

[54] **MECHANICALLY KEYED OPTICAL ORGAN**

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 [51] Int. Cl. .... **G10h 3/06**  
 [58] Field of Search ..... **84/1.18**

[56] **References Cited**  
**UNITED STATES PATENTS**

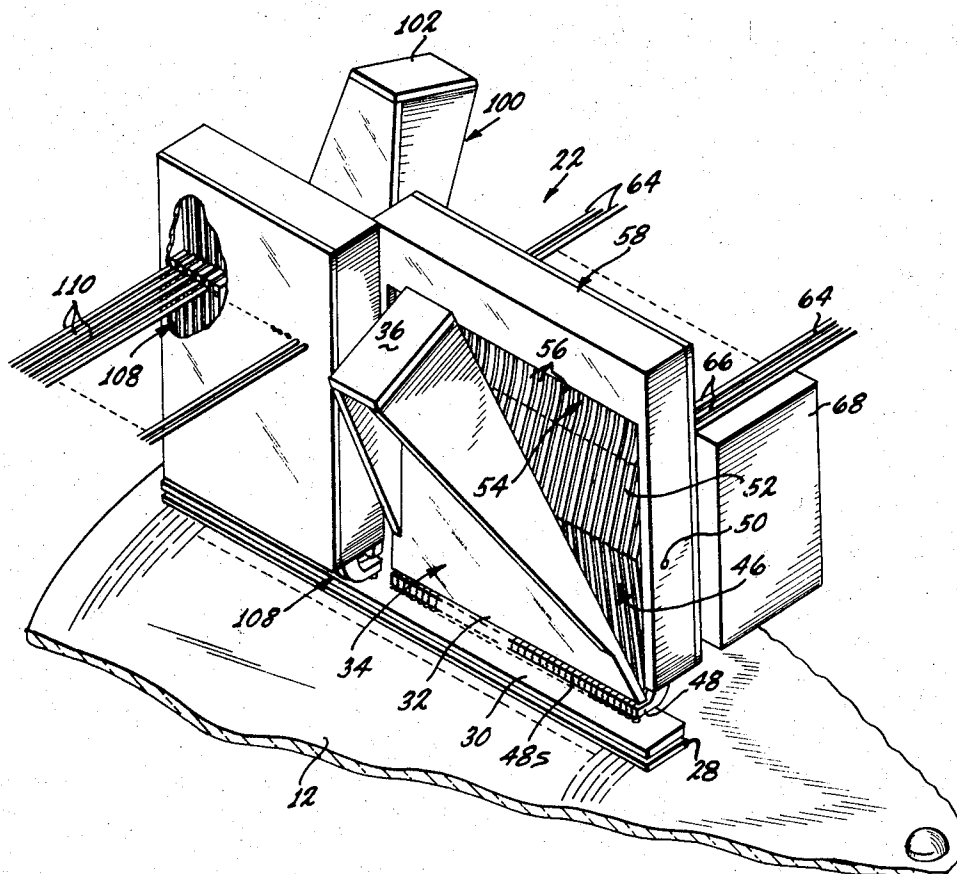
2,734,416	2/1956	Corwin .....	84/1.18 X
2,946,252	7/1960	Clark .....	84/1.18 X
3,250,844	5/1966	Rieth .....	84/1.18
2,586,664	2/1952	Knoblauch.....	84/1.18
2,796,534	6/1957	Williams .....	84/1.18 X

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[57] **ABSTRACT**

An optical organ of the type which shines light through the tracks of a rotating optical record onto photocell apparatus and which utilizes depressable keys to play selected tracks, wherein only one or a few photocells are required. The keys are connected to slideable rods that deflect small light control members positioned between the record and photocell. In one organ, the deflectable members are pivotally mounted shutters with corrugated side walls that interfit one another to prevent the leakage of light between the shutters. In another organ, the deflectable members are resilient light-conducting fingers formed in a sheet-like edge portion of a transparent member, each finger being deflectable to a position where its end can pick up light from a particular optical track and carry it to the photocell.

