THE MACHINE REPORTER:
ITS HISTORY, DESCRIPTION
AND KEYBOARD VALIDATION

by

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A THESIS

submitted to the

OREGON STATE COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

August 1938

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TABLE OF CONTENTS

THE MACHINE REPORTER:
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CHAPTER I

INTRODUCTION

There remains but one function in the modern busi-
ness office which is still largely manual--that of recording
dictation. The stenographer with notebook and pencil is
still the most common method employed by business and pro-
fessional men in transferring their thoughts rapidly to an-
other for verbatim reproduction. The adding machine is
deemed well-nigh indispensable. The typewriter is an accept-
ed and universal device in the modern office. The bookkeep-
ing machine, the check writer, the duplicating machine, and
many others do the work of the office mechanically and effi-
ciently. It seems logical that stenographic and shorthand
methods should be the next processes mechanized.

What has been done toward this end? What general
lines have been followed?

Considerable work has already been done toward the
mechanization of shorthand methods. There are at least five
machines on the American market today. The United States
Patent Office records indicate that a total of 76 patents
have been issued covering shorthand machines and improvements
thereon. This work of mechanization has followed two dis-
tinct lines. In the first method the sound of the dicta-

tor's voice is recorded on a wax or metal record. This record is then placed in another machine which reproduces the sound of the speaker's voice in much the same manner as the phonograph, but at speeds which the operator can control, thus enabling him to transcribe the sounds directly on the typewriter. An example of this type of machine is the DICTA-PHONE. The second method employs a machine somewhat similar to the typewriter, manually operated, but capable of writing whole words or syllables at a stroke instead of single letters. At present there are three machines based upon this principle, the REPORTER, STENOTYPE and DICTATYPE.

There is considerable evidence that the machine method can be learned in one-half to one-third the time required to learn a manual system. STENOTYPE and REPORTER operators claim that it is much less fatiguing to handle long periods of dictation on a machine than with a pen or pencil. It is also claimed that an operator will not forget a machine system as rapidly as a manual system, and that one does not lose his speed as he grows older. If these claims could be tested and should be found to be valid, the schools might well consider the idea of offering instruction in mechanical methods of taking dictation.

The writer, after having taught the operation of one of these machines in high school for a period of three years, is interested in a further study of the possibilities of mechanical methods of shorthand both from the instruction-

al standpoint and as to their potential effectiveness in actual use.

It is the purpose of this thesis to examine one of these machines, the REPORTER, which employs the "word-a-stroke" principle, to determine if possible the theoretical soundness of its writing principle, to measure the requirements of the language against the capacity of the machine, and to determine whether or not the keyboard represents a valid selection and arrangement of letters.

The writer has found material on this subject to be virtually non-existent except in the promotional literature of the companies manufacturing the machines. The information in this study concerning the background and development of the REPORTER was obtained during interviews with the inventor, Mr. Thomas Bilyeu, and by an examination of the complete series of models which are being preserved in the vaults of the Reporter Corporation in Portland, Oregon. The word study reported in Chapter IV of this investigation was made under the direction of Mr. Bilyeu. Information on the history of manual shorthand is amply provided in three excellent works. The criteria for validating the keyboard were formulated after a careful study of the work of Dvorak on the development of the Simplified Keyboard for the typewriter.[2] The lists of letter combinations appearing on the charts in Chapter IV were obtained by analyzing the words

in Webster's Collegiate Dictionary.

The plan of development of this thesis is as follows: In this chapter, the writer has stated the problem with which this study is concerned, has indicated its importance, has explained his interest in it, has pointed out that material on the subject has been found to be very meager, but that he has been able to go directly to original sources for the information desired. Chapter II will present a brief history of manual shorthand from its earliest beginnings down to the development of Gregg's now famous system, will describe the three "word-a-stroke" principle shorthand machines now on the American market, will present a brief biographical sketch of the inventor of the REPORTER, and will give the history of the REPORTER from the first model down to the machine of today. Chapter III contains a detailed description of the REPORTER including its appearance, the arrangement of the keys, the method of operation, an explanation of the keyboard, and a description of the auxiliary equipment for use with it. Validation of the keyboard is the subject of Chapter IV. In this chapter, the writer sets up three criteria for determining validity and then evaluates the keyboard in terms of these criteria. Chapter V contains the summary, conclusions, and some recommendations for further study.

It is hoped that this and subsequent studies may

throw some light on the nature and effectiveness of machine
shorthand.

CHAPTER II

HISTORY OF SHORTHAND

The beginnings of shorthand or "swift-writing" extend back into antiquity. Some historians believe that there was a shorthand method in use in early Egypt. Others contend, however, that the hieratic characters used were an attempt to portray things rather than to talk about them.

The first real evidence of the existence of shorthand is found in the writings of Plutarch. In describing the famous accusation of Cataline by Cato before the Roman Senate, Plutarch declares that shorthand writers were employed to record the exact words of Cato.

"This speech of Cato has been preserved in this manner: Cicero had taught the most skillful writers, beforehand, signs which in small and short characters comprehended the signification of many letters. These writers were placed in different parts of the Curia, and as yet they had developed neither quick-writers, nor did they have any, but were just entering upon that path." (3)

The first recognized system of shorthand and the one referred to in the above quotation, was invented by Marcus Tullius Tiro, a highly educated slave of Cicero's. Tiro's system made use of an alphabet, but used the letters as abbreviations instead of representations of sounds. This resulted in a system that encompassed about 8000 arbitrary

signs to "commit to heart." The most frequent method of abbreviating was the using of the first letters of the words; for example, "A. D." stood for Anno Domini; "A. M." was the symbol for ante meridiem, etc. In addition to abbreviations, speed was also acquired by omitting certain letters. In order to learn the system, therefore, it was necessary to memorize long lists of abbreviations, and to master the method of omitting letters from words not abbreviated.

