

July 19, 1966

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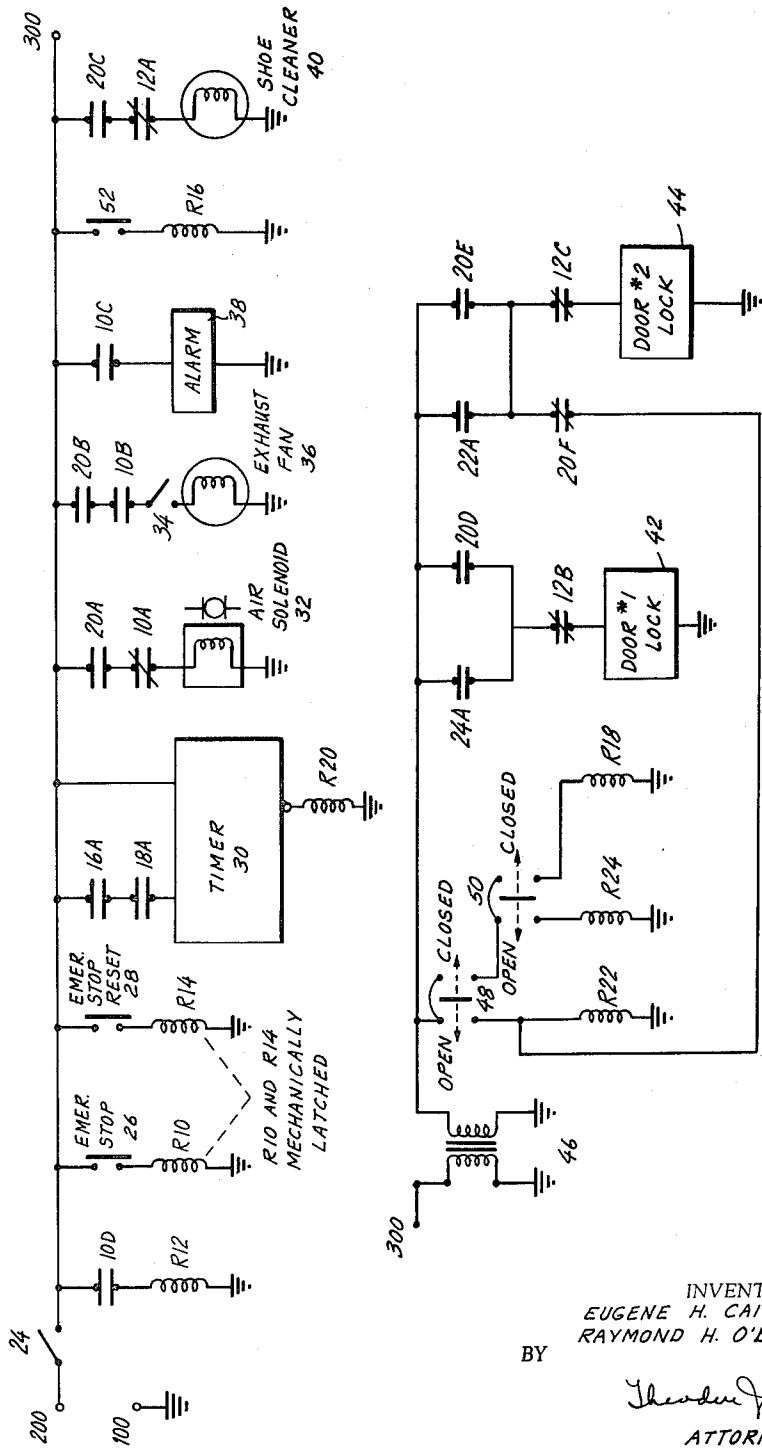
3,261,050