**16 Claims, 16 Drawing Figures**



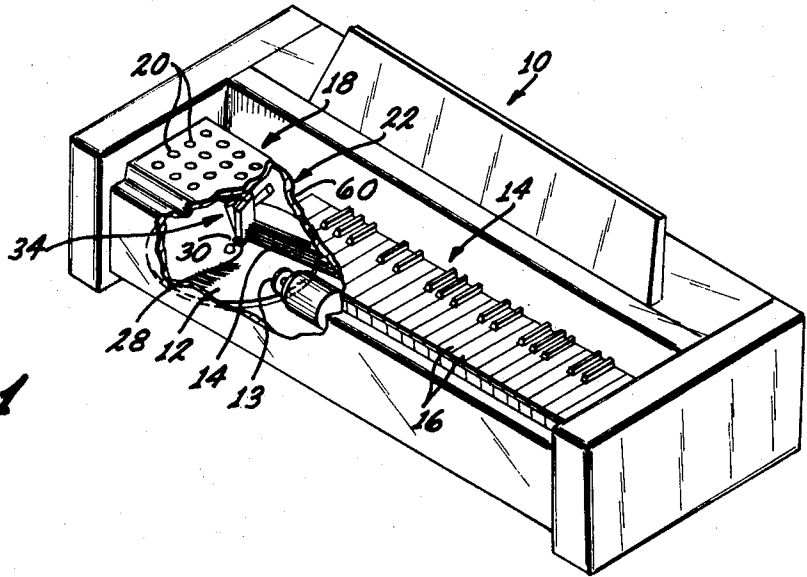


FIG. 1

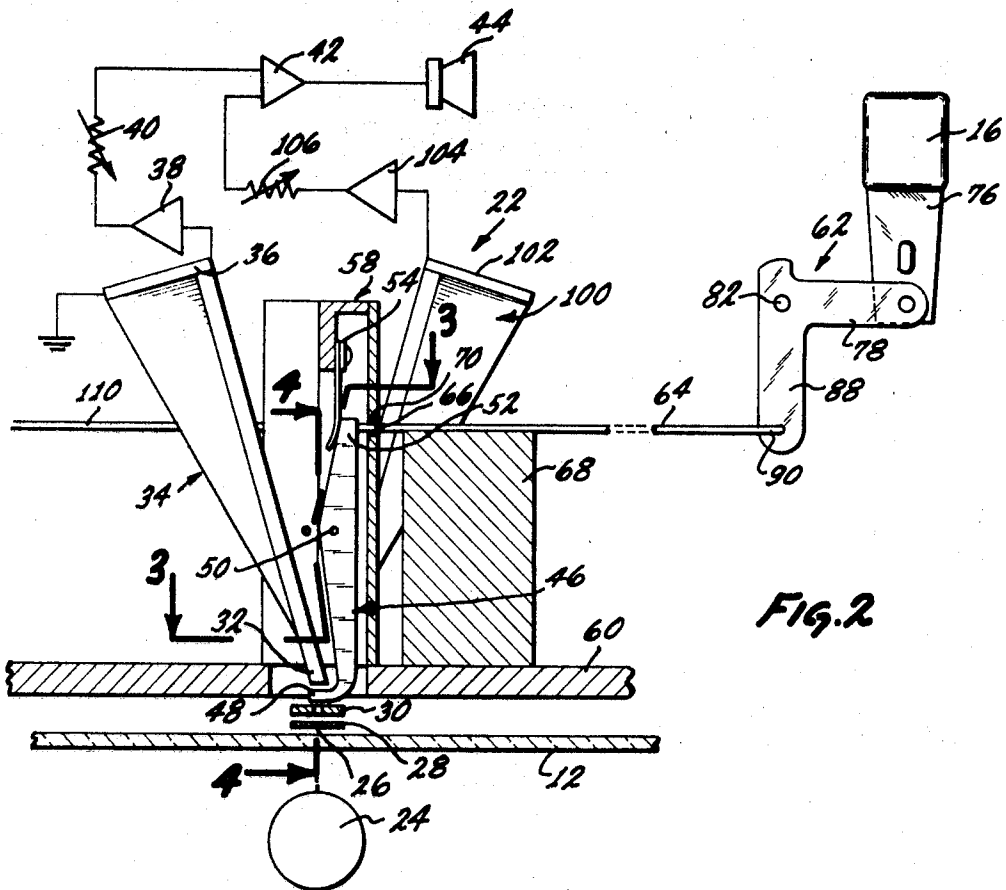


FIG. 2

FIG. 3

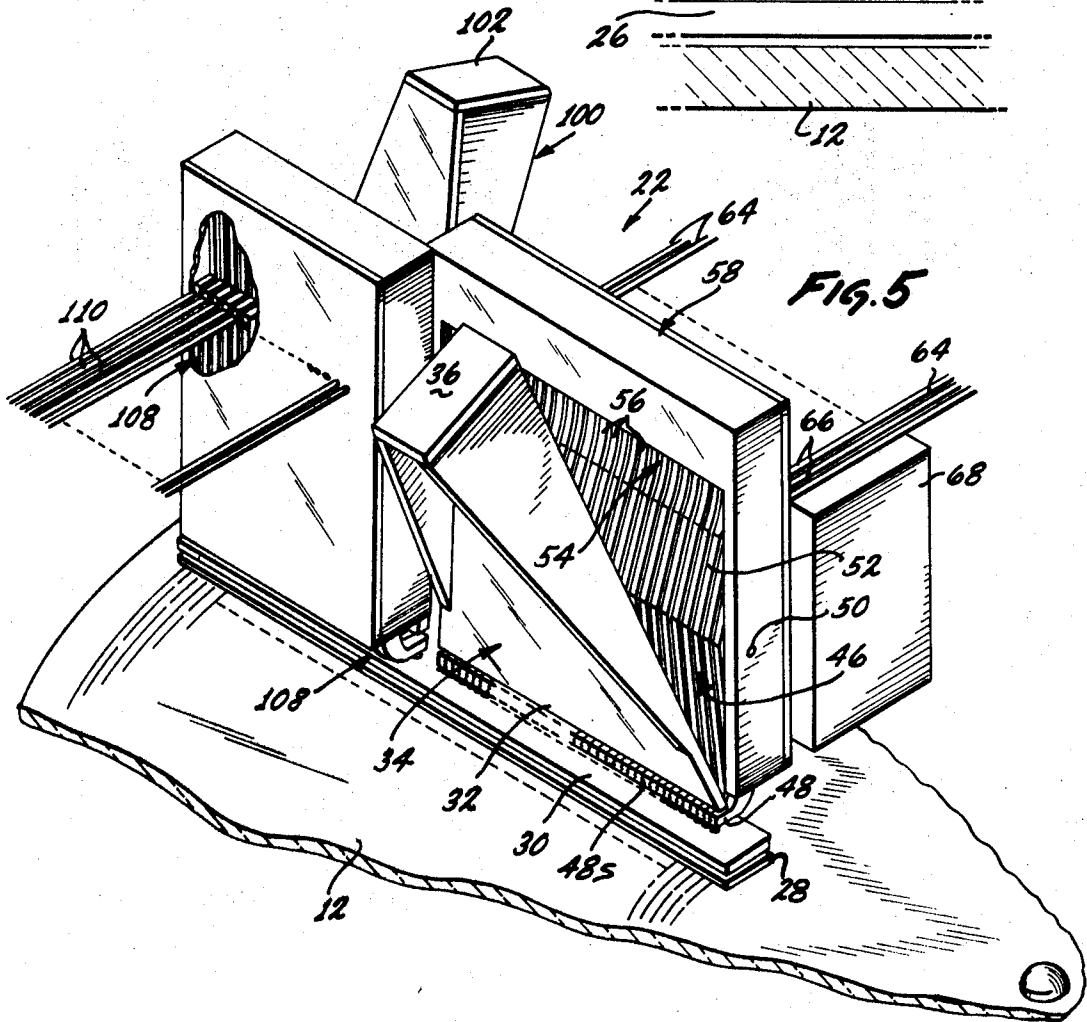