Some idea of the speed of the "swift-writers," or the lack of speed can be obtained by examining their primitive method of recording a speech. As many as forty writers would cover the same speech. The first writer would take six or eight words and then signal the next writer. Writer number two took what he could and then signalled to the next, and so on until it was back to the first writer again. When the speech was ended, the writers put their "takes" together and reproduced the complete speech.

Considering the crude writing implements of that day and Tiro's system of shorthand, it is remarkable that the writers were able to record a speech even with forty of them on the same job. The writing was done on wax tablets which had the edges raised in order to protect the writing when the tablets were piled upon each other. Several tablets could be fastened together to form a book by running a cord through the corners. The writing instrument was a stylus, a device about the size of a pencil but with a sharp metal or ivory

point on one end and a flattened surface on the other to use as an eraser in smoothing out the writing so that the tablet could be used again.

The Tironian system was taught in over four hundred schools in the Roman Empire. It is claimed that many churchmen and statesmen of the day were users of the system, and that there were hundreds of professional writers. So popular was shorthand and so general its use, that it was necessary to make laws regulating the fees of teachers, the charges of writers for their services, and their responsibilities as reporters. Penalties for violations of these laws were severe in the extreme, ranging from banishment, through severing of the hands, to death.

With the decline of the Roman Empire, shorthand as well as virtually all other forms of art and learning, disappeared. During the Dark Ages which followed, shorthand was outlawed as being a form of black magic. All manuscripts were ordered burned and the further use of shorthand forbidden. For almost five centuries there is no mention of shorthand.

The revival of learning, and the invention of paper gave new impetus to the development of shorthand, and during the next two centuries numerous systems were developed. All of these early systems were attempts to speed up the actual spelling of the words by utilizing simple lines and curves in place of the more cumbersome longhand

letters. In his "Story Of Shorthand," John Robert Gregg
presents charts showing the name of the inventor, the date,
and the characters employed in over fifty different systems
of shorthand devised during the seventeenth and eighteenth
centuries. Many of these systems were little more than
copies of former systems, while others contributed some
small items of improvement, culminating in the internation-
ally famous system of Isaac Pitman in 1837.

In 1888 John Robert Gregg published his system
which combined light lines with cursive writing, and elim-
inated all position and shading. That this smooth, rapid
system is the ultimate in manual methods of writing is in-
dicated by the fact that more schools and colleges are now
teaching Gregg Shorthand than all other methods combined.

Manual shorthand has had a long and eventful his-
tory. It has involved thousands of men and thousands of
years in its development. It represents man's efforts to
find an ever faster method of expressing his thoughts, and
a faster, more efficient means of recording the spoken word
on paper. The story of the past has been one of slow but
inevitable progress.

Chart I on page 10 enumerates the high points in
the development of manual shorthand. It presents the names
of the inventors, the dates, and the specific contribution
that was made by each to the development of shorthand.

HIGH POINTS IN THE CHRONOLOGY OF MANUAL SHORTHAND

INVENTOR	DATE	CONTRIBUTION TO SHORTHAND
Egyptians	2500 BC	Beginnings
Greeks	500 BC	Improvements
Tiro	45 BC	First recognized system
Trithemeus	1469	His work in trying to decipher the Tironian code revived interest in shorthand after the Dark Ages
Timothy Bright	1588	First published system
John Wills	1602	First alphabetic system
John Byrom	1767	First to make an analysis of the logical relations of the sounds of the English language to each other.
Isaac Pitman	1837	Complete phonetic system. He popularized shorthand in England by advertising it and teaching it in his school for business training
John R. Gregg	1888	A complete phonetic, cursive system without shading or position. His system is the outstanding system in use at the present time

CHART I

Turning from the field of manual shorthand to that of mechanical, it is observed that there are three machines on the American market today. They are, the STENOTYPE manufactured by the Stenotype Company of Chicago, Illinois; the DICTATYPE, a product of Dictatype Incorporated, Wilmington, Delaware; and the REPORTER manufactured in Portland, Oregon by the Reporter Corporation.

These three machines represent practically all of the successful work that has been done in this field. In general, the principles of construction and operation of the three machines are similar. They differ widely, however, in the application of these principles. The STENOTYPE has nine keys on the left-hand side of the vowels and ten on the right. The STENOTYPE also has a numeral bar by means of which the operator shifts for the numerals. The DICTATYPE has eight keys in each bank of consonants, one of which is a shift key. There are two letters on each of the other seven typebars, making a total of twenty-eight consonants in all. The DICTATYPE has no numerals, the numbers being written as words. The REPORTER has twelve keys in each bank of consonants with but one letter on a key; there is no shifting. Like the DICTATYPE, the REPORTER writes numbers as words.

Chart II, page 12, portrays the keyboards of the three machines.

