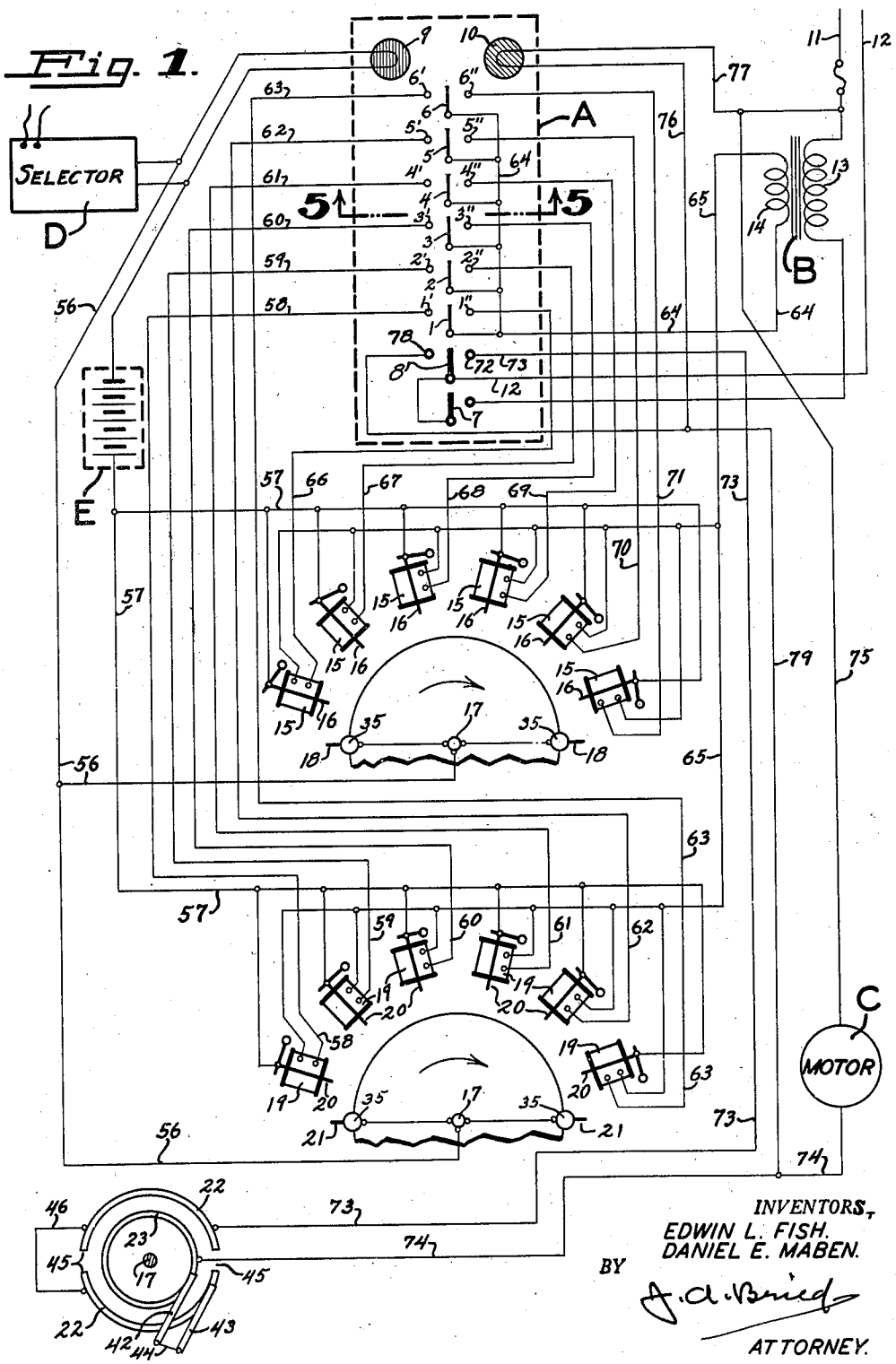
June 6, 1944. E. L. FISH ET AL 2,350,551

ELECTRIC SWITCH APPARATUS

Filed Dec. 22, 1941 2 Sheets-Sheet 1

Fig. 1.