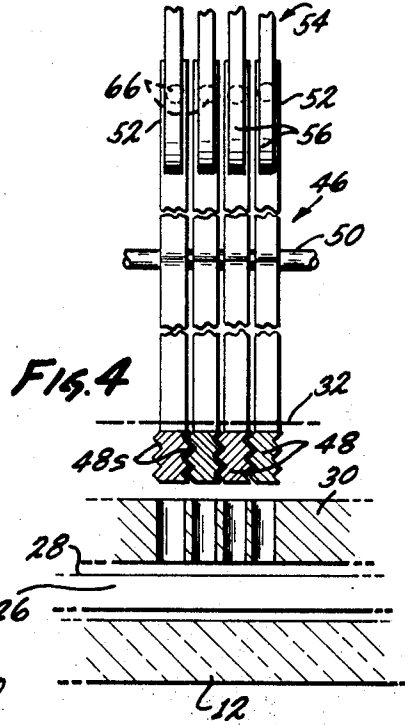
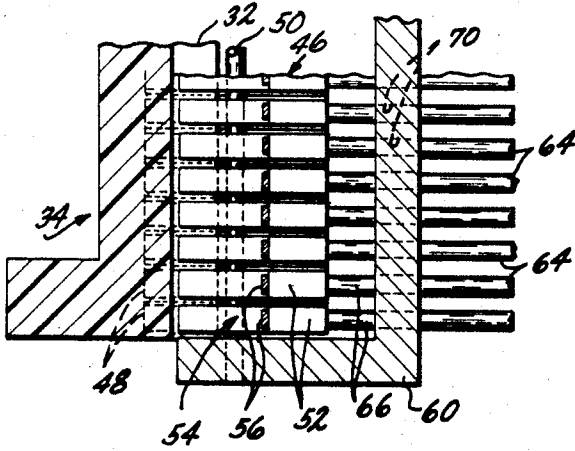
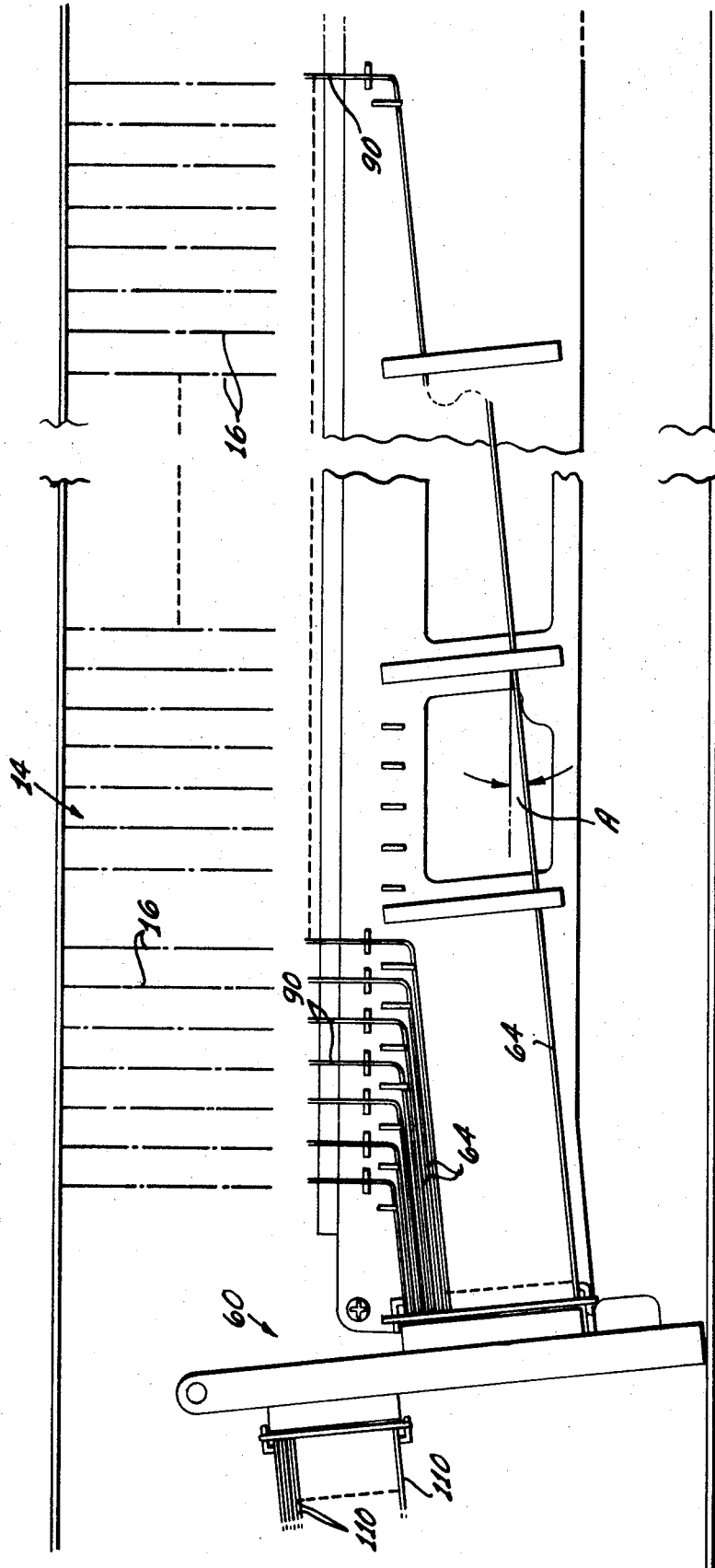
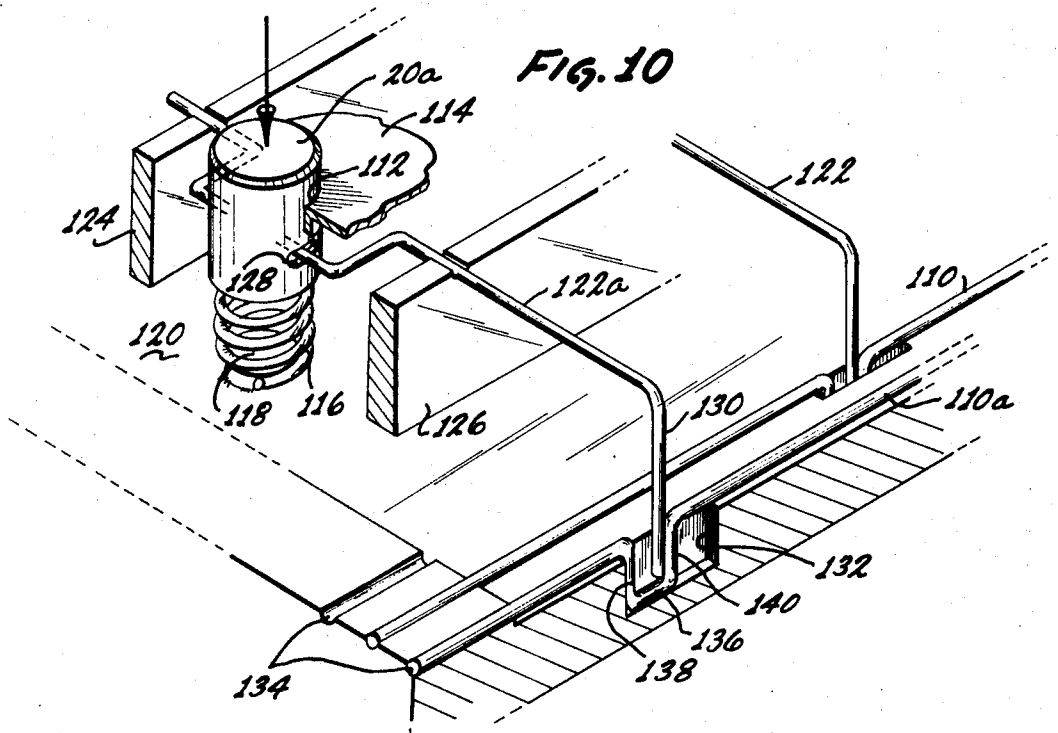
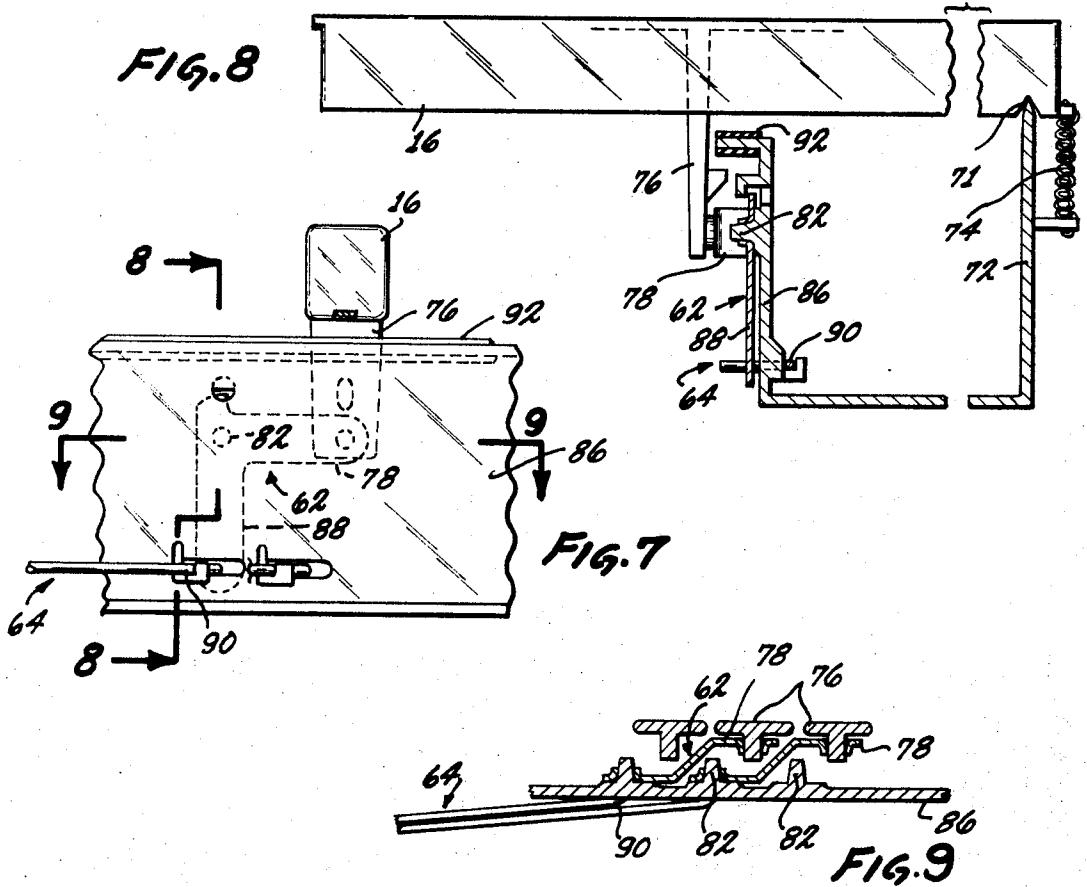