The three machines, the STENOTYPE, DICTATYPE, and

G	D	P	M		F	L	K	D
S	T	H	R		R	N	T	S
C	W	B	L		M	P	G	H

A O I E U

STENOTYPE KEYBOARD

S	T	P	H		F	P	L	T	D
	K	W	R		R	B	G	S	S

A E U I

DICTATYPE KEYBOARD

S S	M C	F W	N R		B V	L R	K T	Z S
P	B D	L N				M N	P D	T H

A E U I
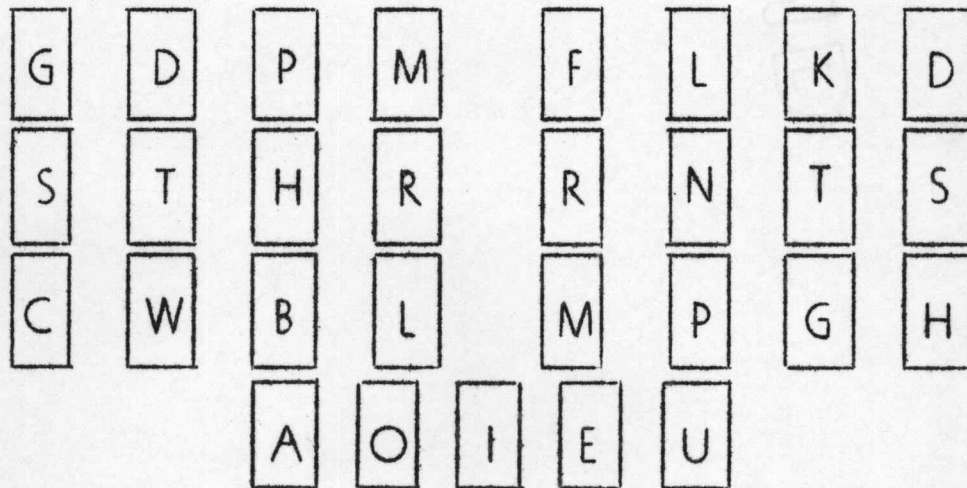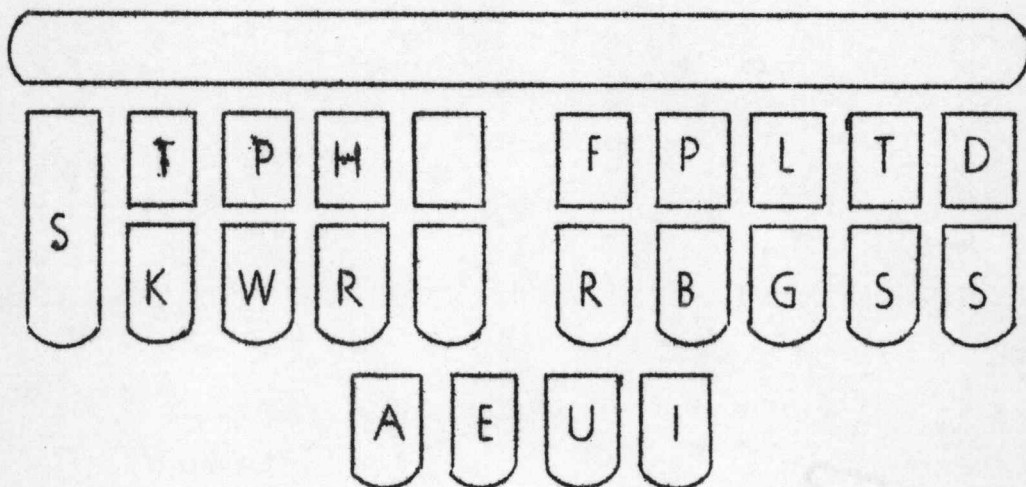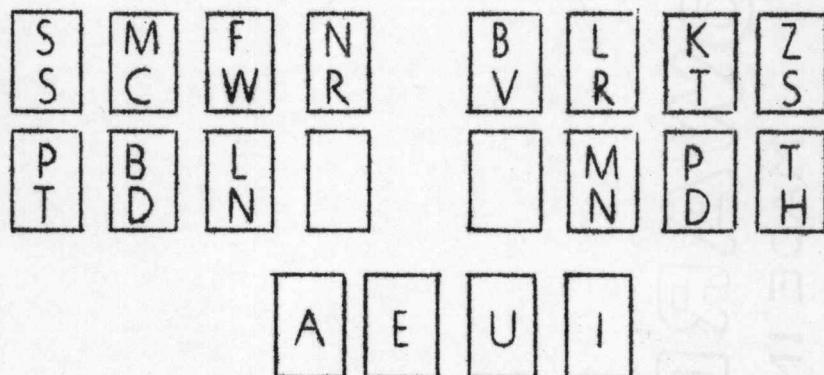
CHART II

the REPORTER have the following in common:

1. Each has two banks or groups of consonants and one group of vowels.

2. The writing is done on self-folding strips of paper.

3. Each letter has a fixed position for striking the paper.

4. Consonants.are struck by the fingers and the vowels by the thumbs.

5. Each machine has automatic spacing.

A comparison of the three keyboards reveals the following similarities and differences:

SELECTION OF CONSONANTS ON THREE SHORTHAND MACHINES

Left Bank

REPORTER.............S T P W R H M C B D L G

DICTATYPE...........S T P W R   M C B D L   M N F S

STENOTYPE...........S T P W R H   K *

Right Bank

REPORTER.............F P L T D R S K M N H G

DICTATYPE...........F P L T D R S K M N H   B Z T

STENOTYPE...........F P L T D R S   G B   S

CHART III

In Chart III the alphabets of each machine are arranged in such a manner as to enable the observer to see at a glance the letters that are common to all three machines,

those common to only two, and those peculiar to each.

The history of the REPORTER which is the special concern of the remainder of this chapter is substantially as follows:

In 1912 Mr. Thomas Bilyeu, a graduate of Oregon State College and Cornell University, and an engineer of national reputation, had just completed and sold the basic patents from which the International Money Machine was perfected. At about that same time, the city of Philadelphia honored Mr. Bilyeu's outstanding work in engineering by presenting him with the John Scott Award for meritorious accomplishments in this field. Covered with glory and backed by a considerable sum of money derived from the sale of his patents on the money machine, Mr. Bilyeu deliberately set about the task of developing some new machine to lighten the burden and speed up production in business.

The problem of a machine to record dictation instead of the pen or pencil appealed to Mr. Bilyeu's ingenuity and he at once started working on such a machine. The first model which was completed in 1915, had three rows of keys with seven letters in each row. The vowels were placed in the center of the keyboard, but were in the same rows with the consonants. The ribbon traveled between two reels placed on top of the machine. The ribbon was reversed by hand. The original model had a total of twenty-one letters including the vowels. This made it necessary to use a code

form of writing. In addition to numerous letter substitutions, certain letters (the entire top row and the letter on the extreme right of the other two rows) and the one symbol on the keyboard were used to indicate numerals. The complete keyboard of this first machine is shown in Figure I, page 15.