INVENTORS,
EDWIN L. FISH.
DANIEL E. MABEN.

BY J. A. Brice

ATTORNEY.

June 6, 1944. E. L. FISH ET AL 2,350,551

ELECTRIC SWITCH APPARATUS

Filed Dec. 22, 1941 2 Sheets-Sheet 2

Fig. 2.

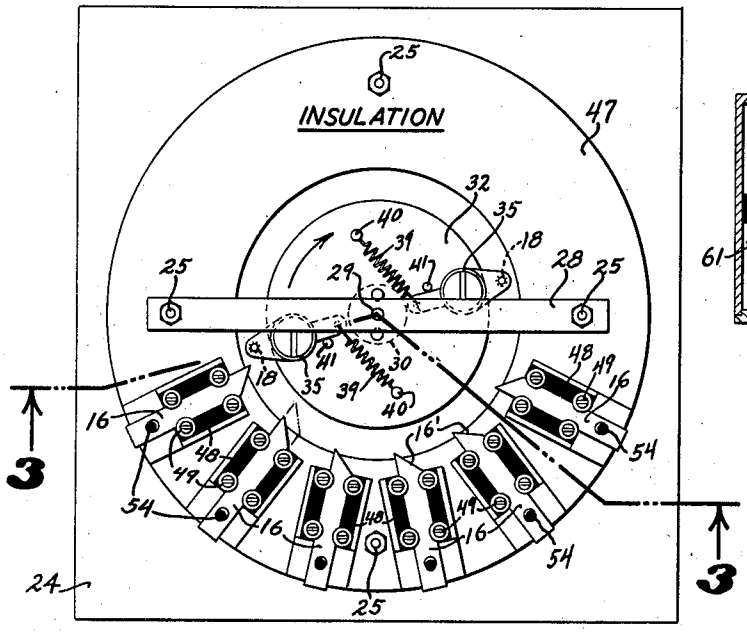
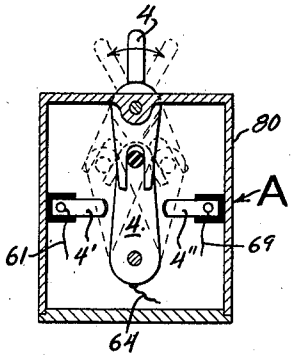


Fig. 5.



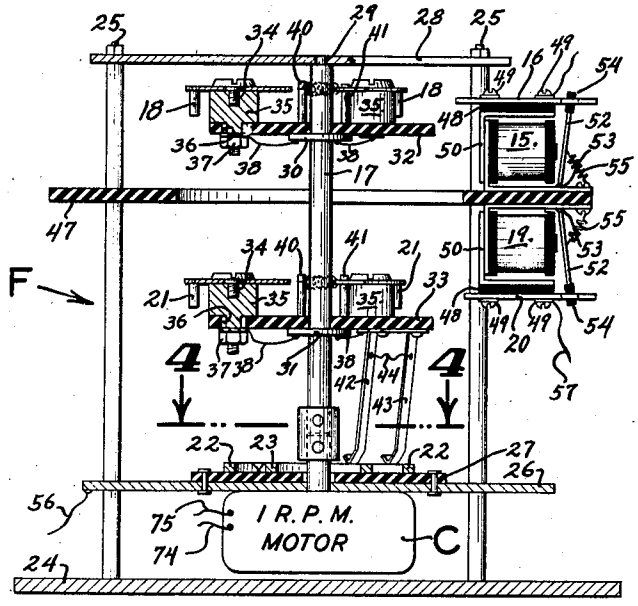
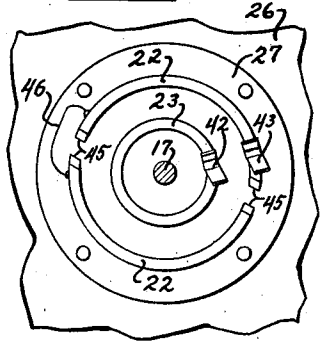


Fig. 3.