FIG. 6





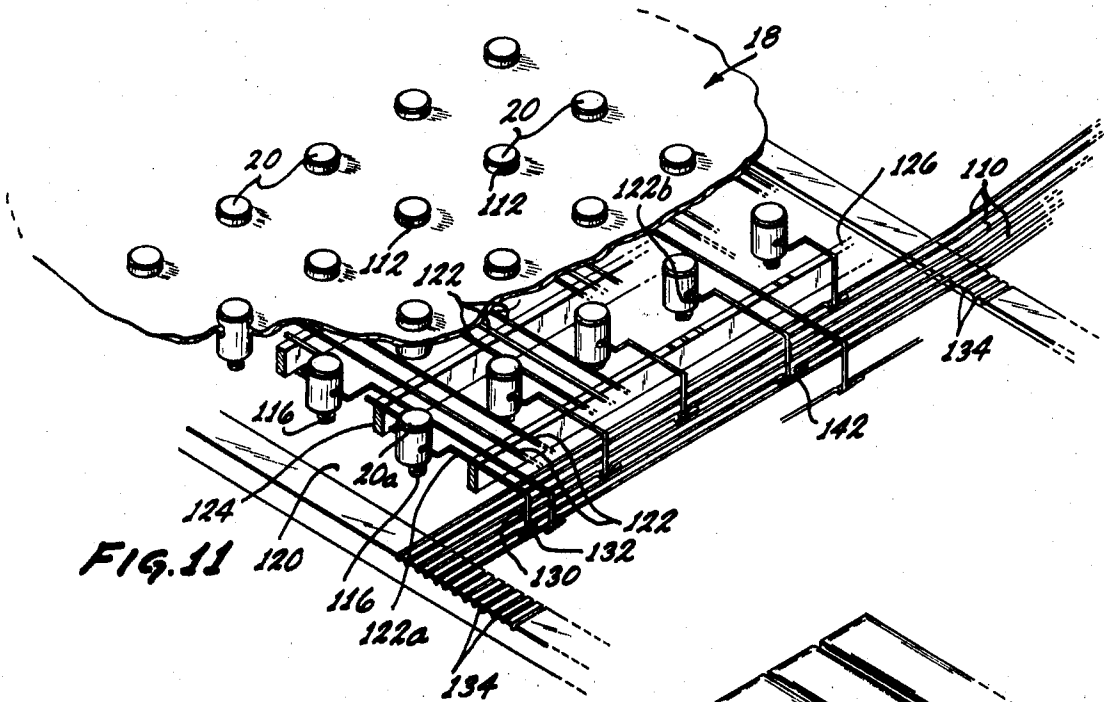


FIG. 11

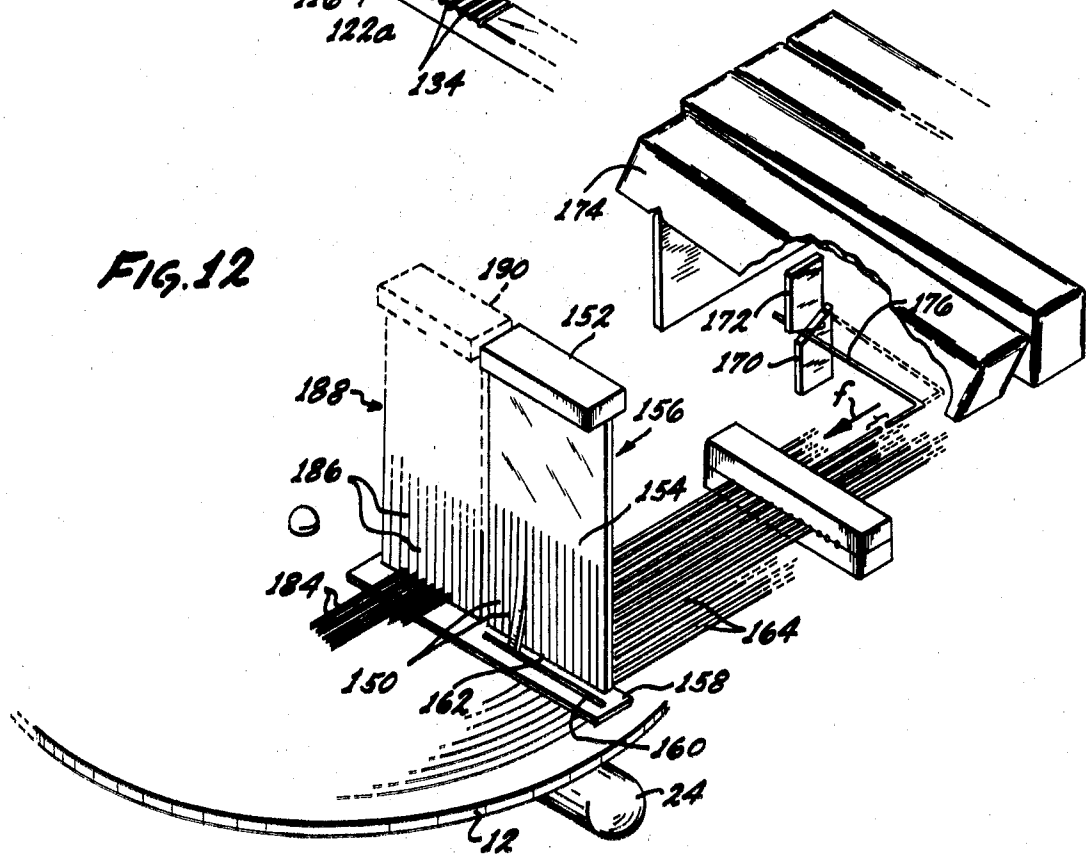
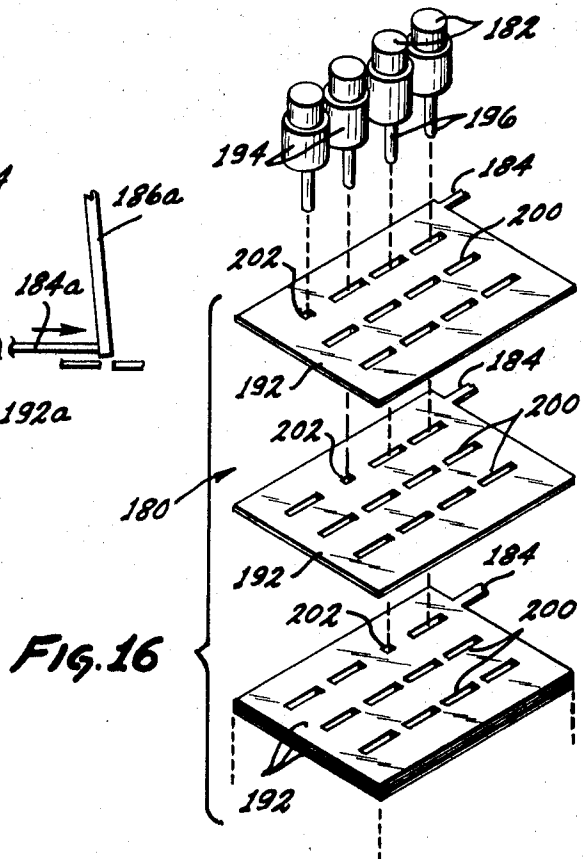
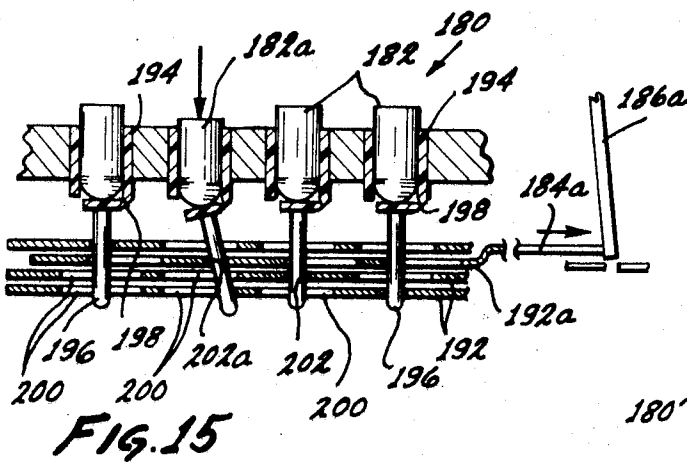
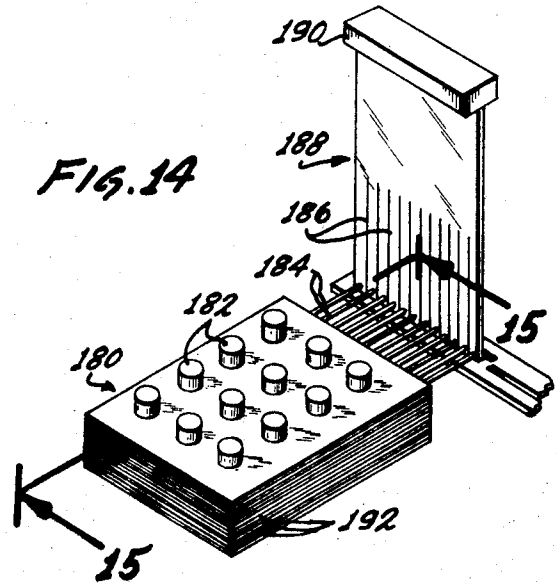
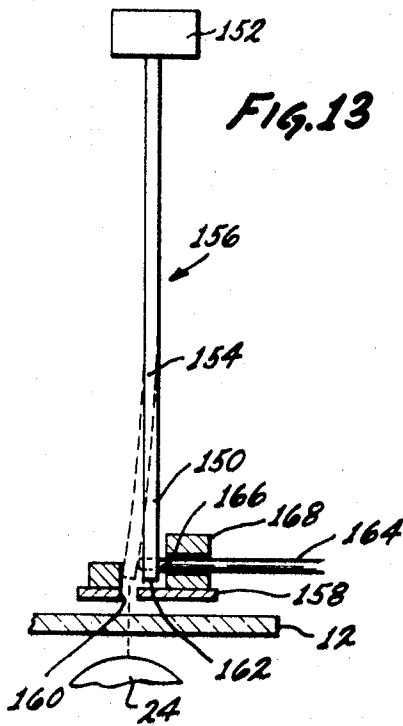