KEYBOARD OF THE FIRST MODEL REPORTER
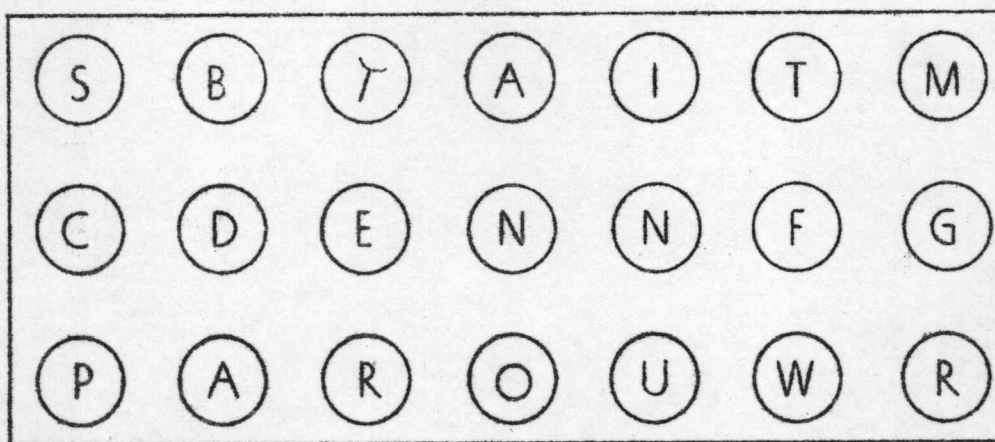
FIGURE I

The first three models were similar in design, but each contained some new mechanical improvements. When model four was produced, six new letters were added, the consonants were grouped on either side of the machine and the five vowels relocated in a fourth row by themselves and in front of the consonants. This model was a vast improvement over the first three. Models five, six and seven appeared with additional mechanical changes, but with no change of keyboard.

During the course of this experimentation, ninety-one people ranging in age from sixteen to fifty-five had been taught to operate the various models. These operators were the proving grounds which disclosed one weakness after another and suggested improvements which were incorporated in subsequent models.

Model nine appeared with two additional keys which brought the total to twenty-nine, and is the same keyboard that is used on the latest model. The newest machine is number twelve in the series. It is made of the finest of metals--dural--is finished in the new crackle enamel, is silent in operation, and has been tested by over two hundred operators in schools and business offices.

From 1912 to 1938, except for the years when Mr. Bilyeu stopped his own work to serve his country in the World War, the REPORTER has been in the process of development. Twelve different models were made, tested and improved in this process of development. As each new model was completed it was thoroughly tested, its weaknesses discovered and remedied. It must be admitted that time, scientific methods, infinite care and testing, and a desire to produce a perfect machine have gone into the development of the REPORTER. Mr. Bilyeu feels that the present model is a perfected instrument ready to assume its role in the business office, the convention hall, or the court room.

CHAPTER III

DESCRIPTION OF THE REPORTER

The present model of the REPORTER is a compact
little machine weighing four and three-quarters pounds. It
measures six and one-half inches in width and eleven inches
in length. It is five inches high at the back, its highest
point, and tapers slightly toward the front, measuring four
inches in height at the keys. The mechanism is entirely
covered by a cast metal casing of alloyed aluminum which is
light and strong. The casing slips down over the operating
parts, is held in place by four bolts, and leaves only the
keys exposed. The casing is finished in crackle enamel in
black, blue or brown.

THE REPORTER
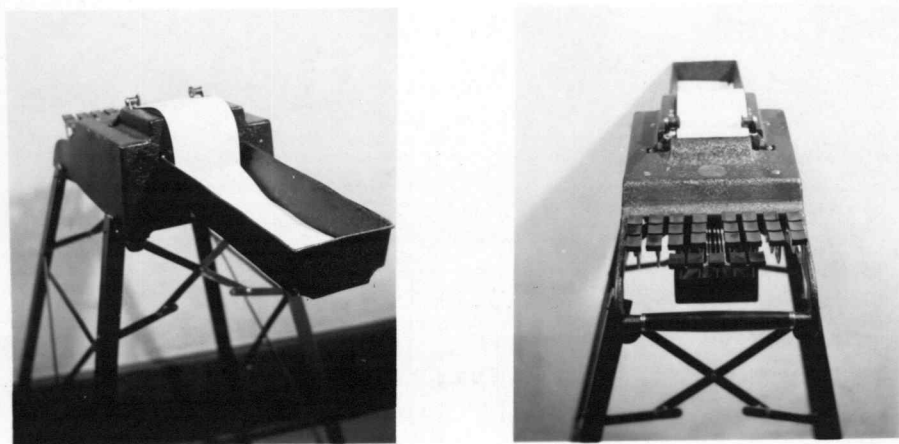
FIGURE II

The keys are arranged in three rows of consonants
and one row of vowels. The three rows of consonants are

further divided into a left and right hand section of twelve
keys each. Thus there are three keys for each of the four
fingers on each hand. The three rows of consonants form a
flat plane similar to the key arrangement on the adding ma-
chine rather than being arranged at three different levels
like the keys on a typewriter. The five vowels (A, O, I, E,
and U) are grouped in a fourth row a quarter of an inch low-
er than the three rows of consonants, and directly in front
of them. The vowels are manipulated by the operator's two
thumbs. Figure III presents two close-ups of the REPORTER,
one showing the keyboard arrangement, and the other the man-
ner in which the tape passes under the guide wheels, over
the paper table, and into the receiving tray.

CLOSE-UPS OF THE REPORTER
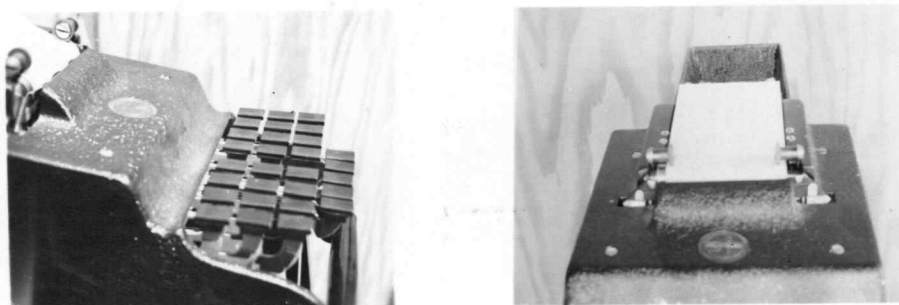
FIGURE III

The writing is done on a strip of paper two and
three-quarters inches wide. This strip closely resembles
adding machine tape, except that it is prepared in pads of
nine-inch folds instead of rolls. The paper is perforated
at each fold and each pad contains two hundred or more

folds.

