

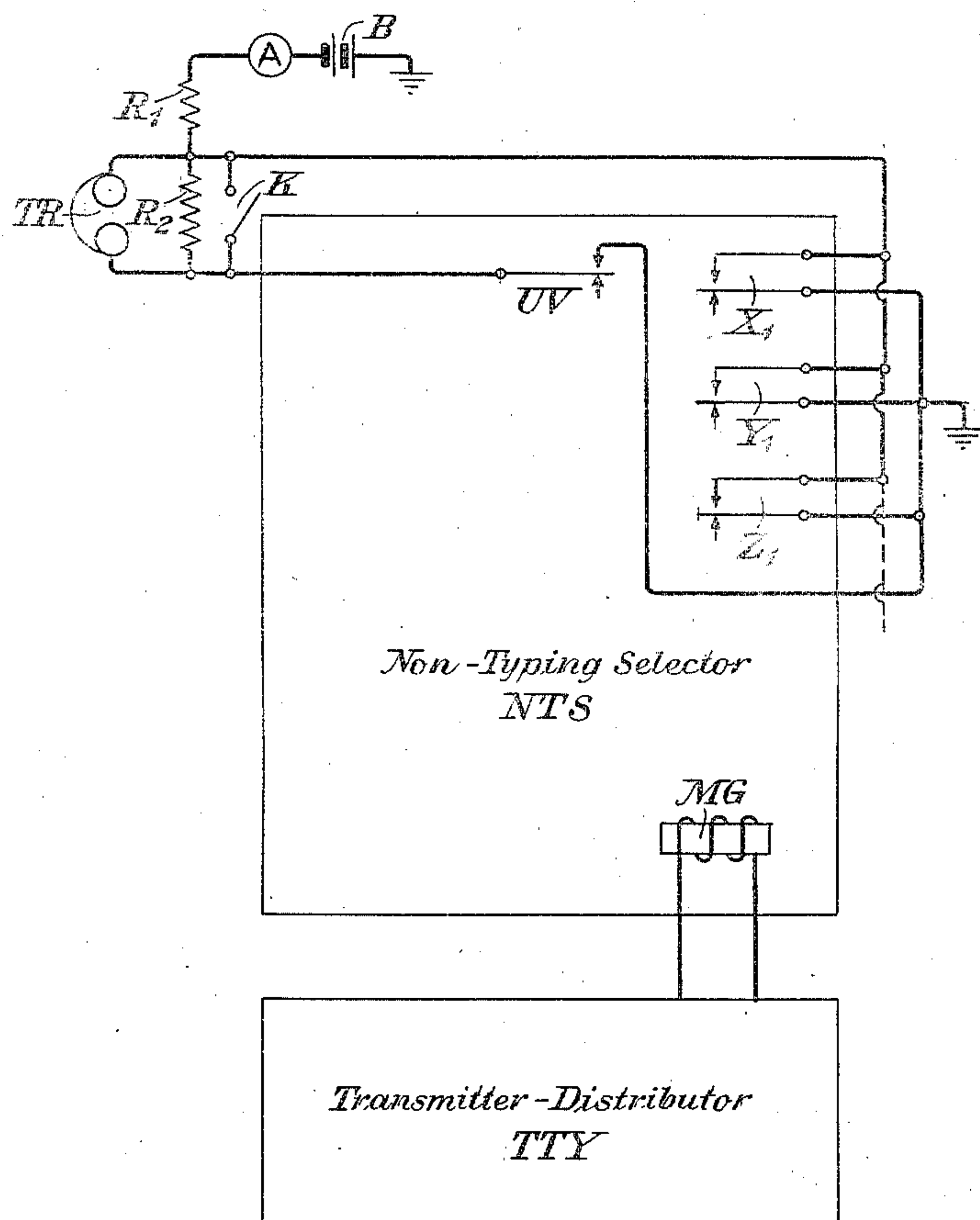
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TESTING SYSTEM FOR NON-TYPING SELECTORS

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TESTING SYSTEM FOR NONTYPING
SELECTORS

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This invention relates generally to telegraph systems. More particularly, this invention relates to teletypewriter systems and apparatus and, still more particularly, to non-typing selector apparatus. The invention provides apparatus for testing non-typing selectors and other teletypewriter apparatus.

