns of six vowel plungers. Since these plungers are to be operated in combination to represent I and U they cannot be operated by an interposer mechanism such as shown in Fig. 14, but instead they are arranged to be operated individually as the vowel punches are operated in Fig. 16. The construction shown in Fig. 16 is followed in all particulars except for the extra provision of embossing faces on the bottom of the punches when they are to be used to produce the combined perforated and embossed record.

Although the novel features of the invention are fully disclosed in this specification, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters, and recording devices controlled by said keyboard to place the representations of one or more letters in the order

SJGPMCFBTWDLYHR;

A, E, I, O or U, A, E, I, O or U, and

RNLDSGCMTHLSYE

from left to right on the record sheet.

2. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters, and recording devices controlled by said keyboard to place the representations of one or more letters in the order KNVZQ: A, E, I, O or U, and A, E, I, O or U, and

WCBPXNSLFTRVKSE

from left to right on the record sheet.

3. In a machine for recording letter represen-

tations on a record sheet, a keyboard for setting up the letters, and recording devices controlled by said keyboard to place the representations of one or more letters in the order KNVZQ; A, E, I, O or U, and A, E, I, O or U, and

RNLDSGTMHTLSYE

from left to right on the record sheet.

4. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters, and recording devices controlled by said keyboard to place the representations of one or more letters in the order

SJGPMCFBTWDLYHR;

A, E, I, O or U, and A, E, I, O or U, and

WCBPXNSLFTRVKSE

from left to right on the record sheet.

5. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters, and recording devices controlled by said keyboard to place the representations of one or more letters in the order

GBTHSFLWRPCDMY;

A, E, I, O or U, and A, E, I, O or U, and

RMDSSLPLTYBNFRE

from left to right on the record sheet.

6. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters, and recording devices controlled by said keyboard to place the representations of one or more letters in the order JVKZQN; A, E, I, O or U, and A, E, I, O or U, and

WGXTSNCSLVRTHKE

from left to right on the record sheet.

7. In a machine for perforating letter representations in a record strip, a keyboard including keys representing the letters

SJGPMCFBTWDLYHR;

A, E, I, O or U, and A, E, I, O or U, and RNLDSGTMHTLSYE, and perforating devices under control of one or more of said keys for perforating said strip with a horizontal line of perforations in the order given from left to right.

8. In a machine for perforating letter representations in a record strip, a keyboard including keys representing the letters KNVZQ; A, E, I, O or U, and A, E, I, O or U, and

WCBPXNSLFTRVKSE,

and perforating devices under control of one or more of said keys for perforating said strip with a horizontal line of perforations in the order given from left to right.

9. In a machine for perforating character representations in a record strip which is preprinted in sections repeatedly as follows:

KN\$(VZQAAWCBPXNSLFTRVKSE
EESJGPMCFBTWDLYHREERNLDSGTMHTLSYESP
12345&/#*@1111"0067890φ)?'.%:;-,

a keyboard including keys representing the characters shown, perforating devices operated by one or more of said keys simultaneously for punching perforations in the strip near the selected preprinted characters, and means for feeding the strip from one preprinted section to the next section between operations of the keys.

10. In a stenographic machine for perforating character representations in a record strip which is preprinted with repeated sets of lines of char-

acters, a plurality of lines of characters in each set, a keyboard with keys representing the characters preprinted, each key representing characters in more than one line, means for selecting in which line each key is to be effective, and means under control of said keys and said selecting means for perforating one or more perforations each near a selected preprinted character.

11. In a stenographic machine a keyboard consisting of three groups of keys positioned to be operated by the fingers and thumbs of both hands of an operator, a left group of keys comprising fifteen keys arranged in three arcs with the five keys in each arc corresponding to the position of the finger tips, a center group of six keys arranged in two sets of three keys in a column, each set operated by a thumb, a right group of keys comprising fifteen keys arranged in three arcs with the five keys in each arc corresponding to the positions of the finger tips, and means under control of said keys operated singly or in combination for recording data represented by the keys.

12. In a machine for recording letter representations on a record strip under control of the fingers of an operator, a line of letter representing members arranged from left to right across the strip in the order that the letters occur in words, a keyboard with separate keys for operating said members, said keys under control of each hand being arranged in three successive arcs corresponding with the arc formed by the natural position of the finger tips, the extreme left key of the top arc being related to the member at the extreme left of the strip and the other key relationships following in order to the right along the top arc, then starting from left to right along the center arc, and continuing from left to right along the bottom arc, and means under control of the keys for operating the related members to make a record on the strip.

13. In a stenographic machine for recording letter representations on a record strip, a series of letter recording elements extending across the machine in the order that they occur in words, the element at the extreme right representing a final "e", a keyboard comprising a plurality of keys operable singly or together, and means under control of the keys for operating related elements to place one or more letter representations on said strip.