FIG. 12



**MECHANICALLY KEYED OPTICAL ORGAN****BACKGROUND OF THE INVENTION**

This invention relates to optical organs.

Optical organs of moderate cost can be constructed by utilizing a disc record containing numerous concentric optical tracks. As the disc is rotated, light shines through the tracks onto photocell apparatus which generates electrical signals that are amplified and which drive a loudspeaker. It is inherent that an organ contains numerous keys that can be selectively operated to play different sounds, and it is necessary to connect each key so that a corresponding optical track is played only when that key is depressed. The cost of providing such connections is considerable because even relatively simple organs that are to be more than mere toys require a large number of optical tracks, such as 50, and a corresponding number of keys or buttons. Also, the optical tracks are closely spaced from one another on the optical record, so that the connecting devices must be small.

One type of optical organ utilizes a large number of tiny photocells, one photocell being positioned opposite each track of the record to pick up light only from that track. A large number of electrical conductors extend from the photocells to the numerous keys, and an electrical switch is provided at each key to control the passage of current from a corresponding photocell to an amplifier. The cost of the numerous photocell switches and their interconnections is considerable. In addition, problems of stray current pickup are encountered due to currents, since they received light through a very thin slit, and because these currents must travel a considerable distance to the switches at the keyboard.

**SUMMARY OF THE INVENTION**

In accordance with one embodiment of the present invention, an optical organ is provided for use with an optical disc record that has numerous closely spaced optical tracks, which utilizes a relatively simple and economical apparatus for controlling the playing of the different tracks from the manually depressable keys. The organ includes numerous closely spaced rods slideably mounted on the frame of the organ, each rod having an inner end connected to a key so that depression of the key causes the rod to slide along its length. The opposite ends of the rods about a row of light shutters which normally block the passage of light from the record tracks to a photocell. When a key is depressed to slide a corresponding rod, the rod moves a corresponding shutter out of a blocking position so that light from a corresponding record track can fall on the photocell. A single photocell picks up all light that passes by the shutters. The shutters have corrugated side portions that interfit one another to prevent the leakage of light between the shutters.

In another embodiment of the invention, the passage of light to the photocells is controlled by numerous light conducting fingers that can be individually deflected to conduct light from corresponding record tracks to a photocell. The fingers are formed by slits in a sheet-like edge portion of a transparent member. The fingers normally lie at positions wherein their ends face an opaque region of a mask. However, each finger can be deflected so its end lies over a slit in the mask, to pick up light from one track and carry it to a photocell. The optical fingers are deflected by the ends of rods

that are slideably mounted on the organ frame and which are slid by keys, as described above.

The novel features of the invention are set forth with particularity in the appended claims. The invention will best be understood from the following description when read in conjunction with the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a perspective view of an organ constructed in accordance with one embodiment of the present invention, with portions of the organ housing removed to show some of the internal mechanisms;

FIG. 2 is a partial substantially front sectional view of the organ of FIG. 1;

FIG. 3 is a view taken on the line 3—3 of FIG. 2;

FIG. 4 is a view taken on the line 4—4 of FIG. 2;

FIG. 5 is a partial perspective view of the mechanism of FIG. 2;

FIG. 6 is a partial plan view of the organ of FIG. 1;

FIG. 7 is a partial front elevation view of the keyboard in the organ of FIG. 1;

FIG. 8 is a view taken on the line 8—8 of FIG. 7;

FIG. 9 is a view taken on the line 9—9 of FIG. 7;

FIG. 10 is a partial perspective view of the keyboard linkage of the organ in FIG. 1;

FIG. 11 is a partial perspective view of the chord section linkage;

FIG. 12 is a partial perspective view of an organ constructed in accordance with another embodiment of the invention;

FIG. 13 is a partial sectional view of the organ of FIG. 12;

FIG. 14 is a partial perspective view of the chord section linkage of the organ of FIG. 12;

FIG. 15 is a sectional view taken on the line 15—15 of FIG. 14; and

FIG. 16 is a partial exploded view of the chord section mechanism of FIG. 14.