CONTROL DEVICES FOR ULTRACLEAN FACILITIES

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3 Sheets-Sheet 1

FIG. 1



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3 Sheets-Sheet 2

FIG. 2

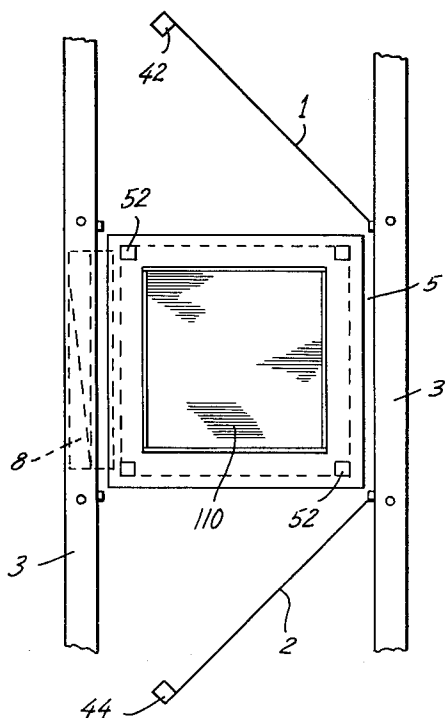


FIG. 3

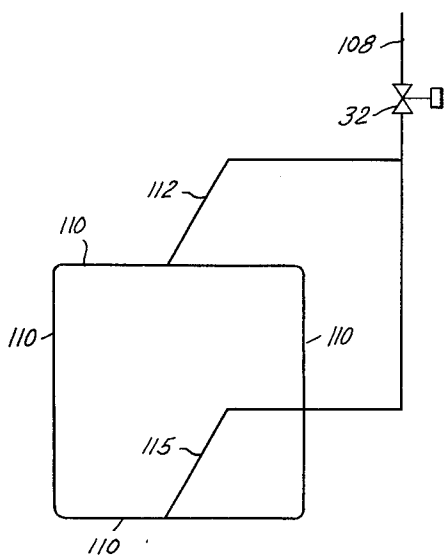
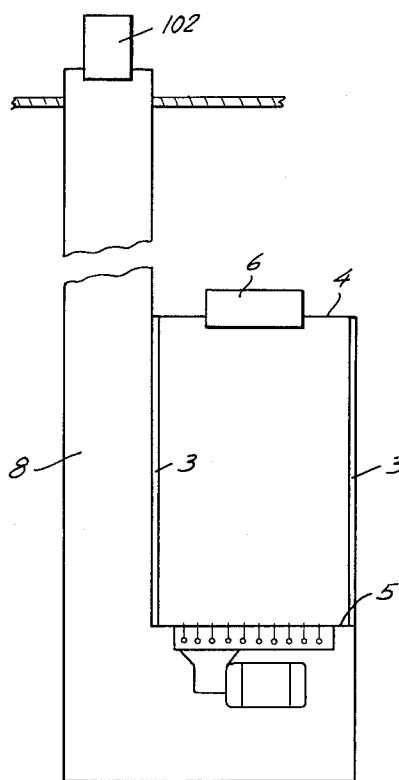


