

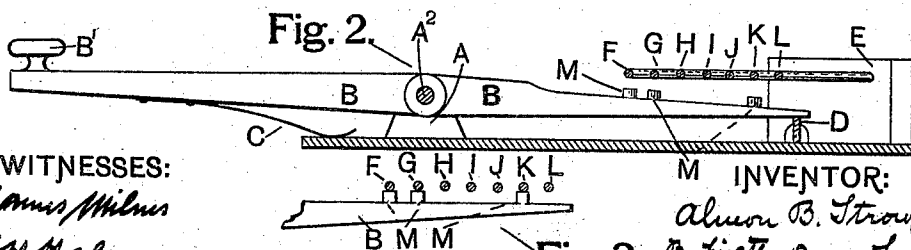
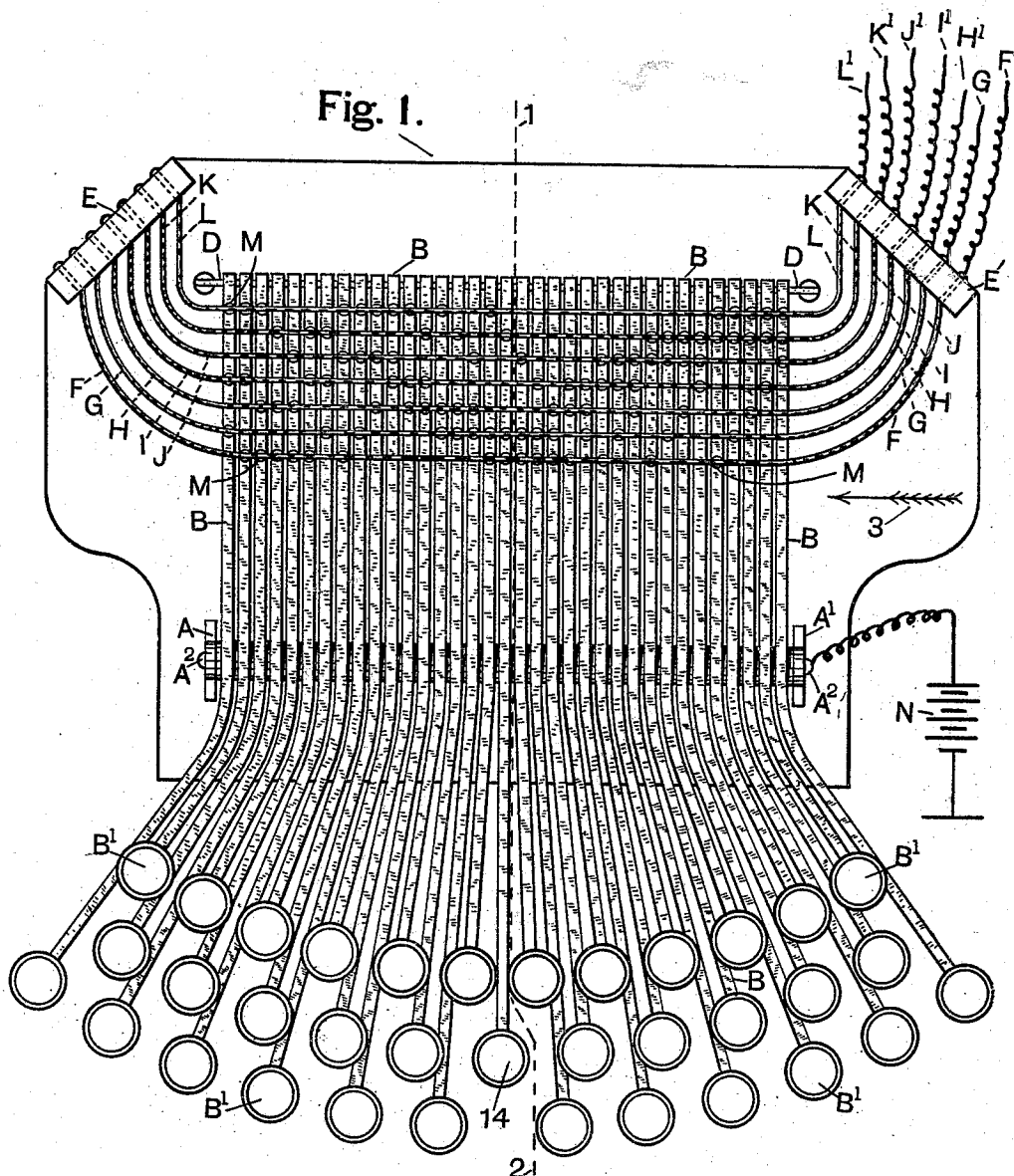
(No Model.)