**DESCRIPTION OF THE PREFERRED EMBODIMENTS**

FIG. 1 illustrates an organ 10 which utilized a changeable optical disc record 12 that contains numerous concentric optical tracks and that is rotated by a motor driven wheel 13. Some of the tracks define sustained notes of different pitches while other tracks define accompaniment patterns of notes. The organ includes a piano type keyboard 14 with numerous keys 16 that can be selectively depressed by a musician to play one of the optical tracks that represents a sustained tone. That is, the depression of one of the keys 16 results in the sounding of a corresponding note. The organ also includes a chord section 18 with numerous button-like keys 20 that also can be manually depressed by a musician. Depression of one of the keys or buttons 20 results in a corresponding record track being played which defines an accompaniment sound. The sounds are produced by shining light through all of the record tracks as the record rotates, and by picking up the light with a photocell. Each record track varies in width, so the tracks create light beams which time vary in predetermined patterns. A compact playing head apparatus 22 permits the selection of particular tracks by controlling the passage of light to the photocell. Linking mechanisms connect the keys 16 of the keyboard and connect the buttons 20 of the chord sec-



tion, to the playing head apparatus 22, so that the passage of light from a particular record track to the photocell occurs only when a corresponding key or button is depressed by the musician.

FIGS. 2-5 illustrate details of the playing head apparatus 22. A lamp 24 lies beneath the record 12 and shines light through the record, through a narrow slit 26 in a mask 28, through a collimator 30 and onto a pickup region 32. A light collector 34 is positioned with a light-receiving end thereof at the pickup region 32. The light collector 34 carries light received at the pickup region 32 to a photocell 36. The photocell generates currents corresponding to the light incident thereon and passes the currents through a pre-amplifier 38 and a volume control 40 to an amplifier 42 that drives a loudspeaker 44.

Normally, all light passing through the tracks of the record 12 are prevented from reaching the pickup region 32 by a row of shutters 46. Each shutter has a blocking portion 48 that normally lies between the record 12 and the pickup region 32. The shutters are pivotally mounted on a shaft 50 that extends through holes in the shutters, and each shutter also has an operating end 52 opposite the blocking portion 48. The operating end 52 of each shutter can be deflected to cause the shutter to pivot and move the blocking portion 48 out of a blocking position. This permits light from one of the optical tracks to reach the pickup region 32 and therefore to be received by the photocell 36. A spring member 54 has numerous spring fingers 56 bearing against the operating ends of the shutters to urge them toward a blocking position. The spring member 54 as well as the axle 50 are fixed to a head mount 58 that is fixed to the frame 60 of the organ.

The deflection of the shutters 46 is controlled by pivoting of the keys 16. Each key is pivotally mounted on the organ frame 60 so that when a forward end of a key is depressed, a crank 62 pivotally mounted on the frame pivots and causes a long rod 64 to slide along its length. The organ includes numerous rods 64, each having an outer end 66 that bears against the operating end 52 of a corresponding light shutter. When the rod 64 slides along its length towards the head assembly 22, it deflects a corresponding light shutter 46 to an unblocking position, so that light from a corresponding track of the record 12 can reach the pickup region 32 for transmission to the photocell 36. Thus, the depression of any key 16 of the keyboard results in the playing of a corresponding record track.

The rods 64 slide along a bearing plate 68 of the frame and pass through holes 70 formed in the head mount 58, so that the positions of the outer ends 66 of the rods are closely controlled. The mounting of the rods and their connection to the keys 16 is best illustrated in FIGS. 6-9. Each key 16 of the keyboard has a recess 71 near its rearward end, where it receives and is pivotally mounted on a pivot bar 72 of the frame. A spring 74 urges the key to pivot in a direction to cause its forward end to move up. The key also has an arm 76 that extends downwardly from a middle portion of the key and which is pivotally connected to an arm 78 of the crank 62. The crank 62 is pivotally mounted on a trunnion 82 of a support bar 86 of the frame. The crank also has a downwardly extending arm 88 that is engaged with an inner end 90 of a rod 64. When the key 16 is depressed, the crank 62 pivots so that its downwardly extending arm 88 moves towards the playing

head assembly 22 and therefore slides the rod 64 in that direction, to cause deflection of a corresponding light shutter out of a light blocking position. When the key is released, the arm 64 moves up until it hits a stop 92, and it also causes the crank to pull the rod 64 back to its original position. It may be noted that the crank 62 not only connects the key to a rod, but also serves to stabilize the key against shifting and wobbling.

The numerous keys 16 of the keyboard are all pivotally mounted on the frame and coupled to their respective rods 62 in the same manner. It is desirable to construct the organ so that the distance between the front of each white key and the pivot point is the same for all keys, and the distance between the front of each white key and the location where it is coupled by a crank to a rod 64 is the same for all keys. This allows all of the white keys to have the same "feel," that is, it provides all keys with the same resistance to depression and results in a uniform distance of key depression to cause playing of notes. A similar uniformity is desirable for all black keys.

The pivot bar 72, which pivotally supports the keys, and the bar 86, on which the cranks are mounted, extend parallel to one another along the width of the organ frame. The rods 64, however, extend at a slight angle A such as 3° from an imaginary laterally extending line. The angle A is chosen so that for a given spacing of the keys from one another along the width of the keyboard, such as an inch, the outer ends 66 of the rods will be spaced from one another in a direction perpendicular to their length by distances equal to the spacing of the record tracks, such as 0.05 inch. This slight angling of the rods 64 provides a close but sufficient spacing to accommodate a large number of thin rods on the organ frame. All of the cranks 62 are identical and are identically connected to their respective keys and rods. The rods 64 are all of different lengths, but they are otherwise identical. The rods 64 can be formed from standard straight rods by cutting off lengths of the required size and forming their inner ends with identical bends. The rods can be easily formed at low cost, and require a minimum of tooling even though a large number of rods is used in each organ and all of the rods are different in length.

One of the problems that can be encountered in the use of numerous light shutters that are closely spaced from one another, is that light can sometimes leak between the shutters and be picked up by the photocell. The amount of light that can leak between the shutters is very small where the shutters are accurately constructed and mounted, so that the leakage light creates a sound of such low intensity that it is not noticeable when any of the tracks is being played. However, when none of the tracks is being played and it is desired to create no sound at all, even a low level of light leakage can create an audible sound that can be annoying.

In order to minimize leakage, the shutters are constructed as illustrated in FIG. 4, with corrugated sides 48 at their blocking portions, and with the corrugated sides interfitting one another. The interfitting corrugated sides greatly reduce the amount of light leakage, so that the organ is much quieter when none of the keys is being depressed. If desired, electrical circuitry can be provided that prevents any signals from reaching the amplifier if the signals are of an extremely low amplitude which is less than results from playing a track, or mechanical devices can be utilized to sense when at

least one key of the keyboard is depressed and to turn on the amplifier only then.

