March 10, 1964 T. A. WRIGHT 3,123,989

AIR CONDITIONING CONTROL SWITCH

Filed Dec. 20, 1961 2 Sheets-Sheet 1

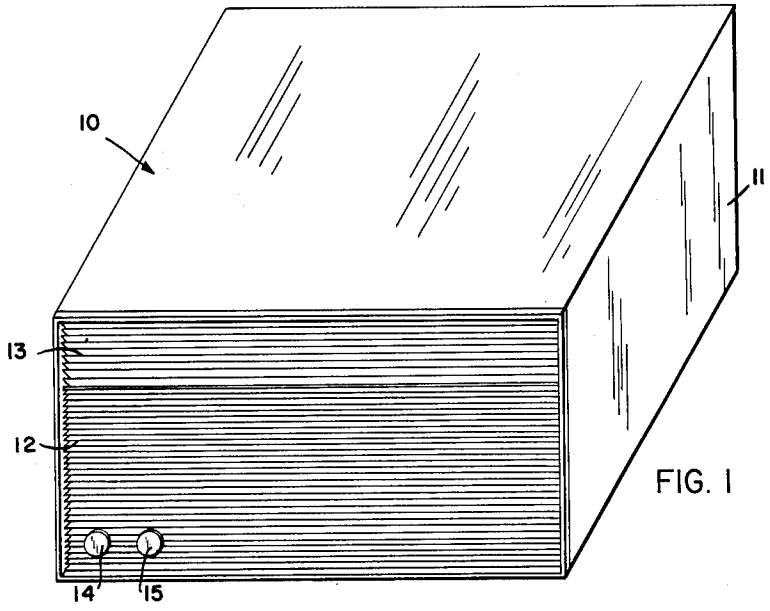


FIG. 1

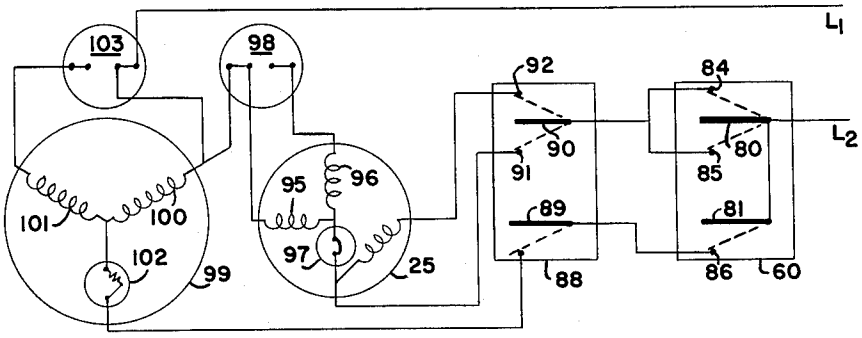


FIG. 6

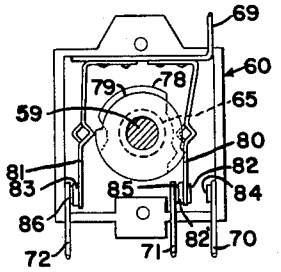


FIG. 5

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AIR CONDITIONING CONTROL SWITCH