2 Sheets—Sheet 1.

A. B. STROWGER.  
PERMUTATION SELECTOR.

No. 550,658.

Patented Dec. 3, 1895.



WITNESSES:

James Milner  
H. A. Hall.

INVENTOR:

Almon B. Strowger  
By his atty. Oscar Snell.

Fig. 3.

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Fig. 4.

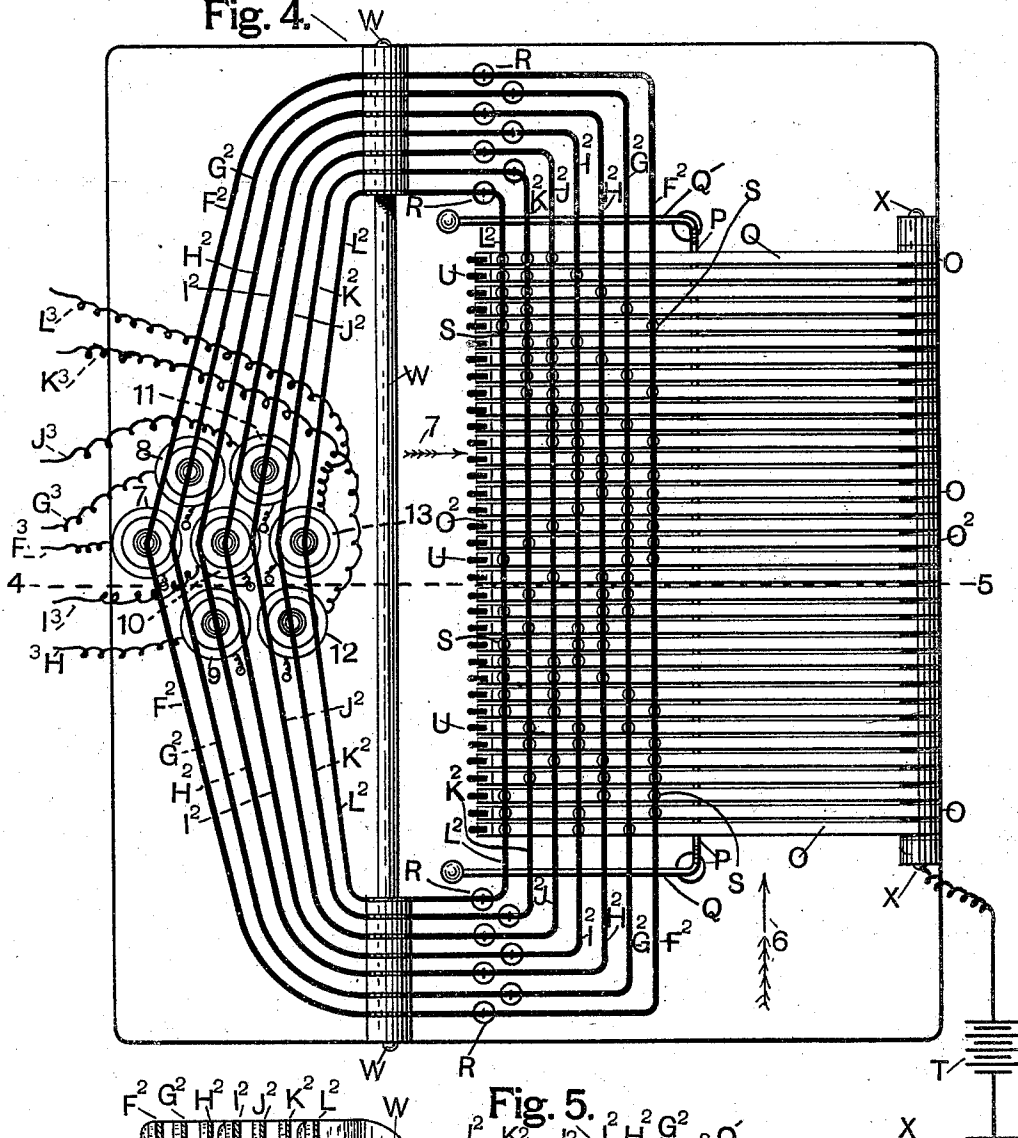
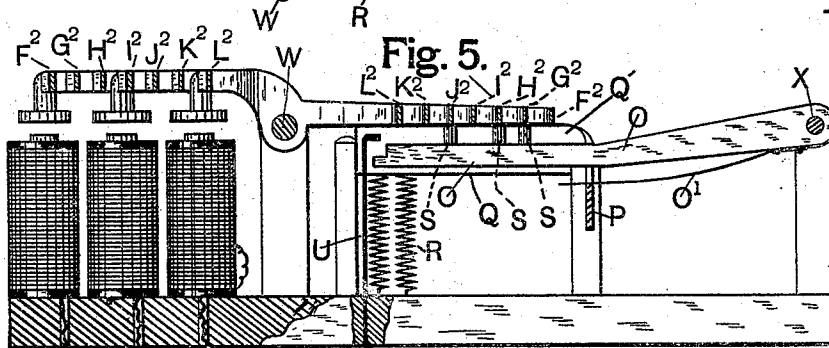