It would be possible to utilize the same light collector 34 and photocell 36 for both the optical tracks played by keys 16 of the keyboard and the tracks played by buttons 20 of the chord section. However, the present organ utilizes a separate light collector and photocell in order to allow independent control of the volume of the keyboard section and of the chord section. As illustrated in FIG. 2 and 5, a separate light collector 100, photocell 102, preamplifier 104 and volume control 106 are utilized for the chord section. In addition, a separate row of shutters 108 is utilized which is substantially identical to the shutters 46. The chord section shutters 108 are moved by rods 110 which are slideably mounted on the frame and which deflect the shutters 108 in the same manner as the rods 64 deflect their shutters 46. A different mechanism, however, is utilized to convert depressing forces applied to a chord section button 20 into sliding movement of a chord section rod 110.

FIG. 10 illustrates the manner in which a chord button 20a is coupled to corresponding chord section rod 110a to slide the rod along its length. The button 20a is slideably mounted in an aperture 112 formed in a cover plate 114. The button is constantly urged upwardly by a spring 116 which extends between a lower end of the button and a spring holder 118 formed on a mounting plate 120 of the organ frame. A linking member or rod 122a which is pivotally mounted on a pair of upstanding flanges 124, 126, extends through a slot 128 formed in the button, so that when the button 20a is depressed, the linking rod 122a is pivoted. The linking rod 122 is formed with an arm 130 that is received in a slot 132 of the mounting plate 120. The chord section rod 110a is slideably mounted in recesses 134 formed on the mounting plate, and has a bend 136 lying in the slot 132. The bend 136 forms a return curve with a pair of legs 138, 140, and the arm 130 of the linking rod lies between these legs 138, 140. When the rod 122 pivots, in response to the depression of the button 20a, the arm 130 pushes against an arm 140 of the chord section rod 110a and causes the rod to slide along its length. When the button 20a is released, the arm 130 pushes against the other leg 138 of the rod 110a to return it to its original position.

The chord section includes numerous buttons 20 that are mounted close together, as illustrated in FIG. 11. Each of the buttons is mounted similarly to button 20a and is connected by a corresponding linking rod 122 to a corresponding chord section rod 110. The organ is constructed so that some of the chord buttons 20 play the same record tracks. Thus, the chord section rod 110a has a second bend 142 where it receives an arm of another linking rod 122b.

The chord section apparatus can be constructed at relatively low cost, because it utilizes a minimum of parts, and because most of the parts are identical. Thus, a single mounting plate 120 can be utilized, which can be formed with numerous slots, and the buttons 20 all can be constructed and mounted identically. The major different parts are the linking rods 122 and the chord section rods 110. These rods all can be constructed from simple rods of the same kind that are used for the keyboard rods, by merely cutting and bending the rods at appropriate places. Thus, even though the numerous buttons of the chord section require numerous con-

necting devices, the chord section can be constructed at low cost.

FIGS. 12-16 illustrate another organ constructed in accordance with the invention, which utilizes numerous light transmitting members or fingers 150 that can carry light from an optical track to a common photocell 152. Unlike the light shutters of the previous embodiment of the invention, the movable members 150 do not block the passage of light but instead carry the light. The fingers 150 are formed on a sheet-like edge portion 154 of an optical member 156, the edge portion 154 having numerous parallel slits that form the fingers 150. A mask 158 blocks the passage of light from the record 12 to the ends of the fingers 150. The mask 158 has a slit 160 spaced a slight distance from the ends 152 of the light fingers when the fingers are in their nondeflected positions. Each of the fingers 150 can be deflected to a position where its extreme end or tip 162 lies over the slit 160 and can pick up light and transmit it to the photocell 152. Where the record 12 is spaced appreciably from the mask and light fingers, a collimator can be utilized to assure that only light from one track reaches the tip 162 of a corresponding light finger when the light finger is over the slit 160.

The light fingers 150 are deflected by rods 164 that are mounted for sliding along their length on the organ. The outer ends 166 of the rods pass through holes in a guide 168 and can push against the light fingers to deflect them. It may be noted that the light fingers are constructed with smooth exterior surfaces so that they pick up light only at their tips 162. Furthermore, if necessary, the light fingers and even the rest of the optical member 156 can be coated with a film of aluminum or silver to prevent pick up of light except at the tips of the fingers and to reduce losses of light picked up thereat.

The rods 164 can be connected to keys of the keyboard in a variety of ways. One method, illustrated in FIG. 12, involves the use of a pair of angled camming members 170, 172 respectively mounted on the frame of the organ and a key 174. The inner end of 176 of each rod is bent to extend between the cam members, so that when the key 174 is depressed, the inner end rod 176 is moved to one side and it causes the major length of the rod 164 to slide and thereby deflect a light finger.

FIGS. 13-16 illustrate details of a chord section assembly 180 which includes button-like keys or buttons 182 that slide up and down. Depression of each of the buttons results in sliding of a corresponding rod portion 184 that deflects a corresponding light finger 186 of another optical member 188 which carries light to another photocell 190. A stack of plates 192 is slideably mounted beneath the buttons 182, and the rod portions 184 that deflect the light fingers are formed by thin connecting regions 198. The guides 194 are constructed of flexible material such as polypropylene so that the connecting regions 198 serve as hinges. Each of the fingers 196 extends through slots formed in the plates 192. Most of the slots 200 in the plates are long, but each plate carries at least one narrow slot 202 which is shorter than the others. When a button such as button 128a is depressed, a corresponding finger 196a is pivoted and it moves sidewardly through all of the slots. Only one of the slots 202a in the plate 192a is short enough, so that a finger 196a will push the plate sidewardly. Accordingly, only that plate 192a will shift

sidewardly so that its rod portion 184a will deflect a corresponding light finger 186a.

The use of an optical member with a sheet-like edge portion divided into numerous optical fingers can simplify the organ construction. The numerous optical fingers 154 on the optical member 156 can be formed integrally with one another by injection molding or other forming operations, and the mounting of the fingers is simplified since only the single member 156 need be accurately mounted. A variety of optical materials can be utilized, such as Lucite plastic, which can transmit light and which are sufficiently flexible.

Thus, the invention provides a simplified optical organ utilizing deflectable elements to control the passage of light from numerous closely spaced optical tracks of a record to one or some other limited number of photocells. The deflection of the light controlling members is accomplished by the use of simple rods which are slideably mounted on the organ frame. In the case of the keyboard, particularly, the use of numerous rods that extend parallel to one another and which are closely spaced from one another, permits the construction of a compact organ using low cost components. The rods have outer ends adjacent to the deflectable members and have inner ends that are connected to the same locations at all of the keys of the keyboard, so that all of the keys have the same "feel." The rods are slideably mounted on the frame so that they extend at a small angle from an imaginary laterally extending line which is parallel to the axes of pivoting of the keys on the keyboard. Rods can be utilized at the chord section by forming them with bends that are received in slots of a mounting plate, and by utilizing additional linking rods connected to the chord buttons to slide the chord section rods that deflect the shutters. In one organ, light shutters are utilized which are deflected by the rods. The light shutters have corrugated and interfitting side walls to minimize the leakage of light around them. In another embodiment of the invention, the light control members actually carry light at least part of the way along the light path extending from the optical track to the photocell. The light carrying members or fingers can be deflected from a normal position wherein they do not carry light along this path to a position to carry light therealong. The light fingers can be formed along an edge portion of a unitary optical member, so that the fingers are formed integrally and are mounted in a simplified manner. The fingers can be mounted so that tips thereof which can pick up light are normally spaced from a slit in a mask, but the fingers being deflectable over the slit to pick up light from the optical tracks.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art and consequently it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. An organ comprising:

- a frame;
- means mounted on said frame for rotating an optical record that has numerous closely spaced optical tracks;
- a light source on said frame for shining light through the optical record;

light pickup means including a photocell, positioned on a side of the record opposite the light source for generating electrical signals corresponding to the light reaching the light pickup means;

a plurality of closely spaced shutters movably mounted on the frame, each shutter pivotable between a blocking position wherein it blocks the passage of light from an optical track to the light pickup means, and an unblocking position spaced therefrom;

spring means for urging said shutters toward said blocking positions;

a plurality of rods slideably mounted on said frame for sliding along their length, each rod having a first end which bears against one of said shutters and an opposite second end; and

a plurality of manually depressable keys coupled to said second ends of said rods to slide them along their lengths.