In actual operation, the paper is placed into the tray underneath the machine. From this tray it feeds automatically over the platen or writing roll until the entire pad is used. As the paper is used, it travels over the top of the machine in full view of the operator and into the receiving tray where it refolds itself into its original form. The top of the machine is flat and serves as a table on which notations or corrections may be made on the tape as it is used. The operator reads the finished series of folds very much as one would read a railway ticket. A picture of the finished tape is shown in Figure II, page 17.

Manipulating the REPORTER requires only the stroking of the keys. The feeding of the paper, the action of the ribbon, and the spacing of the letters are all accomplished automatically. Automatic movement of the paper is made possible by means of a ratchet device which is operated by the movement of the type bars. The ribbon, which moves automatically between two spools beneath the housing of the machine, is protected from dust and drying. The spacing of letters in a word is made possible by the arrangement of the type bars. Each letter strikes the paper in a fixed position. For example, the left bank "G" always prints on the extreme left edge of the paper, while the right-hand "H" strikes the extreme right edge of the paper. The complete sequence across the tape from left to right

is: GSCDTWPHBMRLAOIEUFRMLNPKTGDSH. Since each letter appears always in the same position on the tape, the letters in a word are not equi-distant, but appear as follows:

```
        T   H         I               S
                      I               S
        T   H         E
          W       A
        T   H         E
              M       E               S
              A               G
              A       E   R       P   S
          P           E       N
                  O
          T   H       E
    S   T         R   I           P
                  O   F
          P       A           P
                  E   R
```

By reading a line at a time across the tape, the above example reads: "THIS IS THE WAY THE MESSAGE APPEARS ON THE STRIP OF PAPER."

The basic idea of the inventor in building the REPORTER was that it should be a machine to record the words of a speaker in plain English form, using phonetic spelling whenever such spelling simplified the word. The characters used are the letters of the alphabet in their capital form. In most cases the words appear on the tape exactly as they are spelled; for example, "strong" would be written STRONG, "work" would be written WORK. Final e's and silent letters are omitted. "Are" would appear as AR; "steel" is written STEL, etc.

In order to simplify the keyboard and reduce the

number of keys to provide for a touch system of operation,
only twelve letters are provided on each side of the vowel
bank. This provides three keys for each finger, and makes
a uniform reach possible for all letters. The distance and
direction of each reach is the same for all fingers. This
omission of certain letters necessitates the substitution
of letter combinations for those omitted. The letters omit-
ted and the combinations selected to represent them are
shown in Chart IV, page 21.

COMBINATIONS WHICH REPRESENT LETTERS NOT ON KEYBOARD

Selected because of their resemblence in sound to the letters they represent		Selected because they are never used in sequence in any word	
"f" Represented by	PH	"n" Represented by	RL
"z" Represented by	SC	"j" Represented by	HB
"q" Represented by	CW	"y" Represented by	WB
"v" Represented by	PH	"b" Represented by	NP*
"x" Represented by	KS	* Right-hand "b" only	

Chart IV

The particular combinations selected as the sub-
stitutions for letters not on the keyboard were chosen be-
cause of their phonetic equivalence to the letters omitted,
or because they are combinations that never appear in se-
quence in writing. Stroking these pairs of letters pro-
vides no operating problem. The only additional burden
is that of learning the substitutions.

The effectiveness of the REPORTER is further en-
hanced by means of three units of auxiliary equipment--a
portable stand, the TRANSWRITER, and the COURT REPORTER.
This portable stand enables the REPORTER to be set up for
instant use in any part of the office, the court room, the
convention hall, or any place where it might be necessary
to take dictation. The stand folds into a compact bundle
about two inches square and twenty-eight inches long. It
has four legs, and when extended for use occupies about the
same amount of space as an ordinary chair.

The TRANSWRITER is a machine for the operator's
convenience in transcribing REPORTER "takes." It consists
of an inclined surface over which the finished tape is pro-
pelled by the power of an electric motor at speeds which the
operator controls with a lever. This arrangement enables
the typist to keep the REPORTER tape passing constantly be-
fore his eyes at any rate at which he can transcribe on the
typewriter. Without the aid of the TRANSWRITER it is nec-
essary for the transcriber to turn the folds of his "take"
just as the manual shorthand writer must turn the pages of
his notebook when he is transcribing a message.

A special model of the REPORTER which has an ex-
tra large paper tray capable of holding sufficient paper
for many hours of continuous recording is called the COURT
REPORTER. The special pads of tape for this machine are
approximately three times as long as the standard pads.

CHAPTER IV

VALIDATION OF THE KEYBOARD

Since it is the purpose of the REPORTER to write the actual words of the speaker in plain English with the aid of phonetic spelling, certain questions naturally arise. Is the machine capable of writing any and every word that it might be necessary to record? Can it be operated at speeds sufficiently great to record the speech of the fastest speakers? Inasmuch as there are only twelve keys on each side of the vowels, what letters must be present in order to permit the greatest amount of writing with the least substitution? Is the keyboard a valid selection and arrangement of letters?

In order to determine the validity of the REPORTER keyboard, the writer has set up three criteria which are believed to represent fundamental requirements for a scientifically valid letter selection and arrangement.

(1) Are the most frequently used letters of the alphabet on the keyboard?

(2) Are the consonants in the left-hand bank of the keyboard so arranged as to make it possible to write all of the initial combinations--combinations preceding vowel sounds--of letters in the English language?

