

Jan. 21, 1969

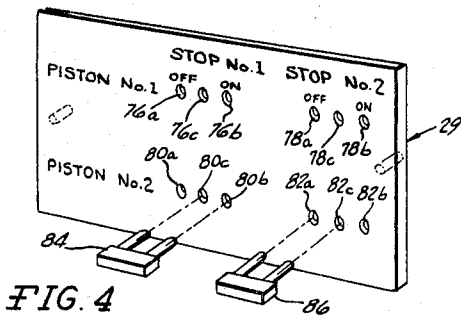
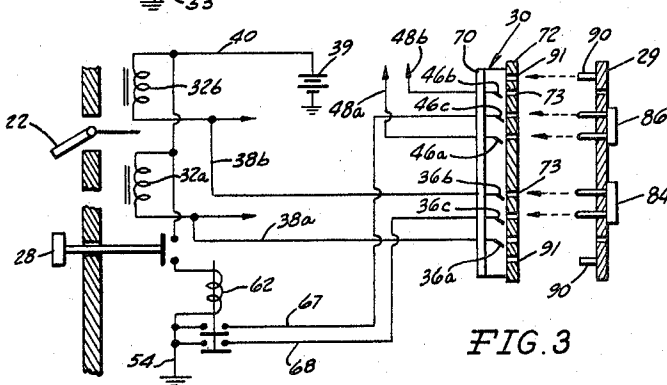
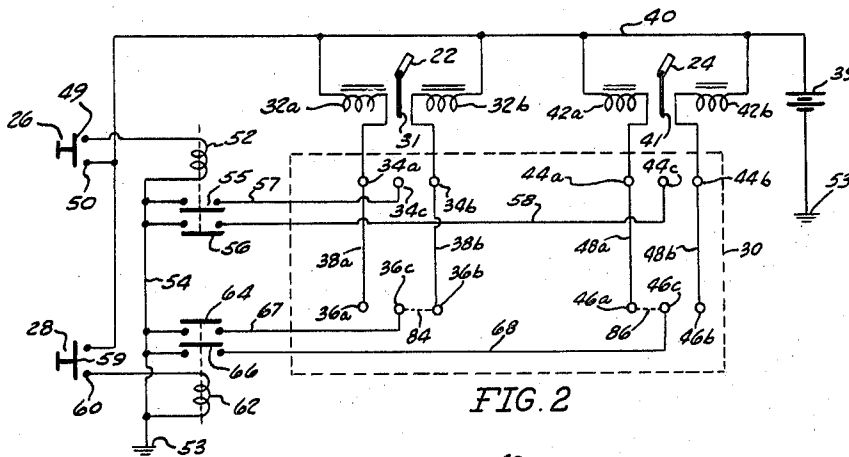
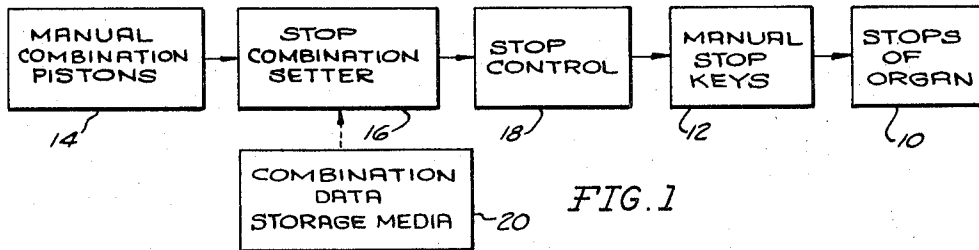
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3,422,718