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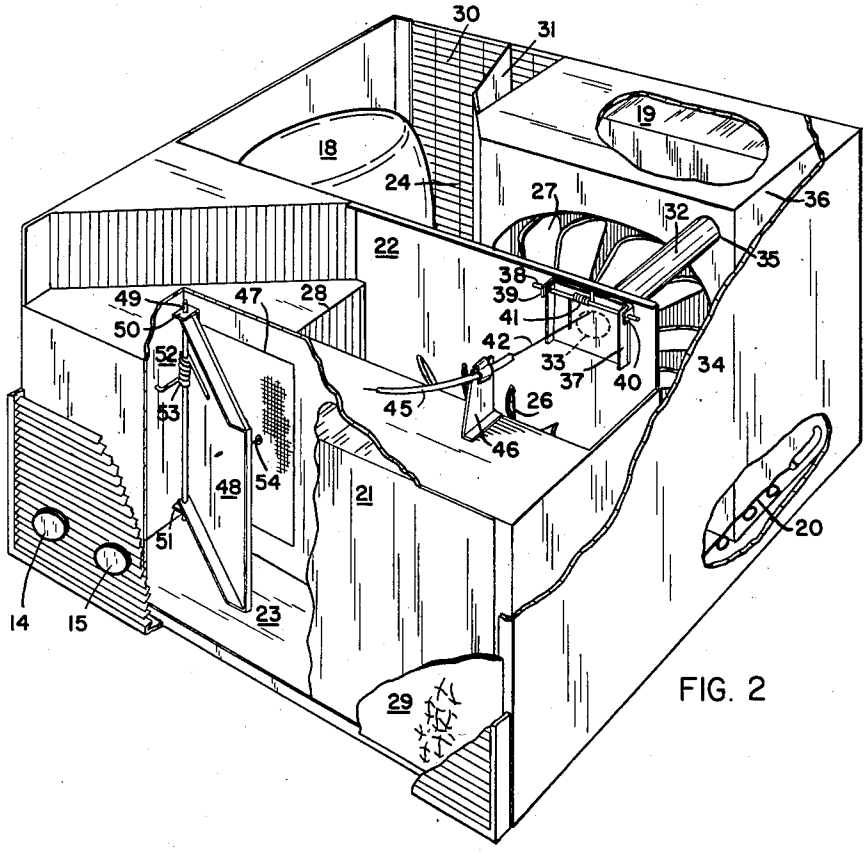


FIG. 2

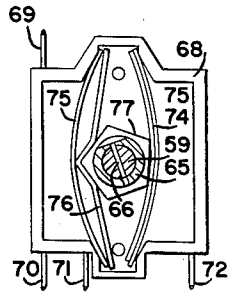


FIG. 4

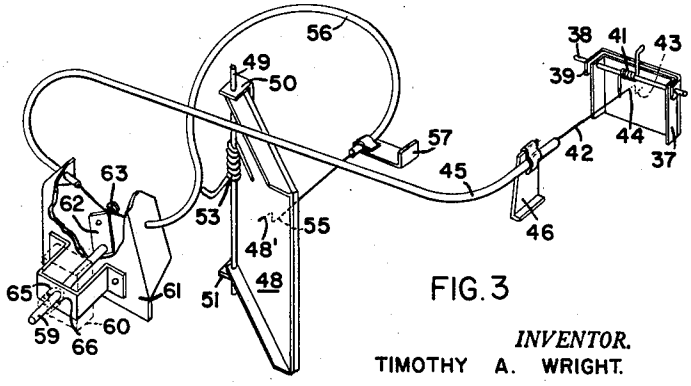


FIG. 3

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AIR CONDITIONING CONTROL SWITCH

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5 Claims. (Cl. 62—427)

The present invention relates to air conditioning apparatus of the self-contained room type and more particularly to a self-contained room air conditioner having an improved control therefor.

Room air conditioners today are required to perform a plurality of functions in addition to merely cooling the air. For example, at times it is desirable to render the refrigeration system inoperative and to circulate air through the room air conditioner by operating only the fan means therein. It is also desirable to operate the room air conditioner so as to cool the area to be treated, yet at the same time remove stale air from the room and discharge it to the ambient. At other times it may be desirable to draw ventilation air from outdoors into the room to be treated. The controls for self-contained room air conditions are rather complex, when the conditioners are required to perform the varied functions abovedescribed as well as others.

An object of this invention is to provide a self-contained room air conditioner having controls which obviate the deficiencies and disadvantages of prior constructions.

Another object of this invention is to provide an air conditioning apparatus having a single mechanism for controlling operation of the refrigeration system and the fan means, as well as opening and closing dampers for regulating the flow of fresh air and stale air through the air conditioning apparatus.

Yet another object of this invention is to provide a room air conditioner with a single rotatable control having a shaft for operating control switches and flexible cable means secured to the shaft for actuating separate ventilation air and exhaust air dampers in a coordinated sequence, so as to sequentially cool and dehumidify the air, circulate room air without cooling, supply fresh air to the area to be treated, or exhaust stale air from the area to be treated to the ambient.

A further object is to provide a room air conditioner with a control arrangement which is simple, compact and economical to manufacture. These and other objects of the invention will become more apparent hereafter.

