

PATENT SPECIFICATION



Application Date: Nov. 29, 1919. No. 29,797 / 19. 155,446

Complete Left: Feb. 26, 1920.

Complete Accepted: Dec. 23, 1920.

PROVISIONAL SPECIFICATION.

Improvements in connexion with Keyboards for Typewriters.

I, WILLIAM WILSON NELSON, of 5, Vale so placed, are also grouped into "com- 45
View. St. Rose in the County of Lancashire, England, have invented a new and
useful improvement in keyboards for typewriters, which will be fully described
in the specification which follows, and which is as follows:

ERRATUM.

SPECIFICATION No. 155,446.

2, lines 73 and 74, for "work-making" read "word-making"

PATENT OFFICE,

March 18th, 1921.

what is of the utmost importance, relieves
eye and brain strain. This keyboard is
the outcome of 7,000,000 separate
25 scrutinies of various styles of English
prose writings undertaken during the last
3 years with a view to the formulation of
a keyboard perfect for its purpose.

EXPLANATION OF THE KEYBOARD DIAGRAM.

The long oblique line, figured 2, drawn
through the centre of the keyboard, marks
the division between its right hand and
left hand sides. Each hand commands 13
letters. The relative values of the 26
35 letters of the English alphabet as word-
makers are as follows:—E 120, T 90, A
85, I 80, O 80, S 80, N 80, H 64, R 63,
D 44, L 40, U 34, C 30, M 30, F 25, W 20,
Y 20, P 17, G 17, B 16, V 12, K 8, Q 5.
40 J 4, X 4, and Z 2 or a sum-total of 1070
for the whole alphabet. The most
efficient letters for word-making are placed
in the most efficient positions at the centre
of the new keyboard, and, besides being

and *two* on the bottom line. This
area contains 987 out of the 1070 units and
within it is written the structure of 90
words out of every 100 English words,
their fingering being all done by the firm 70
and certain touch of the fore and middle
fingers of each hand. The third fingers
(unless specially trained) are somewhat
unreliable in quick typing and only suitable
for use on the outskirts of the keyboard
though the letters B, F, and W
may often be struck more conveniently
by a simple extension of the middle
fingers. The total numerical value of the
top line of the keyboard from Z to Q is 75
367 units, of the middle and most efficient
line from H to R 554 units and of the
bottom line 149 units. As mediating
between the top and bottom lines, the
middle line is the master-line of the key- 80
board, besides being the most convenient
on which to finger.

Dated the 19th day of January, 1920.

WILLIAM WILSON NELSON,

[Price 1/-]

PATENT SPECIFICATION



Application Date: Nov. 29, 1919. No. 29,797 / 19.

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PROVISIONAL SPECIFICATION.

Improvements in connexion with Keyboards for Typewriters.

I, WILLIAM WILSON NELSON, of 5, Vale View, St. Bees, in the County of Cumberland, Steamship Agent, do hereby declare the nature of this invention to be as follows:—

The keyboard is an integral part of a typewriter, and the most important part, since the whole of its mechanism is quite useless without it. The combinational keyboard shown in the accompanying drawing is based on three important factors:—(1). The habits of the hand. (2). The habits of the language. (3). The habits of mind; with the result that the most efficient fingers, the most efficient letters and the most efficient areas of the keyboard are all brought together in mutual co-operation. It, therefore, makes the typing of the English language much easier to the mind and quicker for the fingers than any existing keyboard; and, what is of the utmost importance, relieves eye and brain strain. This keyboard is the outcome of 7,000,000 separate scrutinies of various styles of English prose writings undertaken during the last 3 years with a view to the formulation of a keyboard perfect for its purpose.

EXPLANATION OF THE KEYBOARD DIAGRAM.

The long oblique line, figured 2, drawn through the centre of the keyboard, marks the division between its right hand and left hand sides. Each hand commands 13 letters. The relative values of the letters of the English alphabet as word-makers are as follows:—E 120, T 90, A 85, I 80, O 80, S 80, N 80, H 64, R 63, D 44, L 40, U 34, C 30, M 30, F 25, W 20, Y 20, P 17, G 17, B 16, V 12, K 8, Q 5, J 4, X 4, and Z 2 or a sum-total of 1070 for the whole alphabet. The most efficient letters for word-making are placed in the most efficient positions at the centre of the new keyboard, and, besides being