Fig. 5.



WITNESSES:

*James Milnes*  
*H. H. Hale*

INVENTOR:

*Almon B. Strowger*  
By *his atty.* *Oscar L. Lell.*

Fig. 6.

# UNITED STATES PATENT OFFICE.

ALMON B. STROWGER, OF CHICAGO, ILLINOIS.

## PERMUTATION-SELECTOR.

SPECIFICATION forming part of Letters Patent No. 550,658, dated December 3, 1895.

Application filed June 14, 1894. Serial No. 514,513. (No model.)

*To all whom it may concern:*

Be it known that I, ALMON B. STROWGER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Permutation-Selector, of which the following is a specification.

My invention relates to means for selecting and operating at a distance the parts of such mechanism as type-writers and other similar printing machinery; and my object is to provide a construction in which there are a plurality of line-wires connecting the transmitting and receiving instruments, these line-wires being placed in electrical communication with a battery by means of finger-keys, which are provided with contacts arranged in permutational order, whereby but one key of the whole group of keys is capable of being placed in electrical communication with the same relative combination of the line-wires, thus adapting the system to a variety of uses where it is desirable to operate one or more complicated pieces of mechanism at a distance from the transmitting apparatus, and one form of my new system of mechanism for the purpose hereinbefore stated is described hereinafter and is illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of the transmitter, and Fig. 2 a vertical section of Fig. 1 on broken line 1 2 looking in the direction indicated by arrow 3. Fig. 3 is a detached view of one end of Fig. 2, which will again be referred to. Fig. 4 is a plan view of the receiver; and Fig. 5 is a vertical section through the operative mechanism of Fig. 4 on line 4 5, with portions of the base broken away, looking in the direction indicated by arrow 6. Fig. 6 is a view of a small central portion of Fig. 4, near arrow 7, showing the ends of a series of switch-arms with one of the same in a lifted position.

Similar letters and numerals indicate like parts throughout the several views.

Secured to a base of insulating material are standards A A', which support a cross-rod A<sup>2</sup>, to which are pivotally mounted to slightly vibrate in a vertical plane a series of keys B, each having a finger-button B' at the front end, and each key is provided with a spring C for holding the rear end thereof in yielding

contact with a transverse strip D near the base.