APPARATUS FOR COMBINATION ACTION IN AN ORGAN

Filed May 17, 1965

Sheet 1 of 2



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Sheet 2 of 2

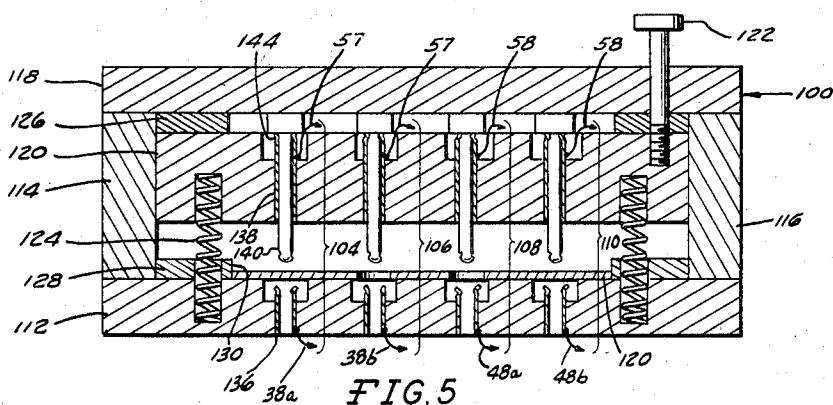


FIG. 5

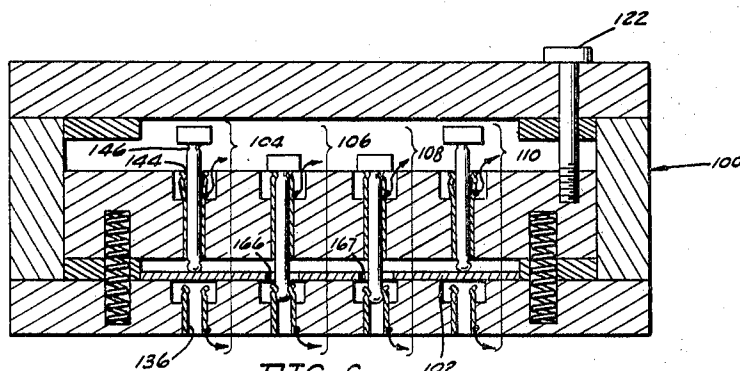


FIG. 6

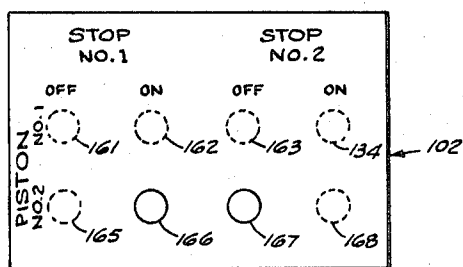


FIG. 7

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3,422,718 APPARATUS FOR COMBINATION ACTION IN AN ORGAN

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7 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for operating the combination action of an organ in accordance with combination data memory media. A combination selection means is provided which has a first unit formed as an integral part of the combination action and a second unit formed separate and detachable from the first unit. The first unit includes discontinuous electrical connections disposed between the combination switches and the stop switches of the combination action and the second unit provides preselected connections for certain of the discontinuous connections for actuating the stops associated with such preselected connections when the associated combination switch is closed. The second unit is constructed and arranged so that a plurality of such units, containing different data memory media, can be interchanged readily.

This invention relates generally to combination actions for pipe organs, electronic organs or the like and more particularly to a apparatus for operating combination actions in accordance with combination data memory media.

Combination actions for organs control various stops of the organ, for example, flute stops, foundation stops, and reed stops, etc., in accordance with preselected combinations of the stops. Generally, combination actions include a plurality of manually operated stop keys or knobs for operating corresponding stops of the organ. The stop keys are located adjacent to the manual keyboard of an organ console so that the organist can control the stops by means of the stop keys while he is playing. Combination actions also include manually operated pistons located under or adjacent to the keyboard. By means of the pistons an organist can operate preselected combinations of stops while he is playing. The combination action per se is a device which holds and stores a preselected combination of stops for one or more pistons corresponding to various stop combinations to be used by the organist. An organist will select stop combinations that yield sounds having desired colors and ensembles according to the demands of the music and the organist's individual interpretation. The selected combinations are then stored in the combination action for use during a subsequent performance.

Various types of combination actions are known in the art. In one simple combination action a pair of solenoids are associated with each stop key to move the key to an on or an off position by remote control. The solenoids for each stop key are wired to each piston through a respective single-pole double-throw (on-off) switch so that each piston can operate each stop key to an on or an off position depending on the position of the switches. All of the switches are mounted on a matrix board located in or near the console of the organ with each horizontal row of switches corresponding to a respective piston and containing a switch for each stop key. The switches for each stop key are vertically in line. For each stop combination desired the organist simply moves the various switches in one horizontal row to either an on or an off position. Once the switches for a particular

piston have been set for a particular stop combination, the organist can use that combination during a performance by operating that particular piston. The stop keys can also be moved with electro-pneumatic means rather than by solenoids. Another type of combination action, sometimes referred to as a "capture-type mechanism" automatically retains a particular stop combination set by the organist on the stop keys for a particular piston. The combination can be recalled by operating that piston. One such combination action is disclosed in the United States Letters Patent No. 2,612,810, entitled "Combination Setter for Organ," and granted Oct. 7, 1952, in the name of Earle L. Kent.