This invention relates to a room air conditioner comprising a casing having a refrigeration system therein. The refrigeration system includes a motor-driven compressor, a first heat exchange coil, expansion means and a second heat exchange coil. Partition means are provided within the casing to form a first compartment and a second compartment. Within the casing are fan means for circulating air over the heat exchange coils. The partition means has first and second openings therein. Secured to the partition means are dampers for closing each opening. Switch means are provided for controlling operation of the compressor motor and the fan means. The switch means are actuated by a rotatable control. A pair of flexible cables are connected to the rotatable control, one for operating each damper. Lost motion means connect each cable to a respective damper. Upon rotation of the rotatable control to different predetermined positions, the switch means will be selectively actuated to control operation of the compressor motor and the fan means and the cables will be actuated to operate the dampers.

The attached drawings illustrate a preferred embodiment of the present invention, in which like numerals designate like elements in each of the several views, and in which:

FIGURE 1 is a perspective view of a room air conditioner embodying the present invention;

FIGURE 2 is a perspective view of the room air conditioner of FIGURE 1 with parts broken away to more clearly illustrate the control for actuating the dampers;

FIGURE 3 is a perspective view illustrating the relationship of the elements of the control of the present invention;

FIGURE 4 is a sectional view of the control switch of FIGURE 3 on an enlarged scale showing the control shaft positioning means;

FIGURE 5 is a sectional view of the control switch of FIGURE 3 on an enlarged scale showing the switches and the cam actuators therefor; and

FIGURE 6 is a schematic wiring diagram of the electric control for the air conditioner illustrated in FIGURE 1.

Referring to FIGURE 1 there is shown an air conditioning unit embodying the present invention. The unit 10 comprises a casing 11 having an inlet 12 and an outlet 13 in the front thereof. Mounted in the front of air conditioning unit 10 are selector switch knob 14 and thermostat knob 15. It will be understood by those versed in the art that the casing may be placed in a window or through a wall such that inlet 12 and outlet 13 are in communication with the room or area to be treated and the opposite end of the casing is in communication with the ambient.

In FIGURE 2 it can be seen that within casing 11 there is provided a refrigeration system comprising compressor 18, condenser 19, expansion means 20 and evaporator 21, interconnected by suitable piping (not shown). It will be readily understood that the expansion means may be a capillary tube as shown or, if desired, a thermal expansion valve may be used.

Partition panel assembly 22 separates the casing 11 into indoor compartment 23 and outdoor compartment 24. Secured to the partition panel assembly is double-ended motor 25. Mounted on the ends of the shafts of motor 25 are evaporator fan 26 and condenser fan 27. It can be seen that the compressor, condenser, and condenser fan are disposed in the outdoor compartment and that the evaporator and evaporator fan are disposed in the indoor compartment. Fan motor 25 (not shown in FIGURE 2) is in outdoor compartment 24.

Evaporator fan 26 draws air into casing 11 through inlet 12 in the face thereof, through filter 29 through evaporator 21, and discharges the air upwardly through opening 28 in partition panel assembly 22 and outwardly into the area to be treated through outlet 13 in the front of casing 11.

Condenser fan 27 draws air into the casing through condenser 19 and discharges it through outlet 30 in the rear of casing 11. Deflector 31 may be provided within the casing to minimize mixing of the air being drawn into the casing in the rear thereof with the air being discharged from the rear of casing 11.

Means for exhausting stale room air are provided in the air conditioning unit. Such means comprise duct 32 and damper means for controlling the passage of air

through the duct. Duct 32 communicates at one end with opening 33 in vertical wall 34 of the partition panel assembly and at the other end with opening 35 in condenser housing 36. As a result of the pressure differential between housing 36 and compartment 23, when the damper means is open, air moves from indoor compartment 23 to condenser housing 36, outdoor compartment 24 and the ambient. The passage of air through duct 32 is controlled by exhaust damper 37. Damper 37 is secured to shaft 38 which is journaled at its ends in support members 39 and 40. The damper is biased to the closed position by coil spring 41. The means for opening damper door 37 includes flexible Bowden cable 42 secured to the door by lost motion means 43. Lost motion means 43 comprise the L-shaped end of the cable which extends through hole 44 in exhaust damper 37. Cable 42 extends through and is movable within sheathing 45 affixed in place by bracket 46. The opposite end of cable 42 is secured to the control switch as will hereafter be more fully explained.