FIG. 5

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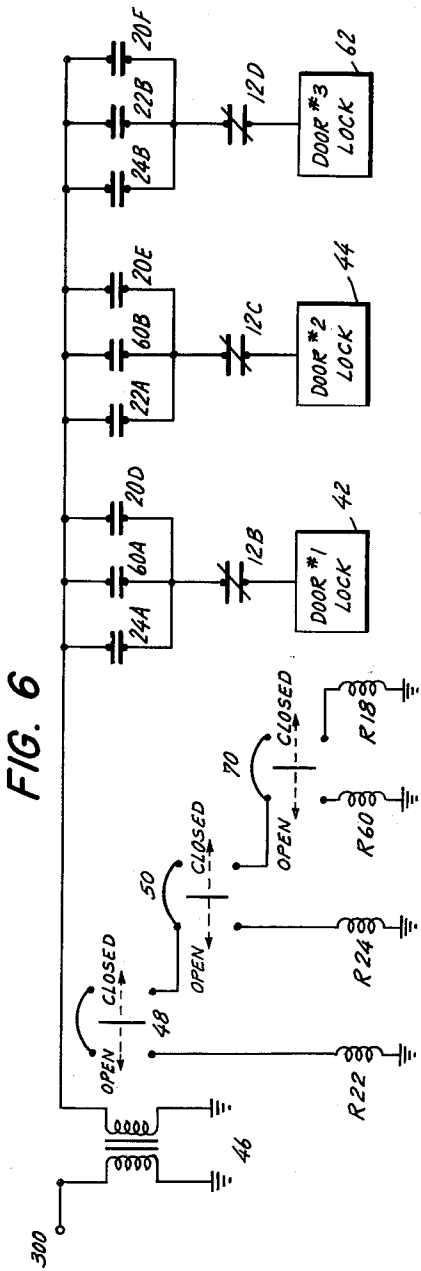
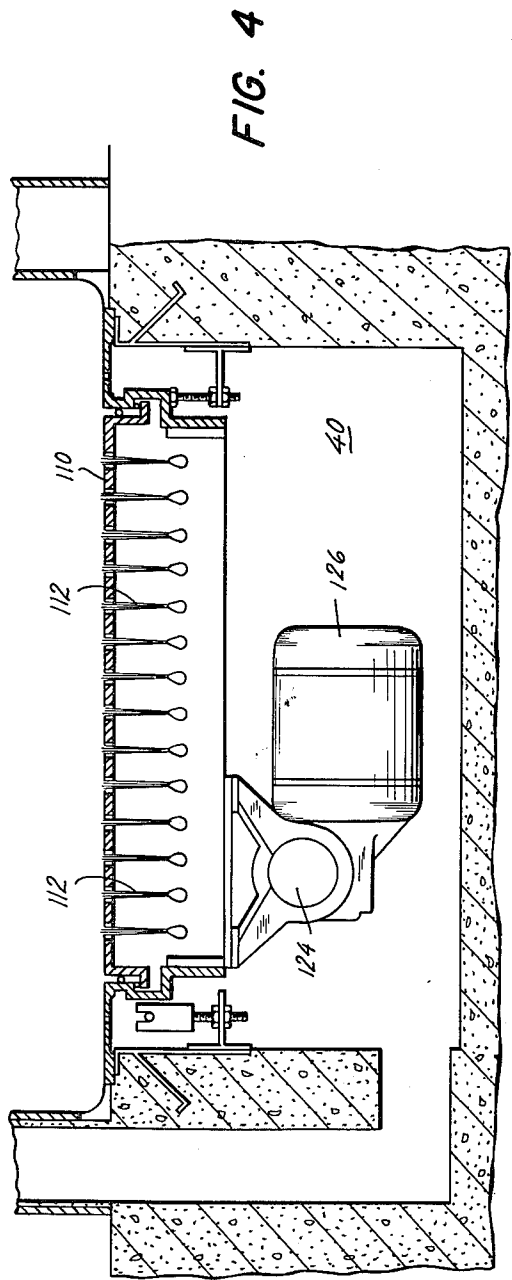
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CONTROL DEVICES FOR ULTRACLEAN FACILITIES

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3 Sheets-Sheet 3



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1

2

3,261,050 CONTROL DEVICES FOR ULTRACLEAN FACILITIES

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5 Claims. (Cl. 15-311)

Our invention is directed toward access chambers for ultraclean facilities, and more particularly relates to control devices of control systems for use with such access chambers.

Ultraclean facilities, i.e., work spaces wherein airborne contaminants cannot be tolerated, find an ever-increasing range of industrial and/or military applications. In order to remove these contaminants from such work space, the air therein must be processed to be maintained in an ultraclean state. However, in addition, the personnel working in these spaces must also be ultraclean. To this end, any person entering the work space must first pass through an access chamber wherein he is subjected to certain cleaning operations. After leaving the access chamber, the person previously subjected to these operations enters a locker room, changes his clothes, and then enters a second access chamber wherein a similar set of cleaning operations are performed. After leaving the second chamber, the person can then enter the work space.

Our invention is directed toward the control of the various cleaning operations in such access chambers and, in addition, is directed toward the locking and unlocking of doors of such chambers.

Accordingly, it is an object of our invention to provide a new and improved system for controlling the cleaning operations in an access chamber.

Another object is to provide a new and improved system for controlling the locking and unlocking of doors of an access chamber.

Still another object is to provide a new and improved system for controlling both the locking and unlocking of doors of an access chamber as well as controlling the air cleaning operations in the chamber.

These and other objects of our invention will either be explained or will become apparent hereinafter.