so placed, are also grouped into "combinations" which form part of the structure of most English words, such as—TH, ND, ST, NG, EA, IO, OU, SION, TION and the like. Thirty eight such "combinations" are embodied on the keyboard, those of most frequent occurrence being placed in the handiest positions for quick typing. The right hand side of the keyboard represents a numerical value of 602 out of 1070 units, and the left hand side 468 units. The right hand is by far the most capable hand for doing work. All the vowels are typed by this hand and it can type them quickly in any order of combination in which they may be required. The space lying between the two shorter oblique lines, figured 1 and 3, forms the central and most efficient area of the keyboard, namely, from G to U on the top line, H to R on the middle line and X to Y on the bottom line. This area contains 987 out of the 1070 units and within it is written the structure of 90 words out of every 100 English words, their fingering being all done by the firm and certain touch of the fore and middle fingers of each hand. The third fingers (unless specially trained) are somewhat unreliable in quick typing and only suitable for use on the outskirts of the keyboard though the letters B, F, and W may often be struck more conveniently by a simple extension of the middle fingers. The total numerical value of the top line of the keyboard from Z to Q is 367 units, of the middle and most efficient line from H to R 554 units and of the bottom line, 149 units. As mediating between the top and bottom lines, the middle line is the master-line of the keyboard, besides being the most convenient on which to finger.

Dated the 19th day of January, 1920.

WILLIAM WILSON NELSON,

[Price 1/-]

COMPLETE SPECIFICATION.

Improvements in connexion with Keyboards for Typewriters.

I, WILLIAM WILSON NELSON, of 5, Vale View, St. Bees, in the County of Cumberland, Steamship Agent, do hereby declare the nature of this invention and in what 5 manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The problem is to design a keyboard which shall be suited to the structure and 10 habits of the English language.

The "combinational keyboard" (a drawing of which can be seen in the Provisional Specification) is based on an extended analysis of the language involving 15 no less than 7,000,000 separate scrutinies of a mass of various writings sufficient to fill a crown octavo volume of 550 pages of brevier print. To my knowledge no such investigation has ever 20 been undertaken before. I confine myself in the following statement briefly to the practical results arrived at.

There are three main factors on which a keyboard perfect for its purpose must be 25 based, namely:

- I. The habits of the hand (manual factor).
- II. The habits of the language (linguistic factor).
- 30 III. The habits of the mind (psychological factor).

(1). THE HANDS.

When typing, the really efficient fingers are the fore and middle fingers of each 35 hand. The third finger can be used for letters lying on the outskirts of the keyboard, but, unless specially trained, it is naturally a somewhat unreliable finger (similarly also in pianoforte fingering). 40 The thumb and little finger are of no practical use on the keyboard. In brief, the first and second fingers are those most instinctively used by typists because their touch is quite firm and certain. Now it 45 is to be observed that when the hands are brought together to begin typing, these really efficient four fingers are all found directly at the centre of the keyboard, and the weaker fingers towards its outskirts. 50 This is the most important fact in our problem as regards the habits of the hands; and it at once delimits the centre of the keyboard as the most efficient area for quick typing.

(2) AND (3). THE LANGUAGE AND THE MIND. 55

It necessarily follows from the action of the fingers being most efficient in the central area of the keyboard, that the most efficient letters of the language must be brought to the centre of the keyboard to meet the direct action of the most efficient fingers. The relative numerical values of the letters of English alphabet as word-makers is as follows:—

E 120, T 90, A 85, S 80, I 80, O 80, N 80, H 64, R 63, D 44, L 40, U 34, C 30, M 30, F 25, W 20, Y 20, P 17, G 17, B 16, V 12, K 8, Q 5, J 4, X 4, and Z 2.	70
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Added together these figures represent a sum-total of 1070, which number may be regarded as the full numerical work-making power of the 26 letters of our alphabet. On analysing these figures, however, it will be found that only 14 letters represent nearly the whole of the sum-total, namely, E 120, T, 90, A 85, S 80, I 80, O 80, N 80, H 64, R 63, D 44, L 40, U 34, C 30, and M 30 or equal to a summed value of 920, the remaining 12 letters reserving a value of 150 only. A simple calculation in fractions serves to show that the above 14 letters build up the structure of 86 words out of every 100 words or more than four-fifths of the whole language. Hence the paramount importance of their being placed in the central area of the keyboard within direct reach of the natural position of the efficient fingers for quickest working. From the logic of these facts there is no escape. 85

Moreover, it must be emphasised that the fingers have a preference for working on the middle line of the alphabetical keyboard, the reason of which is plain, its position being such that the fingers can stretch from it with least effort to the upper line or drop easily to the lowest line. Hence the most powerful assemblage of 100 letters has been placed centrally on the middle line. Collectively the five most powerful letters in our language are the pure vowels E A I O U. Their total numerical value (399) is greater than that of any other five letters of the alphabet. Next to the pure vowels in importance are the six letters classed by philologists and 95 105

grammarians as semi-vowels, namely, S N R L M and Y. The combined numerical value of the eleven letters just enumerated is 712 units out of 1070 for the whole language. This figure (712) is significant of the overwhelming part the vowels and semi-vowels, in close union with each other, play in building up words.