14. In a stenographic machine for recording letter representations on a record strip, a keyboard including a group of consonant keys at the left, sets of vowel keys in the center and another group of consonant keys at the right, a series of letters representing elements arranged across the machine from left to right in the order that the respective letters occur in words with a final "e" element at the extreme right, means under control of said keys for operating said elements to represent related letters on the record, one of said right consonant keys controlling the operation of said final "e" element.

15. In a machine for recording character representations on a record sheet, means for recording a space designation on said sheet, a pair of character keys operable by one finger either singly or together, a recording means under control of said keys for recording representations of one of three characters according to the operation of said keys and a space bar situated near said pair of keys to be operated by the same finger either alone, together with one key, or together with both keys to control said space recording means

so that it places a space designation on said sheet.

16. In a machine for recording character representations on a record sheet, means for feeding said sheet, a pair of character keys operable with an operating digit either separately or simultaneously, a recording means under control of said keys for recording a representation of one of three characters according to the key operation, and a space bar near both of said keys in position to be operated by the same digit either alone, together with one key or together with both keys to operate said feeding means.

17. In a stenographic machine for perforating character representations in a record strip, two adjacent sets of punch plungers each set arranged in alignment, two sets of bellcranks mounted on a common support and positioned to operate the plungers, two sets of keys, key levers operated by the keys, links connecting the bellcranks to the levers for operation thereby, and a die plate behind the strip through which the plungers may be pushed to perforate the record strip.

18. In a recording machine for printing character representations on a record strip, three keys operable singly or in pairs, three key levers operated by said keys, a pair of pendants suspended between the levers, each of said pendants being pulled down when the related pair of levers are operated; a pair of arms on which said pendants are suspended to pull the arms down, a differential mechanism cooperating with the three levers and two arms to be operated to five different extents according to the keys operated, a set of five character type, a platen, a typebar carrying said type and having connections with said differential mechanism so that one of the five types is brought into printing position with respect to the platen by the differential mechanism every time keys are operated, and means under control of any depressed keys for pressing the selected type against the strip and the platen after the type is in printing position.

19. A keyboard for a stenographic machine comprising a group of keys bearing the letters

SJGPM
CFBTW
DLYHR

at one side of the center of the keyboard representing singly or in combination initial consonants and prefixes of words, and another group of keys lettered

RNLDS
CGMTH
TLSYE

at the other side of the keyboard representing singly or in combination final consonants and suffixes of words, and a central group of vowel keys

AA
EE
OO

representing the vowels shown when depressed singly and I and U when depressed in combination.

20. A keyboard for a stenographic machine comprising a group of keys bearing the letters

KN
VZQ

at one side of the center of the keyboard representing singly or in combination initial conso-

nants and prefixes of words, and another group of keys lettered

WCBPX
NSLFT
RVKSE

at the other side of the keyboard representing singly or in combination final consonants and suffixes of words.

21. A keyboard for a stenographic machine comprising a group of keys bearing the letters

GBTH
SFLWR
PCDMY

at one side of the center of the keyboard representing singly or in combination initial consonants and prefixes of words, and another group of keys lettered

RMDSS
LPLTY
BNFRE

at the other side of the keyboard representing singly or in combination final consonants and suffixes of words.

22. A keyboard for a stenographic machine comprising a group of keys bearing the letters

JVK
ZQN

at one side of the center of the keyboard representing singly or in combination initial consonants and prefixes of words, and another group of keys lettered

WGXTS
NCSLV
RTHKE

at the other side of the keyboard representing singly or in combination final consonants and suffixes of words.

23. In a stenographic machine for recording word representations on a record strip, a keyboard with keys operable singly or in combination, devices under control of said keys for recording representations of a word or part of a word on each line of said strip, means under control of said keys for feeding said strip from line to line comprising a feed roller and connections to said keys through a friction clutch, a space key with connections for operating said feeding means, means for recording an "error start" representation on said strip, means for manually operating said feed roller in the reverse to the normal feed direction to bring the strip back into a position to receive the "error start" representation, and means for recording an "error stop" representation on said strip.

24. In a stenographic machine for perforating character representations in a record strip, a key representing three characters, two shift keys operable with the character key to select one or the other of two characters other than the character normally represented by the key, a die plate with three openings representing the three characters, a punch plunger cooperating with one of said openings to perforate said strip, means under control of said character key for operating said plunger, a cam for shifting said plunger out of a normal position to cooperate with either of the other two openings, a pawl operated by one of said shift keys to turn said cam in one direction to shift said plunger to select one opening, and another pawl operated by the other shift key to turn said

cam in the other direction to select the other opening.