Fig. 4.



INVENTORS,
EDWIN L. FISH.
DANIEL E. MABEN.

BY

ATTORNEY.

Patented June 6, 1944 2,350,551

UNITED STATES PATENT OFFICE

2,350,551

ELECTRIC SWITCH APPARATUS

Edwin L. Fish and Daniel E. Maben,
San Francisco, Calif.

Application December 22, 1941, Serial No. 424,034

6 Claims. (Cl. 177—380)

This invention relates to electric switch apparatus in general, and has for its principal object a remote control switch for automatically operating a selective code station electric call apparatus of the long and short bell or impulse type as shown in U. S. Patent No. 2,262,471 of November 11, 1941, and in which variously coded stations may be respectively selected by sending over the wire the proper arrangement of long and short electrical impulses in succession.

A feature of the invention is a series of manually movable short and long contact switch setting and indicating devices or keys, which are first moved to form a visible indication of the code to be sent, followed by an energizing circuit switch and power operated rotary contactor operated thereby for automatically transmitting the arrangement of long and short code impulses as denoted by the setting of the visible indicating devices.

Another feature of the invention is the provision of a lamp or signal at the sending portion of the instrument indicating the operation of the power driven contactor. Also another similar signal indicating at the sending portion of the instrument each long or short impulse as made at the remotely situated selective call apparatus.

Other features and advantages of the invention will appear in the following description and accompanying drawings.

In the drawings

Fig. 1 is a diagrammatic showing of the principal parts of our electric switch apparatus.

Fig. 2 is an enlarged plan view of the power operated rotary contactor.

Fig. 3 is a vertical section of Fig. 2 as seen from the line 3—3 of Fig. 2.

Fig. 4 is a plan view of the contact ring as seen from the line 4—4 of Fig. 3.

Fig. 5 is an enlarged cross section of the setting and indicating devices as seen from the line 5—5 of Fig. 1.

Before describing the drawings in detail the invention may be briefly stated to consist of a motor driven rotary contactor adapted to make a series of successive contacts either long or short, and in any desired relation such as would correspond to the various codes produced by the old hand operated bell signals used on old telephones, the total number of contacts possible to be made in one revolution of the contactor being equal to the largest combined number of short and long contacts required to handle all the stations desired. In the apparatus of the drawings a maximum of six successive contacts can be made, but of course any greater number may be provided.

The contact elements of this rotary contactor are individually connected to a row of manually operated movable switches or keys projecting from a "board" or panel which normally are in intermediate or neutral position so that if the contactor were revolved no contacts would be made, but if any one of these keys were pushed to one side the contact element electrically connected thereto would be moved to produce a short contact when the contactor revolved, and if pushed to the opposite side a long contact. Hence with the row of keys pushed respectively to one side or the other, or left standing in central position the instrument becomes "set" as it were, to a code of long and short contacts and intervals between corresponding to the visible arrangement of the keys.

After thus setting the instrument "board" to the desired code, the motor switch (also on the instrument board) is closed and the contactor revolves to make successive long and short contacts corresponding to the visible setting of the keys and sends corresponding current impulses to the selective code station electric call apparatus (which may be situated at any remote point) so as to transmit the code automatically.

The motor switch and circuit is arranged to give, when in one position, the rotary contactor but one half of a revolution and break the circuit, or when in another position to keep the contactor revolving for repeated calls of the same code until the switch is manually pushed to neutral. The motor circuit also the code contact circuits are both equipped with tellite indicators on the instrument panel so that the operator can always see at a glance whether the motor is running and whether the code contacts are being made. This is important as the contactor as well as the selective call apparatus may both be at a point remote from the sending instrument key board.

In the drawings, Fig. 1, the elements included within the dotted rectangle A constitute the sending instrument or keyboard upon which the "keys" are moved to form a physical representation of the code of impulses to be sent, the six keys being respectively designated 1, 2, 3, 4, 5, and 6, and being here indicated as electric switches standing in central or neutral position between two rows of contacts similarly enumeraled and respectively primed and double primed.