Both the matrix board combination action and the "capture-type" combination action, as well as other types of combination actions, suffer one serious disadvantage. The organist is limited to only one complete combination at a time for each piston. Although some organs include a large number of pistons, the number of pistons is limited if cost, size, and wiring in the organ are to be kept within reason. Because the number of stop combinations available at one time limited, depending on the number of pistons, the pistons must often be reset frequently. Before any or all of the pistons can be set to a new combination it is necessary to erase the existing combination for that piston. Thus when one piston has been set for a given combination and that piston is then reset for a new combination, the first combination is lost. When the first combination is needed again, the piston has to be reset, as for example by resetting all of the switches in the matrix board combination action or manually operating the stop keys in the "capture type" combination action. Additionally, with existing combination actions which require substantial time to reset, it is often inconvenient to change combinations for the pistons during a single musical performance.

The objects of this invention are to provide a method and an apparatus for setting combination actions that provide limitless combinations for one or more pistons; that do not lose one combination for which a piston is set when that piston is reset for a different combination; that reset combinations rapidly and conveniently for one or more pistons; that provide great versatility in an organ or the like for an individual organist and for several organists using the same organ.

Other objects of the present invention are to provide a combination action that is compact; that has few moving parts and thus minimizes mechanical failure; that is economical to manufacture; and that is simple to install and maintain.

Further objects, features, and advantages of this invention will become apparent from a consideration of the following description, the appended claims and the accompanying drawing in which:

FIGURE 1 is a block diagram illustrating the overall organization and operation of the present invention to control the stops of an organ by means of combination data media used to select various stop combinations;

FIGURE 2 is a circuit diagram illustrating two manually-operated combination pistons for selectively controlling two manual stop keys by means of a stationary contact panel which receives a detachable board having contact shorting pins arranged according to predetermined stop combinations;

FIGURE 3 is a schematic diagram illustrating the circuit connections through the contact panel, the board and the pins for a combination piston and one of the stop keys;

FIGURE 4 is a perspective view of the removable terminal board having shorting pins which are manually inserted into the board to preset a particular combination of stops;

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FIGURE 5 is a vertical sectional view illustrating a static card reader for punched cards that are used to select various stop combinations in accordance with a further embodiment of the present invention;

FIGURE 6 is a view of the card reader illustrated in FIG. 5 with a card inserted in the reader and the reader in an operated position; and

FIGURE 7 is a view of a punched card for use with the reader with the card being punched for a stop combination corresponding to the combination on the board illustrated in FIG. 4.

Referring to FIG. 1, the stops 10 of an organ are under control of conventional manual stop keys 12 to selectively open or close selected ones of the organ stops and thus produce a desired tone. Keys 12 are also controlled remotely between an on and off condition by means of manual combination pistons 14 operatively connected to keys 12 through a stop combination setter 16 and a stop control 18. In accordance with the present invention the stop combination setter 16 determine the stop combination for each piston in accordance with selected combination data media 20. As used in this application the terms "combination data media," "combination data storage media," and similar terms, include, but are not limited to, terminal shorting boards which are sometimes referred to as "patch boards," punched cards and tapes, magnetic cards and tapes, and light responsive cards and tapes. In general, stop combinations for one or more pistons are determined by the organist and entered for storage on one of the boards, cards, or the like. If there are not enough pistons available to provide the number of combinations required for a particular performance, more than one board, card, or the like can be used to store the combinations. When the board, card, or the like on which the stop combinations are stored is inserted into the stop combination setter 16, actuation of the pistons 14 will operate the stop keys 12 in accordance with the combinations stored on the board, card, or the like.

Referring to FIGS. 2, 3 and 4, two stop keys 22, 24 (keys 12, FIG. 1) are operated by two combination pistons 26, 28 (pistons 14, FIG. 1) in combinations that are stored on a contact shorting board 29. Board 29 is operatively engaged, physically and electrically, with a contact panel 30. Keys 22, 24 are always in one of two normal positions (on or off) and operate the stops 10 (FIG. 1) of the organ by conventional means (not shown). Panel 30 is a stationary unit, preferably mounted directly on the organ, and is permanently wired to the stop control 18 and to the pistons 14. Board 29 is separate and detachable from panel 30 and can be set to different shorting conditions corresponding to different stop combinations.