(3) Are the consonants in the right-hand bank of the keyboard so arranged as to make it possible to write all of

the final combinations--combinations following vowel sounds --of letters in the English language?

The writer believes that insofar as the answers to the above three questions are in the affirmative, the REPORTER keyboard may be said to be valid.

In order to determine the answer to the question of which letters occur most frequently, the following study was made: One hundred thousand words of material in common use were selected for analysis. This material consisted of business correspondence, newspaper articles, and magazine articles. An assistant was employed to aid in analyzing the selected material. The procedure was as follows: The assistant was provided with a check sheet which contained the alphabet in vertical sequence down the left-hand side of the page. On a line with each letter and extending horizontally across the page were seven squares of approximately equal size, and numbered from one to seven. The experimenter then spelled out each word in the material which he was analyzing to his assistant who scored the letter and its position in the word up to position seven. For example, if the word being spelled were and, "a" was scored once in the first square opposite that letter, "n" was scored in the number two square opposite the "n", and "d" in the number three square opposite the "d". When this procedure was completed for the hundred thousand words and the total number of scores tabulated, the experimenter

knew what letters were used, how often each occurred, and in what position in the word they occurred. The results of this tabulation are shown on Chart V on the next page.

Several interesting observations may be drawn from this study. In the first place, it is quite apparent that the majority of words in common usage are composed of five letters or less. Reference to the chart reveals that the greatest frequency of letters in fifth position is accorded the letter "E" which occurred 2,313 times. "E" was also the most frequently recurring letter in seventh position, but the count there drops to 439, indicating that there are only about one-sixth as many seven-letter words in common use as there are five-letter words.

The letters J, Q, X, and Z occurred so infrequently that they were left out of the count.

More words in common use begin with the letter "T" than any other, and "H" ranks highest in second position. Reading on across the chart, it is found that "E" ranks highest as the third position letter, and also as the fourth, fifth, and seventh, with "R" as the most frequently used letter in sixth position.

If the number of times that each letter appears in all of the seven positions is taken and totalled, it is found that "E" occurs most often in all positions combined, "T" is second, and then follows, O, H, A, I, N, S, R, L,

LETTERS THAT OCCUR IN GREATEST FREQUENCY IN RELATIVE POSITIONS INDICATED FROM STUDY OF WORDS IN COMMON USE*

Position In The Word						
1	2	3	4	5	6	7
T-15643	H-13054	E-12034	E-6477	E-2313	R-780	E-439
A- 9590	O-11457	T- 4628	T-3492	H- 759	E-684	G-186
I- 8811	N- 8115	U- 3447	R-2984	T- 714	S-331	R-140
W- 6499	E- 7889	D- 4446	L-2746	R- 613	D-241	C- 98
O- 6435	A- 5027	R- 3877	N-2169	L- 486	H-270	T- 94
M- 3068	I- 4545	S- 3382	D-1494	K- 523	T-237	H- 84
B- 3031	S- 2081	A- 3330	H-1462	Y- 475	N-251	N- 76
H- 3131	R- 2035	O- 2361	S-1335	D- 466	V-164	A- 53
S- 3211	F- 4133	I- 2216	Y-1192	O- 464	Y-130	L- 63
F- 2482	U- 1967	L- 2151	M- 910	S- 421	A-125	Y- 61
Y- 2537	T- 1663	M- 1391	C- 831	G- 387	L-112	I- 63
N- 1229	Y- 1168	N- 1951	U- 657	I- 250	I- 76	
C- 1351	L- 1190	V- 1143	I- 579	C- 232	C- 83	
D- 1186	V- 518	Y- 1136	A- 566	U- 147		
L- 1022	W- 368	C- 808	K- 533	A- 140		
G- 991	P- 201	K- 643	O- 434	N- 62		
E- 553	M- 211	W- 610	P- 259			
P- 543	B- 295	H- 315	B- 156			
U- 513	C- 112	F- 278	G- 137			
V- 383	G- 62	G- 270	"- 143			
R- 320						
K- 218						

CHART V

*Adapted from an unpublished study by Thomas Bilyeu

W, F, U, Y, M, C, B, D, V, G, K, P, X, J, Q, and Z. This
result parallels very closely the result of Dr. Hoke's
study.* He found the following sequence from highest to
lowest frequency: E, T, A, O, S, I, N, R, H, L, D, C, U,
M, Y, B, P, W, F, G, V, K, J, X, Q, and Z. The results of
the two studies arranged for comparison are as follows:

This study: E-T-O-H-A-I-N-S-R-L-W-F-U-Y-M-C-B-D-V-G-K-P

Dr. Hoke's: E-T-A-O-S-I-N-R-H-L-D-C-U-M-Y-B-P-W-F-G-V-K

This study: X-J-Q-Z (Results of partial count)

Dr. Hoke's: J-X-Q-Z

It is interesting to note that the two studies correlate
.86 with one another, indicating fair agreement. On the
basis of this analysis, the importance of letters in the
alphabet according to frequency of use is as follows: E,
T, O, H, A, I, N, S, R, L, W, F, U, Y, M, C, B, V, G, K,
P, X, J, Q, and Z.

The REPORTER keyboard contains twenty of the
twenty-six letters of the alphabet or 77 per cent. Of the
six letters omitted from the keyboard, four of them (J, Q,
X, Z) are found at the lower end of the scale of frequency
of use, and the other two (Y and V) rank fourteenth and
nineteenth respectively. If J, Q, Z, and X which both
studies found to be of least importance, are dropped from

*Reported in THE TECHNIQUE OF TEACHING TYPEWRITING, Jane
E. Clem, pages 175 and 176. Gregg Publishing Company,
New York, 1929

consideration, the REPORTER keyboard is found to contain twenty of the remaining twenty-two letters or 91 per cent. These twenty letters, however, account for 95 per cent of the letters counted in the study reported in Chart V on page 26. In other words, the letters chosen for the RE-PORTER keyboard account for 95 per cent of the letters in general usage. The remaining five per cent must be represented by selected substitutions. Purely on the basis of a choice of letters, it is evident that the REPORTER keyboard is valid for the purpose for which it was designed.