The means for providing ventilation air to the area to be treated comprise ventilation damper 48 regulating the passage of air through opening 47 in wall 52. Damper 48 is affixed to shaft 49. Vertically disposed shaft 49 is pivotally supported by support members 50, 51 connected to wall 52 of partition panel assembly 22. Spring 53 may be used to bias ventilation damper 48 closed. Such spring may be of the coil type (as shown) or may be of another type, for example, a leaf spring. The means for opening the ventilation damper door comprise flexible Bowden cable 54 suitably connected at one end to the control switch and at its opposite end to lost motion means 55. Lost motion means 55, provided between the end of cable 54 and damper 48, include the offset or L-shaped end of cable 54 which extends through and is movable with respect to hole 48' in damper 48. The relationship of the elements of the control is more clearly illustrated in FIGURE 3. It is apparent that Bowden cables 42 and 54 are secured to a single operator. Cable 54 extends through sheathing 56 which is suitably secured to bracket 57.

Control shaft 59, to which an end of each flexible cable 42 and 54 is secured, not only controls the actuation of the ventilation and exhaust dampers, but also controls the functioning of selector switch 60. Shaft 59 is journaled in switch 60 which is secured to bracket 61. Integrally formed on the end of shaft 59 is crank arm 62. Stub shaft 63 is connected to crank arm 62. The ends of Bowden cables 42 and 54 are suitably secured to stub shaft 63. Control shaft 59 is connected to switch shaft 65 by suitable means as, for example, pin 66.

Referring now to FIGURE 4, there is seen casing 68 for selector switch 60. Extending from the casing are four terminals 69, 70, 71 and 72, by means of which the switch may be electrically connected to the other components. Provided within casing 68 are positioning means for retaining shafts 59 and 65 in a predetermined selected position. It will be noted that when switch shaft 65 is maintained in a predetermined selected position, control cables 42 and 54 and, therefore, dampers 37 and 48 will also be maintained in selected position. The positioning means comprise leaf springs 74 and 75 and positioning spring 76. The positioning spring contacts cam 77 and restrains the movement of cam 77. Cam 77, which is secured on shaft 65, may have a varying number of sides dependent upon the desired number of switch positions. For example, the presently preferred cam is pentagonal and the switch has five positions.

Referring to FIGURE 5 there is shown another view of selector switch 60 more clearly illustrating the switch means therein. Secured on switch shaft 65 are a pair of cams 78 and 79 for actuating arms 80 and 81. Contacts 82 and 82' on arm 80 are adapted to engage contacts 84 and 85 respectively, on terminals 70 and 71, respectively. Contact 83 on arm 81 is adapted to engage contact 86 on terminal 72.

Considering now the wiring diagrams of FIGURE 6, it is seen that power is supplied from a suitable source through leads L1 and L2. Selector switch knob 14 is rotated to properly position selector switch 60. Cams 78 and 79 are rotated when knob 14 is turned to position arms 80 and 81.

Thermostat 88 is regulated by thermostat knob 15 on the face of casing 11. The thermostat comprises arm 89 movable from the "off" position shown in solid line to the "on" position shown in dotted line and arm 90 movable into engagement with either high contact 91 or with low contact 92. The thermostat is adjustable from the high position to the low position to suitably regulate the speed of the two-speed fan motor 25.

Fan motor 25 is of the permanent split-capacitor type and includes run winding 95 and start winding 96. A conventional overload protector 97 may be provided in the motor circuit to protect against excessive temperature in the motor windings or against excessive current. The fan motor circuit is provided with capacitor 98.

Electric motor 99 for operating compressor 18 is preferably of the permanent split-capacitor type and comprises run winding 100 and start winding 101. Provided within the motor is an overload protector 102. To produce the necessary phase change required at startup, a capacitor 103 is provided.

OPERATION

The operation of my improved air conditioning unit may best be understood by reference to the following chart in which are set forth the positions of the ventilation and exhaust dampers and the operating conditions of the compressor motor and fan motor for each setting of the selector switch knob.