More particularly key 22 has a magnetic arm 31 disposed between a pair of solenoids 32a, 32b. When solenoid 32a is energized, arm 31 and key 22 are moved to an off position. Key 22 will remain in the off position when solenoid 32 is de-energized. Solenoid 32b moves arm 31 and key 22 to an on position. Mounted on panel 30 are a first set of three contacts 34a, 34b, 34c and a second set of three contacts 36a, 36b, 36c associated with key 22. Solenoid 32a and contacts 34a, 36a are connected in series by a conductor 38a and to one terminal of a battery 39 by a position supply conductor 40. Solenoid 32b and contacts 34b, 36b are connected in series by a conductor 38b and to battery 39 by conductor 40. Key 24 has a magnetic arm 41 disposed between an off solenoid 42a and an on solenoid 42b. Also associated with key 24 and mounted on panel 30 are a set of three contacts 44a, 44b, 44c and a set of three contacts 46a, 46b, 46c. Solenoid 42a is connected in series with contacts 44a and 46a by a conductor 48a and to battery 39 by conductor 40. Solenoid 42b is connected in series with contacts 44b and 46b by a conductor 48b and to battery 39 by conductor 40.

Piston 26 has a switch arm 49 which closes a pair of switch contacts 50 connected in series with a solenoid 52 across conductor 40 and a ground 53 by a conductor 54.

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Solenoid 52 operates a pair of contact arms 55, 56 with arm 55 being arranged to connect contact 34c with ground 53 through a conductor 57 and conductor 54. Arm 56 connects contact 44c with ground 53 through a conductor 58 and conductor 54. Similarly piston 28 has a switch arm 59 which closes a pair of switch contacts 60 connected in series with a solenoid 62 across conductor 40 and ground 53. Solenoid 62 has a pair of contact arms 64, 66 arranged respectively to connect contacts 36c, 46c to ground 53 through respective conductors 67, 68. Thus contacts 34a, 34b, 34c are arranged to place key 22 under control of piston 26; contacts 36a, 36b, 36c are arranged to place key 22 under control of piston 28; contacts 44a, 44b, 44c are arranged to place key 24 under control of piston 26; and contacts 46a, 46b, 46c are arranged to place key 24 under control of piston 28. As illustrated in FIG. 2 contacts 34a, 34b, 34c (key 22) and contacts 44a, 44b, 46c (key 24) are disposed on panel 30 in a horizontal row corresponding to piston 26 whereas the contacts for keys 22, 24 and piston 28 are disposed on panel 30 in a second horizontal row beneath the row of contacts for piston 26. In the horizontal rows the contacts for key 22 and for key 24, respectively, are vertically in line. Pistons 26, 28 are biased to an open position and thus contacts 50, 60 are closed only as long as the pistons are operated.

Referring to FIGS. 3 and 4, contact panel 30 comprises a backing plate 70 on which contacts 34a-c, 36a-c, 44a-c, and 46a-c are mounted in the matrix configuration illustrated in FIG. 2. An access plate 72 supported in front of plate 70 has twelve apertures 73 in line with a respective one of the contacts. The access plate 72 is arranged to receive and releasably retain the terminal shorting board 29. Board 29 has six apertures 76a, 76b, 76c and 78a, 78b and 78c disposed in an upper horizontal row and spaced to align with contacts 34a-c, 44a-c and the corresponding apertures 73 in plate 72. Board 29 is also fashioned with a second row of six spaced apertures 80a, 80b, 80c and 82a, 82b and 82c arranged to align with contacts 36a-c, 46a-c. A two-pronged shorting pin 84 inserted through apertures 80c, 80b electrically connects contacts 36b, 36c when board 29 is assembled on panel 30. A second shorting pin 86 has prongs projected through apertures 82a, 82c to electrically connect contacts 46a, 46c. Thus when piston 28 is actuated, solenoid 32b is energized through a circuit including battery 39, conductor 40, conductor 38b, solenoid 32b, contact 36b, shorting pin 84, contact 36c, conductor 67, arm 64, conductor 54 and ground 53 to move key 22 to an on position. Similarly key 24 will be moved to an off position when solenoid 42a is energized through a circuit including battery 39, conductors 40, 48a, solenoid 42a, terminal 46a, shorting pin 86, terminal 46c, conductor 68, arm 66, conductor 54 and ground 53. Pins 84, 86 fit snugly in board 29 so that they will stay in place when board 29 is assembled on panel 30. Board 29 has a pair of guide pins 90 that engage in sockets 91 in plate 72 to assure that board 29 is properly aligned with panel 30 and the shorting pins engage the intended contacts. By way of further example, to operate key 22 to an off position by piston 26 a shorting pin would be inserted through apertures 76a, 76c to engage contacts 34a, 34c. A shorting pin would be inserted through apertures 78b, 78c to operate key 24 to an on position by piston 26.