Also positioned on the keyboard is a single

pole switch 7 for closing a step-down transformer circuit, and a two way switch 8 for controlling the timing motor C which revolves the contactor, also a contactor signal lamp 9 and a motor operating signal lamp 10.

The step-down transformer is designated B and its primary winding 13 is energized from house lines 11, 12, and supplies a lower voltage current from its secondary 14 for operating the magnets of the contactor.

The other principal elements shown on Fig. 1 comprise the selective code station electric call apparatus or "selector" D (the details of which may be as shown in U. S. Patent No. 2,262,471 previously mentioned, or may be any other type adapted to utilize codes of long and short electrical impulses), and a battery or other source E of electric energy for the impulse circuit.

The remaining apparatus shown in Fig. 1 comprises the operative parts of the rotary contactor F as follows:

15 is an upper semicircular row of six spaced electromagnets controlling the positions respectively of six movable contact bars or elements 16, positioned around a central shaft 17 carrying two oppositely disposed contact arms adapted to contact elements 16 successively upon rotation of the shaft.

19 is a lower semicircular row of six spaced electromagnets similarly spaced about the shaft 17 and controlling the positions of six movable contact bars or elements 20, and two contact arms 21 carried by the shaft are arranged to contact elements 20 when the shaft is rotated.

Shaft 17 is extended from the motor C and the motor is of the back-geared type so that upon energizing will revolve the shaft slowly at uniform speed, preferably about 1 R. P. M., or so as to give the desired time interval between contacts for sending the code impulses.

22—23 is a pair of slip rings or sliding conductor contacts for conveying current to the motor for automatically stopping the same at each half revolution when the motor switch 8 is moved in one direction, (right) and for starting it again when moved in the opposite direction (left).

The contactor construction chosen to illustrate the operation of the invention is shown in detail in Figs. 2, 3, and 4, and comprises a supporting base plate 24 secured to which are several upright posts 25, and extending transversely of which posts and carried thereby is a lower disk or shelf 26 to the underside of which the motor C is secured and to the upper side of which shelf is secured an insulating disk 27 to the upper surface of which the slip ring conductors 22, 23, are secured.

The extreme upper ends of at least two of the posts 25 are connected by a bar or cross member 28 carrying or forming an upper bearing 29 for the shaft 17, below bar 28 the shaft is provided with two spaced metal flanges 30, 31, to the upper sides of which respectively are secured insulating disks 32, 33. The upper disk 32 carries the contact arms 18 and the lower disk 33 carries the contact arms 21. These arms are pivoted at 34 to metallic bosses 35 in turn adjustably secured in radial slots 36 in their supporting disks as by clamping nuts 37 and are electrically connected with the shaft flange as by flexible wires 38, and each pivoted contact arm is free to turn counterclockwise (see Fig. 2) under restraint of a coiled tension spring 39 secured at one end to the inner end of the arm and at the other to the insulating disk by a pin 40, so as to normally be resiliently held against a stop 41.

Secured to the lower side of the lower insulating disk 33 is a pair of spring contact arms 42, 43, electrically connected together as at 44, and which arms ride resiliently on the slip rings 22, 23 as indicated in Figs. 1, 3, and 4. Ring 22 has two gaps in it at diametrically opposite points (45) to break contact with slider arm 43 at these points, but the segments are electrically connected around the gap at all times as by a conductor 46.

Spaced between the upper and lower revolvable contact arms 18 and 21 is a fixed insulating shelf or ring 47 carried by the posts 25 and spaced around about half of which are the two sets or series of contact elements 16 and 20, the former being on the upper side of the shelf to cooperate with contact arms 18, and the latter on the lower side of the shelf to cooperate with the contact arms 21.