25. In a stenographic machine for perforating character representations in a record strip, a key representing three characters, two shift keys operable with the character key to select one or the other of two characters other than the character normally represented by the key, a die plate with three openings representing the three characters, three punch plungers cooperating with said openings to perforate said strip, an interposer cooperating with one of said plungers and adapted to be shifted to cooperate with either of the other two plungers, means under control of said character key for operating said interposer to actuate the cooperating plunger, means under control of one of said shift keys for shifting said interposer to cooperate with the second plunger, and means under control of the other of said shift keys for shifting said interposer to cooperate with the third plunger.

26. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters and recording devices controlled by said keyboard to place the representations of one or more letters in the order

GBTHSFLWRPCDMY;

AEIO or U, and AEIO or U, and

WGXTSNCSLVRTHKE,

from left to right on the record sheet.

27. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters and recording devices controlled by said keyboard to place the representations of one or more letters in the order

JVKZQN;

AEIO or U, and AEIO or U, and

RMSSSLPLTYBNFRE

from left to right on the record sheet.

28. In a machine for perforating letter representations in a record strip, a keyboard including keys representing the letters

GBTHSFLWRPCDMY;

AEIO or U and AEIO or U, and

RMSSSLPLTYBNFRE,

and perforating devices under control of one or more of said keys for perforating said strip with a horizontal line of perforations in the order given from left to right.

29. In a machine for perforating letter representations in a record strip, a keyboard including keys representing the letters JVKZQN; AEIO or U, and AEIO or U, and

WGXTSNCSLVRTHKE,

and perforating devices under control of one or more of said keys for perforating said strip with a horizontal line of perforations in the order given from left to right.

30. In a machine for perforating character representations in a record strip which is preprinted in sections repeatedly as follows:

"JVK(\$ZQNAAWGXTSNCSLVRTHKE
GBTHSFLWRPCDMYEERMSSSLPLTYBNFRE
12345&/ 1/2* @_ #1/4 0067890φ) ?' .% : ; - ,

a keyboard including keys representing the characters shown, perforating devices operated by one or more of said keys simultaneously for punching perforations in the strip near the se-

lected preprinted characters, and means for feeding the strip from one preprinted section to the next section between operations of the keys.

31. In a record machine for representing words on a record strip, a keyboard comprising a plurality of keys operable singly or in combination, a plurality of lines of embossing dies fixed behind said record strip, a plurality of superimposed sets of separate letter embossing members movable towards said dies and arranged from left to right across the machine in the order that the letters occur in words, and means under control of any of said keys for simultaneously impressing related embossing members in any of the plurality of lines against said strip to form a record.

32. In a machine for recording letter representations on a record strip under control of the fingers of an operator, a line of letter representing members arranged from left to right across the strip in the order that the letters occur in words, a keyboard with separate keys for operating said members, said keys under control of each hand being arranged in three successive rows, the extreme left key of the top row being related to the member at the extreme left of the strip and the other key relationships following in order to the right along the top row, then starting from left to right along the center row and continuing from left to right along the bottom row, and means under control of the keys for operating the related members to make the record on the strip.

33. In a stenographic machine for recording letter representations on a record strip, a series of letter recording elements extending across the machine in the order that they occur in words, the two elements at the extreme right representing final "e" or "ee", a keyboard comprising a plurality of keys operable singly or together, shifting mechanism cooperating with said keys for selectively associating one of a plurality of said elements with a related key, and means under control of the keys for operating related elements to place one or more letter representations on said strip.

34. In a machine for recording character representations on a record sheet, means for recording a space designation on said sheet, three vowel keys operable by one finger either singly or in combinations of two, a recording means under control of said keys for recording representations of one of five characters according to the operation of said keys and a space bar situated near said vowel keys to be operated by the same finger either alone, together with one key, or together with two keys to control said space recording means so that it places a space designation on said sheet.

35. In a machine for recording letter representations on a record sheet, a keyboard for setting up the letters comprising a group of keys bearing the letters

SJGPM
CFBTW
DLYHR

said letters representing singly or in combination letter consonants and parts of words, and recording devices controlled by said keys to place the representations of one or more letters in the order SJGPMCFBTWDLYHR on said record sheet.

36. In a machine for recording letter repre-

sentations on a record sheet, a keyboard for setting up the letters comprising a group of keys bearing the letters

said letters representing singly or in combination letter consonants and parts of words, and recording devices controlled by said keys to place the representations of one or more letters in the order RNLDS CGMTH TLSYE on said record sheet.

WALDEMAR A. AYRES.

RNLDS
CGMTH
TLSYE

CERTIFICATE OF CORRECTION.

Patent No. 2,189,023.

February 6, 1940.

WALDEMAR A. AYRES.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 75, for "frame 31" read frame 37; page 8, first column, line 72, for "163" read 153; and second column, line 37, for the word "rod" read word; line 45, for "ball" read bail; line 56, for "shaft 32" read shaft 92; page 9, second column, line 62, claim 1, after "U," first occurrence, insert and; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of March, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.