In teletypewriter systems a modified form of teletypewriter, known as a non-typing selector, is often used for switching or control purposes. Such a non-typing selector may be a teletypewriter, the typing mechanism of which has been removed or strapped so as to be inoperative. The non-typing selector includes, among other things, an operating magnet and its associated selective elements, together with a universal contact assembly and a plurality of pull-bar contact assemblies. The universal contact assembly may be selected by the magnet in response to the pulses corresponding to teletypewriter character "Letters" and then released shortly thereafter. When a character such as X is received by the non-typing selector to select the corresponding pull-bar assembly, the latter pull-bar assembly will normally be selected and the selection will be followed by the selection of the universal contact assembly. Not only are the pull-bar assembly corresponding to the character X and the universal contact assembly closed in the order named when the appropriate teletypewriter character is received by the magnet of the non-typing selector, but they are then released in the reverse order shortly thereafter. Similarly, when the character S is received by the magnet, the corresponding pull-bar contact assembly and the universal contact assembly will be selected and operated in the order named and released shortly thereafter in the reverse order.

One of the requirements of the non-typing selector to insure its proper operation is to have the closure time of any of the pull-bar contacts exceed and fully overlap the closure time of the universal contact. It is important that each selected pull-bar contact should operate before the universal contact and that it should release after the universal contact has released. Heretofore this requirement was seemingly satisfied by making mechanical adjustments of the various contacts. The mechanical adjustments, however, were sometimes found to be insufficient to assure that the non-typing selector operated properly.

One of the objects of this invention is, therefore, the provision of an electrical testing circuit to observe whether each of the various pull-bar contacts and the universal contact are operated and released in the proper sequence. The electri-

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cal testing circuit of this invention includes an instrument, such as a telephone receiver, for indicating by the presence or absence of an audible signal that these contacts have operated in the proper sequence.

Another of the requirements of the non-typing selector to insure its proper operation is to have each of its various pull-bar contacts or the universal contact remain closed for a specified or predetermined interval of time during each operation of the pull-bar contact or the universal contact. This operating time interval can also be measured with the electrical testing circuit of this invention by converting the measured current flow through the contact as it is repeatedly operated into appropriate units of time.

These and other objects and features of this invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawing illustrating one embodiment of the invention given merely for illustrative purposes.

In the drawing the non-typing selector is designated NTS and a teletypewriter transmitter-distributor is designated TTY. The transmitter-distributor TTY is of well-known type and produces a group of pulses in accordance with each teletypewriter character to be transmitted to the non-typing selector NTS. The transmitter-distributor is shown connected to the operating magnet MG of the non-typing selector. The non-typing selector NTS is also of well known type. Apparatus suitable as a non-typing selector such as NTS is described in the application Serial No. 333,490, filed March 15, 1941, by W. M. Bacon et al., now Patent No. 2,381,871, granted August 14, 1945. The disclosure of the Bacon et al. application may be considered as part of the present application.

The magnet MG of the non-typing selector NTS controls through appropriate selector mechanism (not shown) a plurality of pull-bar contact assemblies, only three of which are shown and are designated X₁, Y₁ and Z₁, and it also controls a universal contact assembly UV. Each pull-bar contact assembly as well as the universal contact assembly include a swinger and two contacts on opposite sides of the swinger, as shown. The lower contact of each of these assemblies is normally closed by the swinger, while the upper contact of the swinger is closed only upon the proper operation of the magnet MG in response to an appropriate teletypewriter signal or character received from the transmitter-distributor TTY.

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However, the closure of the upper contact under such circumstances is only momentary.

The testing apparatus of this invention includes a telephone receiver or detector TR, a milliammeter A, a battery B, two resistors R₁ and R₂ and a key or switch K. When the non-typing selector NTS is provided with the testing apparatus, the swingers of the pull-bar assemblies X₁, Y₁ and Z₁ are strapped together and grounded and the ground is connected to the upper contact of the swinger of the universal contact assembly UV. The swinger of the universal contact assembly UV is connected to the lower terminal of resistor R₂. The upper contacts of the pull-bar contact assemblies are also strapped together and are connected to the terminal common to resistors R₁ and R₂. The resistor R₁, the meter A and the battery B are connected in series with each other and to ground, as shown. The receiver TR is bridged across resistor R₂ so that it may respond to any changes in voltage across resistor R₂. The receiver TR may be replaced by any well known form of detector.