In accordance with one important aspect of the present invention, various stop combinations for each of the pistons 26, 28 can be set up on different boards identical to board 29 and each of the boards can be used when particular stop combinations are desired. When one of the boards is removed from panel 30 and another board is inserted to operate different stop combinations, the first board retains the stop combinations set up on the first board. Although a two-key, two-piston arrangement has been described hereinabove for purposes of illustration, an organ may have many more pistons, for example, thirty or forty pistons, and also have a large number of stop keys, for example, sixty stop keys. In accordance with

the present invention, the method and apparatus described hereinabove can be extended to large numbers of keys and pistons in a simple manner.

Referring to FIGS. 5-7, another embodiment of the present invention uses a static card reader 100 and a punched card 102 (FIG. 7) in place of the shorting board 29, panel 30 and pins 84, 86 described in connection with FIGS. 2-4, to selectively interconnect keys 22, 24 with pistons 26, 28 in accordance with a hole pattern punched on card 102. Although various static card readers could be used and the particular construction of reader 100 is not essential to the present invention, reader 100 generally comprises eight individual switches four of which art illustrated in FIGS. 5 and 6 and designated by numerals 104, 106, 108, 110. The switches 104, 106, 108, 110 are arranged to operate stop keys 22, 24 (FIG. 2) by means of piston 28. A second row of four switches (not shown) would also be included in reader 100 for operating stop keys 22, 24 by means of piston 26.

More particularly reader 100 comprises a stationary base 112, a pair of sides 114, 116 and a top 118. A horizontal shelf 120 extending between sides 114, 116 is mounted for vertically slidable movement in reader 100. A hand operated plunger 122 extends slidably through top 118 and is fastened at its lower end in shelf 120 to shift the shelf from a raised to a lowered position. A pair of compression springs 124 are mounted between shelf 120 and base 112 to spring bias shelf 120 away from base 112. Fastened on top 118 in the corners adjacent sides 114, 116 are a pair of stops 126 which limit upward travel of shelf 120. Fastened on base 112 in the corners adjacent sides 114, 116 are flat strips 128 that limit downward travel of shelf 120. Strips 128 each have an inner vertical face 130 which form a guide for card 102 when it is inserted into reader 100.

Each of the switches 104, 106, 108, 110 generally comprises a female contact socket 136 mounted in base 112, a stem 138 mounted in shelf 120 and a contact pin 140 yieldably and slidably retained in stem 138. Sockets 136, stems 138 and pins 140 are electrical conductors. The sockets 136 of switches 104, 106, 108, 110 are arranged in a horizontal row in base 112. The stems 138 of the switches 104, 106, 108, 110 are mounted in a row in shelf 126 and are vertically aligned with a corresponding socket 136. Each of the stems 138 has a split annular ridge 144 which yieldably engages in a mating annular groove 146 on a corresponding pin 140. With shelf 120 in a raised position illustrated in FIG. 5, the top of each pin 140 abuts top 118 and the lower end of each pin is disposed above card 102. Ridges 144 serve as yieldable detents so that pins 140 can move downward with shelf 126 but can ride out of stems 136 when a pin engages card 102. Sockets 136 of switches 104, 106 correspond to contacts 36a, 36b (FIG. 2) and would be wired to solenoids 32a, 32b, respectively, by conductors 38a, 38b as indicated by conductors in FIGS. 5 and 6 bearing like reference numerals. Sockets 136 of switches 108, 110 correspond to contacts 46a, 46b and would be wired to solenoids 42a, 42b, respectively, by conductors 48a, 48b. Stems 138 of switches 104, 106 correspond to contact 36c (FIG. 2) and would be wired to the contact for arm 64 by conductor 67. Stems 138 of switches 108, 110 correspond to contact 46c and would be wired to the contact for arm 66 by conductor 68.