At E and E' are standards secured to the base, which form an attachment and support for the ends of a series of rods F, G, H, I, J, K, and L, which are bent into a U shape and disposed in substantially the same plane and project forwardly, the long straight central portion of each rod occupying a plane above the rear ends of the keys B, and each of the rods is insulatingly attached to the standards E and E' and each rod out of contact with the other. In this instance each key B is provided with three contact projections M, which register with some particular three of the rods above, the projections having electrical communication with the keys, thence through the pivotal rod A<sup>2</sup> thereof to an electric battery N. It must be understood, however, that the contacts M may be attached to the rods F, G, H, I, J, K, and L, and contact a plain portion of the ends of keys B without changing the principle of action of these parts.

Each of the rods F, G, H, I, J, K, and L is electrically connected to one of the line-wires F', G', H', I', J', K', and L' at standard E'. The receiver comprises a base of insulating material upon which are mounted upon a pivotal rod X, supported by standards from the base, a series of switch-arms O equal in number to the number of keys B of the transmitter, Fig. 1, and attached to each switch-arm is a spring O', Fig. 5, which bears upon a transverse bar P of insulating material. Pivotaly mounted upon a transverse rod W attached to standards secured to the base of the receiver are as many frames F<sup>2</sup>, G<sup>2</sup>, H<sup>2</sup>, I<sup>2</sup>, J<sup>2</sup>, K<sup>2</sup>, and L<sup>2</sup> as rods F, G, H, I, J, K, and L in the transmitter, Fig. 1, and attached to the rear portion of each of these frames is an armature, there being an electromagnet for operating each armature, which magnets are designated by the numerals 7, 8, 9, 10, 11, 12, and 13, and to these magnets are, respectively, connected the wires F<sup>3</sup>, G<sup>3</sup>, H<sup>3</sup>, I<sup>3</sup>, J<sup>3</sup>, K<sup>3</sup>, and L<sup>3</sup>, which are connected respectively with wires F', G', H', I', J', K', and L' of the transmitter, Fig. 1.

All of the frames mentioned are yieldingly held in the same plane upon cross-pieces Q and Q' by helical springs R, the armatures of

the magnets shown being out of contact thereby, as shown in Fig. 5. Each of the switch-arms O is provided with as many projections S of insulating material as there are contacts M on keys B, and for convenience these switch-arms are arranged from left to right, respectively, with the projections S disposed upon each arm relatively to the other arms of the group, the same as the contacts M on each of the keys B, so that the relative disposition of all the projections of arms O is a duplicate of the relative disposition of all the contacts M of keys B.

It will be noticed that all the contacts M of keys B are normally out of contact with rods F, G, H, I, J, K, and L, while the projections S of arms O are normally always in contact with frames F<sup>2</sup>, G<sup>2</sup>, H<sup>2</sup>, I<sup>2</sup>, J<sup>2</sup>, K<sup>2</sup>, and L<sup>2</sup> in the herein-described system of mechanism. All the switch-arms O are in electrical connection with battery T through its connection with the pivotal shaft X of the arms, Fig. 4.

Close to the end of each switch-arm O is a wire U, whose lower end is attached to and passes through the base, the upper end of the wire being bent to a right angle and projecting over the end of the switch-arms, Fig. 5.