To determine whether the closure time of a swinger of one of the pull-bar contact assemblies, such as X₁, overlaps that of the universal contact assembly UV, the teletypewriter transmitter-distributor TTY is first caused to send a "Letters" signal to the non-typing selector NTS. This will cause the swinger of the universal contact assembly UV to close its upper contact and thereafter return to its lower contact. Upon the closure of the upper contact of the universal assembly UV, current will flow over a circuit extending from battery B, through meter A, through resistors R₁ and R₂, through the swinger and upper contact of the universal assembly UV to ground. As the receiver TR is bridged across resistor R₂, a click will be heard in the receiver. Thus, a click will be heard in the receiver TR for each operation of the non-typing selector NTS in response to the "Letters" signal.

Now the teletypewriter transmitter-distributor TTY is caused to send the teletypewriter character X repeatedly to the non-typing selector NTS. If the non-typing selector is operating properly, the swinger of the pull-bar contact assembly X₁, first will be moved to its upper contact. Current will then flow over a circuit which includes battery B, meter A, resistor R₁, the upper contact and swinger of assembly X₁, and ground. At this moment no current will traverse resistor R₂. Then the swinger of the universal assembly UV will close its upper contact. This will complete the circuit previously described through the swinger of the universal assembly UV. Therefore two circuits will be simultaneously established, one through the swinger of the pull-bar assembly X₁ and the other through the swinger of the universal assembly UV. However, because of the greater resistance in the latter circuit due to the inclusion of resistor R₂ and receiver TR in parallel therein, all of the current will be drained through the circuit of the swinger of the pull-bar assembly X₁ and there will be no click in the receiver TR. Then the swinger of the universal assembly UV will return to its lower contact without producing any current flow through the receiver TR. Finally, the swinger of the pull-bar assembly X₁ will return to its lower contact, whereupon the flow of current from battery B will cease. This same cycle will be repeated again and again with the next teletypewriter characters X received by the non-typing selector NTS from the teletype-

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writer transmitter-distributor TTY. Thus, no clicks will be heard in receiver TR when the character X is received, provided the contact closure time of the pull-bar assembly X₁ fully overlaps or masks the contact closure time of the universal assembly UV.

If the teletypewriter character Y is successively received by the non-typing selector NTS, a similar cycle will be repeated. The swinger of the pull-bar assembly Y₁ will close its upper contact, then the swinger of the universal assembly UV will close its upper contact, then the swinger of the universal assembly UV will return to its lower contact, and finally the swinger of the pull-bar assembly Y₁ will return to its lower contact. However, there will be no clicks in receiver TR if the upper contact of the pull-bar is clean and its closure time fully overlaps the closure time of the universal contact assembly UV.

Suppose that the upper contact of the pull-bar assembly X₁ is dirty when the characters X are received from the teletypewriter transmitter-distributor TTY. Then the closure of the upper contact of the pull-bar assembly X₁ will complete a circuit therethrough of considerable resistance. The parallel circuit subsequently completed through the swinger and upper contact of the universal assembly UV will carry an appreciable amount of current, the magnitude of the latter current depending on the contact resistance of the pull-bar assembly X₁. If the contact resistance of the pull-bar assembly X₁ is very large, then practically all of the current will be drained through the swinger of the universal assembly UV, whereupon a loud click will be heard in the receiver TR. A lesser contact resistance in the pull-bar assembly X₁ will produce a softer click in the receiver TR. Thus, the intensity of the click will depend on the contact resistance of the swinger of the pull-bar assembly X₁ upon reaching its upper contact. A similar result will be observed if the pull-bar assembly X₁ is improperly tensioned, or if there is a lack of "contact follow."

It was assumed hereinabove that in response to a character, such as X, the swinger of the pull-bar assembly X₁ closed its upper contact before the swinger of the universal assembly UV closed its upper contact and that the swinger of the universal assembly UV released its upper contact before the swinger of the pull-bar assembly X₁ released its upper contact. This produced a complete masking of the universal contact closure time and failed to operate the receiver TR. However, although seemingly in good mechanical adjustment, the pull-bar assembly X₁ may produce clicks in receiver TR.

Such clicks in receiver TR may be caused when, in response to a teletypewriter character X received from the transmitter-distributor TTY, the swinger of the universal assembly UV closes its upper contact before the swinger of the pull-bar assembly X₁ closes its upper contact. Under such conditions current will flow from battery B through the swinger of the universal contact UV previously traced and this current will flow until the swinger of the pull-bar assembly X₁ closes its upper contact. This flow of current will of course actuate the receiver TR. Such clicks in the receiver TR may also be caused when the swinger of the pull-bar assembly X₁ releases before the swinger of the universal assembly UV releases in response to a teletypewriter character X received from the transmitter-dis-

tributor TTY. In the latter case the circuit through the swinger of the pull-bar assembly X_1 will be established before the parallel circuit through the swinger of the universal assembly UV is established, but the current from battery B will be diverted to the latter parallel circuit of the universal contact as soon as the swinger of the pull-bar assembly X_1 opens its circuit. Thus, clicks will be heard in receiver TR at any time when the contact closure time of the pull-bar assembly fails to fully overlap or mask the universal contact closure time. The overlapping time is usually between about twenty and thirty milliseconds.