In accordance with the principles of our invention, an access chamber is provided with side walls having at least two doors mounted therein, a ceiling and a floor. An air shower head is mounted in the ceiling; shoe cleaning apparatus is mounted in the floor; an air exhaust duct containing an exhaust fan is connected at one end to the floor and communicates therewith, the other end of the duct communicating with a discharge space outside of the chamber. Each door is provided with an electrical locking device.

Initially, all doors are closed but not locked. An electrical relay system interconnects the locking devices, the air shower, the apparatus and the exhaust fan.

When a person approaches the chamber and opens one door, the locking devices on all other doors are actuated, and these other doors are locked. As the person steps into the chamber and onto the floor, and the one door previously opened is closed, the locking device on this one door is actuated and this door also is locked. At the same time, the shoe cleaning apparatus is energized, and the bottom of the person's shoes are cleaned; the air shower is actuated, and the air is blown down onto and around the person to remove any contaminants on his clothes; and the exhaust fan is energized to discharge the blown air (containing entrained contaminants) from the chamber. After a predetermined period, the apparatus and fan are deenergized; the shower is deactivated; and

all of the door locking devices are deactivated. Consequently, the person can then open any door and leave the chamber.

An illustrative embodiment of our invention will now be described with reference both to this specification and to the drawings wherein:

FIG. 1 is an electrical circuit diagram of one form of our invention;

FIG. 2 is a plan view of an access chamber as used in our invention;

FIG. 3 is an elevation view of the chamber of FIG. 2;

FIG. 4 is a detail view of the shoe cleaning apparatus as used in the access chamber of FIGS. 2 and 3;

FIG. 5 is a detail view of the air shower as used in the access chamber of FIGS. 2 and 3; and

FIG. 6 is an electrical circuit diagram of another form of our invention.

Referring now to FIGS. 1-5, our invention will now be described with reference to an access chamber having two doors. The chamber has side walls 3 containing oppositely disposed entrance and exit doors identified respectively at 1 and 2, a ceiling 4 and a floor 5. An air shower head 6 depends downward from ceiling 4; shoe cleaning apparatus 40 is mounted in the floor. An exhaust duct 8 running parallel to a side wall vertically past both the floor and the ceiling of the chamber, communicates at one end 9 with the floor (through the open grid of apparatus 7) and at the other end is connected to an exhaust blower fan 102 mounted above a roof of a building 104 in which the chamber is located.

Door 1 carries an electromechanical door locking device 42; door 2 carries a like door locking device 42.

Air suitably controlled as to temperature, humidity, pressure and the like is fed through a feed pipe 108 (carrying an air solenoid 32) from outside the chamber down through the ceiling to the air shower head 6.

A plurality of switches 52 are floor mounted and carried by the shoe cleaning apparatus 40. Apparatus 42 (which is of known type) contains a floor mounted grid 110 having a plurality of parallel slots. When the apparatus is operative, brush elements 112 rise upward through the slots and oscillate back and forth in the slots under the control of driving gear mechanism 124 and motor 126 to clean the under surface of any shoes resting on the grill. The contaminants so removed are entrained in the air stream produced when air is blown downwards in the chamber from head 6 and is exhausted through the exhaust duct through operation of exhaust fan 102.

The shower head 6 consists of four horizontal hollow pipes 110 arranged to form a rectangle and perforated to permit air to pass downward therethrough. The air is fed to these pipes from pipe 108 by way of two vertical feed pipes 112 and 114 and two horizontal feed pipes 116.

The operation of our invention will now be described with specific reference to the circuit diagram. (The relays, timer and the like shown in FIG. 1 are mounted on a control panel positioned outside of the chamber.)

In normal operation, line voltage (for example, 110 volts 60 cycles per second alternating voltage) is applied between terminals 100 and 200, ON-OFF switch 24 and fan switch 34 are both closed, and low voltage (for example 24 volts) appears across the secondary winding of transformer 46. The chamber is empty and both doors 1 and 2 are closed.

At this point, switch 48 (operated by door 1) and switch 50 (operated by door 2) are both closed and relay R18 is energized. Contacts 18A (controlled by relay R18) are closed. Timer 30 is deenergized; all other relays are deenergized; door lock 42 (for door 1) and door lock 44 (for door 2) are both closed. The air exhaust fan and

shoe cleaning apparatus are both deenergized; the air shower is closed and no air passes therethrough.