Contact elements 16 and 20 take the form of elongated flat plates arranged radially with respect to shaft 17 and are each slidably positioned on an insulating block 48 and guided by screws and washers 49 so that their inner ends may be projected into the path of the contact arms 18 (or 21) as they revolve, or withdraw therefrom, and the inner ends of the sliding elements are preferably beveled off as indicated at 16', so that the revolving contact arms will make contact at these beveled edges and under influence of their springs 39 yield until they slip off the outer ends. Thus the length of time of the contact will depend on how far inward these tapered elements are projected and/or how far outward the bosses 35 of the contact arms are positioned in their slotted mountings, or with duplicate positioning of upper and lower contact arms the upper set of slidable elements may extend further inward (as indicated in Fig. 3 of the drawings) to secure the longer contact when the elements are projected into the path of the revolving arms.

Blocks 48 are mounted on separate brackets 50 in turn secured to shelf 47 and each bracket also carries an electromagnet (15 or 19) operating on a movable armature 52 pivoted at its lower end at 53 and carrying an insulating upper end 54 projecting freely in a slotted hole in the outer end of the slidable contact element so as to slide the same inwardly into the path of the revolving contact arms when the magnet is energized, and to be pulled outwardly again when de-energized as by a tension spring 55.

The revolving contact arms 18 and 21 are electrically connected by any suitable means, such as by shaft 17, frame member 26 of the machine to a circuit wire 56 extending to the selector D and to the signal lamp 9 and to the source of the impulse current (E) as indicated, while each slidable contact element is connected through appropriate wiring 57 to the opposite leg of the impulse circuit.

The slidable element moving magets are wired to and for operation by the code "keys" or switches on the visible code instrument board as follows:

The lower or "short" contact set (taking them from left to right in Fig. 1), each magnet 19 has one terminal wire (58 to 63) respectively connecting with switch key contacts 1' to 6' to be connected to a common lead 64 to the output side of transformer 14 through the key switches when their respective key switches 1 to 6 are moved to the left (in Fig. 1). The other terminal

of the magnets 19 are all connected to a common lead 65 extending to the opposite end of the transformer output side.

Similarly one wire of each of the magnets 15 of the upper or "long" contact set extends as at 66, to 71, to the opposite key switch contacts 1'' to 6'' to be connected to the common return wire 64 to the transformer through the key switches when moved to the right (in Fig. 1), and the other wire of magnets 15 all extend to common lead 65 of the transformer.

In the arrangement shown, there are but six magnets and contact elements for short and for long contacts arranged in superimposed relation, but it is manifest there could be any number, or extending clear around the circle, also additional layers, for other length of contacts, if desired, also their spacing circumferentially and the speed of the contactor shaft 17 may be arranged to suit any contact time or interval of time between contacts as may be required for the particular installation.

In operation, say to transmit a code of two shorts, one long, one short, and two longs (. . — . — —) keys 1 and 2 are pushed to the left, key 3 to the right, key 4 to the left, and keys 5 and 6 to the right. This forms a visible indication of the code to be sent starting from the lowest key switch upward, or, if the instrument board is horizontally positioned as is preferable, the visible code will read from left to right. Before setting the code however, it is best to close switch 7 to start the transformer so that the magnets as their circuits are closed will project their respective contact elements into the path of the revolvable arm.

After the code is thus visibly set on the board, and assuming slip ring contacts 42—43 to be in position shown in Fig. 1, and the motor or shaft 17 to turn in direction of the arrow, the motor switch 8 on power wire 12 is moved to the right to connect with terminal 72 and wire 73 thence to outer slip ring 22, through slip contactors 42—43 to wire 74, through the timing and driving motor C and back through wire 75 to power wire 11, while a shunt circuit lights signal lamp 10 during the operation of the motor for one half revolution of shaft 17, and goes out when slip contact 43 meets one of the gaps 45 in ring 22 and the motor stops, but during which half turn of shaft 17 the successive contacts were made by whichever rotating contact arms were in position to pass over the inwardly projecting contact strips or elements 16—20, and the code impulses corresponding to the visible setting of the keys on the board were transmitted to the seelctor D.

As the shaft 17 stops with slip contact 43 over an open gap, the motor must be started next time by a momentary throwing of the motor switch 8 to the left to close with terminal 78 which completes the motor circuit by wire 79 without going through the slip rings, and immediately bringing the switch 8 over to the right to close at 72 with the circuit first described.