But apart altogether from letters of the highest values being placed at the centre of the keyboard, and those of least value and use at its outskirts, it is no less important that those special "combinations of letters" so constantly found together in a fixed order in the structure of words, should also be found together on the keyboard, and the most efficient of them in the central area. These combinations are to be seen in hundreds on each page of every English book, and are of the utmost importance for the fluent writing of our language. Hundreds of the commonest words are from start to finish composed of combinations, and other thousands are largely combinational in structure. The following are those combinations of the greatest use, marshalled under each class in the order of their utility. (The figures given within brackets indicate the number of times each combination occurred in 165,000 words of prose writings):—

CLASS (A)—CONSONANTAL COMBINATIONS:—

TH (23,874), ND (9,131), ST (6,038),
 5 NG (5,900), NT (5,183), CH (3,481), WH (2,984), NC (2,513), CT (2,430), SH (2,176), GH—T (1,895), NS (1,619), MP (1,398), SP (1,066), XP (959), SC (897), CK (588), MB (386), SM (248), SW (178),
 0 BJ (172)—or a total of 73,107 occurrences for this class of combinations.

CLASS (B)—DIPHTHONGAL COMBINATIONS:—

OU (5,414), EA (4,496), IO—OI (4,348), AI—IA (3,083), EI—IE (3,020), AU—UA (1,066), and OA—AO (315)—or a total of 21,742 occurrences. (The combinations "tIOOn" (2,900) and "sIOn" (455) are included in the IO—OI (4,348) given above.)

CLASS (C)—COMBINATIONS PARTLY VOWEL AND PARTLY CONSONANTAL:—

ED (5,815) past participle ending; ES (3,417) plural ending; LY (2,512) adverbial ending; QU (907), DIS (713) and NESS (462).

Of this (C) type of combination are also those combinations composed of the vowels and semi-vowels in close union. I have

"combed out" only those occurring between the semi-vowels R and L and the five pure vowels (for instance, -ear, -are, -era, -our, rou-, -eir, -ire, -ore, -ure, -eal, -ale, -ial, -ail, -ole, -ule, -ual, -ile, and the like); and these are so varied, interesting, characteristic and universal in their embodiments as to form one of the most beautiful and indispensable features of the new keyboard. The occurrences of R plus vowels were 41,320 in number and those of L plus vowels 23,202. These figures are additional to those given above for the 38 "fixed" combinations. Similar vowel plus semi-vowel combinations are formed with S N M and Y throughout the whole of our language, but these have not been analysed out notwithstanding their great utility, it being sufficient for illustrative purposes to have exploited the riches of the R and L combinations. The total occurrences of Class (C) are 78,349.

Summing up results from Classes (A), (B) and (C), the collective total of occurrences in 550 pages of various prose is 173,197 exclusive of the S N M Y unanalyzed combinations. The significance of this result for easy and fluent typing speaks for itself.

Special care has been taken to place all these combinations, 38 in number plus the R and L series on the keyboard in the most efficient positions in the order of their utility; and those of most frequent occurrence have their letters placed next each other on the same line of keyboard; hence their fingering is taken with the greatest facility. Other less frequent combinations are arranged with only one space between their component letters, for instance, SH, NG, CH and the like, for the sake of easy fingering. (See the drawing of keyboard which accompanies the Provisional Specification.)

One of the most distinctive features of the new keyboard consists in the grouping of all the vowels and semi-vowels together within the central area and, as regards the diphthongs, in their natural order as they are usually to be found in words, that is OU, EA, IO, IA, AU, EU, EO, IOU, EOU. The mind expects them to be so written in the majority of words and the fingers find pleasure in so writing them. Another still more important feature is the grouping of the five pure vowels all together on the right hand side of the keyboard. There is no greater fallacy than to suppose that any advantage is gained by scattering them all over the keyboard. Such an arrangement is the worst possible. On the combinational key-