Selector Switch Knob Position	Compressor Motor	Fan Motor	Ventilation Damper	Exhaust Damper
Off	Off	Off	Closed	Closed.
Power Vent	Off	On	Open	Closed.
Circulate	Off	On	Closed	Closed.
Cool Vent	On	On	Closed	Open.
Power Cool	On	On	Closed	Closed.

The purpose of each of the operations of the air conditioning unit determined by the setting of selector switch knob 14 is as follows:

(1) *Off.*—The ventilation damper and exhaust damper are closed and the compressor motor and the fan motor are inoperative so that no conditioning effect is applied to the room.

(2) *Power Vent.*—The fan motor is operative and the ventilation damper is open to change the air within the room by permitting fresh outdoor air to enter without any conditioning effect being applied thereto.

(3) *Circulate.*—The ventilation damper and exhaust damper are closed and the fan motor is operative to recirculate room air without conditioning the same.

(4) *Cool Vent.*—The compressor motor and fan motor are operative and the exhaust damper is open to remove some of the room air while at the same time cooling the air supply to the room.

(5) *Power Cool.*—The compressor motor and fan motor are operative to condition and circulate room air.

Considering FIGURE 6, it will be seen that leads L1 and L2 are adapted to be connected to a source of power, for example, a 220-volt power source. Selector switch knob 14 may be set to a predetermined condition, for example, Power Cool. Arm 80 would be positioned in engagement with contact 85 and arm 81 would be positioned as shown in dotted line.

Thermostat 88 is appropriately set by turning thermostat knob 15. Arm 89 would be moved to the "on" po-

sition shown in the dotted line and arm **90** would be moved in accordance with the desired temperature condition into engagement with either high contact **91** or low contact **92**. Assume for purposes of illustration that low speed of fan motor **25** is desired. Arm **90** is in engagement with low contact **92**.

In these positions of the selector switch and the thermostat, fan motor **25** would be operative on low speed and the compressor motor would also be operative.

It will be noted that when selector switch control knob **14** was rotated to the Power Cool position, crank arm **62** was moved to properly position the dampers **37** and **48**. In this instance, springs **41** and **53** would bias the doors to the closed position. Room air would be drawn in inlet **12** in the face of casing **11** and through evaporator **21** by evaporator fan **26** and then discharged upwardly through opening **28** in partition panel assembly **22** and outwardly into the room through outlet **13** in the face of casing **11**. At the same time, outdoor air would be drawn over condenser **19** by condenser fan **27**. The air would then be discharged through outlet **30** in the rear of casing **11**.

The refrigeration system functions in its normal fashion, that is compressor **18** forwards high pressure vaporous refrigerant to condenser **19** wherein the refrigerant may be condensed by the cool air passing over the condenser. The condensed refrigerant passes through expansion means **20** wherein it is appropriately metered. The expanding vaporous refrigerant in evaporator **21** cools the room air passing thereover. When thermostat **88** is set in the "low" position, fan motor **25** operates on low speed and thorough dehumidification of the air may be obtained. For top capacity operation and rapid cooling, thermostat **88** may be set in the "high" position.

Control shaft **59** and switch shaft **65** are maintained or restrained in the selected position by the spring means shown in FIGURE 4. Pentagonal cam **77** provided on shaft **65** engages within a recess in positioning spring **76**. Leaf spring **75** bears upon positioning spring **76** and leaf spring **74** bears upon the opposite side of cam **77**. Thus, in each selected position of selector switch knob **14**, the spring means function to restrain movement of switch shaft **65**. Inasmuch as control shaft **59** is secured to shaft **65** and thus also restrained from motion, crank arm **62** and cables **42** and **54** connected thereto are maintained inoperative.

Assume now that selector switch knob **14** is positioned in the Cool Vent position. Arm **80** would be in engagement with contact **84** and arm **81** would be in the dotted line position. Thermostat arm **90** would be in engagement with either contact **91** or contact **92**. Thus, in operation both compressor motor **99** and fan motor **25** are operative. When selector switch shaft **65** was rotated, crank arm **62** was moved to open exhaust damper **37**. Cable **42** pulled damper **37** against the force of spring **41** to open the damper door. Cable **54** rode freely through lost motion means **55** so that spring **53** maintained ventilation damper **48** closed. Evaporator fan **26** pushes stale air into duct **32** and condenser fan **27** pulls stale air from the duct and forces such air from casing **11** through outlet **30**.