As soon as a person opens door 1, switch 48 is placed in the open position. Relay 22 is energized, closing contacts 22A. A circuit is completed through contacts 22A and normally closed contacts 12C to energize lock 44 and electrically lock door 2 closed. At the same time a holding circuit through contacts 22A and normally closed contacts 20F holds a relay 22 energized as door 1 closes.

However, after opening the door 1 and entering the chamber, the person necessarily steps on one of a plurality of floor switches 52 (all of switches 52 are connected electrically in parallel, but only one of these switches is shown in FIG. 1), thus energizing relay R16. Contacts 16A are then closed.

As door 1 closes with the person in the chamber, switch 48 is placed in the closed position, and a circuit is completed through switches 48 and 50 to energize relay R18. (Relay R22 remains energized even though switch 48 is closed, because of the holding circuit previously described.) Contacts 18A are then closed and a circuit is completed through timer 30 and relay 20. The timer is then energized for a predetermined period of time (determined by the timer setting), and relay 20 is energized, closing contacts 20A, 20B, 20C and 20D and opening normally closed contacts 20F. Relay R22 is deenergized (because its holding circuit is opened) and lock 42 is energized (through contacts 20D and normally closed contacts 12B) to lock door 1. A circuit is completed through contacts 20A and normally closed contacts 10A, energizing the air solenoid 32 and permitting air under pressure to flow through the feed pipe to the air shower wherein it is released downward into the chamber. At the same time, a circuit is completed through contacts 20B, normally closed contacts 10B and closed switch 34 to exhaust fan 36, the fan is energized and begins to exhaust air from the bottom of the chamber. In addition, another circuit is completed through contacts 20C and normally closed contacts 12A to energize the shoe cleaning apparatus 40.

After timer 30 has completed its timing cycle, relay 20 is deenergized and contacts 20A, 20B and 20C are opened. Consequently, solenoid 52 is deenergized, cutting off the air shower; the exhaust fan 36 and the shoe cleaner 40 are both deenergized, and the air exhaust and shoe cleaning operations cease. At the same time, contacts 20D and 20E are opened, and contacts 20F are closed. Consequently, both locks 42 and 44 are deenergized, and either or both doors 1 and 2 can be opened at will. The person can then step out of the chamber through door 2. (The timer 30 will be automatically reset only after this person has stepped off of microswitches 52; at this point, the chamber is set to receive another person and repeat the entire operation.) However, when door 2 is opened, switch 50 is opened, and relay R24 is energized. Consequently, contacts 24A are closed, completing a circuit through normally closed contacts 12B to energize lock 42 to lock door 1 until the person in the chamber has left through door 2, and door 2 has closed again.

If a person is in the chamber with both doors 1 and 2 electrically locked, and the air and shoe cleaning operations are proceeding as before, and this person desires for any reason to unlock the doors before the timer cycle is completed, he pushes the emergency stop button 26. This completes a circuit through relay R10, energizing same and opening normally closed contacts 10A and 10B (which cuts off the air shower and exhaust). In addition, contacts 10C are closed, energizing relay R12. Normally closed contacts 12A, 12B and 12C are opened, cutting off the shoe cleaning apparatus 40, and deenergizing locks 42 and 44. Then, either or both of doors 1 and 2 can be opened at will. At the same time, alarm 38 (which, for example, can be a bell) is energized, and the alarm is sounded.

Once the emergency stop button 26 has been pressed, relay R10 will remain energized, the alarm will continue to sound, the doors will remain unlocked and the air and shoe cleaning operations will remain cut off until the emergency

stop reset button 28 is depressed. When button 28 is depressed, relay R14 is energized. (Relays R14 and R10 are mechanically latched in such manner that when relay R14 is energized, relay R10 is deenergized. Similarly, when relay R10 is energized, relay R14 is deenergized). At this point, therefore, normal operation is restored.

If a person decides to enter through door 2 or leave through door 1, it will be seen that the same operations take place. Opening either door causes the other door to be locked, and when a person steps into the chamber, and the door previously opened is closed, this door also is locked.