However, when it is desired to automatically repeat the code signal several times, the motor switch may be left closed with terminal 78, and shaft 17 will continue to revolve until the switch is pulled. In this case, if shaft 17 is revolving about one revolution per minute, there will be about a quarter minute interval between repeat calls, by reason of the second set of contact areas used.

During the operation of the contactor F the red light 9 will show the code pulses being sent so that the operator will know just when to pull the motor switch 8 after several repeat calls have been sent.

In contemplating the rotary contactor as above described, it will naturally be asked why the lower or short contact set, or series of contact elements 20 were not placed on the opposite blank half of the upper side of disk shelf 47 in the same plane with elements 16 to be contacted by one of the two revolving contact arms 18 while the other was taking care of the long contact set (16), and in answer it can be said in such case the time interval between repeat codes (when the motor circuit switch 8 is closed at 78) would be too short, unless the disk 47 were made much larger, or the circumferential spacing of the elements 16 and 20 were made much closer and the shaft 17 run at about half the speed.

Since the key switches 1 to 6 visibly denote the code setting, they should be uniform and visibly different from switches 7 and 8 which do not form part of the visible code, hence switches 7 and 8 should be of a different type or smaller, as indicated in Fig. 1.

When through sending, the keys should all be returned to central or neutral position. Fig. 5 indicates one form of construction of the key switches pivotally mounted in a panel board or box 80 with its upper surface forming the panel or board on which the visible code is shown.

Having thus described our improved electric switch apparatus and the manner of its operation, it will be evident to anyone skilled in the art that numerous changes may be made in detailed construction without departing from the spirit of the invention as sought to be expressed in the appended claims.

We therefore claim:

1. In an electric switch apparatus for sending a series of long and short impulse codes, a panel with a plurality of movable switch keys thereon corresponding to the greatest number of pulses to be sent in a complete code, means mounting said keys for moving to positions respectively denoting long and short pulses so as to collectively form a visible representation of all of the successive code pulses to be sent, a rotary contactor adapted for automatically making successive electrical contacts of long and short duration in any desired order, electric circuit means connecting the contactor with the switch keys of the panel determining the order of making said long and short contacts successively in accordance with said visible representation of the code by the setting of said switch keys on said panel, and means for starting and stopping the rotary contactor, said rotary contactor comprising a rotary motor with a timing shaft revolved thereby, contact means carried by said shaft, a plurality of movable contact elements spaced about said shaft each arranged to produce a long contact with the shaft contact means when moved into the path of the same as the shaft revolves and a plurality of movable contact elements similarly spaced about said shaft each arraged to produce a short contact with the shaft contact means when moved into the path of the same, electrically operated means for moving the contact elements individually into the path of the contact means, and said electric circuit means connecting the long and short contact positions of the keys for respectively so moving the long and short contact elements to successively make the contacts in accordance with the

code denoted by the switch setting as the contactor is revolved.

2. In an electric switch apparatus for sending a series of long and short impulse codes, a panel with a plurality of movable switch keys thereon corresponding to the greatest number of pulses to be sent in a complete code, means mounting said keys for moving to positions respectively denoting long and short pulses so as to collectively form a visible representation of all of the successive code pulses to be sent, a rotary contactor adapted for automatically making successive electrical contacts of long and short duration in any desired order, electric circuit means connecting the contactor with the switch keys of the panel determining the order of making said long and short contacts successively in accordance with said visible representation of the code by the setting of said switch keys on said panel, and means for starting and stopping the rotary contactor, said rotary contactor comprising a rotary motor with a timing shaft revolved thereby, contact means carried by said shaft, a plurality of individually movable relatively long and short contact elements positioned about said shaft, and electrically operated means energized by movement of said switch keys respectively arranged to move said contact elements into the path of said contact means, said electric circuit means connecting the long and short positions of the panel keys for respectively so moving the long and short contact elements.