2. The organ described in claim 1 wherein said shutters have end portions normally lying between the record and light pickup means, which have corrugated sides that interfit one another.

3. The organ described in claim 1 wherein: said shutters are pivotally mounted on a common axle that is mounted on the frame and that extends through holes in the shutters; and said first ends of said rods abut portions of the shutters which lie opposite the shutter portions that normally block light from passing from the record to the pickup means.

4. An organ comprising:

means defining a plurality of light pickup regions; means for directing a plurality of light beams which time vary in predetermined patterns at said pickup regions;

photocell means responsive to light at said pickup regions for generating electrical currents;

means responsive to said photocell means for generating sounds;

a plurality of light shutters selectively movable between first and second positions wherein they respectively block or unblock said light beams from reaching said pickup regions; and

manually operable means for moving said shutters, said shutters having corrugations on opposite sides that interfit the corrugations on adjacent shutters, whereby to minimize leakage of light between shutters.

5. An organ comprising:

a frame having a forward portion and opposite side portions;

an elongated keyboard extending laterally along said forward portion of said frame and having a plurality of keys spaced from one another along the length of the keyboard;

means for pivotally mounting said keys on said frame;

means defining a plurality of light pickup regions at a location on said frame which is substantially at one side of said keyboard;

means for directing a plurality of light beams which time vary in predetermined patterns at said pickup regions;

photocell means responsive to light received at said light pickup regions for generating electrical signals;

means responsive to the output of said photocell means for generating sounds;  
 light control means including a plurality of elements movably mounted at said pickup region, each element movable between first and second positions to respectively pass or not pass one of said light beams to said photocell means; and  
 means for coupling said keys to said elements to move them, including a plurality of rods slideably mounted on said frame, said rods extending parallel to one another primarily in a direction parallel to the length of the keyboard but at a small angle with the length of the keyboard, each rod having an outer end coupled to one of said elements to move it and an inner end, said means for coupling also including connecting means coupling the inner ends of the rod to locations on said keys spaced a uniform distance from the axis of pivoting of the keys on the keyboard, whereby to provide substantially the same resistance to depression and substantially the same distance of depression for the keys.

6. The organ described in claim 5 wherein:

said light control means includes a light conducting member constructed of flexible light-conducting material, said member having an edge portion containing a plurality of slits dividing it into a plurality of flexible light conducting fingers that form said elements, the ends of said fingers normally spaced from said pickup regions but deflectable to said pickup region to receive light; and  
 the outer end of each rod lies adjacent to a different one of said fingers, so that when the rod is slid along its length toward a corresponding finger the rod deflects the finger to a pickup region.

7. The organ described in claim 5 wherein:

said elements of said light control means includes a plurality of shutters pivotally mounted on the frame to block and unblock the passage of light between said pickup regions and photocell means; and

the outer end of each rod lies adjacent to a different one of said shutters, so that when the rod is slid along its length towards a corresponding shutter, the rod pushes on a shutter portion to pivot the shutter to an unblocking position.

8. The organ described in claim 5 wherein said means for coupling includes pairs of cam members, one member of each pair mounted on each key and the other mounted on the frame, said cam members extending across one another, and the inner end of a corresponding rod extending substantially perpendicular to most of its rod length and lying between the pair of cam members, so that depression of a key urges sliding of the rod along its length.

9. The organ described in claim 5 wherein:

each of said keys is elongated, extends perpendicular to the length of the keyboard, and pivots about an axis perpendicular to the length of the key; and  
 said means for coupling includes a plurality of cranks pivotally mounted on the frame about axes substantially perpendicular to the axis of pivoting of the keys, each crank having a first arm pivotally coupled to the key and another arm pivotally coupled to an inner end of a rod, whereby the rods help stabilize the positions of the keys.

10. An organ comprising:

means defining a plurality of light pickup regions;  
 means for directing a plurality of light beams which time vary in predetermined patterns at said pickup regions;

photocell means responsive to light received at said pickup regions for generating electrical signals;  
 a plurality of light control elements movably mounted at said pickup regions, each element movable between first and second positions to respectively pass or not pass one of said light beams to said photocell means;

a plurality of manually depressable members;

a plurality of rods mounted to slide along their length, each rod having an outer end disposed against one of said light control elements, and each rod having an inner end portion that is bent in a return curve which forms a pair of legs spaced along the length of the rod; and

a plurality of pivotally mounted linking members, each having a first arm coupled to one of said depressable members to be pivoted by it and each having a second arm extending between the legs at the inner end of a rod.

11. The organ described in claim 10 including a frame apparatus having first bearings pivotally supporting said linking members about axes substantially perpendicular to said rods, and having a plurality of narrow elongated recesses each extending parallel to a rod and receiving said bent inner end portion of the rod, the second arm of each linking member extending into a corresponding slot.

12. An organ comprising:

means defining a plurality of light pickup regions;  
 means for directing a plurality of light beams which time vary in predetermined patterns at said pickup regions;

photocell means for converting light into electrical signals;

light conducting means for conducting light from said light pickup regions to said photocell means, including a plurality of elongated light conducting elements individually movable between first positions wherein they carry light along at least part of a path that extends from a corresponding light pickup region to said photocell means and second positions wherein they do not carry light from the light pickup region to the photocell means;

keyboard means having a plurality of manually operable keys;

means coupling said keys to said light conducting elements for selectively moving said elements in response to operation of said keys; and

means responsive to the output of said photocell means for generating sounds.

13. The organ described in claim 12 wherein said light conducting means includes a member constructed of resilient light conducting material having an edge portion with a plurality of slots therein dividing it into a plurality of fingers forming said light conducting elements.

14. The organ described in claim 12 wherein:

said means defining a plurality of light pickup regions includes means defining a slit for blocking light except along a predetermined path; and  
 said light conducting elements have end portions which lie over and away from said slit when the ele-

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ments are respectively in said first and second positions.

15. An organ for use with an optical record comprising:

- a frame;
- means for rotating an optical record on said frame;
- means for shining light through said optical record;
- means for masking a region at a side of the optical record opposite said means for shining light, except for an elongated pickup area;
- a light collector having a sheet-like edge portion containing a plurality of slits that divide the edge portion into a plurality of optical fingers, said light collector mounted on said frame with the ends of the fingers near said elongated pickup area;
- photocell means coupled to said light collector to re-

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ceive any light picked up by any of said optical fingers;

speaker means coupled to said photocell means for generating sounds; and

5 manually operable means for selectively deflecting said optical fingers between positions away from and over said pickup area.

16. The organ described in claim 15 wherein said manually operable means includes a plurality of rods slideably mounted on said frame, said rods having outer ends adjacent to said optical fingers to deflect them and having inner ends, and said manually operable means also includes manually depressable members coupled

10 to said rods to slide them along the frame.

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