The time of closure of the universal contact UV may also be obtained with the apparatus of this invention. The key K is first closed and the motor of the non-typing selector is turned over by hand until the upper contact of the universal assembly UV is closed. The reading on meter A is then noted. The motor of the non-typing selector is then started and the "Letters" signal is then transmitted repeatedly as before by having the transmitter-distributor TTY "free running." The reading on meter A is again noted. The closure time is then calculated from the formula

$$\frac{C \times E}{D}$$

where C is the first-noted reading on meter A, D is the second-noted reading on meter A and E is the time required to transmit each character. In a 75 speed machine, E is about 130 milliseconds. Here is an example merely for illustration: if C is 5.0 milli-amperes and D is 1.8 milli-amperes, then the universal contact closure time will be about 47 milliseconds.

The time of closure of any pull-bar contact such as X_1 may be obtained by holding key K closed and again observing meter A to obtain the steady current value when the motor is turned over by hand until the upper contact of the universal assembly UV is again closed. The motor of the non-typing selector is then started and the character X is repeatedly transmitted as before and the reading on meter A is again noted. The closure time of the pull-bar contact may be obtained from the formula given above. It will be understood, of course, that for any given installation and apparatus, meter A may be calibrated to read the closure time directly.

The overlapping time ordinarily corresponds to the closure time of the universal contact. The difference between the closure time of a particular pull-bar assembly such as X_1 and the closure time of the universal assembly UV corresponds to the interval when no overlap occurs.

The apparatus and circuit described hereinabove for testing the closure times of the various contacts of a non-typing selector as well as their overlap are simple and relatively inexpensive. The arrangement performs satisfactorily. The arrangement may be applied to any form of teletypewriter apparatus having similar elements.

While this invention has been shown and described in certain particular embodiments merely for illustrative purposes, it will be understood

that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. An arrangement for testing a non-typing selector to determine whether the operating times of its pull-bar contacts overlap the operating time of its universal contact comprising, in addition to the pull-bar contacts and the universal contact of said non-typing selector, a source of voltage connected between all of the pull-bar contacts and their swingers, and a detector connected between all of the pull-bar contacts and the universal swinger, the swingers of the pull-bars being connected in parallel to the universal contact, said non-typing selector being connected to a source of teletypewriter signals.

2. A testing arrangement comprising a non-typing selector having a pull-bar swinger and a universal swinger together with a magnet for controlling the operation of the pull-bar swinger against its contact as well as the operation of the universal swinger against its contact, a source of voltage connected between the pull-bar contact and the pull-bar swinger, the pull-bar swinger being connected to the universal contact, a detecting device connected between the universal swinger and the pull-bar contact, and a source of teletypewriter signals connected to the magnet of said non-typing selector.

3. The combination of teletypewriter apparatus having a plurality of pull-bar swingers and their corresponding contacts and a universal swinger and its corresponding contact, together with a magnet for selectively operating the plurality of pull-bar swingers against their contacts and the universal swinger against its contact, a teletypewriter transmitter-distributor connected to said magnet, the various pull-bar swingers being connected to each other and to the universal contact, a source of voltage one terminal of which is connected to all of the pull-bar contacts and its other terminal to all of the pull-bar swingers, and a detector connected between the universal swinger and all of the pull-bar contacts.

4. An arrangement for testing a non-typing selector to determine whether the time during which any one of its pull-bar swingers closes its contact fully overlaps the time during which the universal swinger closes its contact comprising, in addition to the pull-bar swingers and the universal swinger of the non-typing selector and the corresponding contacts of said swingers, a source of voltage, a meter connected in a series circuit with said source of voltage, said series circuit being connected between all of the pull-bar swingers and all of the pull-bar contacts, all of the pull-bar swingers being connected to the universal contact, a detector connected between the universal swinger and all of the pull-bar contacts, and a teletypewriter transmitter-distributor connected to said non-typing selector to transmit teletypewriter signals thereto.

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