In operation after batteries N and T have been charged and connected, as shown, should finger-button 14 be pressed down the opposite end of the attached key B will be forced upwardly, causing the three contacts M to strike rods F, G, and K, Fig. 3, when an electric current will pass from battery N through the rods named, thence by wires F' G' K' and wires F<sup>3</sup> G<sup>3</sup> K<sup>3</sup> through electromagnets 7 8 12 and cause the armatures thereof to draw down one side of frames F<sup>2</sup> G<sup>2</sup> K<sup>2</sup>, whereby the opposite sides of these frames are raised, and switch-arm O<sup>3</sup>, having its three projections in contact only with these three frames, will rise by the action of its spring O' to the position shown in Fig. 6, where it will contact the bent-over portion of the top of wire U and thus establish electrical communication between this wire and the receiver-battery T, which wire U may be connected to any machine which is to be operated electrically. In the same manner by operating any one of the keys B as described its duplicate will be operated in the series of switch-arms of the receiver. In the drawings are shown thirty-five keys B and seven contact-rods F, G, H, I, J, K, and L, and the contacts M on each key are so disposed in relation to the contacts on all the other keys of the group that no relatively-disposed same three rods of the seven are capable of being placed in electrical communication with any two keys at one time. It is obvious that should each of the wires U be connected to a separate electromagnet each magnet would be operated independently of the others by pressing upon the key-buttons B', such magnets being adapted to operate the type-levers of a type-writer at a great distance from the transmitting apparatus shown in Fig. 1, or be applied to oper-

ate various signals or switches or separate machines, as desired.

It will be understood that I do not confine myself to the exact form of mechanism herein shown and described, for the reason that this mechanical construction has been adopted to illustrate my new system of contacts whereby electrical communication is established to operate any designated one of a plurality of distant switches by manipulating one of an equal plurality of keys, as hereinbefore explained, the electric current for the purpose controlled by each key being transmitted to two or more independent operative electromagnets practically simultaneously over two or more designated and separate wires of a plurality of line-wires.

It is obvious that a greater or less number of line-wires than seven may be used, and a greater or less number than three wires be placed in electrical communication at one time with each key; but where the number of electrical contacts for each key and the number of line-wires bear a certain mathematical relation the greatest number of switch-arms O at the receiver may be operated electrically through the least number of line-wires, as is illustrated in the following table arranged according to the laws of permutation, viz:

| Number of line-wires. | Number of contacts for each key. | Maximum number of keys and switch-arms. |
|-----------------------|----------------------------------|-----------------------------------------|
| 4 .....               | 2                                | 6                                       |
| 5 .....               | 2                                | 10                                      |
| 6 .....               | 3                                | 20                                      |
| 7 .....               | 3                                | 35                                      |
| 8 .....               | 4                                | 70                                      |
| 9 .....               | 4                                | 126                                     |
| 10 .....              | 5                                | 252                                     |
| 11 .....              | 5                                | 462                                     |

The movements of switch-arms O are such that signals may be directly attached to the arms and be displayed or each of the arms may have a direct mechanical connection to operate or control the separate parts of various kinds of apparatus without any electrical connection therewith, so that battery T and the switch-wires U may be dispensed with in such cases.

I claim as my invention—

1. In a permutational selector, the combination, with a base, standards thereon, an electrically connected cross-rod between two of the standards, and a series of substantially U shaped rods between the other standards, a series of keys pivotally secured upon the cross-rods, the outer end of each of which is provided with a finger button and the opposite end with contact points for engaging with a portion of the U shaped rods, a transverse bar below the contact ends of the keys, a spring for holding the keys normally against the bar, a series of switch arms, frames for operating them, means between the arms and frames corresponding in number and arrange-

ment with the contact points of the keys, and electrical means for operating the frames from the keys, substantially as set forth.

2. The combination, with a series of spring actuated switch arms, of a contact point for each arm, a series of frames pivotally secured above the arms, an armature on each arm, a magnet for each armature, projections upon the arms for engaging with the frames and normally holding them out of engagement with their respective contact points, a series of keys and means for establishing electrical connection between the keys and the magnets, substantially as set forth.

3. The combination, with a series of switch arms, each provided with projections, a contact point for each arm, a series of frames, a

portion of each of which is adapted to engage with the projections on the arms, and hold the arm out of engagement with its respective contact point, an armature upon another portion of each arm, a magnet for each armature, a series of in rods electrical connection with said magnet, and means for engaging with said rods and establishing electrical connection therewith, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand, this 17th day of April, 1894, in the presence of two witnesses.

ALMON B. STROWGER.

Witnesses:

OSCAR SULL,  
H. L. BROWN.