Granting that the REPORTER keyboard does contain the most frequently used letters of the alphabet, and is capable of representing the others not included by justifiable substitutions, there remains the question of their arrangement with respect to each other.

A shorthand machine, in order to gain speed faster than that of a typewriter, must enable one to write whole words or syllables at a stroke instead of single letters. The next question, then, is: Are the letters so arranged on the keyboard that the combinations of consonants and vowels which make up English words can be written at one stroke?

It has been shown that all English words or syllables contain:

(1) A vowel sound, as I, a, etc.

(2) A vowel and a consonant, as <u>an</u>, <u>on</u>, <u>it</u>, etc.

(3) A consonant and a vowel, as <u>so</u>, <u>to</u>, <u>he</u>, etc.

(4) A consonant, a vowel and a consonant as, <u>run</u>, <u>tap</u>, etc.

(5) A combination of consonants, a vowel, and another combination of consonants, as <u>bring</u>, <u>strong</u>, <u>strings</u>, etc.

In Chapter III it was pointed out that the vowels are located in the center of the REPORTER keyboard, with a bank of consonants on either side. This arrangement permits the vowels to stand alone, or to precede or follow single consonants or combinations of consonants. This arrangement satisfies the general rules for forming words and syllables.

The second criterion of the three set up as a standard of validity of the REPORTER keyboard asks: Are the consonants in the left-hand bank of the keyboard so arranged as to make it possible to write all of the initial combinations of letters in the English language?

A study of the words in Webster's Collegiate Dictionary reveals the fact that there are fifty-five combinations of consonants which precede vowels in the words in the English language. In Chart VI these fifty-five combinations are listed together with their sounds, and the manner in which they are written on the REPORTER.

If the principle of using substitutions in lieu of complicating the keyboard with additional keys, and if the substitutions which were analyzed earlier in this study

CONSONANT COMBINATIONS WHICH PRECEDE VOWELS

Combination	Sound Of Combination	As Written On The REPORTER
BL	BL	BL
BR	BR	BR
CH	CH	CH
CHR	KR	CR
CHTH	TH	TH
CL	KL	CL
CLY	KLI	CLI
CR	KR	CR
CHY	CHY	CHI
CN	N	RL
CRY	KRI	CRI
CT	T	T
CI	SI	SI
DH	D	D
DR	DR	DR
DW	DW	DW
DY	DI	DI
FL	FL	PHL
FR	FR	PHR
GH	G	G
GL	GL	GL
GN	N	RL
GR	GR	GR
CY	SI	SI
KN	N	RL
KL	KL	CL
KW	KW	CW
KY	KI	CI
LY	LI	LI
MN	N	RL
MY	MI	MI
NY	NI	RLI
PH	F	PH
PL	PL	PL
PN	N	RL

(Continued on next page)

CONSONANT COMBINATIONS WHICH PRECEDE VOWELS (CON'TD)

PR	PR	PR
PS	S	S
RH	R	R
SC	SK	SC
SH	SH	SH
SK	SK	SC
SL	SL	SL
SM	SM	SM
SN	SN	SRL
SP	SP	SP
SQ	SQ	SCW
ST	ST	ST
STR	STR	STR
SW	SW	SW
SY	SI	SI
TH	TH	TH
THR	THR	THR
TR	TR	TR
TW	TW	TW
WH	WH	WH
WR	R	R

CHART VI

are accepted as valid representations of the letters not on
the keyboard, then the REPORTER is capable of writing all
of the _initial_ combinations, or combinations of letters
that precede vowels. In other words, there is no word in
the language which contains an initial combination of con-
sonants that cannot be represented on the REPORTER in one
stroke. The arrangement of the keys on the left bank of
the REPORTER keyboard, therefore, satisfies the second cri-
terion of validity.

The final criterion of validity raises the same

question about the right-hand bank of consonants that the second question asked concerning the left bank.

Referring again to Webster's Collegiate Dictionary, it is found that there are seventy-four consonant combinations that follow vowels in making up words and syllables in the English language. Chart VII lists the combinations, the sounds of the combinations, and the manner of writing them on the REPORTER.

Analyzing the data presented in Chart VII, it is found that of the seventy-four possible combinations of consonants which follow vowels in the English language, the REPORTER keyboard permits the writing of sixty-four, or 86 per cent, in one stroke, but requires two strokes for the remaining ten, or 14 per cent, of the combinations.

In order to determine how frequently these two-stroke combinations occur in ordinary usage, the writer counted the number of times they appeared in a magazine article, a short story, and two business letters totalling 6,580 words. Only 42 of the two-stroke combinations were found in this analysis. This number represents only .006 per cent of the total number of words considered. Granting that the sampling of words might have been too small for complete accuracy, and allowing for even as much as fifty per cent error in the findings, these two-stroke combinations probably occur in no more than one per cent of the total words in common usage. This would tend to qualify the

CONSONANT COMBINATIONS WHICH FOLLOW VOWELS

Combinations	Sounds Of Combinations	As Written On The REPORTER
BL	BL	* (2 strokes)
BS	BS	NPS
CH	CH	H
CK	K	K
CT	KT	KT
DG	G	G
DS	DS	DS
FS	FS	FS
FT	FT	FT
GH	F	F
HT	T	T
HS	HS	* (2 strokes)
KS	KS	KS
LB	LB	LNP
LC	LK	LK
LD	LD	LD
LF	F	F
LG	LG	LG
LK	LK	LK
LM	M	M
LN	LN	LN
LP	LP	LP
LS	LS	LS
LT	LT	LT
LTH	LTH	LTH
LV	LV	* (2 strokes)
MB	M	M
MP	MP	MP
MPS	MPS	MPS
MS	MS	MS
NC (E)	NS	NS
NCH	NCH	NH
ND	ND	ND
NG	NG	NG
NGTH	NGTH	NGTH
NK	NK	NK