Referring to FIG. 7, each card 102 may be formed of stiff paper material or the like and is fashioned with eight hole positions 161-168 shown in dash lines. Each of the hole positions 161-168 are preferably perforated to form a circular line of weakness and thus facilitate punching a hole at any selected position. The hole positions 161-168 are arranged in two horizontal rows of four hole positions each and four vertical rows of two hole positions each. The top horizontal row designated "Piston No. 1" corresponds to piston 26 (FIG. 2) whereas the second horizontal row designated "Piston No. 2" corresponds to piston 28 (FIG. 2). The first two vertical rows designated "Off" and "On" 75

under "Stop No. 1" correspond to off and on positions of stop key 22 (FIG. 2) whereas the last two vertical rows under "Stop No. 2" correspond to on and off positions for key 24. For purposes of illustration the hole positions 166, 167 have been punched out to correspond to the stop combination set up for piston 28 on the shorting board 29 (FIGS. 2-4). Card 102 is dimensioned relative to strips 128 such that the hole positions 165-168 in card 102 are vertically in line with a respective and corresponding one of the switches 104-110 and the hole positions 161-164 are vertically in line with the other four switches (not shown) corresponding to piston 26.

An organist can determine desired stop combinations and enter the combinations on one of the cards 102, as for example, by punching hole positions 166, 167 as illustrated in FIGS. 5-7. When that combination is to be used, the card is inserted into reader 100. When plunger 122 is pressed downwardly, shelf 120 moves downwardly carrying stems 138 and pins 140 downwardly until the pins reached card 102. With further downward movement of plunger 122, the pins 140 of switches 106, 108 move through the holes in hole positions 166, 167 and make electrical contact with the sockets 136 of switches 106, 108 to energize the on solenoid 32b of stop key 22 and the off solenoid 42a of stop key 24. However, the pins 140 of switches 104, 110 engage the card 102 at hole positions 165, 168 which have not been punched and these pins move upwardly out of the stems 138 so that switches 104, 110 do not close. When plunger 122 is released, springs 124 move shelf 120 upwardly to its raised position where pins 140 are reset in stems 138 by engaging top 118.

Reader is similar in many respects to card readers of the type disclosed in United States Letters Patent No. 2,924,678, granted Feb. 9, 1960, in the name of R. D. Hickok, Jr., and entitled "Switch and Method of Assembly." Various other circuit connections of a card reader can be used. For example, one switch in the reader can be used to operate a single-pole, double-throw relay that is biased, electrically or mechanically, to one normal contact position. In this normal position one of the stop key solenoids will be energized when a piston is operated and the switch in the reader is open. However when the switch in the reader is closed and the piston is operated, the relay will trip to its other position and the other stop key solenoid will be energized. Thus only one card position can be used to indicate when a stop key is to be moved to an on position or to an off position.

When several stop combinations for one or more of the pistons are determined and set up on different shorting boards 29 (FIGS. 3-4) or on different punched cards 102 (FIGS. 5-7) any of the stored combinations can be recalled at any time by merely selecting the appropriate board or card and inserting the board into panel 30 or the card into the reader 100. If it is desired to change the combination for one or more of the pistons, the first board or card is merely removed and a new board or card having the desired combinations is inserted. Limitless combinations are available by merely selecting boards or cards which are set up in advance and stored for use at any desired time in the future. An organist may at his leisure, determine in advance of a performance, particular stop combinations that will be required and enter the combinations on one or more boards or cards. During the performance stop combinations for one or more of the pistons can be changed by merely changing boards or cards depending on the system being used. Although various types of cards and boards are useful with the present invention, it will be understood that particular cards and boards must be indexed and programmed for a particular organ or type of organ. The combination action disclosed and described hereinabove is very dependable, versatile, and simple in operation and construction.

What is claimed is:

1. In a combination action for use with an organ or the like having a plurality of manual stop switches, a plurality of manual combination switches, electrical actuating

means for operating each of said stop switches, electrical actuated means operated by each of said combination switches and combination selecting means operative in response to one of said combination switches for substantially simultaneously operating a predetermined combination of said stop switches, that improvement wherein said combination selecting means comprises a first unit and a second unit, said first unit having electrically discontinuous connections between each of said actuating means and each of said actuated means arranged and adapted to be completed in selected combinations, said second unit being separate and detachable from said first unit and having data storage conditions corresponding to an electrical connection for completing each of said discontinuous connections, and circuit connection means in one of said units for completing selected ones of said discontinuous connections in accordance with preset conditions of said second unit.