board they are all taken by the two efficient fingers of the right hand. This is as it ought to be. In ordinary long-hand writing it is the universal habit to use the right hand and in all the usual avocations of life the right hand is par excellence the capable hand. The left is merely the steadyng or supporting hand, the right is the active, cunning and efficient hand for doing essential work; and in the division of work between the two hands in typing, this superior efficiency of the right hand can and must be taken into account. Accordingly the right hand area of the new keyboard has a numerical word-making power of 602 units, but the left hand only 468 units. However, the really vital part of the work assigned to the right hand is a complete control of all the vowels, and of all the semi-vowels except two. It soon learns that the task of providing all the vowels falls solely to its care, and their arrangement is such that it can type them rapidly in any order of combination in which they may be required. On the left hand is thrown the duty of providing the leading consonants or consonantal combinations; and in this way the two hands conspire together to turn out words in the most workmanlike fashion. The bad habit of having to pick up vowels first at one end of the keyboard and then at the other is avoided, and words come together in a more natural way. Seeing that the majority of English words begin with a consonant or consonantal combination followed by a vowel or diphthong, and that the mind is attuned by the law of association to this requirement of the language, it is evident that in writing on the new keyboard, the general flow of producing words, wholly sometimes, largely at all times, is serially from left to right as it would be if written by the pen according to customary habit. This feature in conjunction with all the other special points of the keyboard, gives a great psychological value to its writing powers. In other words, there is much less reverse action or travel of the mind, eyes and fingers when typing than on other keyboards.

It must not be overlooked, and too much stress cannot be laid on this fact, that, instinctively, the eyes are continually following the fingers, and that the mind is always precedent in its action to the movements of both eyes and fingers; for it is certain that not a movement of the eyes or fingers can take place without the consent of the mind even though it may seem to act with almost unconscious

instantaneity. Nor can the mind think of two things at one and the same moment. One letter must follow the other by a separate consent however swiftly such steps may seem to be taken. Even for a blind typist, the interior travel of the mind from one part of the keyboard to another is just as active as for a seeing typist; and it is precisely this incessant mental action that demands as much relief as it is possible to secure.

The conclusion to be drawn from these psychological considerations is, that when the efficient letters of our language are largely scattered on the outskirts of a keyboard (as in case of the keyboard at present in common use), and besides being so scattered, are lacking in those combinational relations so largely involved in word structure, the fingers and eyes not only require to be extensively in incessant operation all over the keyboard, but the mind is to the same degree intensively active and, to a considerable extent, distracted by the merely mechanical process of typing from its intellectual action in thinking about what is to be typed.

Now it is well known to medical men and oculists that this kind of incessant action is alike physically trying to the eyes and nervously fatiguing to the brain and, ultimately, to the mind which is dependent on the freshness of the physical brain for the exercise of its full powers.

The bearing of these remarks is not far to seek. It must be concluded therefrom that a badly arranged keyboard is one that makes the maximum demand on fatigue of brain and effort of mind, whereas a well arranged keyboard is one which by centralizing the fourteen all-important word-making letters thereby limits, and so minimizes the action of the eyes and mind, and at the same time arranges these important letters, together with the remaining twelve letters of the alphabet, in combinations structural to the language and expected by the laws of mental association. The "combinational keyboard" has taken the whole body of these manual, linguistic and psychological considerations into account in its arrangement. It is the only keyboard on which the most efficient letters, the most efficient structural combinations of our language and the most efficient area of the keyboard are all brought together under the direct manipulation of the most efficient fingers for quickest writing.

ILLUSTRATIONS OF COMBINATIONS.

A few examples, confined to mono-

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syllables only as being the foundation stones of our language, may be given of the usage of combinations on the keyboard. Of these the most interesting, 5 varied and widespread are those of the semi-vowels L & R in union with the five pure vowels:—

10 EAL—s.eal, st.eal, st.eal.th, r.eal, d.eal, m.eal, p.eal, h.eal, l.eal.th, w.eal.th, squ.eal, and the like.

ALE—s.ale, st.ale, ale, t.ale, sh.ale, h.ale, d.ale, m.ale, p.ale, b.ale, wh.ale, g.ale, and the like.

15 LEA—lea.se, lea.st, lea.d, lea.p, p.lea.se, p.lea.d, p.lea, c.lea.r, c.lea.n, b.lea.ch, and the like.

EAR—ear, s.ear, t.ear, sh.ear, s.ear.ch, ear.l, ear.n, ear.th, n.ear, d.ear, d.ear.th, h.ear, h.ear.th, sp.ear, y.ear, p.ear.l, 20 b.ear.d, p.ear, sw.ear, and the like.