3. In an electric switch apparatus for sending a series of long and short impulse codes, a panel with a plurality of movable switch keys thereon corresponding to the greatest number of pulses to be sent in a complete code, means mounting said keys for moving to positions respectively denoting long and short pulses so as to collectively form a visible representation of all of the successive code pulses to be sent, a rotary contactor adapted for automatically making successive electrical contacts of long and short duration in any desired order, electric circuit means connecting the contactor with the switch keys of the panel determining the order of making said long and short contacts successively in accordance with said visible representation of the code by the setting of said switch keys on said panel, and means for starting and stopping the rotary contactor, said rotary contactor comprising a rotary motor with a timing shaft revolved thereby, contact means carried by said shaft, a plurality of individually movable relatively long and short contact elements positioned about said shaft, and electrically operated means energized by movement of said switch keys respectively arranged to move said contact elements into the path of said contact means, said electric circuit means connecting the long and short positions of the panel keys for respectively so moving the long and short contact elements, said contact elements being elongated flat plates mounted to slide radially with respect to said shaft, and said contact means arranged and formed to make contact along the edges of said flat plates.

4. In an electric switch apparatus for sending a series of long and short impulse codes, a panel with a plurality of movable switch keys thereon corresponding to the greatest number of pulses to be sent in a complete code, means mounting said keys for moving to positions respectively denoting long and short pulses so as to collectively form a visible representation of all of the successive code pulses to be sent, a rotary contactor adapted for automatically making successive electrical contacts of long and short duration in any desired order, electric circuit means connecting the contactor with the switch keys of the panel determining the order of making said long and short contacts successively in accordance with said visible representation of the code by the setting of said switch keys on said panel, and means for starting and stopping the rotary contactor, said rotary contactor comprising a rotary motor with a timing shaft revolved thereby, contact means carried by said shaft, a plurality of individually movable relatively long and short contact elements positioned about said shaft, and electrically operated means energized by movement of said switch keys respectively arranged to move said contact elements into the path of said contact means, said electric circuit means connecting the long and short positions of the panel keys for respectively so moving the long and short contact elements, said contact elements being elongated flat plates mounted to slide radially with respect to said shaft, and said contact means arranged and formed to make contact along the inner edges of said flat plates and the inner ends of said plates being mitered or beveled.

5. In an electric switch apparatus for sending a series of long and short impulse codes, a panel with a plurality of movable switch keys thereon corresponding to the greatest number of pulses to be sent in a complete code, means mounting said keys for moving to positions respectively denoting long and short pulses so as to collectively form a visible representation of all of the successive code pulses to be sent, a rotary contactor adapted for automatically making successive electrical contacts of long and short duration in any desired order, electric circuit means connecting the contactor with the switch keys of the panel determining the order of making said long and short contacts successively in accordance with said visible representation of the code by the setting of said switch keys on said panel, and means for starting and stopping the rotary contactor, said switch keys arranged in a row on said panel and being pivoted to each move from a central neutral position to a position to one side of the central position for the long pulses and to the opposite side for the short pulses, and electric circuits with contact terminals at the different positions of said keys extending to said rotary contactor, and means operated by said circuits determining the succeeding pulse contacts made by the contactor to be respectively long or short and in the same successive order visibly shown by said keys.

6. In an electric switch apparatus for sending a series of long and short impulse codes, a panel with a plurality of movable switch keys thereon corresponding to the greatest number of pulses to be sent in a complete code, means mounting said keys for moving to positions respectively denoting long and short pulses so as to collectively form a visible representation of all of the successive code pulses to be sent, a rotary contactor adapted for automatically making successive electrical contacts of long and short duration in any desired order, electric circuit means connecting the contactor with the switch keys of the panel determining the order of making said long and short contacts successively in accordance with said visible representation of the code by the setting of said switch keys on said panel, and means for starting and stopping the rotary con-

tactor, said rotary contactor comprising a rotary motor with a timing shaft revolved thereby, a contact arm carried by the shaft, a plurality of long and short contact elements movably positioned about said shaft, and electrically operated means energized by one way movement of said switch keys respectively arranged to respectively project the short contact elements into the path of said contact arm, and similarly upon opposite directional movement the long contact elements, to yield long or short pulse contacts as the arm revolves.

EDWIN L. FISH.
DANIEL E. MABEN.