CONSONANT COMBINATIONS WHICH FOLLOW VOWELS (CON'TD)

NS	NS	NS
NT	NT	NT
PH	F	F
PCT	PKT	PKT
PS	PS	PS
PT	PT	PT
RB	RB	RNP
RC (E)	RS	RS
RCH	RCH	RH
RD	RD	RD
RF	RF	* (2 strokes)
RG	RG	RG
RK	RK	RK
RL	RL	RL
RM	RM	RM
RN	RN	RN
RP	RP	RP
RS	RS	RS
RSH	RSH	RSH
RT	RT	RT
RTH	RTH	RTH
RV	RV	* (2 strokes)
SH	SH	SH
SK	SK	* (2 strokes)
SM	SM	* (2 strokes)
SP	SP	* (2 strokes)
ST	ST	* (2 strokes)
TCH	TCH	TH
TH	TH	TH
TS	TS	TS
WD	AUD	AUD
WK	AUK	AUK
WL	AUL	AUL
WM	AUM	AUM
WN	AUN	AUN
XT	EKST	* (2 strokes)

CHART VII

the right bank of the REPORTER keyboard as at least 99 per
cent efficient for the purpose for which it was designed.

Since the REPORTER keyboard does contain the most important letters of the alphabet, and since they are arranged in relation to each other in such a manner that all initial combinations occurring in the words in the English language can be represented in one stroke, each, and since 86 per cent of the final combinations which account for 99 per cent of the combinations in common usage are one-stroke combinations, the writer concludes that the keyboard of the REPORTER is valid.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In Chapter I of this study, it was pointed out
that in this machine age virtually every job in the modern
business office is done with or by some machine except the
process of recording dictation which is still largely a man-
ual operation. It was indicated that considerable work has
been done toward the mechanization of stenographic pro-
cesses, and that there are no less than five machines for
recording dictation on the market at the present time. The
DICTAPHONE, STENOTYPE, DICTATYPE and REPORTER were mention-
ed as examples. The writer's interest in the subject was
explained as having grown out of three years of teaching
experience with the REPORTER and a desire to pursue further
the possibilities of shorthand machines. The lack of avail-
able literature from which material for this study could be
acquired was cited, and the fact that most of the informa-
tion contained in this thesis was derived from original
sources was mentioned. Mr. Bilyeu, the inventor of the
REPORTER was very cooperative in providing a brief sketch
of his own life and in supplying information about the de-
velopment of the REPORTER. Mr. Bilyeu also provided the
word study described in Chapter IV.

Chapter II reviewed the history of shorthand from
Tiro to Gregg. The possible Egyptian and Greek beginnings

of shorthand were mentioned, and the nature and importance of the first recognized shorthand system, Tiro's, were discussed. The disappearance of shorthand during the Dark Ages and the outstanding points in its later revival and development were delineated. A chart was presented showing the highlights in the history of manual shorthand. Drawings of the keyboards of the REPORTER, STENOTYPE, and the DICTATYPE were presented along with an enumeration of the principal points of similarity and difference in the three machines. A brief biographical sketch of the inventor of the REPORTER was followed by a history of the development of the REPORTER from model one to the present. A drawing of the keyboard of model one accompanies the text.

Chapter III was a detailed description of the REPORTER supported by four photographs. A description of the physical appearance of the REPORTER was accompanied by two pictures showing a front and rear view of the machine. The arrangement of the keys was described and illustrated with a photograph. The method of operation was explained and visualized by means of a photograph showing a close-up view of the top of the machine while it was in action. The manner in which the printing is done was explained and illustrated by a model of a strip of finished tape. The substitution of certain letter combinations for letters not on the keyboard was explained. A chart was provided which gave criteria for the selection of substitutions,

the letters for which substitutions are necessary, and the letter combinations selected to represent them. The chapter concluded with a description of the portable stand, the TRANSWRITER, and the COURT REPORTER, three units of auxiliary equipment for use with the REPORTER.

Chapter IV attempted a validation of the REPORTER keyboard. Three criteria were set up as a standard of validity and the keyboard evaluated in terms of those criteria. The criteria selected were: (1) that the keyboard must contain the most frequently used letters of the alphabet, (2) that they must be so arranged that all initial letter combinations can be written with one stroke each, and (3) that the same condition be true with respect to all final combinations. A study involving an actual count of the letters used in 100,000 words of miscellaneous literature revealed which letters were most frequently used in ordinary writing and a comparison of the results of this study with the keyboard revealed that the REPORTER keyboard contained 77 per cent of the twenty-six letters in the alphabet, but 91 per cent of the twenty-two found to be most frequently used. An analysis of the words in Webster's Collegiate Dictionary provided the answers to the questions raised in criteria two and three. The analysis disclosed all of the combinations of consonants in the English language which either precede or follow vowel sounds. These combinations together with their sounds and the manner in

which they are written by the REPORTER were tabulated in two charts. Analysis of the two charts revealed the fact that all of the possible initial combinations were capable of being written with one stroke by the REPORTER, but that only 86 per cent of the final combinations were possible with one stroke each. The other 14 per cent of the final combinations required two strokes each. A further analysis of the 14 per cent of combinations which require two strokes indicated that these combinations represent not more than one per cent of the total combinations used in ordinary writing. This fact tended to make the right-hand bank of the REPORTER keyboard at least 99 per cent efficient.

As a result of this analysis, the writer concluded that the REPORTER keyboard is valid.

It is recommended that the following further investigations be carried on:

(1) An experiment to determine the relative learning periods for manual and mechanical shorthand methods.

(2) An experiment to determine the relative amount of energy consumed by writers working with the two methods.

(3) An experiment to determine the relative rate of forgetting for machine and manual methods of shorthand.

If these studies could be conducted and the results show that the machine method is superior to the manual method, it would be well for secretarial training de-

partments of schools and colleges to consider offering a course of instruction in mechanical methods of shorthand.

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