ARE—are, st.are, t.are, r.are, sh.are, p.are, sp.are, sc.are, d.are, c.are, b.are m.are, f.are, h.are, and the like.

REA—real rea.r, st.rea.m, t.rea.t, 25 th.rea.t, sp.rea.d, c.rea.m, sc.rea.m, p.rea.ch, c.rea.se, b.rea.th, and the like.

Similar monosyllables can be formed from : -ile, -ole, -ail, -ial, -oul, lou-, -olu, -oil, -aul, -ual, -oal, loa-, -eir, -ier, -ire, 30 -air, rai-, -our, rou-, -oir, -oar, roa- and the like.

A few other monosyllables, embodying fixed combinations of which there are often two or three in each word:—

35 St.a.nd, ea.st, sh.ea.th, st.ea.m, st.a.mp, ch.e.st, ch.ea.p, ch.a.nt, sp.e.nt, sp.e.nd, au.nt, s.ai.nt, t.au.nt, t.ou.ch, c.oa.st, y.ea.st, sh.ou.t, sh.ea.f, m.ou.nd, p.ou.nd, b.ou.nd, f.ou.nd,

40 s.ou.nd, t.ea.ch, ea.ch, ch.ea.t, m.ea.nt, p.ai.nt, t.ai.nt, st.i.nt, c.ou.nt, p.ou.ch, wh.i.ch, th.ou.ght, s.ou.ght, ou.ght, th.ou.gh, wh.ea.t, w.ei.ght, sw.ea.t, sc.ra.tch, th.e, th.e.e, th.e.e, th.at, th.en,

45 th.is, th.ose, th.us, th.ou, o.th.er, ano.th.er, wh.e.th.er, th.i.ng, pa.th, and so on all through the language.

EXPLANATION OF THE KEYBOARD DIAGRAM. (For which see Provisional Specification.)

50 The long oblique line, figured 2, is not only drawn through the centre of the whole keyboard to mark the division between the right hand and left hand areas, each hand controlling thirteen letters, but it also divides into equal parts the especially important central area of the keyboard hereinafter referred to.

55 The relative numerical values of the 26 letters of the English alphabet as word-makers are given on page 2 of this specification, and are there shown to make up

a sum-total of 1070 units for the whole of the English language. The nine letters placed on the top line of the keyboard, namely, Z G D N I O U F and Q represent 367 units of wordmaking power; the ten letters placed on the middle and most important line, namely, V W H T S E A R B J represent 554 such units, and the seven letters on the bottom line, namely, K X C P L M Y, 149 units.

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A scrutiny of the keyboard being made, it will be seen that the most efficient letters for wordmaking are grouped within the central area which lies between the two shorter oblique lines, figured 1 and 3 on the diagram:—Namely, on the top line the six letters G D N I O U; on the middle line the six letters H T S E A R; and on the bottom line the six letters X C P L M Y, all of which are typed by the most efficient fingers of both hands, each hand having control of nine letters. These 18 letters collectively represent 978 units out of a total of 1070 units of wordmaking power for the whole language.

The 8 letters placed on the outskirts of the keyboard, outside the central area, namely, Z W V K and F Q B J are mostly letters of small value as wordmakers, and are to be fingered by an extension outwards from the central area of the second or third finger of each hand.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A typewriter keyboard having collectively the letters V W H T S E A R B J on its middle line, the letters Z G D N I O U F Q on its top line, and the letters K X C P L M Y on its bottom line, all these letters being so arranged as to form in close union with each other certain "combinations" which are structural in English words, namely, TH, ST, NG, ND, EA, OU, IO and many others such like as already statistically displayed in this specification.

2. A typewriter keyboard with the pure vowels E A I O U and the semi-vowels R L M Y grouped together on its right hand side within the central area to be fingered by the first and second fingers of the right hand only; moreover so grouped that the diphthongs EA, IO, OU, AU, IA, EU, EO are typed serially from left to right as here written.

3. A typewriter keyboard having the letters H T S E A R in the centre of its middle line and flanked by the letters V W and B J. Collectively these letters form

one half the structure of our language.

4. A typewriter keyboard having within its central area the letters:—

5 G D N
 H T S
 X C P

for fingering by the first and second fingers of the left hand. And the letters:—

10 I O U
 E A R
 L M Y

for fingering by the first and second fingers of the right hand. Collectively these letters write 97 *per cent.* of all English words.

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5. A typewriter keyboard having the letters arranged substantially as described in the accompanying specification and illustrated in the accompanying diagram.

Dated this 23rd day of February, 1920. 20

WILLIAM WILSON NELSON.