When desired, another set of stop and stop reset buttons can be installed outside the chamber to permit the doors to be unlocked by persons outside the chamber. In addition, an indicator light can be mounted in a wall inside or outside the chamber which is turned on or off as the exhaust fan is turned on or off.

The air supplied by the air shower is used for cleaning. The air supplied to and removed from the chamber for ventilation purposes is supplied via other conventional equipment not shown.

While the invention shown in the preceding drawings employs only two doors, it will be apparent that a chamber having more than two doors can also be used. The principles are the same, i.e., opening one door causes all other doors to be locked electrically. When a person steps through the open door into the chamber, and the open door then closes, this door is locked and the various cleaning operations are initiated and completed as before, all doors being electrically unlocked after the cycle is completed.

FIG. 6 shows a portion of an electrical circuit diagram for controlling a three door chamber. (The remaining part of this circuit is substantially identical with that of FIG. 1 and, hence, is not shown again in FIG. 6).

The circuit of FIG. 6 employs doors 1 and 2 as before operating corresponding switches 48 and 50 and having electrical locking devices 42 and 44. In addition, however, there is another door 20D having an electrical locking device 62 and operating a separate switch 70. Initially, all doors are closed, and relays R22, R24 and R60 are deenergized. When door 1 is opened, switch 48 is placed in the open position. Relay R22 is closed, closing contacts 22A and 22B. Consequently, a circuit is completed through closed contacts 22A and normally closed contacts 12C to lock 44, energizing same and locking door 2. At the same time, another circuit is completed through closed contacts 22B and normally closed contacts 12D to lock 62, energizing same and locking door 20D. The person then steps in the chamber, door 1 closes and is locked, and the air cleaning cycle begins and ends as before.

Note that if the operation started by opening door 2, switch 50 would be placed in the open position, relay R24 would be energized, and locks 42 and 62 would be energized to lock doors 1 and 20D. Similarly, if the operation started by opening door 20D, switch 70 would be placed in the open position, relay R60 would be energized and locks 42 and 44 would be energized to lock doors 1 and 2.

While we have described our invention with particular reference to the embodiments shown in the drawings, our protection is to be limited only by the terms of the claims which follow.

We claim:

1. In combination with an access chamber having a ceiling, a floor, side walls extending between said ceiling and floor, and a plurality of doors mounted in said side walls, in combination,

- (a) a like plurality of electrically operated door locks, each lock being associated with a corresponding door whereby when a door is closed and its corresponding lock is energized said closed door is locked, said closed door being unlocked when said corresponding lock is deenergized;
- (b) a like plurality of door switches, each switch being associated with a corresponding door, each switch

5

having a first switch position when its corresponding door is open and having a second switch position when its corresponding door is closed:

- (c) door locking and unlocking apparatus electrically interconnected between said switches and locks, said apparatus having first means actuated when one of said doors is opened and all other doors are closed to energize the locks of all other doors in order to lock each of said all other doors, second means actuated after said first means is actuated and said one door is closed to energize the lock of said one door to lock said one door, and third means actuated a predetermined interval after said first and second means are actuated to deactuate said first and second means and deenergize all locks to unlock all of said doors;
- (d) a timer for determining the length of said interval, said timer being coupled to said third means to actuate same when the timer has indicated the expiration of said interval; and
- (e) foot pressure responsive means in the floor of said chamber which when stepped on cooperates with the actuated second means to cause said timer to initiate the timing action to determine the length of said interval.

2. The combination as set forth in claim 1 further including an air shower mounted in the interior of said chamber and suspended from said ceiling.

6

3. The combination as set forth in claim 2 further including shoe cleaning apparatus mounted in the floor.

4. The combination as set forth in claim 3 further including air exhaust means including an exhaust fan communicating between the interior of said chamber through the floor thereof and a suitable exhaust space outside of said chamber.

5. The combination as set forth in claim 4 wherein said door apparatus includes a timer relay operated by said timer for energizing the shower, the cleaning apparatus and the exhaust means when the timer is energized and for deenergizing the shower, the cleaning apparatus and the exhaust means when the timer is deenergized.

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