If selector switch knob **14** is moved to the Circulate position, arm **80** would be in engagement with contact **85** and arm **81** would be in the position shown in solid line. Compressor motor **99** will be inoperative and only fan motor **25** will be operative. Both ventilation damper **48** and exhaust damper **37** are closed, inasmuch as the ends of cables **42** and **54** are inoperative through lost motion means **43** and **55**.

When selector switch knob **14** is rotated to the Power Vent position, arm **80** would be in engagement with contact **84** and arm **81** would be in the solid line position. Compressor motor **99** is inoperative in this mode of operation. Control shaft **59** is positioned so that crank arm **62** moves control cable **54** against damper **48** to open the ventilation damper. Exhaust damper **37** is closed. Thus, fan motor **25** circulates room air and draws ventilation air from the outdoors into outdoor compartment **24**, through opening in the partition panel assembly into indoor compartment **23**, and through outlet **13** into the room to be treated.

If selector switch knob **14** is positioned in the Off position, there would be no contact made between arms **80** and **81** and their respective contacts. Thus, compressor motor **99** and fan motor **25** are inoperative. Crank arm **62** is positioned so that both ventilation damper **48** and exhaust damper **37** may be biased to the closed position.

Thus, it will be seen that by the present invention there has been provided a simplified control for a room air conditioning unit. By movement of a single knob the electrical switch for controlling the compressor motor and fan motor may be properly positioned and at the same time the dampers for regulating the flow of air through the casing of the air conditioning unit may also be selectively positioned. Positioning means are provided in the electrical switch to maintain the control shaft in a predetermined selected position and as a result, the dampers are also maintained in the predetermined selected position. The linkages for effecting movement of the dampers are relatively simple and inexpensive to assemble. Thus, manufacture of the air conditioning unit is facilitated.

While I have shown a preferred embodiment of the present invention, it will be obvious that other modifications may be made without departing from the invention and I desire that my invention be limited only within the scope of the appended claims.

I claim:

1. A room air conditioner comprising a casing; a refrigeration system in said casing including a motor-driven compressor, a first heat exchange coil, expansion means and a second heat exchange coil; partition means forming a first compartment and a second compartment in said casing; fan means for circulating air over the heat exchange coils; said partition means having a first opening and a second opening therein; a damper for closing each opening; switch means for controlling operation of the compressor motor and fan means; a rotatable control for actuating the switch means; a pair of flexible cable means connected to the rotatable control, one for operating each damper; and lost motion means connecting each cable means to a damper, whereby rotation of the rotatable control to different predetermined positions will selectively actuate the switch means to control operation of the compressor motor and fan means and will actuate the cables to operate the dampers.

2. A room air conditioner as in claim 1 wherein each of said dampers are biased to the closed position by a spring.

3. A room air conditioner as in claim 1 wherein said rotatable control comprises a shaft having a crank arm secured thereto, the flexible cable means being secured to such crank arm.

4. A room air conditioner comprising a casing; a refrigeration system in said casing, said refrigeration system comprising a compressor, a condenser, expansion means and an evaporator; partition means defining an indoor compartment and an outdoor compartment in said casing; a housing for said condenser, a fan for drawing air through said condenser; a fan for drawing air through said evaporator; motor means for driving said fans; said partition means having first and second openings therein, said first opening communicating said indoor compartment with said outdoor compartment; duct means communicating said second opening with said condenser housing; a ventilation damper for closing said first opening; an exhaust damper for closing said second opening; switch means for controlling operation of the compressor and motor means; a rotatable control for actuating the switch means; a pair of flexible cable means connected to the

rotatable control, one for operating the ventilation damper and the other for operating the exhaust damper; first lost motion means connecting said one cable means to the ventilation damper; and second lost motion means connecting said other cable means to the exhaust damper, whereby rotation of the rotatable control to different predetermined positions will selectively actuate the switch means to control operation of the compressor motor and fan means and will also selectively operate the ventilation damper and the exhaust damper.

5. A room air conditioner as in claim 4 including position restraining means cooperating with said rotatable control for releasably retaining the rotatable control in a predetermined selected position, thereby maintaining the switch means as well as the ventilation and exhaust dampers in a predetermined selected position.

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