2. In a combination action for use with an organ or the like having a plurality of manual stop switches, a plurality of manual combination switches, and combination selecting means operative in response to actuation of one of said combination switches for substantially simultaneously operating a predetermined combination of said stop switches, that improvement wherein said combination selecting means comprises combination data storage means having data for a predetermined combination of stop switches for said one combination switch, and data operated means operable in accordance with the data combination of said storage means and the actuation of said one combination switch to operate substantially simultaneously the predetermined combination of said stop switches said data storage means being a separate and removable unit of the combination selecting means so that other data storage means can be interchanged readily with the first-named storage means, said combination selecting means having discontinuous electrical connections disposed between each of said stop switches and said combination switch, the data of said data storage means including preselected electrical connections for certain of said discontinuous electrical connections so as to provide for operation of said predetermined combination of stop switches when said combination switch is actuated.

3. In an organ or the like having a plurality of manual stop switches and a plurality of manual combination switches, a combination action for operating a predetermined combination of said stop switches in response to actuation of one of said combination switches comprising a first solenoid and a second solenoid for each of said stop switches arranged and adapted to operate said stop switches to a first condition and to a second condition, a source of electrical energy, a first contact connected in series with said first solenoid and said source, a second contact connected in series with said second solenoid and said source, a third contact connected in series with said one combination switch and said source, and detachable means for establishing a preselected electrical connection between either said third contact and said first contact or between said third contact and said second contact comprising a detachable combination data storage means having a data combination corresponding to an electrical connection between said third contact and a preselected one of said first and second contacts, and means responsive to the data combination of said storage means and said one combination switch for establishing an electrical connection between said third contact and the preselected one of said first and second contacts.

4. In a combination action for use with an organ and the like having a plurality of manual stop switches, a plurality of manual combination switches, and combination selection means operative in response to actuation of one of said combination switches for substantially simultaneously operating a predetermined combination of

said stop switches, that improvement wherein said combination selection means comprises electrical circuit means for each of said stop switches to determine a first or a second condition of each of said stop switches, master contact panel means permanently wired to said circuit means and to said combination switches, each stop switch circuit means having a separate contact group on said panel means for each of said combination switches, each of said contact groups having contacts arranged and adapted to connect its circuit means and its combination switch to energize its circuit means and determine said first or said second condition of a stop switch, a combination data storage means, means for releasably receiving said data storage means, said data storage means having data storage conditions corresponding to said first and said second condition of said stop switches for each of said combination switches, and means associated with said data storage means for interconnecting contacts in said contact groups in accordance with the storage condition of said data storage means, said data storage means being detachable from said receiving means to permit substitution of other data storage means in said receiving means for other determinations of the first and second conditions of said stop switches.

5. The combination action set forth in claim 4 wherein said contact groups are arranged in a matrix plan having a first plurality of rows in a first direction and a second plurality of rows in a second direction, said contact groups in each of said first rows corresponding to one stop switch for each of said combination switches, and said contact groups in each of said second rows corresponding to stop switches for one of said combination switches.

6. The combination action set forth in claim 4 wherein said receiving means includes a fixed plate having insertion holes corresponding to each contact in each of said contact groups, and each of said data storage means includes a separate plate having insertion holes corresponding to each of said storage conditions, and a plurality of electrical contact pins releasably mounted in said insertion holes in said separate plate in a predetermined pattern corresponding to predetermined stop combinations, said pins projecting outwardly from one side of said separate plate and being arranged and adapted to penetrate said insertion holes of said fixed plate into engagement with certain of said contacts.

7. The combination action set forth in claim 4 wherein said data storage means is a punched card having a plurality of hole positions corresponding to contacts in each of said contact groups, said hole positions being apertured in a predetermined pattern corresponding to predetermined stop combinations, and said means for interconnecting contacts in said contact groups comprises a card reader for receiving said card to connect contacts in said contact groups in accordance with said predetermined pattern of apertured hole positions.

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U.S. Cl. X.R.

84—103